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VI/2020

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Cover : MiG-29K of the Indian Navy over INS Vikramaditya
(Photo courtesy Indian Navy)

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Malabar Signals

In a major move coming after years of deliberation, Australia has participated in this year's Malabar naval exercises. The decision marks an important inflexion point not only in India's bilateral relations with Australia but also in the geopolitics of the Indo-Pacific, the new strategic geography stretching from the east coast of Africa to the waters of East Asia. The naval exercise, which took place in the Bay of Bengal and the Arabian Sea, imparts a military dimension to the so-called Quadrilateral Dialogue Framework, involving India, US, Japan and Australia. Despite the eagerness of Australia to join Malabar, Delhi held back and limited it to India, US and Japan. The main reason behind Delhi's hesitation was the concern that including Australia into the Quad might offend China's rather fragile political sensitivity. Something, then, has clearly changed India's calculus on China. As China's muscular unilateralism rises and undermines India's core interests across a broad range of issues — from territorial integrity to regional and multilateral interests — Delhi has had no option but to reconsider its strategic deference to Beijing. China's Ladakh aggression this spring was possibly the last straw. The reluctance to turn the Quad into a military coalition, Delhi could not but note, produced no Chinese consideration for India's concerns. The die is now cast.


Drawing By Amarjya Mitra

The last time Australian naval ships joined Malabar was back in 2007, when it was a five-nation exercise involving India, US, Japan, Singapore and Australia. Until 2007, Malabar was an annual bilateral exercise with the US Navy that was launched in 1992. The Indian Navy's decision to convene the five-nation exercise was probably more administrative than geopolitical. Rather than have separate exercises with each of these partners, it was considered sensible to combine them into one. But the multilateral exercise in the Bay of Bengal produced vehement protests from China, which dubbed it as an "Asian NATO". The external Chinese opposition found an internal political echo. The CPI(M) and the Left parties, which formed a sizeable part of the UPA coalition, demanded an end to the exercise. A flustered UPA government ordered an end to multilateral Malabar. This policy endured until 2015, when the NDA government invited Japan to join the annual Malabar exercises. It has now taken the next step towards quadrilateral military engagement.

Although the decision to welcome Australia into Malabar has come in the middle of the continuing confrontation with China in Ladakh, the naval exercise is not about changing the military equation in the Himalayan theatre. Delhi has no interest in bringing its Quad partners into India's territorial battles against Beijing. It is about expanding India's bilateral security ties with Australia, whose potential is immense. The military Quad is, above all, an important part of building a sustainable Indo-Pacific coalition that is capable of addressing the massive strategic imbalance generated by the rise of an aggressive Chinese party-state.

From *The Indian Express*

LAC is new LoC

India and China are inching their way towards a new equilibrium on the border. The new border equation is likely to make the Line of Actual Control (LAC), marked by large buffer zones and winter withdrawals, similar to the Line of Control (LoC), marked by permanent deployments, firing range distances, and constant friction. Managing this transition, while restoring, to use the euphemism adopted by both governments, "peace and tranquility" along the border, is now the primary challenge. During this, India must show no signs of weakness or impatience as these will be exploited by a China which respects only power in its rawest, hardest sense. The two governments have been talking at multiple levels. Despite this, they have barely budged from their original positions and tens of thousands of soldiers are digging in for a stand-off that will, in all likelihood, run through the winter. Or they could well be further rounds of fighting designed to strengthen negotiating positions. There has been a sharp change in the options with New Delhi since Indian troops moved to the heights of Chushul Ridge in late August.

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If China is baulking at rolling back its intrusion along Pangong Tso, India will not pull its soldiers back from the heights. There is now insufficient trust between the militaries for such a move. On paper, this will seem as if India has conceded a chunk of land behind its version of LAC. And all effort must be geared even now to get China to vacate. But in reality, neither side had "actual control" of either bits of territory. They had been part of a no-man's land and their forward deployments have now shrunk that buffer to nothing. This is a reality which Indian border policy is adjusting to.

Restoring status quo ante would also imply returning Sino-Indian economic relations to what they were before. That is also out of the question. New Delhi had once seen trade and investment as a confidence-building exercise with Beijing. Today, New Delhi must draft a five year plan to reduce China's economic footprint in India as much as possible. And it should be working out how to do so in conjunction with other countries. Peace along the border is the obvious short-term goal, but struggle everywhere else should be India's new long march.

From *The Hindustan Times*

Vacant posts in the Army

That important Army positions, which play a crucial role in operational preparedness, have been lying vacant is a matter of concern. Happening at a time when the country is faced with Chinese belligerence, along with the pandemic, points to the need for finding ways to strengthen the morale and effectiveness of the armed forces. The management of promotions and postings was handed over to the Department of Military Affairs from the Department of Defence in January this year and the transition might have been affected amid the hostilities, with action in the field taking precedence over routine procedures. The teething troubles need to be got over and the assimilation and integration expedited with the powers vested being exercised to tone up the forces.

It is after a gap of six weeks that the Ministry of Defence has approved the posting of a regular Director General of Military Intelligence, who coordinates human resources and technical inputs on enemy movement and action along the border. Important posts of the Director General of Infantry who advises on equipment, battle worthiness, training and modernisation along with the DG of Army Aviation, in charge of flying operations, have been waiting to be filled. Promotions and postings of officers in the ranks of Major Generals and Lieutenant Generals also have been cleared after months. For a frontline force, it is only natural that its men should get their due.

Some time back, the military had proposed raising the retirement age of jawans. 'I am looking at manpower costs. Why should a jawan serve for 15-17 years when he can work for 30 years? We are losing trained manpower,' CDS General Bipin Rawat, who is also the DMA Secretary, had said. There was also a proposal to cut the pension of those seeking premature retirement. The defence forces have been facing the task of modernisation amid a slender hike in budgetary allocation. The tension at the border, while straining resources, might as well offer an opportunity to transform the forces.

From *The Tribune*

Winter thaw in Ladakh

After a six-month standoff, the first hopeful signs of disengagement between the Indian and Chinese military in Ladakh appear to be emerging. To be sure, much of the current impulse for the pullback is driven by convenience for both sides as the winter sets in and the expense and effort of maintaining battle-ready troops at terrain over 13,000 feet, when the temperature drops below -20 degrees Celsius, rise sharply.

But the few details that are available suggest that the deal–after the eighth round of talks between the two armed forces–is confined to the scenic Pangong Tso area, where Indian forces recently gained some countervailing advantage. This builds on the partial disengagement in the Galwan area further north in July after a clash a month earlier when 20 Indian soldiers died. Reports suggest that according to the broad proposal, the main adjustments will be along the northern bank of the lake where China's People's Liberation Army (PLA) had occupied four of the eight "fingers" or ridges–specifically Fingers Four through Eight–which lie squarely in territory that India claims.

Under the agreement, the details of which are yet to be finalised, the Chinese will move back from the Finger Four area of the northern banks of Pangong Tso to beyond Finger Eight (close to the Line of Actual Control or LAC) and the Indian troops will move back to Finger Two (they currently occupy a post on higher ground just short of Finger Four). This essentially leaves a buffer zone between Chinese and Indian troops to avoid fresh conflict. But this buffer is, in reality, entirely on the Indian side of the LAC. In the broader scheme of the Indo-China border dispute, therefore, this military-to-military plan based on reciprocal action is likely to be somewhat limited, just as the disengagement in the Galwan Valley area did not progress to other areas. Disengagement is welcome, but from the multiple rounds of negotiations it is obvious that even limited agreement has not been easily arrived at. The points of difference are still wide enough to ensure that conflict in this region will resume once the snows melt in the summer.

Even at this stage, the Modi and Xi administrations appear to be talking past each other. For instance, *The Global Times*, mouthpiece of the Chinese Communist Party, claims the disengagement plan requires India to withdraw from friction points along east Ladakh, which India claims at its territory. The Indian government, meanwhile, has reiterated its demand for a settlement all along the LAC. On this, there seems to be no agreement, especially on the plateau leading into Daulat Beg Oldie, which is close to the Karakoram Pass, where China has occupied the maximum territory. The key obstacle to negotiations, whether military or diplomatic, in the region is China's fluid and flexible definition of the LAC, which essentially renders negotiations a game of smoke and mirrors. The partial disengagement along Pangong Tso may meet immediate practical exigencies for both sides. It would, however, be premature for it to be seen as a precursor to a wider or, indeed, lasting peace along the LAC.

From *Business Standard*

OPINION

Air Marshal Brijesh Jayal on

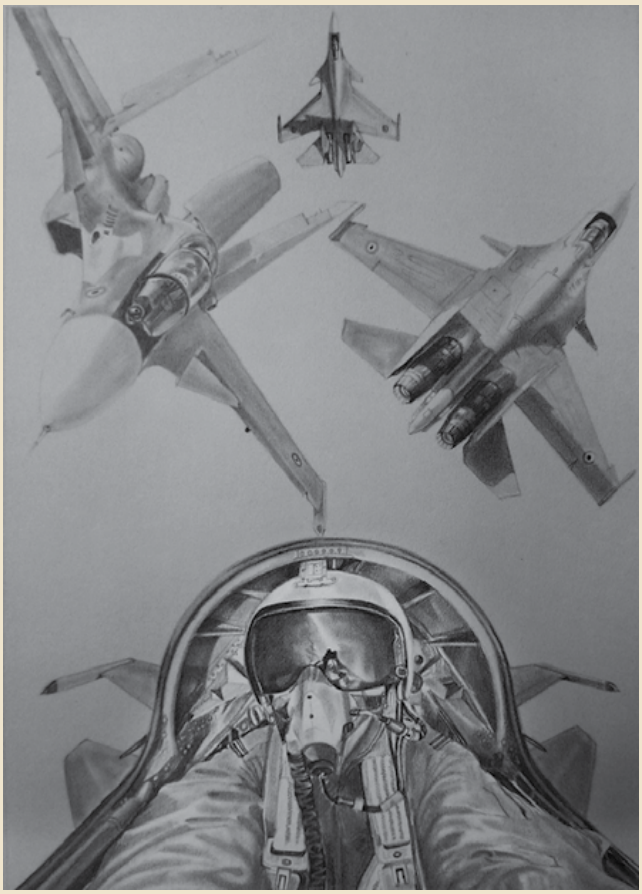
Chinese mind games (and our false sense of well-being)

Judging by the absence of any meaningful news or analysis in the Indian media on the continuing eye-ball to eye-ball confrontation between the militaries of India and China, it would appear that our people have been lulled into a false sense of well-being and perceive little likelihood of any threat to national security. The Chinese on the other hand, believe and practice the advice of Sun Tzu that counseled: 'The supreme art of war is to subdue the enemy without fighting'. They perceive India to be preoccupied with challenges of the pandemic, internal political dynamics and scandals involving celebrities and lulled into a false sense of security. Focused, as the Chinese are on their strategic objective of altering the status quo at the LAC, they continue with their relentless effort to subdue us and weaken our resolve through psychological and information warfare, domains in which their political system excels.

One can conjecture that whatever offensive plans the Chinese strategic planners had conceived towards breaching the LAC this time around, Indian air power capability and its potential use would have played an important part in the thought process. The timing perhaps was driven by sensing a window of opportunity before the Rafale and its weapon system began to augment the IAF arsenal in any substantial way operationally.

Clearly, the IAF's forward deployment of its front-line assets and aggressive flexing of its airborne muscle along the front line, combined with the alacrity with which the IAF has shown its resolve to field its very limited Rafale resources, seems to have come as a surprise to the Chinese.

They perceive Indian air power in general and the Rafale weapon system at the hands of the IAF in particular to be an obstacle to their plans and have chosen to resort to psychological warfare targeting the Rafale and its operations. A report in the *Eurasian Times* under the title 'Chinese J-20s outgun Rafales in Simulation Drills ….' , quotes the Chinese claiming that ' their fifth-generation, stealth, J-20 fighter jets shot down 17 enemy Rafales during a simulation drill.' Clearly, this is the start of a psychological war aimed to dent the morale of our air warriors exploiting the Rafale weapon system to their disadvantage.



Drawing by Amartya Mitra

One had hoped that every institution of our democracy, conscious of the serious threat that its armed forces face against a ruthless and wily enemy, would be conveying a message, both in spirit and deed, to our armed forces, that at this hour, every institution stands solidly behind them and will do nothing to undermine their mission.

Sadly, such a thought appears too idealistic, or else what could explain the 'business as usual attitude' of the CAG report on defence offsets being tabled in Parliament at this crucial juncture, where the Rafale again features? Comments suggesting that suppliers of the aircraft had not fulfilled their offset obligations, whilst also admitting that the contractual time had not run out, is clearly an invitation to reopen old wounds. One can only hope that this does not result in another politico-media slugfest against the Rafale deal reminiscent of the earlier one, more so as the suppliers have reportedly gone the extra mile in maintaining delivery deadlines notwithstanding the Covid-19 pandemic and have much more work to do.

Now that the die is cast, it should surprise none that the Chinese information and psychological war machine will work overtime to help ignite this fuse. Let institutions of our democracy not fall for this trap!

Admiral (R) Arun Prakash on the 'Quad'

Navies are, indeed, fortunate in that, unlike armies and air forces, they have many roles to play, even in peacetime. This was driven home by Soviet Admiral Sergei Gorshkov many years ago, when he said, "Demonstrative actions by the fleet, in many cases, have made it possible to achieve political ends without resorting to armed action, by merely putting pressure… Thus, the navy has always been an instrument of policy and an important aid to diplomacy in peacetime." This unique attribute of navies enables their use in support of foreign policy objectives, to deliver messages of reassurance to friends and of deterrence or coercion to adversaries.

The fact that it has taken a border confrontation in the Himalayas to bring focus on India's maritime domain clearly indicates that the salience of maritime power is not yet understood in India. The stark reality is that given the huge economic, military and technological asymmetry between China and India, and the active China-Pakistan nexus, the best that India can hope for is a stalemate on its northern and western fronts. Attention has, therefore, been focused on the maritime domain, where it is believed that India may have some cards to play !

This is the lens through which one must see the progressive evolution of Exercise 'Malabar', from a bilateral event involving just the Indian and US navies, to a tri-lateral that embraced Japan in 2015, and now to a four-cornered naval drill that also includes Australia. Apart from its geo-political significance for the Indo-Pacific, this development poses two conundrums. Firstly, given the same composition, what is the distinction, now, between 'Malabar' and the 'Quad'? Secondly, if Malabar 1992, was emblematic of India's emergence from its chrysalis of non-alignment, does Malabar 2020 mark the release of Australia from China's thralldom?

China's extreme concern about Malabar as well as the Quad arises from the suspicion that they are precursors to "containment", America's Cold War geopolitical strategy

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which eventually brought about the collapse of the USSR. China's intimidatory conduct has aroused trepidation amongst 'Quad' members, and marked caginess has been evident in their actions and articulations. For India, which faces a massive Chinese military mobilisation on its borders, accompanied by blatant territorial claims, the time for ambivalence is over. While preparing to fight its own battles with determination, it is time for India to seek external balancing – best done via the maritime domain.

While *Malabar* is the code name given to a naval exercise, the Quadrilateral Security Dialogue or Quad has its roots in the Core Group of four senior diplomats representing the US, India, Japan and Australia, formed to coordinate relief efforts after the Great Asian Tsunami 26 December, 2004. Hailing it as "a new style of diplomacy", its US member, Marc Grossman, says "… it was an organisation that never met… never issued a communiqué, never created a secretariat, and took as one of its successes, its own demise."

The present 'Quad' has obviously retained this tradition and its members have neither created a charter nor invested it with any substance, leading China to describe it as a "headline grabbing idea which will dissipate like sea-foam". The 'Quad' is 16 years old now, and *Malabar* 28. Both have served a useful purpose, and a reappraisal of the roles and relationship of the *Quad-Malabar* concepts is, therefore, overdue. Since it is India which faces a "clear and present danger", it should boldly take the initiative to do so.

Given China's ambitious 'Belt and Road Initiative' and its predicted trajectory as an economic and military superpower, it is clear that no nation would like to burn its bridges with Beijing. At the same time, in order to rein in China's hegemonic urges, there is need for affected nations to come together to show their solidarity and determination in a common cause. In this context, there is need to create a broad-based 'Indo-Pacific Concord', of like-minded regional democracies, not as an 'Asian NATO' but as an organisation with a maritime security charter, which has no offensive or provocative connotations.

Using the *Quad* and *Malabar* templates, a shore-based secretariat can be established in a central location like Port Blair, in the Andaman Islands, which would schedule and conduct periodic multinational naval exercises. The exercises could be structured to hone the skills of participating navies in specialisations like humanitarian assistance and disaster relief, countering non-traditional threats, undertaking search-and-rescue operations and establishing networked maritime domain awareness. The Concord could also designate forces to uphold maritime security or "good order at sea".

Returning to the current context of 'Quad', there are muted expressions of satisfaction in New Delhi on two counts — the prospect of Australia belatedly joining the 'Quad' and of India signing the BECA (Basic Exchange and Cooperation Agreement) with the US. These are expected to reinforce the 'Quad' and enhance its credibility, but there are reasons for India to be circumspect in both cases.

While Australia's admission to the 'Quad' is to be welcomed, memories are still alive of its past political ambivalence towards India, its trenchant criticism of our naval expansion and its vociferous condemnation of the 1998 nuclear tests. Nor should one overlook Beijing's recent influence on Australia's foreign policy, which prompted its flip-flops over the sale of uranium to India as well as its peremptory withdrawal from the 'Quad' in 2008.

The signing of BECA, last of the four "foundational agreements", after more than two decades of negotiations, would eliminate a source of frustration in the Indo-US defence relationship and enhance interoperability between the respective militaries. However, there is need to pay heed to valid concerns, regarding the possible compromise of information impinging on India's security and whether these agreements will barter away the last vestiges of India's strategic autonomy.

To conclude, Indians, given our history, should never lose sight of the truism in international relations, that it is the unerring pursuit of national interests that guides the actions and policies of every nation.

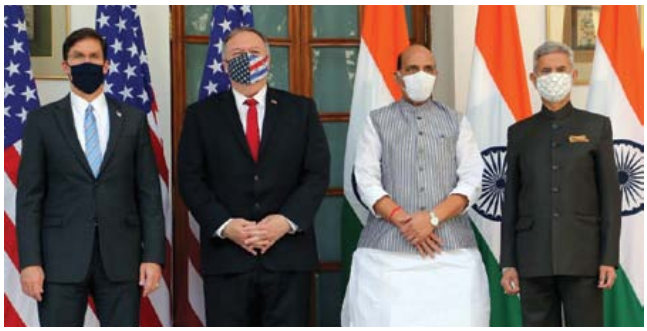
All photos are from Malabar 2020 (courtesy MoD)

Indian and US Defence Ministers in 2+2 meet

Indian Defence Minister Rajnath Singh held a 2+2 meeting with his (then) United States counterpart Dr Mark T Esper in New Delhi on 26 October 2020. The two ministers reviewed bilateral defence cooperation spanning military to military cooperation, secure communication systems and information sharing, defence trade and industrial issues and also discussed ways to take bilateral cooperation forward. Mr Rajnath Singh reportedly discussed the initiatives under *Atmanirbhar Bharat* to encourage investments in the defence industry in India and invited US companies to avail the liberalised policies "and the favorable Defence Industry ecosystem" in India.

US and India sign BECA

During the visit of US Secretary of State Michael Pompeo to India, the two countries signed the Basic Exchange and Cooperation Agreement for Geo-spatial Cooperation, BECA following the signing of LEMOA in 2016 and COMCASA in 2018. Mr Rajnath Singh also highlighted some major steps recently taken which include "Positioning a USN LO at IFC-IOR and Indian LO at NAVCENT, Bahrain; greater interaction and coordination with CENTCOM and AFRICOM; setting up of the COMSEC account and increasing the scope and complexities of our exercises. Now LO's at each other's establishments could be leveraged to enhance our information sharing architecture. To sum it up, our military to military cooperation is progressing well"!



Five Theatre Commands by 2022?

According to reports from New Delhi, the Department of Military Affairs have advised a major re-organisation wherein the Armed Forces would function under five theatre commands by 2022 with "defined areas of operation and seamless command structure for synchronised operation." These were include a Peninsula Command, an Air Defence Command while the present Andaman & Nicobar Command could be merge into the Maritime Command. According to a former VCOAS "Theaterisation of Commands is imperative to integrate resources of the three services for maximising impact in any war. The geographical expanse of theatres in India demands unified commands for strategic decisions and critical outcomes that will be possible in concentrated employment of resources".

"Prepare to combat hybrid threats" : CAS

Addressing cadets of the National Defence Academy (NDA) at Khadakvasla, Air Chief Marshal RKS Bhadauria has said that the modern day battle space was "highly complex and multi-dimensional" with unpredictable security scenarios and that the armed forces have to be prepared for hybrid threats emanating from multiple fronts. The CAS also said that appointment of the Chief of Defence Staff (CDS) and formation of the Department of Military Affairs (DMA) marks the beginning of a most historic phase of defence reforms in India.

CNS visits Campbell Bay

Chief of the Naval Staff Admiral Karambir Singh visited INS *Baaz*, the Naval Air Station at Campbell Bay, Great Nicobar Island on 13 November 2020, the visit on Diwali day was "also to express solidarity with personnel" stationed at this southernmost tip of the A&N Island chain, just north of Sumatra in Indonesia. The geo-strategically located Air Station is critical to surveillance of International Sea Lanes passing through the IOR, supporting operations of various military aircraft, which enable observation of the Southern Bay of Bengal, South Andaman Sea, Malacca Straits and the Southern Indian Ocean.

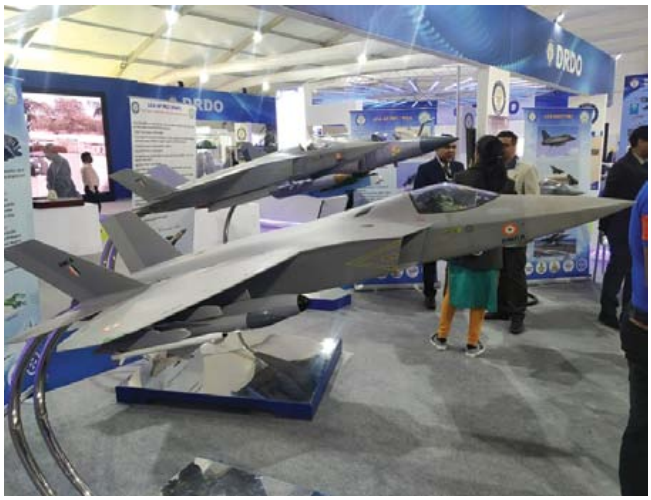
DAC approves capital acquisitions for Rs 2,290 crore

The Defence Acquisition Council meeting, held under Chairmanship of Defence Minister Rajnath approved proposals for Capital acquisitions of various equipment required by the Indian Armed Forces at an approximate cost of Rs 2,290 crore. These included Static HF Tans-receiver sets and Smart Anti Airfield Weapon (SAAW). For the Army, the DAC accorded approval for procurement of SIG SAUER Assault Rifles at a cost of approx. Rs.780 crore.

Second batch of Rafales arrive

The second batch of Dassault Rafales F3Rs for the Indian Air Force were ferried non-stop from France to India, arriving at Jamnagar on 4 November 2020. The aircraft were mid-air refueled three times by French Air Force tankers enroute.

IAF plans for 125 AMCAs



In his pre-Air Force Day Press Conference, Air Chief Marshal RKS Bhadauria stated that the Indian Air Force was considering an order for 125 next generation Advanced Medium Combat Aircraft (AMCA). He said that the first two AMCA squadrons would be powered the current General Electric F.414 engines of 90KN thrust while the follow-on five squadrons were likely to get an indigenous power plant with a higher thrust of 125KN. Under the current plans, first flight of the AMCA prototype would be in 2027, leading to full production by 2029.

663 Army Aviation Squadron awarded Trophy

The Chief of Army Staff (COAS) Flight Safety Trophy, instituted to promote the efforts towards flight safety among Indian Army Aviation Corps units has been awarded to 663 Army Aviation Squadron deployed in Kashmir. This is one of the oldest Army Aviation formations and has been actively involved in operations along the line of control and counter insurgency in Kashmir valley. General MM Naravane, COAS is seen in the picture presenting the Flight Safety Trophy to the CO and Subedar Major of the Squadron.

HAL delivers 175th F/A-18 Gun Bay Door

HAL's Aircraft Division has recently delivered the 175th F/A-18 Gun Bay Door to Boeing. Since January 2018, HAL has been maintaining 'Gold' rating for 100% quality and on-time delivery. Earlier, HAL shipped new configuration FAI Door four months ahead of schedule. Owing to high performance, Boeing awarded HAL purchase contract for additional 74 such doors in May 2020 for a business volume of Rs. 21.5 crore.

Dornier 228s of 3 Navies over the Bay of Bengal

During recent joint maritime exercises in the Bay of Bengal, Dornier 228 maritime patrol aircraft of the Indian, Royal Thai and Bangladesh Navies participated along with surface ships and submarines. These included CORPAT with the Royal

Thai Navy, *Bongosagar* with the Bangladesh Navy and *SITMEX 20*, also with the Royal Thai and Singapore Navies. The Indian Navy has the largest inventory of Dornier 228 maritime patrol aircraft, being built in India by HAL and also equipping a special 'Information Warfare' squadron with over 40 of the type in operational service.

Last overhauled 'Bison'

HAL Nasik Division has handed over the 'last' MiG-21bison aircraft (CU-2780) to the Indian Air Force on 20 October 2020. This was done 'virtually' by Mr V Seshagiri Rao, CEO MiG Complex and accepted by Air Marshal Vibhas Pande AOM. HAL had produced 220 MiG-21bis from 1978 till 1987, some 125 of these later being upgraded to 'Bison' standard for equipping six IAF squadrons.

$90 million FMS deal for C-130J Super Hercules Support

The Government of India has requested to buy items and services to extend follow-on support for their fleet of C-130J Super Hercules aircraft, these items including aircraft consumables spares and repair/return parts; ground support and equipment; Cartridge Actuated Devices/Propellant Actuated Devices (CAD/PAD) fire extinguisher cartridges; flare cartridges; BBU-35/B cartridge impulse squibs; one spare AN/ALR-56M Advanced Radar Warning Receiver shipset; spare AN/ALE-47 Counter-Measures Dispenser System shipset; ten Lightweight Night Vision Binocular (F5032); ten AN/AVS-9 Night Vision Goggle (NVG)(F4949); GPS; Electronic Warfare; instruments and lab equipment support; Joint Mission Planning System; cryptographic device spares and loaders; software and software support; publications and technical documentation; personnel training and training and training equipment; US and contractor engineering, technical, and logistical support; and other related elements of programme support. The estimated total case value is $90 million.

'Air India One': B-777s for VIP travel

The first of two Boeing 777-300ERs for transportation of India's President, Vice President and Prime Minister (VT-ALV) arrived at Palam Airport Delhi on 1 October 2020. Formerly with Air India, cabins of the two 777s were extensively refitted and the aircraft equipped with missile defence systems, known as *large aircraft infrastructure counter measures* (LAIRCM) and Self-Protection Suites (SPS). 'Air India One' is equipped with an advanced and secured communication system that allows availing of audio and video communication functions in flight without concerns of hacking or being taped.

Modified IJT commences spin flight testing

On 23 November, 2020, a modified HAL HJT-36 (*Sitara*) Intermediate Jet Trainer (IJT) designed and developed by HAL to replace the HJT-16 Kiran basic jet trainers of the IAF commenced spin flight testing in Bengaluru. The flight was piloted by HAL's test pilots Gp Capt HV Thakur (Retd) and Wg Cdr P Avasti (Retd). Spin testing of an aircraft is a crucial phase of flight testing, which will be gradually progressed to assess behaviour of the aircraft till six turn spins to either side to meet the targeted requirement. The test aircraft have been fitted with necessary safety devices (Anti-Spin Parachute Systems).

IMRH programme progresses

According to official HAL sources, the company has embarked on the concept and configuration studies of the Indian Multi-Role Helicopter (IMRH) of the 13-ton medium lift class. The IMRH is being designed and developed to progressively replace the Mi-17 variants being used by the Indian Air Force and Army. In finalising configuration of the IMRH, a 1:10 scale wind tunnel model will be tested to ascertain the basic aerodynamic characteristics of the helicopter. HAL is working towards meeting the target committed to the MoD as per the MoU signed for 2020-21.

300th ALH (Dhruv) produced

The 300th Advanced Light Helicopter (ALH) was 'rolled out' from HAL's production hangar at Bangalore on 29 September 2020. The relevant certificate was handed over to Mr. Bhaskar, CEO, Helicopter Complex by YK Sharma of the Directorate General of Aeronautical Quality Assurance (DGAQA). In the current phase, HAL is producing 73 ALHs contracted for the Army (41), Indian Navy (16) and Indian Coast Guard (16). Of these 38 ALHs have been produced with the remaining to be completed by 2022.

Air Chief reviews LCH programme

On 20 November 2020, Air Chief Marshal RKS Bhadauria, reviewed the light combat helicopter (LCH) programme at HAL Bangalore and later flew in a prototype along with HAL's Deputy Chief Test Pilot, Wg Cdr (retd) SP John. Mr R Madhavan, CMD HAL stated that "HAL is geared up for productionisation of LCH to meet all the requirements of the Air Force".

First LSP LCH in ground run

Coinciding with the 300th ALH rollout, 'Ground Run' of the first Limited Series Production (LSP) Light Combat Helicopter was carried out on 29 September. This project has been taken up by the Company proactively while the order from Services 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.

BrahMos test fired from INS *Chennai*

On 18 October 2020, a BrahMos supersonic cruise missile was test fired from the Indian Navy's built stealth destroyer INS *Chennai*, accurately impacting a target in the Arabian Sea. BrahMos as 'prime strike weapon' will ensure the warship's invincibility by engaging naval surface targets at long ranges, thus making the destroyer another lethal platform of Indian Navy. The highly versatile BrahMos has been jointly designed, developed and produced by India and Russia.

Shaurya missile test fired

A new version of the nuclear-capable Shaurya missile was test fired on 3 October 2020 off the coast of Odisha, and is slated for induction by the Indian Strategic Forces Command to complement the existing missiles in the same class. This missile, however is reportedly "lighter and easier to operate as compared to the existing ones".

BrahMos with indigenous booster flight tested

On 30 September 2020, a BrahMos supersonic cruise missile having an indigenous booster and with many 'Made in India' sub-systems was successfully flight tested from ITR, Balasore in Odisha.

Second flight test of QRSAM

In a second flight test, the indigenous Quick Reaction Surface to Air Missile (QRSAM) System tracked the target accurately and successfully neutralised the airborne target. This flight test was conducted on 17 November 2020 from the Integrated Test Range, Chandipur, off the coast of Odisha. The test was carried out once again, against the Banshee high performance jet unmanned aerial target, which simulates an aircraft. Teams from ARDE and R&DE(E) from Pune, LRDE Bengaluru and IRDE Dehra Dun in addition to the Missile Complex Laboratories from Hyderabad and Balasore participated in the test.

Enhanced Pinaka rocket system flight tested

The Enhanced Pinaka rocket system, developed by the DRDO, was successfully flight tested from Integrated Test Range, Chandipur off the coast of Odisha on 4 November 2020. The design and development has been carried out by Pune-based DRDO laboratories, essentially the Armament Research and Development Establishment, ARDE and High Energy Materials Research Laboratory, HEMRL. A total of six rockets were launched in quick succession and the tests "met complete mission objectives". The rockets were tested by Economic Explosives Limited, Nagpur, to whom the technology was transferred. All the flight articles were tracked by Range instruments such as telemetry, radar and Electro Optical Tracking Systems which confirmed the flight performance.

Final User Trial of Nag Missile

Final user trials of the 3rd generation Nag Anti-Tank Guided Missile (ATGM) was carried out on 22 October 2020 at the Pokhran ranges. The missile was integrated with the actual warhead and a tank target was kept at designated range, being launched from the Nag Missile Carrier NAMICA. The NAG missile carrier NAMICA is a BMP II based system with amphibious capability, and after final user trials the Nag will enter into production phase, produced by Bharat Dynamics Limited (BDL), whereas the Ordnance Factory Medak will manufacture the NAMICA.

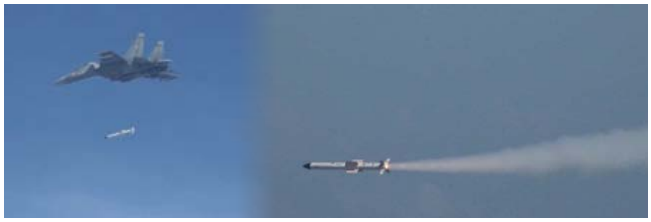
Indian Army test fires BrahMos in A&N

The BrahMos supersonic cruise missile was fired by an Indian Army unit from the Andaman and Nicobar Islands, "the target of the missile was on another island, which then hit its target." The Indian Army has a number of regiments equipped with the BrahMos supersonic missile whose strike range has been enhanced to over 400 km.

PSLV launches EOS-01 and nine customer satellites

On 7 November 2020, India's Polar Satellite Launch Vehicle, in its fifty first flight (PSLV-C49), successfully launched EOS-01 along with nine international customer satellites from the First Launch Pad of Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota. After 15 minutes and 20 seconds, EOS-01 was successfully injected into its orbit. Subsequently, nine commercial satellites were injected into their intended orbits. After separation, the two solar arrays of EOS-01 were deployed automatically and the ISRO Telemetry Tracking and Command Network at Bengaluru assumed control of the satellite.

RUDRAM flight tested



On 9 October 2020, the new generation, indigenously developed RUDRAM (anti-radiation missile) was successfully flight tested after launch from a Su-30MKI onto a radiation target located on Wheeler Island off the coast of Odisha. The RUDRAM is first indigenous anti-radiation missile of the country being developed by DRDO. This has INS-GPS navigation with Passive Homing Head for the final attack. The passive homing head can detect, classify and engage targets over a wide band of frequencies as programmed, a potent weapon for *Suppression of Enemy Air Defences.*

First of four new P-8Is for IN

On 18 November, the first of four new Boeing P-8I long range maritime patrol and ASW aircraft arrived at INS *Hansa*, Goa. The other three P-8Is, under the $ 1.1billion contract signed with the US in July 2016 are to be delivered in 2021 for eventual basing on the Western Coast of India. The earlier eight P-8Is equip INAS 312 at INS *Dega* in Arakonam (Tamil Nadu).

IN leases two MQ-9Bs

The Indian Navy has inducted two MQ-9B SeaGuardian RPAs for surveillance missions, on lease from General Atomics (GA-ASI). The two MQ-9Bs are presently based at INS *Rajali*, at Arakonam in Tamil Nadu

Although a US team is stationed at Arakonam for maintenance & training purposes, the Indian Navy controls all operations and data generated in the ISR missions. The one-year lease of the two drones from General Atomics, which is extendable by another

(GA-ASI file photo of the MQ-9B SeaGuardian)

year, is prelude to the IN's plan to procure 18-30 'hunter-killer' weaponised Sea Guardian or MQ-9 Reapers, with possible fast-track procurement of six of these.

Navy to lease auxiliary vessels and operational enablers?

The Indian Navy is looking to leasing certain military platforms under the new policy allowing lease of military hardware. Vice Chief of the Naval Staff, Vice Admiral G Ashok Kumar, while speaking at the symposium on "Leveraging leasing for force level maintenance & modernisation" organised by the FICCI, said leasing could mitigate short term capability gaps. The Navy looks to lease operational support and auxiliary vessels and these could be mine-sweepers, utility helicopters and unmanned platforms (UAV). Elaborating, the VCNS said that these could include vessels for coastal security patrols, minesweeping, seabed mapping, and auxiliary vessels such as tankers, barges and tugs. "We could also look at operational enablers such as utility helicopters unmanned vehicles and high speed aerial and surface targets for operational training".

INS *Vagir* launched

Indian Navy's fifth *Scorpene*-class submarine INS *Vagir* was launched on 12 November 2020 at Mumbai's Mazagon Dock. According to an official statement, Minister of State for Defence, Shripad Naik launched the submarine through video conferencing. The diesel-electric 1565-tonne INS *Vagir* is part of the six *Kalvari*-class submarines being built in India, designed by French naval defence and energy company DCNS (now Naval Group) and

built as part of Indian Navy's Project-75. The Indian Navy has so far commissioned two such submarines, INS *Kalvari* and INS *Khanderi* while INS *Karanj* is now in third phase of sea trials while the fourth, INS *Vela* has just begun these. The sixth, INS *Vagsheer* is likely to be commissioned by 2020.

Commissioning of Coast Guard Ship C-452

Indian Coast Guard Ship C-452, 52nd ship in the series of 54 Interceptor Boats was commissioned at Ratnagiri on 3 November 2020 via video conference. Equipped with state-of-the-art sensors including navigational and communication systems, the ship is capable of operating in tropical conditions with a maximum speed of 45 knots. The ship has been designed and built indigenously by Larsen and Toubro Shipyard Limited in Surat.

GSL 'ahead of schedule' delivery of new OPV

The second in the class of 5 Coast Guard Offshore Patrol Vessel (OPV), designed by GSL was delivered to the Indian Coast Guard on 12 November 2020. This largest and most advanced 105 meters long, new generation OPV was handed over to the Coast Guard in the presence of senior officers.

INS *Kavaratti* commissioned

The last of four indigenously built Anti-Submarine Warfare (ASW) stealth corvettes INS *Kavaratti* under Project 28 (*Kamorta*-class) was commissioned into the Indian Navy by General Manoj Mukund Naravane, COAS at Naval Dockyard, Visakhapatnam on 22 October 2020. INS *Kavaratti* has state-of-the-art weapons and sensor suite capable of detecting and prosecuting submarines. In addition to its anti-submarine warfare capability, the ship also has a credible self defence capability and good endurance for long-range deployments.

Commissioning of ICGS 'Kanaklata Barua'

Indian Coast Guard Ship *Kanaklata Barua* was commissioned at Kolkata on 30 September 2020 via video conferencing. This is the last in the series of five Fast Patrol Vessels (FPVs) designed & built indigenously by Garden Reach Shipbuilders & Engineers (GRSE) Ltd, Kolkata. The 49 m ship displaces about 310 tons, is propelled by three MTU 4000 Series engines designed to attain a maximum speed of 35 knots. A further 40 ships are at various stages of construction at different Indian Shipyards as also 16 Advanced Light Helicopters under production at HAL, Bengaluru for the Coast Guard.

Kongsberg to supply HUGIN AUV survey systems to GRSE

Kongsberg Maritime has announced the sale of four HUGIN AUV systems to Garden Reach Shipbuilders & Engineers Limited (GRSE), at Kolkata. This also includes HiPAP 502 high-accuracy acoustic positioning and communication systems to support AUV operations, to be installed on the four large survey vessels currently in build for the Indian Navy.

IIA Group launch customer for Airbus maintenance training

The Indian Institute of Aeronautics (IIA) Group has entered into an agreement with Airbus to use the training solution 'Airbus Competence Training (ACT) for Academy' in its curriculum. 'ACT for Academy' is a specific training software under Airbus' Training Services that aims at familiarising students with the latest Airbus aircraft technology and maintenance procedures, in a classroom environment.

L&T launch hardware for Gaganyaan Mission

Larsen & Toubro has delivered the first hardware, a booster segment, for Gaganyaan Launch Vehicle to ISRO ahead of schedule in a virtual flag-off ceremony presided over by Dr. K Sivan, Chairman, Indian Space Research Organisation (ISRO). The segment was produced at L&T's Powai Aerospace Manufacturing Facility meeting the enhanced quality and timeline requirements for India's maiden manned mission. The critical booster segment, with a diameter of 3.2 meters, 8.5 meters in length and weighing 5.5 tons, was jointly flagged off in a virtual event by Dr. K Sivan, Secretary Department of Space & Chairman ISRO and Mr Jayant Patil Director and Member of L&T board.

M&M exits aerospace subsidiary

Mahindra & Mahindra has announced its exit from Australian aerospace subsidiary Gippsland Aerospace as part of its evaluation process to reduce exposure to loss-making global subsidiaries. However, M&M will continue in the aerostructure business which provides components to major aircraft manufacturers.

SpiceJet plays key role

SpiceJet has operated 1,019 charter flights during the initial months of the Covid-19 pandemic, flying Indian and foreign nationals to and from India with some 175,000 passengers flown till early October. SpiceJet presently has a fleet of 74 Boeing 737s, 26 Bombardier Q-400s, 11 B737 & Bombardier Q-400 freighters and is the country's largest regional player operating 49 daily flights under UDAN or the Regional Connectivity Scheme. The FAA's recent clearance for scheduled flights by the Boeing 737MAX has come as a 'game changer' for SpiceJet which has 13 such aircraft in its fleet with another 37 being delivered.

IndiGo operates 100,000 flights since lockdown

On 11 November 2020, IndiGo, India's largest Airline, completed 100,000 flights since the lockdown. The tally includes scheduled commercial operations, passenger charters, CarGo charters, Air Bubble flights and repatriation flights under the *Vande Bharat* programme.

Virgin Hyperloop at Bangalore International Airport

Virgin Hyperloop, the category leader in hyperloop technology, and Bangalore International Airport Limited (BIAL), have signed a first-of-its-kind Memorandum of Understanding to conduct a feasibility study for the proposed Hyperloop corridor from Bangalore Airport. BIAL aims to make Bangalore's airport a transportation hub that connects people and places together through various modes of transport. In addition to its well-established road network, this will soon be connected with the sub-urban railway in few weeks and have Metro connectivity in four years.

APPOINTMENTS

S Anbuvelan is CEO of HAL Helicopter Complex

S. Anbuvelan has taken over as Chief Executive Officer (CEO) of HAL's Helicopter Complex prior to which he was heading the Helicopter Division as Executive Director. He had joined HAL as a management trainee (technical) in 1986 and has experience of 34 years in various key positions including productionision of ALH's integrated transmission assembly, ramping up production of ALH gear boxes, reduction of snags during equipping of ALH, training & development of employees, quality improvements in ROH of Cheetah and Chetak helicopters at Barrackpore, streamlining of ALH production and implementation of latest technologies in the field of manufacturing & assembly of helicopter products.

Air Marshal RJ Duckworth appointed as AOP

Air Marshal RJ Duckworth took over as Air Officer in charge Personnel at Air Headquarters on 1 October 2020. Commissioned into the fighter stream of the IAF on 29 May 1983, in his career spanning nearly 38 years, he has flown wide variety of fighter and trainer aircraft in the inventory of IAF including MiG-21s and MiG-29s.

Air Marshal Vikram Singh is SASO, WAC

Air Marshal Vikram Singh has taken over as Senior Air Staff Officer, Headquarters Western Air 1 October 2020. Commissioned into the fighter stream on 21 December 1984, he has flown a large number of aircraft types including MiG-21s and Mirage 2000s before undergoing the Flying Instructor's Course, Experimental Flight Test Course and Staff Course at Pretoria, South Africa. He has been with the National Flight Test Centre where he flew a large number of test flights of the Tejas LCA. He later commanded an Air Force Station, served in various staff appointments at Air Headquarters and was Air Attache at Moscow. He has also served at the Integrated Defence Staff Headquarters and was Assistant Chief of the Air Staff (Plans) at Air Headquarters.

Lt Gen PGK Menon takes charge of XIV Corps

Lt Gen PGK Menon has taken over as GOC of the Indian Army's Leh-based XIV ('Fire and Fury') Corps, which is dual tasked to face China in Ladakh and also Pakistan in the Dras-Kargil-Batalik and the Siachen sectors. He was commissioned into the 17th Battalion of the Sikh Regiment and is presently Colonel Commandant of the Sikh Regiment. In 2008, he was the Colonel GS (General Staff) of the 3rd Infantry Division headquartered at Leh which has responsibility for the LAC in Ladakh since 1963. As a Major General, he commanded the 71st Mountain Division in Arunachal Pradesh. "The officer has been born into the Army as the son of a Subedar. He has now risen to the top and is a proud moment for us as the Army," stated a senior Army officer.

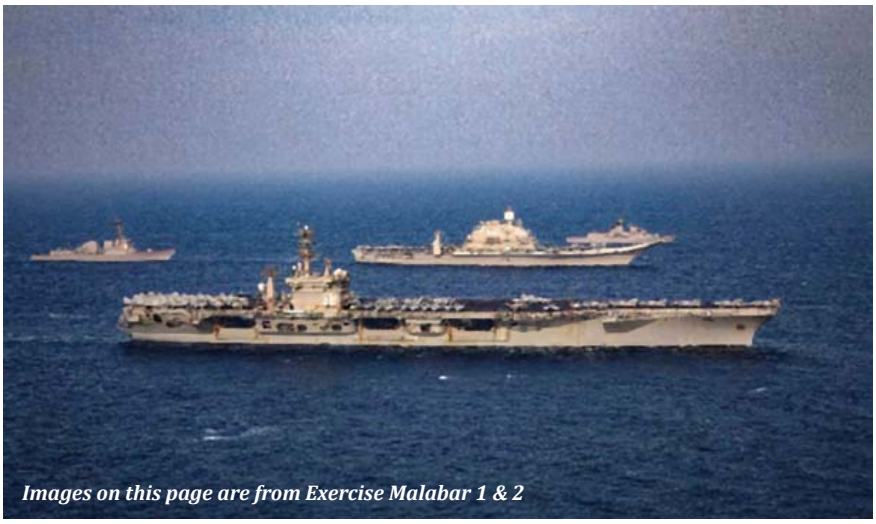
Flexing the Maritime Muscle

Indian Navy in multiple joint exercises

Exercising with 'friendly' maritime forces is not new to the Indian Navy, but in context of the ongoing face off with the Chinese in the high Himalayas, the series of naval exercises involving both the Eastern and Western Fleets for over two months from September 2020 is surely indicative of the resolve to strengthen India's maritime muscle. That China has taken serious note is clear from this Communist nations objection to what it terms as creation of an "Asian NATO".

India's clear message to China is that the maritime option will be exercised, if necessary, and is exemplified by Australia's participation in the annual naval exercises alongside the US and Japan. This has taken sometime since 2007 when the Indian Navy first invited maritime forces of Japan, Singapore and Australia to join its annual bilateral *Malabar* naval exercises with the United States. Surely having more 'friendly' Navies take part was logical in the geopolitical context of the present times, even though much time has passed since those initial Bay of Bengal Exercises. Meanwhile, the Chinese Navy has since grown exponentially and has acquired bases not only in Pakistan (both Karachi and Gwadar) but at Djibouti in the Horn of Africa while there is speculation about an arrangement with Iran which would have PLAN units positioned near the strategic Strait of Hormuz.

But back to the Indian Navy and its recent joint exercises.



Images on this page are from Exercise Malabar 1 & 2

Exercise Malabar-2020

The Malabar series of maritime exercises had commenced in 1992 as a bilateral IN-USN exercise, the JMSDF joining in 2015, and in 2020, the RAN was a participant. 24th edition of the Malabar naval exercise was conducted in two phases during November 2020. Phase 1 of the Exercise involved participation of the Indian Navy (IN), United States Navy (USN), Japan Maritime Self Defence Force (JMSDF) and Royal Australian Navy (RAN) and were carried out off Visakhapatnam in the Bay of Bengal from 3 to 6 November 2020.

The Indian Navy's participation was led by Rear Admiral Sanjay Vatsayan, FOC Eastern Fleet and IN units participating included the guided missile destroyer INS *Ranvijay*, frigate INS *Shivalik*, OPV INS *Sukanya*, Fleet Support Ship INS *Shakti* and submarine INS *Sindhuraj*. In addition, the Indian Navy deployed BAE Hawks, Boeing P-8Is, HAL-Dornier 228s and some helicopters.

The Indian Navy units exercised with USS *John S McCain* (guided-missile destroyer), HMAS *Ballarat* (long range frigate) with its integral MH-60 helicopter and the JMSDF's *Onami* (destroyer) with its integral SH-60 helicopter. Malabar 20 Phase1 witnessed complex and advanced naval exercises including surface, anti-submarine and anti-air warfare operations, cross deck flying, seamanship evolutions and weapon firing exercises.

The exercise, conducted as a 'non-contact, at sea only' exercise in view of the COVID-19 pandemic, showcased high-levels of synergy and coordination between the friendly navies, "which is based on their shared values and commitment to an open, inclusive Indo-Pacific and a rules-based international order".

All images above are from Exercise Malabar - 2020

Second phase of Exercise *Malabar* 2020 was conducted in the Northern Arabian Sea, from 17 to 20 November 2020, taking forward the synergies achieved in Phase-1 conducted in the Bay of Bengal. The Second phase involved coordinated operations of increasing complexity between the navies of Australia, India, Japan and the United States and was centered around the INS *Vikramaditya* Carrier Battle Group of the Indian Navy and the USS *Nimitz* Carrier Strike Group of the US Navy. The two carriers, along with other ships, submarines and aircraft of the participating navies, engaged in high intensity naval operations over four days, exercises including cross-deck flying operations and advanced air defence exercises by MiG-29K fighters of the *Vikramaditya* and F-18 Super Hornets fighters and E-2C Hawkeyes from USS *Nimitz*. In addition, advanced surface and anti-submarine warfare exercises, seamanship evolutions and weapon firings were undertaken "to further enhance inter-operability and synergy between the four friendly navies".

Apart from the INS *Vikramaditya* with its fighter and helicopter air-wings, the IN's guided missile destroyers INS *Kolkata* and INS *Chennai*, stealth frigate INS *Talwar,* Fleet Support Ship *INS Deepak* with their integral helicopters also participated in the exercise, led by Rear Admiral Krishna Swaminathan, FOC Western Fleet. The submarine INS *Khanderi* and P-8Is of the Indian Navy were very much also involved.

The US Navy›s Strike Carrier USS *Nimitz* was accompanied by cruiser USS *Princeton* and destroyer USS *Sterett* in addition to P-8A aircraft operating from shore bases. The Royal Australian Navy was represented by the frigate HMAS *Ballarat* with its integral helicopter, and the JMSDF also participated.

The Indian Navy had begun joint exercises earlier, having undertaken a *Passage Exercise* (PASSEX) with the Royal Australian Navy (RAN) in the East Indian Ocean Region from 23 to 24 September 2020. The exercise involved participation of HMAS *Hobart, INS Sahyadri* and INS *Karmuk*. In addition, IN P-8Is and helicopters from both Navies participated in the Exercise, aimed at "enhancing interoperability, improving understanding and imbibing best practices from each other, involving advanced surface and anti-air exercises including weapon firings, seamanship exercises, naval manoeuvres and Cross Deck Flying Operations".

The two images above are from Exercise PASSEX

JIMEX 20

In the wake of PASSEX was 4th edition of the India - Japan Maritime bilateral exercise JIMEX, held in North Arabian Sea from 26 to 28 September 2020. Naval cooperation between India and Japan has increased in scope and complexity over the years. Advanced level of operations and exercises carried out during JIMEX-20 were indicative of "the continued upswing in Indo-Japanese defence relations and continued efforts by both Governments to work closely for a more secure, open and inclusive global commons, in accordance with international regulations".

JIMEX 20 was spread over three days and conducted in a 'non-contact at-sea-only format', in view of COVID-19 restrictions. The Indian Navy's guided missile destroyer INS *Chennai*, stealth frigates INS *Teg* and *Tarkash* and Fleet Tanker *INS Deepak*, under command of Rear Admiral Krishna Swaminathan, FOC Western Fleet, represented the Indian Navy. The Japanese Maritime Self-Defense Force was represented by JMSDF ships *Kaga*, an *Izumo*-class *Ikazuchi*, destroyer, led by Rear Admiral Konno Yasushige, Commander Escort Flotilla–2 (CCF-2). In addition to ships, P-8I Long Range Maritime Patrol Aircraft, integral helicopters and MiG-29Ks also participated in the exercise.

The two images above are from Exercise JIMEX

Exercise Bongosagar

Second edition of the Indian and Bangladesh Navy Bilateral Exercise *Bongosagar* took place in the northern Bay of Bengal on 3 October 2020, aimed at developing inter-operability and joint operational skills through conduct of a wide spectrum of maritime exercises and operations. This exercise was followed by the 3rd edition of IN-BN Coordinated Patrol (CORPAT) in the Northern Bay of Bengal from 4 to 5 October 2020, wherein IN and BN units undertook joint patrolling along the International Maritime Boundary Line (IMBL).

Taking part were INS *Kiltan*, the indigenously built ASW Corvette and Guided-Missile Corvette INS *Khukri*, along with Bangladesh Naval Ship (BNS) guided-missile frigate *Abu Bakr* and a guided-missile corvette BNS Prottoy. In addition to the ships, Maritime Patrol Aircraft from both navies and integral helicopters also participated in the exercise, including HAL-Dornier 228s and RUAG Do 228s.

SLINEX-20

Shortly thereafter eighth Edition of annual the Indian Navy – Sri Lanka Navy bilateral maritime exercise SLINEX-20 off Trincomalee, Sri Lanka from 19 to 21 October 2020. The Sri Lanka Navy was represented by SLN ships *Sayura* and *Gajabahu* led by Rear Admiral Bandara Jayathilaka. The Indian Navy had its ASW corvettes INS *Kamorta* and INS *Kiltan* under the command of Rear Admiral Sanjay Vatsayan, FOC Eastern Fleet. IN ALHs and Chetaks embarked onboard the *IN* ships plus HAL-Dornier 228 MPAs also participated.

SLINEX-20 aims to enhance inter-operability, improve mutual understanding and exchange best practices and procedures for multi-faceted maritime operations between both navies….. "and exemplifies the deep engagement between India and Sri Lanka which has strengthened mutual cooperation in the maritime domain".

CORPAT

As part of Government of India's vision of SAGAR (*Security And Growth for All in the Region*), the Indian Navy has been assisting countries in the Indian Ocean Region with EEZ Surveillance, Humanitarian Assistance and Disaster Relief (HADR), other capacity building and capability-enhancement activities, on their request. "India and Thailand have especially enjoyed a close and friendly relationship covering a wide spectrum of activities and interactions, which have strengthened over the years".

30th edition of India-Thailand Coordinated Patrol (Indo-Thai CORPAT) between the Indian Navy and the Royal Thai Navy took place 18–20 November 2020. INS *Karmuk*, the indigenously built missile corvette and His Majesty's Thailand Ship (HTMS) *Kraburi*, a *Chao Phraya*-class frigate along with Dornier 228 MPAs from both navies participated in the CORPAT.

The two navies have been conducting CORPAT along their International Maritime Boundary Line twice a year since 2005, with the aim of keeping this vital part of the Indian Ocean safe and secure for commercial shipping and international trade. "Build up understanding and interoperability between navies and facilitates institution of measures to prevent and suppress Illegal Unreported Unregulated (IUU) fishing, drug trafficking, maritime terrorism, armed robbery and piracy. It further enhances the operational

Image from Exercise CORPAT

synergy by exchange of information for prevention of smuggling, illegal immigration and for conduct of SAR operations at sea".

SITMEX-20

Thereafter, was Exercise SITMEX-20 during 21-21 November 2020 in the Andaman Sea where Indian Navy ships including ASW corvette INS *Kamorta* and missile corvette INS *Karmuk* participated in 2nd edition of the India, Singapore and Thailand Trilateral Maritime Exercise. The RSN was represented by its *Formidable*-class frigate *Intrepid* and *Endurance*-class landing ship tank *Endeavour* and the RTN by *Chao Phraya*-class frigate *Kraburi.*

First edition of SITMEX, hosted by Indian Navy had taken place off Port Blair in September 2019, the SITMEX series of exercises being conducted "to enhance mutual inter-operability and imbibing best practices between IN, Republic of Singapore Navy (RSN) and Royal Thai Navy (RTN)".

The exercise, was conducted as a 'non-contact, at sea only' exercise in view of COVID-19 pandemic to highlight growing synergy, coordination and cooperation in the maritime domain between the three friendly navies and maritime neighbours. The two days of maritime drills had the three navies participate in a variety of exercises including naval manoeuvres, surface warfare exercises and weapon firings.

Exercise SITMEX

Exercise SIMBEX-20

Then the 27th edition of India-Singapore Bilateral Maritime Exercise SIMBEX-20 from 23 to 25 November 2020 in the Andaman Sea. These have been conducted annually since 1994, aimed at "enhancing mutual inter-operability and imbibing best practices from each other". The scope and complexity of these exercises has increased steadily over the past two decades to include advanced naval drills covering a wide spectrum of maritime operations.

The 2020 edition of SIMBEX had participation of various Indian Navy warships, including destroyer INS *Rana* with integral Chetak helicopter and corvettes INS *Kamorta* and *Karmuk.* In addition, the submarine INS *Sindhuraj* and P-8I maritime reconnaissance aircraft also participated in the exercise. The RSN was represented by its *Formidable*-class frigates *Intrepid* and *Steadfast* with integral S 70B helicopter and 'Endurance' class landing ship tank *Endeavour*.

SIMBEX-20 included surface, anti-air warfare and anti-submarine warfare exercises including weapon firings, over three days of intensive joint operations at sea.

Air Marshal (R) M Matheswaran on

A third aircraft carrier for India

INS Vikramaditya (image from the internet)

Budget versus Necessity

The Indian military is undergoing what may be its most significant reorganisation since India's independence, with considerable implications for its future strategic posture. One important issue that has been brought to the fore is the role of the Indian Navy as a regional power projection force built around three aircraft carriers. The government's decision on this issue will have significant implications for the region.

The Indian Navy currently operates one carrier, the 45,000 tonne Russian-origin INS *Vikramaditya,* with a second, the indigenous 37,500 tonne INS *Vikrant*, having just entered sea trials, both being 'ski-jump' carriers. But the Indian Navy regards a third, conventional 'flat-topped' aircraft carrier, which is planned to be of 65,000 tonne displacement for superior power projection capabilities, as an absolute necessity.

The Indian Navy's plans for a three-carrier based force structure, first proposed in the early 2000s, has been accepted in principle. This would allow the navy to operate two carrier task groups at all times, with a total fighter strength of more than 150 aircraft.

However, India's new Chief of Defence Staff General Bipin Rawat, who took office in January 2020, has stated that budgetary constraints will force the navy to defer plans for the third carrier. Some in the government see the third aircraft carrier as a "frightfully expensive white elephant" arguing that India can ill-afford such expenditure on one single platform when there are many other requirements crying for immediate attention.

This view is reinforced by India's bitter experience in acquiring the *Vikramaditya* from Russia, when the original price rose from US $ 974 million to $2.35 billion. Together with 45 MiG-29K aircraft and additional modifications, the overall price came to somewhere between $6 billion and $7 billion.

This experience has been compounded by delays and escalating costs of the first Indian-built aircraft carrier, the *Vikrant*, which is already more than five years behind schedule. With cost overruns and 36 aircraft, the total price is likely to be $10–11 billion. The third proposed carrier, (INS *Viraat*, although many refer to this as the *Vishal*), still in conceptual stages, is expected to cost $6–8 billion and take 10–14 years to build. Including its air component of Super Hornets or Rafale Ms at current prices, the total cost is likely to be in the order of $16–17 billion.

General Bipin Rawat has given hints at his priorities in view of likely budgetary constraints over the next few years. His focus is on strengthening the land defences

against China and Pakistan and hence his priority is for the army, followed by the air force. The army certainly has urgent requirements for long-pending infantry weapons, artillery and modernisation of the strike corps requirements. The Indian Air Force's combat squadron strength is down to 32, well below its projected operational requirement of 42 squadrons. In his view, the navy should focus on submarines and smaller surface ships, principally in a defensive role. In his capacity as the military advisor to the government and as secretary of the newly created Department of Military Affairs, in addition to his primary role as the permanent chairman of the Chiefs of Staff Committee, General Rawat's views could well carry the day.

However, India's rising stature, its geopolitical interests and its role as a net security provider in the Indian Ocean region necessitate a strong navy with significant reach and power projection capabilities. Carrier-based airpower is a critical component in responding to contingencies rapidly at extended ranges and would complement land-based air power. With China accelerating its aircraft carrier developments, this country will be able to deploy a carrier task group in the Indian Ocean sooner rather than later. The IN's third carrier, therefore, assumes great importance for India's maritime strategy.

The Indian Navy has been operating 'ski-jump' carriers for nearly four decades, which provide significant cost savings but have major operational constraints. Currently, the *Vikramaditya* operates a maximum of 24 MiG-29K fighters, along with six helicopters for anti-submarine warfare and other tasks. At least 70% of *Vikramaditya's* resources go into its own air defence, leaving very little for long-range strike. INS *Vikrant*'s position will be similar. More importantly, ski-jump carriers are handicapped by their inability to launch heavier platforms, such as airborne early warning aircraft.

The proposed third carrier would be a flat-top with catapult assisted take off (CATOBAR) capability, which could include the revolutionary electromagnetic launch system, or EMALS. This carrier would have a sizeable air component of 70–80 aircraft, multi-role fighters, helicopters and AEW aircraft, giving it a significant strike capability with long reach.

An aircraft carrier with the Electromagnetic Aircraft Launch System (EMALS)

Concerns of the government around the budget should therefore be seen in perspective. The costs of the project would be spread over 10–14 years, which would make it more "manageable". There certainly are important implications for India's security which cannot be quantified as necessary skill sets must continue to be maintained.

Time is of the essence if the third carrier is to move forward, even as new disruptive concepts and technologies are likely to emerge to challenge the economic and operational viability of aircraft carriers. New technological developments have enabled the possibility of more agile and faster ships, submarines, a spectrum of unmanned vehicle technologies – be they aerial, surface, underwater or autonomous – which will dominate maritime operational strategies with new dimensions of cost effectiveness for better reach, flexibility and application of force. Artificial intelligence–influenced operational concepts such as swarming could make the use of drones the most important element in naval warfare of the future.

The third aircraft carrier is regarded as a vital necessity for the Indian Navy, given the current tensions with China, but with the Indian government delaying decisions, the chances of a decision favourable to the navy could be receding.

General Atomics EMALS is on USS Gerald R. Ford (Photo by MCS2 Ridge Leoni/U.S. Navy/UPI)

Project 75 India:
A new era of submarine warfare

In the quest of becoming a twenty first century blue water navy, India has taken a number of initiatives to exponentially expand its naval assets. This can only be successful with a powerful fleet of modern submarines, a large fleet of which will not only protect Indian interests in the Bay of Bengal, Indian Oceanic Region and the Arabian Sea but maintain dominance from the Malacca Strait or beyond to the East Coast of Africa, assuring India's security.

In 1997, the Ministry of Defence approved a plan to acquire 24 submarines under Project 75. Later the plan was changed and along with a new refurbished Project 75, the new Project 75I (for India) was initiated, the aim being to establish two production lines to build twelve boats using transfer of technology from different foreign manufacturers. Submarines to be built under P-75I will be more advanced than the *Kalvari*-class submarines currently being manufactured under the P-75, and will be equipped with air-independent-propulsion (AIP) allowing much longer under water endurance also featuring vertical launch system enabling launch of land attack cruise missiles.

In October 2014, the Defence Acquisition Council cleared the P-75I with an approved budget of Rs. 53,000 crore. State-owned Mazagon Dock, Hindustan Shipyard and Cochin Shipyard, privately owned Larsen & Toubro and Pipavav Shipyard have been shortlisted to bid for the project in collaboration with a foreign shipyard.

According to latest reports following are the likely contenders for the project:

Russia

According to reports, Russia has indicated an undisclosed system based on the *Amur* 1650 as an official contender for the multi-billion dollar project. The *Amur* 1650 is an export version of the Project 677 *Lada*-class submarine whose latest unit, the *Kronshtadt* was recently been inducted in the Russian Navy and four more units are likely to be commissioned. The fourth generation diesel-electric submarine with future fifth generation *Kalina*-class will bolster the conventional submarine fleet of Russian Navy. *Amur*-class from Rubin Central Design Bureau has been developed mainly for exports, essentially to India or China. Rubin's parent company United Ship Corporation is offering this in partnership with an Indian company.

Deputy Director General for foreign activities of Rubin Design Bureau, Andrei Baranov said that the Amur 1650 is an advanced conventional submarine capable of fulfilling any mission required from this class of submarines "whereas P75I is an Indian specific submarine, with its own particular requirements and it is therefore another project." However, the prototype for this would be the *Amur* 1650, with displacement of 1650 tonnes when surfaced, a length of 66.7 meters, range of 6000 km and endurance of 45 days.

Germany

According to reports, Thyssen Krupp Marine Systems (TKMS) is offering six *Invincible*-class submarines. The *Invincible-class* or Type 218 is built by Howaldtswerke-Deutsche Werft (HDW) and is the latest conventional platform from Germany, with Singapore as first customer of the type. The 75m long submarine has a surface displacement of 2200 tonnes and an endurance of 84 days, and believed by some experts to feature the Li-Ion battery as well. The previous offer from TKMS was for the Type-214 (an export variant of Type 212).

As TKMS India Managing Director Gurnad Sodhi stated, "Virtually no shipyard in the world has more experience in designing and constructing conventional submarines than does TKMS Business Unit HDW". While praising its anti-surface and

Developed by Russia's Rubin is the Amur 1650 submarine

Invincible Class or Type 218 submarine being launched for the Singapore Navy

anti-submarine capability, Sodhi reiterated that its AIP is the "best available in the market".

Spain

The Spanish defence industry, especially its naval sector, has an enviable reputation. Navantia is offering *Isaac Peral*-class, the S-80 Plus/Flight 2 submarines, with air-independent-propulsion developed jointly by Spanish company Abengoa and American Collins Aerospace. The submarine has a length of 80.81 m, displacement of 2695 tonnes and endurance of 50 days. In future, the platform would be able to operate UAVs, UUVs and AAWs. Navantia is also exploring options to install Li-Ion battery, thus greatly enhancing the capability.

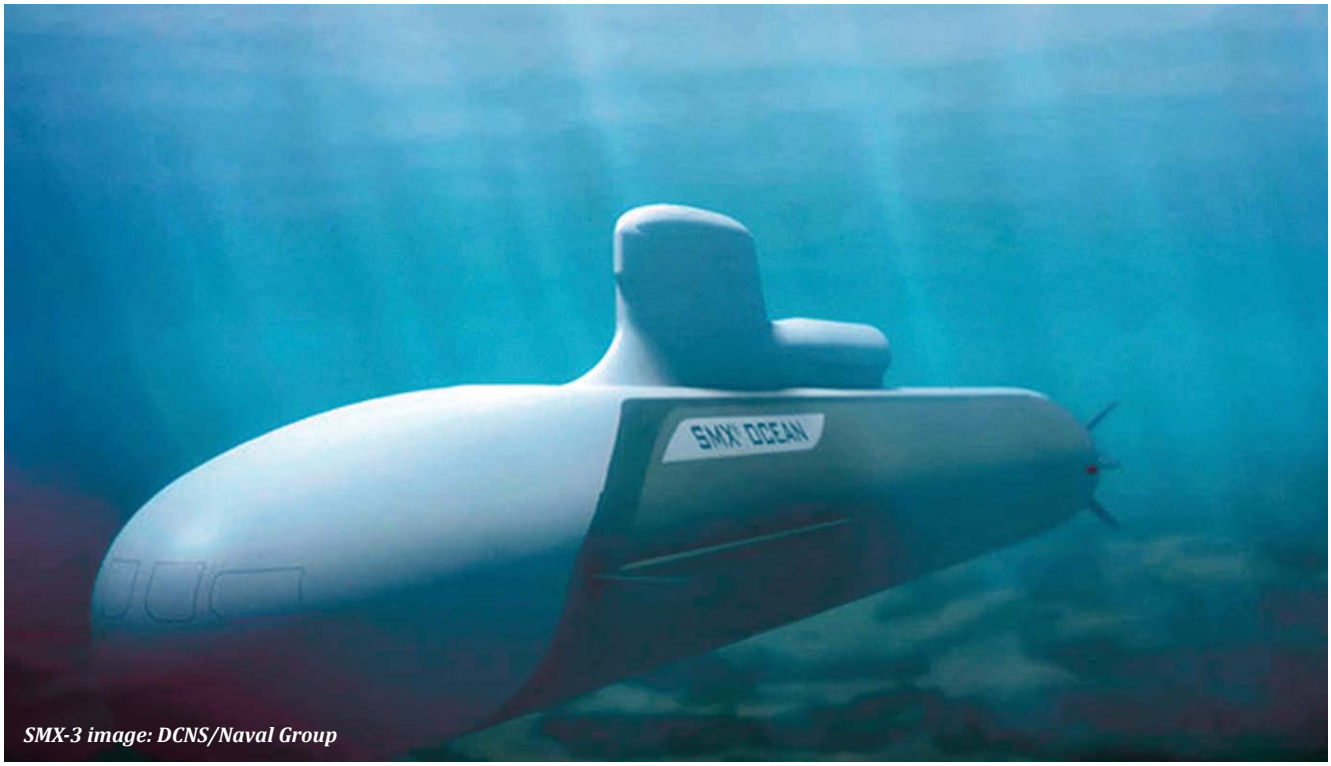
South Korea

The Dosan Anh *Changho*-class is likely to be a contender from South Korea. This advanced submarine from Daewoo Shipbuilding & Marine Engineering (DSME) was developed for the South Korean Navy, and will later also feature Li-Ion batteries. According to reports, the Batch III will be offered to the Indian Navy, the most advanced version of the class, and likely to feature a High-Temperature Superconductor (HTS) motor for integrated full electric propulsion system as well. The 83.5 m long submarine will have a displacement of 3358 tonnes and an endurance of 50 days. However this submarine will only be ready by 2025.

France

India's Mazagon Dock Limited is presently manufacturing six *Kalvari*-class submarines under transfer of technology, which is a modified version of *Scorpene*-class originally designed by *Direction des Constructions Navales* or DCNS (and now renamed as the Naval Group). "The close cooperation between India and France in enhancing India›s naval capability has definitely given France better chance than any other contender in this project", according to company officials. Initially an enlarged version of the *Scorpene*-class was offered, but now offered is the SMX 3.0, one of the latest conventional platforms developed. It is 85 m long and has a surface displacement of 3000 tonnes. The French FC2G AIP

Navantia's S-80

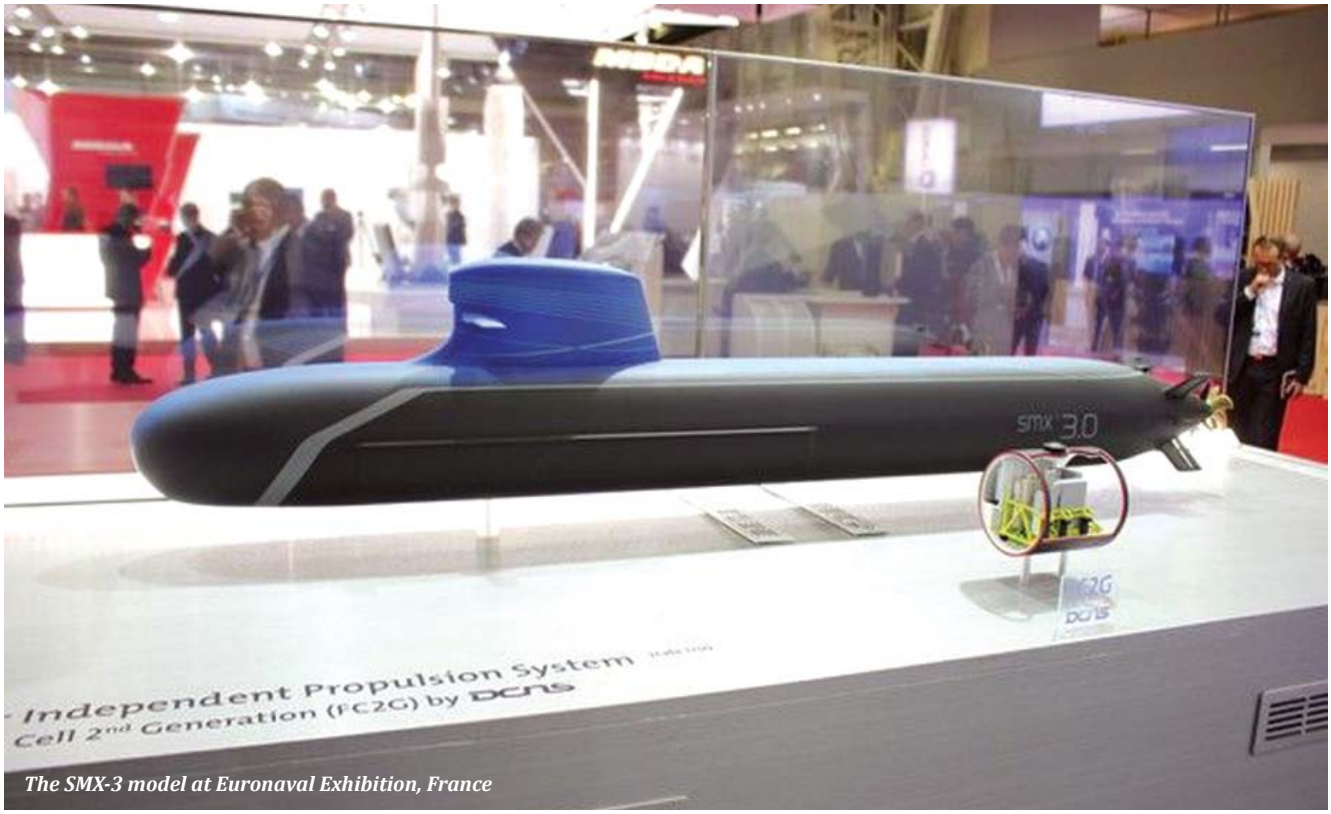


SMX-3 image: DCNS/Naval Group

gives it an endurance of 45 days. Along with the F21 torpedo and SM 39 Exocet tube launched cruise missile, France has recently offered the Naval Cruise Missile for land attack purposes.

Larsen & Toubro and Mazagon Dock Shipbuilders have been shortlisted as the two Indian firms who will eventually work with one of the selected five foreign firms to manufacture the platform in India. The request-for-proposal is expected to be released soon.

Sankalan Chattopadhyay
(Twitter @VinodDX9)



The SMX-3 model at Euronaval Exhibition, France

Launching of INS *Vagir*, 5th *Kalvari*-class submarine

INS *Vagir* was launched on 12 November 2020, the fifth P75 *Scorpene*-class submarine built entirely by Mazagon Dock Shipbuilders Limited (MDL), following years of technology transfer and partnership with Naval Group.

Following commissioning of INS *Khanderi* in September 2019 and launch of INS *Vela* in May 2019, the *Vagir*, fifth of the series of six *Kalvari*-class submarines ordered by India in 2005, was launched, completely built by Mazagon Dock Shipbuilders Limited (MDL) through a transfer of technology from Naval Group, in line with Indian Government's "Make in India" policy. This series of six submarines are fitted with equipment built in India by qualified and highly trained industrial Micro, Small and Medium enterprises (MSMEs) which form the sound basis of the Indian submarine building ecosystem.

"Naval Group is proud to be part of first of its kind P75 *Kalvari* programme to deliver entirely "Made in India" submarines to the Indian Navy. The P75 programme is a major element of the strategic Indo-French partnership developed over the last decades. This launch, amidst Covid-19 challenges, represents a new milestone for this unique industrial programme and illustrates the Aatmanirbharta (self-reliance) of Indian Navy and industry", stated Alain Guillou, Senior EVP - International Development at Naval Group.

The *Scorpene* is a conventional-propulsion submarine designed and developed by Naval Group for all types of mission, such as surface warfare, anti-submarine warfare, long-range strikes, special operations or intelligence gathering. Stealthy and fast, its level of operating automation allows for a limited crew which reduces its operating costs significantly, its combat edge highlighted by the fact that it has 6 weapon launching tubes and 18 weapons (torpedoes, missiles, mines).

With 14 submarines sold internationally by Naval Group, the *Scorpene* is an essential reference product in the area of conventional attack submarines (SSK) for Navies across the world and can be adapted to meet special needs of international navies.

Naval Group is present in India through its 100% subsidiary Naval Group India. Established in September 2008, Naval Group India's mission has been to support the indigenisation of equipment for Scorpene submarine, to develop the Indian defence eco-system, as well as to develop design services in India with talented Indian engineers. Naval Group India endeavours to be a visionary and to further its involvement in empowering more industries by creating a robust eco-system that can cater to the varied defence needs of the country.

Courtesy Naval Group

Sea Ceptor CAMM launch

Exocet

MBDA: Excellence on the Indian Navy's side

As the Indian Navy patrols the seas, it has excellence on its side, with high-performance missile systems from MBDA such as the Exocet on board its new *Kalvari*-class submarines. "MBDA is proud of its long history of supporting the Indian Navy and joins the service in celebrating Navy Day."

Just as important as is its proud history with the Indian Navy, are MBDA's industrial partnerships in India. MBDA has been working in close partnership with Indian industry for over 50 years, building missile technologies in India and assisting with the development of a sovereign Indian missile industry, both in the public and private sector.

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 new 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. The JV's offer of Sea Ceptor, the next generation of naval air defence system, is its RFP response for the Indian Navy's Short-Range Surface to Air Missile (SRSAM) requirement, and has been offered with the aim to 'Make in India'.

Sea Ceptor utilises the CAMM missile that features a next generation all-weather RF-seeker, two-way datalink and soft-vertical launch system to provide a step-change in performance compared with previous generation systems able to protect Indian vessels from attacks from fast sea-skimming missiles simultaneously attacking from multiple directions. Sea Ceptor provides easy platform integration and significant space, weight and safety benefits compared with the older systems.

Sea Ceptor is a high-performance and modern air defence system available in the market today and has been by chosen by several navies including the UK, New Zealand, Canada, Chile and Brazil, amongst others.

L&T MBDA Missile Systems Ltd is also offering Exocet MM40 Block 3 for the Indian Navy's Medium Range Anti-Ship Missile (MRAShM) requirement, the latest version of the venerable Exocet missile already in service with the Indian Armed Forces, having improved electronics and an extended range. The Exocet family of missiles comprises a range of standoff 'fire and forget' stealthy missiles, with skimming flight for engaging high-value naval targets. They have the flexibility of launching from all maritime platforms: surface ships, submarines, fixed-wing aircraft, helicopters and coastal batteries.

MBDA also has a full spectrum of missile systems to meet requirements of naval helicopters. For long-range requirements, MBDA's offers the well-known and combat proven Exocet AM 39 missile, Marte ER provides excellent extended medium range capability, while Sea Venom/ANL provides unrivalled fire-and-forget or operator above the loop ability to engage multiple targets at short to medium ranges in open waters or even challenging littoral environments.

For the Indian Navy's Special Forces ATGM requirements, L&T MBDA Missile Systems Ltd is offering the world's only true 5th Generation Anti-Tank Missile as an Indian Designed, Developed and Manufactured (IDDM) product under the *Make in India* programme. ATGM5 offers many unique capabilities, being truly network enabled, a multipurpose warhead with selectable effects and high-performance seeker technologies. It is proven for use in the maritime environment from small Special Forces vessels.

"MBDA understands the importance of operational capability and sovereignty to the Indian Navy and is proud to deliver it. That is why MBDA is strongly committed to 'Make in India' with the level of investment made for both industrial sovereignty and the best of equipment to ensure India's maritime superiority."

Article by Boris Solomiac, General Delegate, MBDA India

The top 10 weapons of India's Navy

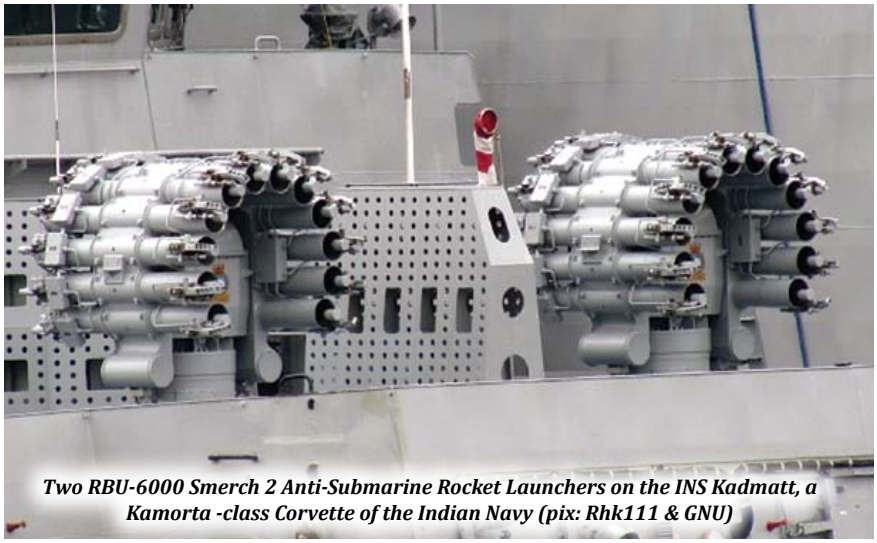
What is a naval ship without its armament?! Here are top ten weapon systems of the Indian Navy either inducted, or soon to be, which will be a major deterrence for potential adversaries!

(photo: Vayu)

Brahmos: We begin with the Brahmos! This ramjet-propelled supersonic Anti-Ship/Land Attack Cruise Missile jointly developed by Russia and India with sea-skimming capability defeats air defence systems and strikes targets at long distances with high accuracy. At a speed of Mach 3, the BrahMos can sink enemy ships in a single salvo owing to its high kinetic energy. This mainstay of the Indian Navy can be launched from an Universal Vertical Launcher Module (UVLM) and will be deployed by P-75I submarines as well. Range of the missile will be gradually increased to 600 km and

The Brahmos NG on LCA Tejas at Aero India 2019

The RBU-6000 seen on a Russian Navy warship (pix: mil.ru & GNU)



Two RBU-6000 Smerch 2 Anti-Submarine Rocket Launchers on the INS Kadmatt, a Kamorta -class Corvette of the Indian Navy (pix: Rhk111 & GNU)

later 900 km. The hypersonic version being developed will surely be the game changer for India's armed forces in the future.

BrahMos NG: this lighter version under development is designed for launch from torpedo tubes of submarines and is expected to be ready in the next four years. From P-75I submarines, BrahMos will be launched from the UVLM for land-attack roles and this lighter version also used for anti-ship tasks. The lighter, air-launched version will be carried by MiG-29Ks of the Indian Navy, as well as future carrier borne fighter aircraft.

K-4: This nuclear-tipped Submarine Launched Ballistic Missile (SLBM) has a range of 3500 km and will be deployed on *Arihant*-class SSBN, indigenously developed in India. The long range missile will enable the Indian Navy to target major strategic targets while remaining out of their strike range. After several successful tests, the last development trial was conducted this year on 24 January. According to the latest reports this is ready for induction into the forces. The next challenge will be to develop a 5000 km-range SLBM.

RBU-6000: This 213 mm anti-submarine rocket launcher widely used by the Indian Navy fires RGB-60 rockets with a range of 5500 metres. The ARDE has recently developed the Extended Range Anti-Submarine Rocket (ER-ASR) to enhance range of the existing RGB-60 Anti Submarine Rocket from 5.3 km to 8.0+ km. The ER-ASR consists of two motor propulsion systems which can fire the rocket in both Short Range and Long Range modes with different range capabilities, from 500 m to 8900 m.

Varunastra Torpedo: This indigenous heavy weight torpedo has been developed by the Naval Science and Technological Laboratory (NSTL). This ship-launched, electrically-propelled platform is capable of targeting stealthy submarines, both in deep and shallow waters in an intense countermeasures environment. The submarine-launched version is under development and will be "one of the most advanced torpedoes in the world". With a speed of 74 kmph, it is currently the third fastest torpedo in the world and can attain a depth of 400 mtrs. It has a dual guidance system which includes wire-guidance and active-passive acoustic homing. A fibre-optic channel is to be developed for the submarine launched version which will feature an improved front-end seeker. To avoid enemy countermeasures, this can be guided with the help of Global Positioning System (GPS). The *Varunastra* is claimed to be the first torpedo in the world with such technology.

(photo: Vayu)

(photos: Vayu)

Long Range Long Attack Cruise Missile: The LRLACM was unveiled at DefExpo 2020 *(see above)* and according to reports, this new system will have a range of 1000 km launched from a UVLM and some 20 development flight trials are planned. The subsonic missile will complement the hypersonic BrahMos in long range operations. A 1500 km version will reportedly be developed in the future.

Supersonic Missile Assisted Release of Torpedo (SMART): Successful maiden-test of the SMART took place on 5 October 2020. With a 650 km strike range, Indian Navy ships are now capable of engaging far off submarines, with SMART sinking an enemy submarine before the crew knows what hit them! Once developed, the Indian Navy could saturate enemy ports, quickly and effectively. The system is currently equipped with a light weight torpedo but soon it will feature a heavier weight one.

Naval Strike Missile: Developed by Kongsberg, the advanced platform will come in a package with the MH-60R multi-role helicopter, having has a range of 185 km. It will be difficult to detect this incoming missile because of its sea skimming capability.

NASM-SR: Existence of the NASM-SR was revealed in 2018 when, in the Lok Sabha, the RM Nirmala Sitharaman named this in the list of DRDO developments. Initial details of this much speculated platform were unveiled at DefExpo 2020 and according to DRDO, the NASM-SR will be a 380 kg projectile with a maximum range of 55 km. Later, a longer range version will be developed as well; once developed and will complement the Naval Strike Missile.

Long Range Surface to Air Missile: The LRSAM will give 'absolute protection' to Indian warships, this potent air defence system not only capable of engaging enemy fighter aircraft at a range of 100 km but also thwart ballistic, cruise and drone strikes. This is jointly developed by the Defence Research and Development Organisation (DRDO) and Israel Aerospace Industries (IAI). The LRSAM along with future short range air defence system and Close-in Weapon System (CIWS) will form an excellent shield for the Indian warships. A 150 km range version is under development.

The Barak-8 or the LR-SAM/MR-SAM is jointly being developed by DRDO and IAI.

This review is not comprehensive but an overview of the Indian Navy's offensive and defensive capabilities; with rapid modernisation the Navy, there will surely be more modern systems being inducted. It is heartening that most of the weapon systems that the Navy is inducting are indigenous as self-reliance is what India is aiming for and slowly, but surely, this seems to be becoming a reality!

Sankalan Chattopadhyay
(Twitter @VinodDX9)


(photo: DRDO)

VAYU Interview with

Michael Koch, VP, Boeing Defence, Space & Security, India

VAYU : Boeing has strengthened its defence business in India with many of its platforms now with the Indian armed forces. What is your perspective on the Indian market? Where does Boeing see itself some years from now?

BOEING: India's defence sector is poised for growth and Boeing is committed to supporting and enabling this progress. Boeing has had a presence in the country for over 75 years now, and we have had many 'firsts' with India: the first international customer for the P-8, the largest international operator of C-17s and the Harpoon missile was the first US weapon system on an Indian-built fighter.

The future looks promising and we continue to see several opportunities in India. We are engaged with our defence customers on their requirements for the Air Force's Multi-Role Fighter Aircraft (MRFA) and the Navy's Carrier-Borne Fighter programme. Earlier this year, the Ministry of Defence signed the contract for acquisition of an additional six Apaches for the Indian Army – much of these aircraft are built in Hyderabad. We are also seeing the growth in our localisation of MRO services and training, and the value Boeing is able to provide through the lifecycle of its products. We work with the Indian Air Force and the Indian Navy to provide exceptional operational capability and readiness to the P-8Is, C-17s, and Head of State aircraft through local sustainment services in India.

Boeing is also providing pilot training for the Indian Air Force fleet of C-17 aircraft while construction is underway in another facility for training Indian Navy pilots on the P-8I. We are big advocates on "for India, by India" which is our nickname for localisation to tap into the talent and innovation in India to sustain, train and produce these systems. Also, there are exciting developments in India's space arena that allow the private sector to carry out space activities like building rockets, satellites and providing launch services is positive. We admire India's strides in space exploration and ambitious plans for human space flights before August 2022 and want to support ISRO's mission.

Today, with 11 C-17s, eight P-8Is with four more on order, 22 AH-64 Apaches with six more on order and 15 CH-47 Chinooks, India is at the front and centre of Boeing's business plans. We have established a local company in India, Boeing Defence India, to deliver advanced capability and readiness to our military customers. We are contributing to the growth of India's aerospace industry; that is why we're investing in partnerships across the ecosystem in skilling, research & technology, and manufacturing. India's role in our global supply chain is big and getting bigger. Our commitment to India is deep and it is for the long term; our vision is to bring the best of Boeing to India and export the best of India to the world.

VAYU : Boeing has offered its F/A-18 Block III Super Hornet as response to the Indian Navy fighter RFI? Can you elaborate on your offer?

BOEING: We continue to engage with the Indian Navy on their requirement and have responded to the RFI for the Multi-role Carrier Borne Fighter programme (MRCBF). This is a very exciting opportunity to partner with both the Indian Navy and the United States

IAF AH-64E

Pair of Boeing F/A-18 Super Hornet's

Navy, who as you know, have incredible depth of experience and technology in the domain of carrier-borne fighters. The F/A-18 Block III Super Hornet is the frontline carrier-based fighter of the U.S Navy and in the hands of Indian Navy aviators, would be an incredible weapon system to ensure security and safety in the Indian Ocean region for decades to come.

VAYU ***: Why do you believe the Super Hornet will meet the Indian Navy's requirements for a carrier borne fighter?***

BOEING: Before we even focus on the aircraft itself, it's important to understand that part of what is on the table is to benefit from the incredible know-how and technology investments made by the US Navy related to aircraft carriers and fighter operations at sea. As a strategic partner for security, the US Navy is leaning in to provide the best solution available for the Indian Navy, bar none. Of course, this includes the F/A-18 Block III Super Hornet, but it also includes deep capabilities in sustainment, logistics, flight ops, carrier and network integration, etc. These machines are powerful on their own, but they are far more potent when they are part of a fully integrated capability.

In terms of the aircraft itself, the Block III Super Hornet will deliver the Indian Navy the most advanced, proven technologies at unmatched cost per flight hour because of its ease of maintainability and the durable maritime design of Super Hornet. It was designed for the carrier deck and benefits from decades of experience Boeing and US Navy have had operating classic Hornets. The Indian Navy would receive the benefit of US Navy's multi-billion dollar investments in Block III technologies, including advanced networks, low-drag with conformal fuel tanks, longer-range detection with Infrared Search & Track, an all-new Advanced Cockpit System, improved signature reduction and a 10,000+ hour life.

As part of Boeing's "for India, by India" philosophy, the Block III Super Hornets can be serviced in partnership with the Indian Navy, US Navy and industrial partners from India and the US throughout the lifecycle of the aircraft. This will further develop advanced expertise in aircraft MRO in India, resulting in higher availability of the aircraft, at competitive pricing. All of this together, differentiates Boeing's F/A-18 Block III Super Hornet offer for the Indian Navy.

VAYU ***: The P-8I has been a strong pillar for Indian Navy when it comes to maritime security. The Indian Navy has also ordered four additional P-8I to meet their requirement. Is there an update on their deliveries?***

BOEING: The P-8I is a proven long-range multi-mission maritime patrol aircraft which is very capable in maritime surveillance and has unique deterrence in anti-submarine warfare. The first of the four options aircraft will be delivered this year, and the remaining three in 2021.

VAYU ***: Boeing has been supporting mission-readiness of the P-8I. Can you elaborate more on services of the P-8I fleet?***

BOEING: India's P-8I fleet is also supported through and *Performance Based Logistics* service concept providing spares, ground support equipment and field service support. Boeing's integrated support has enabled the highest state of fleet readiness at lower costs. Since their induction, the Indian Navy P-8I fleet has quickly surpassed well over 25,000 flight hours. Boeing's training and support package for the P-8I will continue to increase efficiency while reducing the on-aircraft training time resulting in more aircraft availability for its core missions. A 60,000 sq. ft. *Training Support and Data Handling Centre* is being built at INS *Rajali*, the base for the P-8I fleet, with a secondary centre at the Naval Institute of Aeronautical Technology at Kochi.

We are also working with Indian companies to perform MRO maintenance locally. In partnership with Boeing, in 2019, Airworks completed P-8I's first heavy checks in India. Further capability development is in-work to support the growing P-8I fleet and this will expand the local aerospace ecosystem while ensuring quicker turnaround for the Indian Navy. Again, it's about "for India, by India" and being fully committed to being a trusted partner under *Atmanirbhar Bharat.* We have to keep earning that trust through actions, not just words.

Indian Navy Boeing P-8I over Seattle, before delivery to India

VAYU : The government has been big on the focus on indigenisation and on promoting defence exports. What is your stand on this? Is Boeing working with Indian defence manufacturers to promote indigenisation of defence equipment?

BOEING: Boeing has always supported the development of indigenous aerospace and defence capabilities in India. Our growing partnership with the country's defence forces and our expanding supplier base makes it imperative for us invest in, develop, and nurture talent in India.

Our sourcing from India stands at close to US$1 billion per year from 225 suppliers who are manufacturing critical systems and components for some of Boeing's most advanced products. I think that speaks clearly on to how committed we are. Boeing continues to grow a globally competitive supplier base in India, with strong partnerships to help achieve the government's Atmanirbhar Bharat vision.

Tata Boeing Aerospace (TBAL), Boeing's manufacturing joint venture with Tata, is an example of Boeing's strategic focus on *Make in India* and marks a major step towards the co-development of integrated systems in aerospace and defence in India. The Apache fuselages and structures made in this cutting-edge factory in Hyderabad are bound for customers all around the world, including the US Army. We look forward to seeing Indian Army's recently contracted six new Apaches rolling down that production line.

Further, Dynamatic Technologies manufactures the ramp and complex aft pylon for the Chinook heavy-lift helicopters. Rossell Techsys manufactures wire harness and panels for the Apaches, SASMOS manufactures these for F/A-18 Super Hornets and F-15 Strike Eagle. HAL manufactures F/A-18 gun bay doors and wire harnesses, P-8I weapons bay doors and IFF transponders. These are just a few examples of the work done by our Indian suppliers.

In terms of our skilling and up-skilling initiatives, we are developing Indian MSMEs and training hundreds of pilots, aircraft maintenance engineers, technicians, and frontline factory workers across India with our industry partners like Tata, Rossell, Jaivel and Lakshmi Machine Works. Our vision is a robust, globally competitive aerospace and defence ecosystem in India.

In my view it's about nothing less than fast tracking India's journey to becoming an aerospace and defence design, production and support hub.


Indian Air Force CH-47 Chinook

R-R and the Indian Navy & Coast Guard

VAYU Interview with Kishore Jayaraman

President, Rolls-Royce India & South Asia

VAYU : How has Rolls-Royce's relationship with the Indian Navy and Coast Guard evolved over the years?

RR: Rolls-Royce has a strong legacy partnership with the armed forces, including the Indian Navy and Coast Guard. Our Power Systems division's MTU range of engines power several vessels of both Navy and Coast Guard, with service teams stationed at several locations along India's coastline. Our engines are known for their high-power density and power-to-weight ratio, their compact design as well as their mechanical and thermal stability.

We remain committed to serving the Indian Navy's power needs with advanced technology product offerings and customised solutions. The Rolls-Royce MT30 marine gas turbine is a strong offering for navies and within twelve years of being in service, the MT30 has already become the engine of choice for some of the world's most advanced naval platforms, including the Royal Navy's *Queen Elizabeth* Aircraft Carriers and Type 26 Global Combat Ship plus variants, the US Navy's Littoral Combat Ship *Freedom*-class variant and DDG-1000 advanced destroyers, Republic of Korea Navy's FFX-Batch II frigate, the Japanese Maritime Defence Force's 30FFM frigate and the Italian Navy's new LHD.

We look forward to expanding our relationship with the Indian armed forces through our advanced technology platforms as well as customised power solutions.

VAYU : What are the power solutions Rolls-Royce is offering to the Navy and Coast Guard?

RR: As India grows to adopt an even more important role at regional and global levels, it is imperative that Indian Navy equips itself to play an increasingly important role in regional maritime security. Choosing the right propulsion system is a crucial decision and it has to be the right decision to ensure a ship will still perform as its systems and capability are upgraded throughout the operational life. We presented capabilities of the mighty MT30 marine gas turbine at DefExpo 2020. Derived from the Aero Trent engine family, the Rolls-Royce MT30 is the world's most power dense in-service gas turbine, offering a superior power-to-weight ratio, generating up to 43MW from a 30-tonne packaged unit, including most of the auxiliary systems. Many factors have converged to

lead to the success of the MT30 during its first decade, not least its aerospace heritage.

This gives navies more power in less machinery space than alternative engine types, and offers ship designers much more options and flexibility in designing the naval vessels of tomorrow. The MT30 also supports the 'lean manning' concept by virtue of its ultra-low on-board maintenance requirement. Developed as futuristic technology and to meet the growing demand for electrical power, MT30 is operating or has been selected in all conceivable propulsion arrangements across seven ship types: mechanical, hybrid and integrated full electric, with power delivered to water-jets, controllable and fixed-pitch propellers, depending on application.

VAYU : What updates can you share about the MTU offerings for India?

RR: From our Power Systems Division, MTU engines currently propel and power many Indian Coast Guard and Indian Navy vessels. We offer a range of exceptionally reliable and efficient engines, power generation solutions, service solutions, automation systems and digital solutions to secure superior performance of MTU drives and systems. Our products find varied applications across commercial ships and naval vessels, construction and industrial vehicles, agricultural machinery, mining, rail and military vehicles as well as for the oil and gas industry.

MTU systems today power the largest ships, the strongest tugboats and the biggest land vehicles and provide energy for the world's most important mission-critical applications. We also offer a range of completely integrated hybrid ship propulsion systems under the MTU brand, consisting of internal combustion engines, electric drive modules, transmission systems, batteries, monitoring and control systems, in addition to other electronic components. The hybrid propulsion system offers the flexibility of being able to manoeuvre precisely using the electric motor, or to deliver a powerful bollard pull using the entire power output of the diesel engines and electric motors combined. The combination of diesel engines and electric motors, in addition to batteries will offer our customers significant benefits in a variety of marine applications.

VAYU : What partnerships does Rolls-Royce have in India in the naval sector and what are your plans for the future?

RR: India's defence requirements are evolving, making indigenous development of modern defence hardware and technology top priority for the government. We recognise the needs of 21st Century India, and we have been working to strengthen the entire ecosystem for Aerospace and Defence in India, including supply chain, sourcing, engineering/ Research & Development and manufacturing capabilities.

Currently, we have a partnership with Garden Reach Shipbuilders and Engineers to assemble the MTU Series 4000 engines for naval vessels at the Diesel Engine Plant in Ranchi. We believe the future will be about collaboration to 'Create in India' with customised technology solutions for India's power needs.

Going forward, we seek to embrace opportunities to co-develop and co-manufacture for the growing aerospace and defence sector with select Indian strategic partners. This will pave the way for a stronger ecosystem with further upstream and downstream value chains forming as a natural corollary. With strong supply chain partnerships and established engineering capabilities in India, we believe we are well-positioned to support such programmes and further help India's ambitions of indigenisation in the defence sector.

MT30 marine gas turbine engine

PBS INDIA team at the DefExpo 2020

PBS INDIA: Solutions for Aerospace

PBS INDIA, is an Indian company and designer and manufacturer of aircraft engines, auxiliary power units (APU), environmental control systems (ECS), specific custom-made aircraft solutions, cryogenics and investment casting products. PBS INDIA is part of the PBS GROUP, a Czech engineering manufacturer that operates globally in aerospace, precision casting, precision engineering, cryogenics and energy. With more than 200 years of history, this is arguably one of the oldest engineering brands in the world.

The ability to design, construct, manufacture and test an entire product is a significant competitive advantage, as is the ability to adapt products to specific customer requirements. Thanks to in-house production, the highest quality and reliability of its products is guaranteed. PBS is a certified company and holder of design authorisation (DOA), manufacturing authorisation (POA) and maintenance authorisation (MOA) issued by the European Union Aviation Safety Agency (EASA). The PBS quality management system is ISO 9001, AS 9100, ISO 14001 and is Nadcap certified.

PBS has been developing and supplying small turbine drive units for the aerospace industry for half a century, the company celebrating the 20th anniversary of cooperation with manufacturers of MIL helicopters. PBS essentially supplies the Safir 5K/G MI auxiliary power unit (APU), for the main engines of a significant number of Mi-17 helicopters. PBS continually works on modifications of existing products, but the company also develops other devices for new types of helicopters as well as jet aircraft and UAVs.

Learn more about our products and solutions on **www.pbsindia.com** and come to visit us in our Bengaluru office (No. 303, 'Pushpak, MES Ring Road, Jalahalli Village). We will be pleased to meet you at our booth at **Aero India 2021** exhibition to discuss our products and services for aerospace.

20 years of cooperation with MIL

Over the decades, PBS has been involved with thousands of APUs and last year celebrated the 20th anniversary of cooperation with the manufacturers of MIL helicopters for which it developed the Safir 5K/G MI APU, designed for Russian Mi-8, Mi-17 and Mi-171 helicopters, which are considered as the most successful helicopters in the world in terms of both numbers sold and the number of countries in which they operate. Mi-17s have operated in more than 60 countries, including with the Indian Air Force.

Products for helicopters and jet aircraft

PBS APUs are especially suitable for civil and military helicopters, training and light combat aircraft and business jets. Applications in ground military forces or marine applications are also feasible, incorporated in several types of helicopters, but also in training and combat aircraft. PBS is currently following up on previous cooperation with the development and supply of several systems for new generation of this aircraft, for example the Czech L-39NG, L-159 and others. This includes the environmental control system, some fuel system instruments, the EMG-200 starter generator and other devices.

PBS is a specialised manufacturer of castings made of superalloys based on nickel and cobalt for the power engineering, aerospace, marine, healthcare and transport industries worldwide

Turbine engines

PBS is a well-known supplier of turbojet engines, their high quality and reliability reflected in the fact that they are installed in over 1,300 aircraft worldwide. With certification from European Aviation Safety Agency (EASA) their quality makes them distinct in their category. The main advantage of PBS India's turbojet engines is their reliability and weight-to-thrust ratio and these engines are suitable for use in UAV and UCAS projects. The worldwide recognised turbojet engine PBS TJ100, is of the 4th generation and PBS India supplies of these engines in India.

Development and innovations

PBS continuously invests in development and has high-quality technical support and development plus testing capacities available. Latest addition to the PBS turbojet engine family is the TJ100P, an oil-free version of the well known PBS TJ100 engine. The company continually extends the time limits of overhauls for the Safir 5K/G MI, thus increasing its competitiveness. The company has also developed the relatively new EMG-200 starter generator for the Ansat helicopter, with several dozen units sold annually.

The MIL Mi-171A2 has received type certification in India for civilian use issued by the Civil Aviation Authority of India. The PBS CS-M1V environmental control system for the Mi-171A2 helicopter is another example of successful development, this system heating and cooling simultaneously, not only in the cockpit, but also in the cargo space of the helicopter.

Cryogenics and investment casting

The PBS investment casting foundry, with more than 50 years of experience, focuses mainly on blades and segments of stationary gas turbines, turbocharger wheels for automotive, impellers and guide wheels for aircraft engines, spinner discs for the glass industry and femoral components for the health sector. PBS is responsible for everything from the design, casting and machining to the final product to guarantee the highest quality at a reasonable price.

PBS is also a reliable supplier of compressors, pumps and helium expansion turbines for the cryogenic industry and very low temperatures from 4 to 150 K.

The latest addition to PBS *turbojet engines family is PBS TJ100P. Oil-free version of the proven TJ100 brings many new interesting features and can be fitted into any modern UAV or UCAV system.*

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FOR TARGET DRONES, MISSILES,
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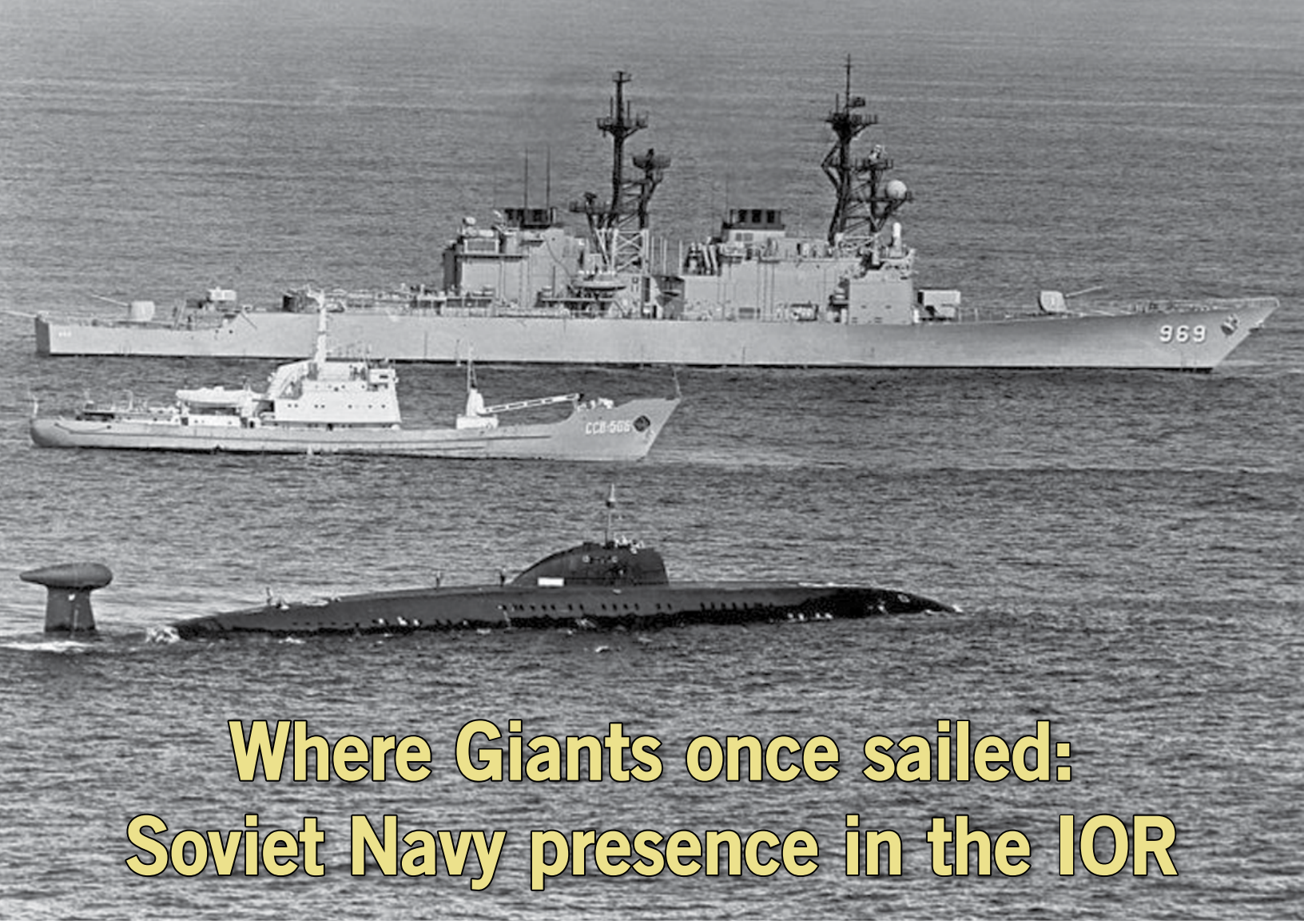


Where Giants once sailed: Soviet Navy presence in the IOR

During height of the Cold War in the' 60s, strategic importance of the Indian Ocean, and its littoral states grew for both the US and USSR. Asia had emerged as a 'hotbed' for proxy wars, with directly participating in conflicts, the focus increasingly on the third world.

Before the mid-60s, USN SSBNs were equipped with Polaris A1 and A2 missiles, which had a max range of 2600 and 2800 km respectively. Because of this limited range, the Indian Ocean was not considered an effective patrolling area, but following the deployment of A3s in 1964, the SSBNs could hit their targets (primarily Soviet) even from the Arabian Sea. This coupled with the US constructing a low frequency communication station in North West Cape, Western Australia to contact their patrolling subs, convinced the Soviet Union that USN deployment in Indian Ocean was imminent.

In 1968, the British Prime Minister Harold Wilson announced the decision to withdraw from Britain's major military bases East of the Suez, owing to a multitude of reasons. This pull-out, although announced in 1968, was to happen by 1971. The Soviet deployment in the region quickly followed this announcement.

Soviet Naval presence in the Indian Ocean region first began when Moscow dispatched a 4-ship flotilla from Vladivostok on a goodwill visit to six Indian Ocean littoral states, being India, Pakistan, Sri Lanka, Kenya, South Yemen and Somalia in March 1968. The flotilla was or would become the 8th Operational (Indian Ocean) Squadron.

USN deployment in the region had started much earlier, with Seventh Fleet deployment in the Indian Ocean by April 1964 as the *Concord Squadron*. Still, by 1969, the Soviets had gained access to several port facilities in the region and the flotilla spent most of its time in the north-western portion of the ocean. After that, the Soviets steadily increased their ship-days in the region from about 1000 in 1968, reaching 9000 by 1974 and about 11,800 by 1980.

Numerous reasons have been given as to why the Soviets finally decided to deploy in the region, the most apparent being to counter US influence there. Other reasons that can be argued include keeping Chinese threat at bay. The Sino Soviet split had happened in the 60s, and by 1972 Nixon had visited China, alarming the Soviets to a serious Chinese threat to the Russian Far East. An Indian Ocean deployment gave another area to respond from in case of hostilities and to ensure connection with Siberia.

Yet another could be that the Soviets simply wanted to exploit the power vacuum left after the British pullout or a simple logistical one: protecting shipping lanes in the region and disrupting the enemies.

The exploitation of such a power vacuum was surely on the minds of Soviet planners', even if primary motivation would have been any one of those mentioned above. Any such deployment would certainly allow them to exert some power over littoral states, through goodwill visits and if need

be through 'gunboat diplomacy' as many littoral countries were "non-aligned".

The diplomatic aspect was routinely clear with the deployment, when the Soviet flotilla would make port calls, conduct surveillance and try to improve diplomatic relations to "sympathetic countries" as also a show of force to improve military perception of the Soviet Union in the region. Nevertheless, no reason was ever officially provided, but one could assume a mix of these.

The 'Indian Ocean Squadron' or officially designated the 8th Operational (Indian Ocean) Squadron with home port at Vladivostok, was activated on August 1968 and remained operational till collapse of the Soviet Union. While the squadron was operational, it automatically assumed operational command of any Soviet ship operating in the Indian Ocean Region.

Strength of the deployment was not a constant and would often change. According to the CIA, the core flotilla usually consisted of a destroyer, 2 frigates, 2 minesweepers, 1 amphibious ship, 1 SSK and around 7 auxiliary support ships including a merchant tanker. Sometimes the flotilla would be joined by a cruiser as well.

Allen Stout mentions the standard strength of Indian Ocean Squadron as 1 cruiser, 2 destroyers, 1 attack submarine, 2 frigates, 1 minesweeper, 2 amphibious ships, 1 cruise missile submarine, 1 intelligence collector, 10 auxiliary ships and 1 hydrographic research vessel. The strength of the force did vary, increasing during the period of hostilities in the region such as during the Indo-Pakistan War of 1971 or the 1973 Oil Crisis or Ethiopian-Somalian conflict of 1977 and waned in times of relative peace. Interestingly, the force spent considerable time during 1972–1975 for mine clearing and salvage operations in Chittagong, involving up to 15 ships immediately after the war. Otherwise prior to and even for the most part of 1973, the ships had spent most of their time anchored in ports.

The ships usually belonged to the Pacific fleet but would sometimes be from the western fleet too. The logistics support to the force was solely under the Pacific fleet. The ships transferring from the western fleets to Pacific would also serve a few months in Indian Ocean, making their sort of a buffer deployment, before transfer.

Throughout its deployment the 8th Operational squadron would conduct mainly Naval Diplomacy as peacetime mission but should there have been war, its mission would have been to interdict Western reinforcements and help any Soviet offensive. The show of force happened quite many times during the deployment, even coming face to face with USN vessels sometime. After the December 1971 war broke out, naval deployments by both US and Soviets reached a high, with the US having 14 ships, British 21 ships and Soviets having 26 ships deployed in the region. The British deployment was ostensibly in the region to help in withdrawal from the Persian Gulf ("East of Suez") and not in connection with the war. The Soviets, although in response to the both USN and Royal Navy's deployments, had sent 2 task forces of then as own to counter both of them with each task force configured for anti-carrier operations. Their quick reaction to US forces, and Task Force 74's subsequent diversion from the Bay of Bengal after being aware of Soviet response, would have logically resulted in an increment in their credibility of power projection after the war, "staring down the 'imperialists' in the region". The Soviets certainly conducted surveillance of annual CENTO naval exercises in 1973–74 while in the region.

There was a popular (but incredulous) story about the Indian Navy using Russian language to communicate, so as to fool Pakistani intelligence during the 1971 war.

After collapse of the Soviet Union, almost all aspects of Russian military suffered drastically. The political and economic climate was unsuitable to sustain the behemoth that had been the Soviet military. Defence expenditure was reduced drastically, many ships scrapped and many in construction continued in their berths for years to come as construction of new ships was effectively stopped. The Pacific Fleet lost many of its vessels, and subsequently the 8th Operational (Indian Ocean) Squadron soon met its demise and was officially disbanded on December 1992. With its disbandment, the Russians lost their presence in the Indian Ocean.

Shwetabh Singh
(Twitter @singhshwetabh71)

Navantia launches 1st of 5 Corvettes for Saudi Arabia

Navantia has successfully carried out the launching of *Al-Jubail,* the first of five corvettes for the Royal Saudi Naval Forces (RSNF). The ceremony was held at the San Fernando shipyard and was attended by the Commander of RSNF, H.E. Vice Admiral Fahad Bin Abdullah Al-Ghofaily; by the Chairwoman of Navantia, Susana de Sarriá; by the Acting CEO of SAMI, Eng. Walid Abukhaled and Admiral of Logistics Support Bay of Cadiz of Spanish Navy, Vice Admiral Ricardo A. Hernández López (Alardiz).

Commander of the RSNF highlighted importance of the ALSARAWAT Project contracted to Navantia, as one of the largest capability-acquisition programmes for the RSNF which "reflects a strong strategic relation between Kingdom of Saudi Arabia and Kingdom of Spain and enlarges the cooperation between the RSNF and Spanish Navy in shipbuilding, education and training". The Commander of RSNF also indicated that the success of this project was a key factor for ambitious future projects and an enduring partnership.

The Al-Jubail corvette has a length of 104 metres, a beam of 14 metres and will be able to accommodate 102 people (crew and additional personnel). It is designed for a maximum speed of 27 knots.

There corvettes are the latest generation of Navantia-designed combatants and incorporate state-of-the-art Navantia products, such as the Catiz Combat System, Dorna Gun Fire Control System, NAVCOMS/HERMESYS Integrated External and Internal Communications System, MINERVA Integrated Navigation and Bridge System, or Complex-Simplex Integrated Platform Management Platform together with equipment manufactured by Navantia under license such as the Leonardo Super Rapid 76mm main gun, Rheinmetall Air Defence Millennium 35mm close-in weapon system, MTU propulsion engines and diesel generators, and RENK gearboxes.

For the follow-on sister ships, the objective is to recover time and meet the initial milestones, so that the second corvette can be launched by December 2020. The corvette programme, which entered into force in November 2018, strengthens the immediate future of Navantia and benefits all the company's shipyards and its auxiliary industry, especially the entire Bay of Cádiz.

Navantia passes the first safety milestone of the S-81 submarine

Navantia shipyard in Cartagena has successfully carried out the power-up activity tests to the S-81 "Isaac Peral" submarine. The S-81 is the first of four S-80P class submarines under construction for the Spanish Navy by Navantia. This is a relevant safety-related commissioning milestone prior to delivery.

The power-up is a process in which the boat is electrically energised. This involves start-up of the main electricity distribution networks, as well as the emergency systems, which allow the gradual electrification of all equipment installed in the submarine. The power-up is carried out in order to check the submarine's correct operation, both individually and integrated along with the rest of its equipment.

The S-80 P submarines are 3000-tonne non-nuclear submarines provided with a 'revolutionary' third generation Air Independent Propulsion system (AIP), and are equipped with powerful attack capabilities including heavy weight torpedoes, mines and submarine launched anti-ship and cruise missiles, etc. The S-80P submarines are proposed as baseline for the P-75(I) project for India and the S-81 shall be launched during the spring of 2021.

BAE Systems and the Royal Navy's autonomous sea boats of the future

During *Armed Forces Week* mid-June 2020, BAE Systems and the Royal Navy announced a £3.2 million autonomous boat contract that will "increase Navy's capabilities while protecting sailor's lives." The Autonomous Pacific 24 Rigid Inflatable Boat is crewless so has potential for dangerous small boat missions such as force protection and anti-piracy. It will be stowed and operated from Royal Navy warships and could equip the future naval surface fleet.

The autonomous capabilities of BAE Systems' Pacific 24 (P24) Rigid Inflatable Boat (RIB), as standard in the Royal Navy surface fleet, could significantly enhance the ability to protect its sailors, as the upgraded sea boat is able to execute its own missions without crew and be run from warships. Such missions could include anti-piracy operations, border control, persistent intelligence gathering, maritime security and force protection, all autonomously.

The P24 has been procured under the Royal Navy's autonomy and lethality accelerator programme, *Navy X*, which aims to deliver new technology into the hands of sailors and marines. As Minister for Defence Procurement Jeremy Quin stated, "Commencing the trials of the crewless Pacific 24 boat is an important stepping stone in the Royal Navy's development of its autonomous capability to ensure our fleet remains at the forefront of military innovation and technology, ready to meet the evolving threats of modern warfare."

Brooke Hoskins, Products & Training Services Director at BAE Systems, stated "It's fantastic to see the Royal Navy's first autonomous Pacific 24 enter the water during this challenging time. This milestone has been a goal since we demonstrated the autonomous capabilities of this sea boat last year. It is a key step in supporting Navy X, turning what was originally an innovative research and development experiment into a fielded capability for the Royal Navy. This contract is one of the first autonomous boat contracts for Navy X. We are proud to support the Royal Navy›s autonomous requirements, which includes increasing its operational effectiveness while reducing the burden on, or threat to, its sailors."

Lt Cdr Rob Manson, Navy X Requirements Manager, stated, "The autonomous P24 is not just a step-change for the Royal Navy in unmanned operations, it also ensures we remain at the forefront of technological improvement and innovation. While initial tasks are likely to be familiar to our Royal Navy crews who already operate manned P24 RIBs, the autonomous nature of this craft adds huge capability and flexibility. Additionally, this capability can be constantly improved, allowing continuous updates and capability upgrades, resulting in regular additions to the toolbox of our sailors and ships."

The successful launch of the sea boat took place at Trafalgar Wharf, Portsmouth in spite of the challenges posed by the current COVID-19 pandemic.

BAE Systems and Navy X will continue to collaborate on the development of its first autonomous P24 which is carrying out a series of acceptance trials throughout 2020. The success of these trials could determine whether the Royal Navy decides to upgrade or procure an entire fleet of such craft and could include their adoption on future classes of warships, such as the Type 26 or Type 31 frigate.

Sailing The 'Big Stick'

USS 'Theodore Roosevelt' completes Carrier Qualifications

The aircraft carrier USS *Theodore Roosevelt* (CVN 71) and Carrier Air Wing (CVW) 11 completed carrier qualifications 2 June 2020. *Theodore Roosevelt* qualified pilots from the "Tomcatters" of Strike Fighter Squadron VFA-31, "Golden Warriors" of VFA-87, "Blue Diamonds" of VFA-146, "Black Knights" of VFA-154, "Liberty Bells" of Airborne Command and Control Squadron (VAW) 115, "The Gray Wolves" of Electronic Attack Squadron (VAQ) 142, and the "Providers" of Fleet Logistics Support Squadron VRC-30.

The "Eightballers" of Helicopter Sea Combat Squadron HSC-8, and the "Wolf Pack" of Helicopter Maritime Strike Squadron HSM-75 also worked with the ship in support of carrier qualification operations.

"It is very gratifying to be able to return to our primary mission in the Indo-Pacific," stated Capt. Steve Jaureguizar, Commander, Carrier Air Wing CVW-11. "The carrier air wing joined together with the carrier is the bedrock of naval aviation and power projection."

Carrier qualifications are a time for naval aviators to refine their skills practiced during field carrier landing practice (FCLP) for sustained operations at sea aboard the aircraft carrier. Carrier qualifications fortified the operational relationship between CVW-11 and the *Theodore Roosevelt.*

"It felt great to get back in the cockpit and launch from the catapult while at sea," stated Lt. William Leagon, a naval aviator assigned to VAQ 142. "As a naval aviator this is what we signed up to do and it's really exciting to get back to business."

USS *Theodore Roosevelt* and CVW-11 are on a scheduled deployment to the US 7th Fleet area of operations to provide maritime security, maintain freedom of the seas in accordance with international law and customs, "and operate with international partners and allies to promote regional stability and prosperity."

Completing carrier qualification was the last milestone in returning USS *Theodore Roosevelt* to sea as a ready, credible naval asset capable of projecting power over the horizon. "You can see and feel the excitement around the ship as we have returned to flight operations," stated Capt. Carlos Sardiello, *Theodore Roosevelt's* commanding officer. "It is very rewarding for all sailors involved to exercise their skill set and see the TR back in action."

USS *Theodore Roosevelt* is the nation's fourth *Nimitz*-class aircraft carrier with a crew of nearly 5,000 sailors who support and conduct air operations at sea. USS *Theodore Roosevelt* departed San Diego for a scheduled Indo-Pacific deployment on 17 January 2020.

General Atomics EMALS and the USS 'Gerald R. Ford'

General Atomics Electromagnetic Systems (GA-EMS) have announced that more than 3,000 catapult launches and landing arrestments using the Electromagnetic Aircraft Launch System (EMALS) and Advanced Arresting Gear (AAG) system had been successfully and safely completed aboard USS *Gerald R. Ford* (CVN 78). This milestone marks a significant achievement for the ship and crew, as the Navy moves towards a goal of 8,000 aircraft launches and arrestments during at-sea events scheduled through the end of 2020.

GA-EMS is delivering EMALS and AAG for the future USS *John F. Kennedy* (CVN 79) and USS *Enterprise* (CVN 80). Significant cost savings are being realised through multiple ship production contracts, which minimise gaps in production while maximising planning, scheduling and delivery to support all three *Ford*-class carriers.

CVN 78 'Ford' completes largest aircraft embark

With Carrier Air Wing (CVW) 8 embarked, USS *Gerald R. Ford* (CVN 78) logged significant milestones during Post Delivery Test and Trials (PDT&T) operations at sea.

During *Ford's* largest aircraft embark to date, CVW-8 completed critical milestones on the first-in-class ship, testing secure communications and tactical data links, supporting the use of Network Enabled Weapons (NEW), Combined fixed- and rotary-wing Close Air Support integration, and SIMDIS, a multi-dimensional interactive graphical and video display to playback large events for debriefs.

Underway, CVW-8 conducted day and night cyclic flight operations totaling 324 catapult launches and arrested landings, qualifying 50 pilots, including *Ford's* Commanding Officer, Capt. J.J. Cummings. To date, the *Ford* has conducted 3,480 catapult launches and arrested landings with EMALS and AAG. Additionally, during this execution of cyclic flight operations with CVW-8, the *Ford* moved thousands of pounds of inert ordnance via Advanced Weapons Elevators to F/A-18 Super Hornets, employed during close air support and air-to-ground training missions. Executing cyclic operations and arming aircraft with bombs from the ship's magazines were firsts for the team.

The Air Wing's embark provided the first opportunity for *Ford's* weapons department to execute a full ordnance movement using a lower stage weapons elevator. Performing as advertised, *Ford's* AWEs conducted more than 1,300 cycles during this latest at sea period that enabled the successful transfer of 176 inert bombs in support of air wing operations. *Ford's* AWEs have conducted over 10,000 cycles to date.

Year of the Heron TP

The proliferation of drones in conflict areas highlights the role that large unmanned aircraft systems (UAS) have in modern conflict. The USA, China and Israel are currently the sole providers of large UAS platforms which offer long mission endurance and mission versatility. One of the largest, most advanced systems is the Heron TP from Israel Aerospace Industries (IAI).

Equipped with most advanced avionics, line of sight and satellite communications and multiple mission payloads, the Heron TP climbs up to 45,000 ft, high above commercial air traffic routes, where it can operate on missions spanning over 30 hours, carrying more than 1,000 kg of payload. Its robust structural design features double boom, twin-tail design which is most suitable for such missions, offering better antennae separation, optimal coverage and a stable platform necessary for precision signal measurements.

Israel Aerospace Industries (IAI) had signed a strategic collaboration MOU with focus on UAVs with Hindustan Aeronautics Limited (HAL) and Dynamatic Technologies Limited (DTL) at DefExpo 2020. The MOU will reflect existing capabilities developed by IAI over the years and promote the production of Indian UAVs, in line with the Indian Government's 'Make in India' and 'self-reliance' policy. Strategic partnership with the Indian corporations will allow the implementation of optimal solutions for the needs of the Indian forces based on their specific technologies and needs.

New Mission Capabilities

The Heron TP is configured to carry multiple payloads in a large internal payload bay, with universal payload attachments and underwing hardpoints. Such payloads include electro-optical systems, SAR and maritime search radars, COMINT and ELINT systems as also persistent surveillance systems designed for operation from standoff range.

In addition to the payloads integrated in the aircraft, Heron TP can also carry mission payloads in underwing pods. Such EO pods can deliver in real-time a 3D image of the ground scene, other sensors designed for persistent surveillance, provide continuous coverage of large areas, monitoring all movements over time, enabling analysts to follow objects of interests by specific parameters such as vehicles type, shape and colour, define life patterns and identify anomalies from such patterns.

A new capability provided by the Heron TP is maritime anti-submarine surveillance, integrating maritime surveillance radar, EO payload, magnetic anomaly detector (MAD) and sonobuoys that are dropped on water and transmit sonar data to the aircraft. With this equipment, the Heron can detect submarines underwater and track them at

periscope depth. On such missions, Herons are launched from land bases but can be controlled from ships at sea. At twice the speed of other drones, and long mission endurance, the TP can cover larger areas, well out at sea. Flying higher than other drones and using EO payloads covering extremely long range, the Heron TP significantly enhances mission capabilities of maritime surveillance and ASW in its ability to move quickly to new positions and recognise targets without descending to a lower altitude, or from stand-off range.

"A Good Year for the Heron TP"

Operationally deployed with Israel's Air Force since 2010, the Heron-TP has performed countless missions, extended farther and longer than any other manned or unmanned aerial combat system. "90 percent of our activity covers the northern theatre, where we are required to provide persistent surveillance and real-time intelligence," states Lt Colonel S of the 210th squadron, "The Heron TP enables us to operate farther and extend our vision even longer". In 2018, the Indian Air Force took delivery of additional Heron TPs that significantly increases the UAV fleet size and increases operational flight hours by 70%.

Germany will soon become the second operator of Heron TP, following the award of €1 billion contract to Airbus in June 2018. The contract funds operational leasing of five Heron TP drones, for a period of nine years. The project will have a two-year set up phase, followed by an operational phase for a further seven years.

"This project will provide the *Bundeswehr* with an even more efficient system that will better protect soldiers in a wide range of threat situations as well as the at-risk civilian population," stated Jana Rosenmann, Head of Unmanned Aerial Systems at Airbus. Heron TP will also get military certification from the German Armed Forces aviation authority in accordance with Stanag 4671, allowing the system to be operated around the world.

A month after the German announcement, the Indian government approved procurement of Heron-TP platforms to augment the fleet of Heron I's operated by the Indian Air Force. Similar to the German configuration, these platforms will offer enhanced mission capabilities, addressing an urgent Indian requirement for unmanned weapon-carrying platforms. The new Heron TP platform will further extend capabilities of the current Heron I, enable the Indian operators to fly missions higher, farther and with more versatile, heavier loads.

Courtesy: IAI

IAI's family of loitering weapons goes Naval

Harop launched

Rotem 2

Loitering Munitions (LM) evolved in Israel in the mid-1970s, based on operational lessons during the Yom Kippur War, where Israel failed to achieve sufficient air superiority over enemy air defences. In the years that followed the 1973 war, the Israeli defence establishment encouraged industry research and development in unmanned and autonomous capabilities for the Suppression and Destruction of Enemy Air Defences (SEAD/DEAD), measures that paved the way for manned aircraft to strike those Surface-to-Air Missile (SAM) sites.

The Harpy 'suicide drone' conceived in the mid-1980s was one of these solutions developed by Israel Aerospace Industries (IAI) Missile Division. Harpy comprised of swarms of autonomous aerial platforms equipped with a radar-seeker and warhead. It could loiter for hours at high altitude inside a SAM- Defended Area and once threat radar became active, it rapidly engaged that radar, steeply diving to hit the radar with devastating effect.

Evolving through decades of operational service, the Harpy was recently modernised in two aspects: A-new Anti-Radiation (AR) seekers offering improved target location, identification and classification and extended frequency coverage, particularly in the lower frequency bands- utilising a modern and versatile platform, the system now offers longer loitering, of up to nine hours. Its unique autonomous capabilities and ground based operability turn Harpy into a disruptive capability against land-based adversary Anti-Access/Access Denial assets.

To excel as multi-mission combat system, IAI evolved its autonomous LM to be remotely operated, conducting reconnaissance and surveillance missions with the ability to attack targets immediately as they are detected. For such missions, 'Man in The Loop' control was first introduced with the Harop –a loitering platform with maritime capabilities powerful enough to carry a sophisticated multi-sensor EO payload, large warhead, data link and enough fuel for a 9-hour mission. Sharing a common platform with Harpy NG, Harop delivers imagery intelligence in real-time over a two-way data link. Once a target is detected by the operator, from distances hundreds of kilometres away, Harop is commanded to attack, dives in on the designated target and activates its large warhead. The approach azimuth, as well as the dive angle is selectable by the operator, to suit various operational scenarios.

At Defexpo 2020, IAI displayed its LM family with its newest member- Mini Harpy, a newly-developed loitering munition, based on unique IAI development and technology, the Mini Harpy combines the capabilities of the company's two flagship loitering missiles, the Harop and the Harpy, offering detection of broadcast radiation with electro optical capabilities. The Mini Harpy is a tactical system designed for field or marine units. It can be launched from land, marine and helicopter borne platforms, providing complete independence in intelligence collection for an updated situational picture and closing the attack circle at low cost.

The system was designed to provide operators with control up to the last moment, including cessation of attach at any stage. Electrically powered, it is extremely quiet, carries shaped charge of approximately eight kg and operates in mission range of 100 km for duration of two hours and 45 kg in weight.

A smaller LM from IAI is the Rotem, designed specifically for warfare in complex terrain and urban areas. It employs a folding multi-rotor as a platform, multiple imaging and IR cameras for sensors and multiple acoustic transducers to detect and avoid obstacle and safely manoeuver narrow urban streets or dense vegetation. Its payload bay holds enough space to carry warhead of one kilogramme or extra batteries, extending the mission endurance from 30 to 45 minutes. It is operated by a single soldier using simple point and click commands on a tablet controller, similar to the one operating the Green Dragon.

Boaz Levi, IAI Corporate Vice President and General Manager of the Systems, Missiles & Space Group stated, "IAI's advanced loitering munitions offer an operational solution to the complex arena experienced by armies, with a special emphasis to the congested naval arena warfare. The new naval adjustments made to the loitering munitions provide an excellent solution for costal protection, Combat Ships, Offshore Patrol Vessels and Patrol Boats. The unique organic independent capabilities provide an operational flexibility to the naval commending level, both at the intelligence level and at the operational level."

Updates from Israel

Arrow-2 Ballistic Missile Interceptor tested

Israel has successfully tested its advanced defence system against a medium-range ballistic missile (MRBM). The Arrow Weapon System is a central part of Israel's multi-layer defence system and is based on four operational layers: Iron Dome Defence System, David's Sling Weapon System, the Arrow-2, and the Arrow-3.

Following the test, Alternate Prime Minister and Defence Minister Benny Gantz said that "Israel must face challenges both near and far, and our 'elite technological unit' led by the Directorate of Defense Research and Development, Israel Aerospace Industries and additional defence industries, ensures that we will always be one step ahead of our enemies–and that we will defend Israeli skies from any threat."

UAV agreement between Israel and Germany

Preceding delivery to the German Armed Forces, the German Heron TP UAV has completed its first flight in Israel. The UAV was modified according to the needs and requirements of the German Ministry of Defence. It is the result of a joint programme led by the UAV Executive Office in the Directorate of Defense Research and Development (DDR&D), of the Israel Ministry of Defence (IMoD), Israel Aerospace Industries (IAI), and Airbus DS Airborne Solutions, an Airbus Group company. The German Heron TP UAV is a medium altitude, long endurance, and multi-mission aircraft with a range of payloads. It is based on the Israeli 'Eitan' UAV, already in operational use by the Israel Air Force.

IAI introduces MultiFlyer

Israel Aerospace Industries has introduced the MultiFlyer, a UAV unit of small unmanned helicopters that can fulfill a large range of non-military tasks. MultiFlyer provides advanced monitoring capabilities for large areas and is based on commercial, off-the-shelf helicopter UAVs from Alpha Unmanned Systems integrated with components from IAI and several Israeli startup companies. The command and control system was designed by Simplex with the area scanning technologies powered by Sightec. Its use includes disaster area monitoring, guiding rescue units in lifesaving missions, traffic control in mass events, securing sensitive facilities, police enforcement, and surveys of large agricultural or marine areas

Aeronautics selected by the BIRD Foundation

Aeronautics has been selected by the BIRD Foundation on a joint development project with American company, Prevision. The joint project will have the two companies develop a real-time persistent

surveillance system (WAMI) with an automated interface to an electro-optical camera. Designed specifically for use with unmanned aerial vehicles, the system will automatically detect any change that occurs in the area and alert operators to exact location of the target, handing over the target to the EO/IR payload to meet the mission objectives.

SpearUAV unveils Ninox

SpearUAV, a company that develops and supplies unique UAS solutions for defence and HLS applications, has unveiled its Ninox family of encapsulated drones. Instantly launched and intuitively operated, the drones provide on-demand and on-the-move intelligence capabilities to create new dimensions on the battlefield. Ninox is available in a range of drone and capsule sizes, and can be customised to meet customer requirements. Requiring no deployment, the Ninox system comprises a drone launched at high speed from the weapon, which then unfold and stabilises without operator intervention. There are currently three members of the Ninox family: Ninox 40, Ninox 66 and Ninox 103.

Controp's iSea-25HD for India and Vietnam

Controp has been selected to supply iSea-25HD observation systems for installation on the new ships under construction at L&T's shipyards in India, and also vessels being built for the Vietnamese Border Guard by Hong Ha shipyards in Vietnam. The systems will be delivered during 2020 and 2021. Capable of maintaining boresight even in conditions where there are shocks and vibrations, the iSea-25HD incorporates digital and mechanical compensatory mechanisms developed by CONTROP to significantly enhance image quality.

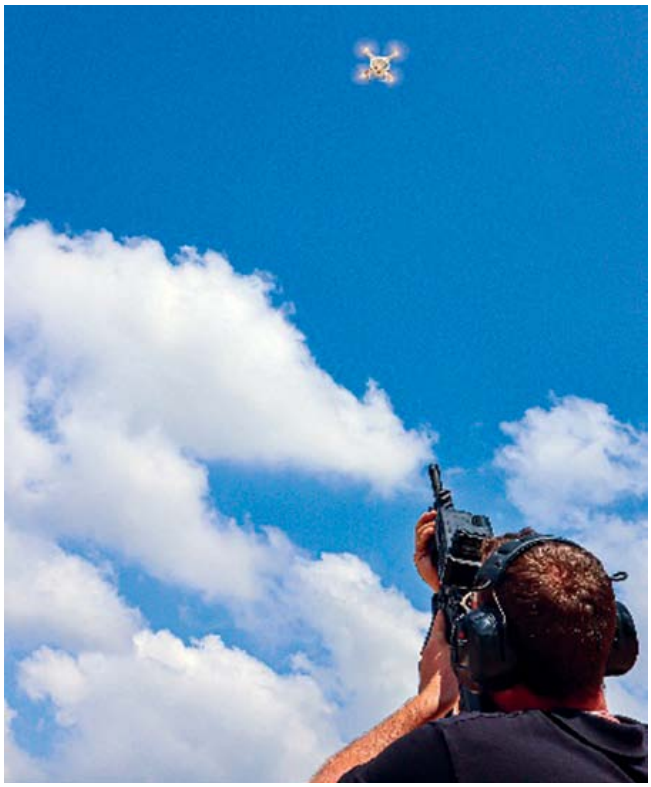
The iSea-25HD lightweight system provides maximum range surveillance using highly sensitive sensors, including a high-performance thermal imaging (TI) camera using 3-5µ IR detector with a continuous zoom lens, a high-sensitivity color day camera, and an eye-safe laser range finder (LRF).

Elbit's THOR VTOL completes Environmental Qualification

Elbit Systems' THOR, the multi-rotor Vertical Take-off and Landing (VTOL) mini Unmanned Aircraft System (UAS), has completed a series of environmental qualification tests ahead of the delivery of more than a thousand of units "to an army in Southeast Asia." The THOR VTOL mini-UAS is designed for surveillance and reconnaissance missions over land and at sea. Electrically propelled, THOR is capable of carrying up to three kg of payloads and has a flight duration capability of up to 75 minutes of operation, a maximal range of 10 kilometers and a flight ceiling of up to 2,000 ft.

SMART SHOOTER for NATO DAT PoW

SMART SHOOTER, a developer and manufacturer of Fire Control Systems, has been considered as a potential solution-provider and its technology has been selected for a NATO Defence Against Terrorism Programme of Work (DAT PoW) exercise in the domain of the fight against small UAVs. Smart Shooter's SMASH Fire Control Solution will be tested and evaluated on the engagement part of the UAV kill chain.



Steadicopter unveils Black Eagle 25E and Black Eagle 50E

Steadicopter, which produces Rotary Unmanned Aerial Systems (RUAS), has unveiled the Black Eagle 25E and Black Eagle 50E, the newest models of its RUAV now operated with electric motors, and designed for a wide range of law enforcement, maritime, civilian, and covert missions. Based on the company's Black Eagle platform, which has been proven to be operational for military needs, the new systems enable high performance and operational flexibility for other security forces, as well as many civilian applications.

Elbit contract for US Army Bradley IFV components

Elbit Systems of America has been awarded an Indefinite Delivery/ Indefinite Quantity (ID/IQ) contract by the Defence Logistics Agency Land based in Warren, Michigan to supply the US Army with gunner hand stations, commander hand stations and circuit cards for the Bradley Infantry Fighting Vehicle.

Rafael/Raytheon team to establish Iron Dome production facility

Raytheon and Rafael have signed a joint venture to establish an Iron Dome Weapon System production facility in the United States. The new partnership, called Raytheon RAFAEL Area Protection Systems, anticipates finalising a site location before end of the year. The new facility will produce both the Iron Dome Weapon System, which consists of the Tamir interceptor and launcher, and the SkyHunter missile, a US derivative of the Tamir. Both Tamir and SkyHunter intercept incoming cruise missiles, unmanned aerial systems and short-range targets such as rockets, artillery, mortars and other aerial threats.

Rafael's Typhoon Mk.30c

Rafael Advanced Defense Systems Ltd. has presented its Typhoon Mk.30c, the newest member of the company's reputable Typhoon family of stabilised, small calibre naval guns. It benefits from the experience gained by Rafael over two decades of R&D greatly enhanced by actual experience of its customers. In this new product, emphasis was put on compact design, ease of maintenance, low Life Cycle Cost (LCC), and on extending the capabilities against the latest emerging aerial and asymmetric swarm attack threats.

Equipped with the highly-reliable ATK Mk44 Bushmaster 30 mm gun and its full complementary high explosive and Air Burst Munition (ABM), the Typhoon Mk.30c offers superior capability in defending against multiple threats in swarm attack scenarios.

Elbit to Supply Assemblies for the F-35

Elbit has been awarded a contract by Lockheed Martin for the manufacture of assemblies for Forward Equipment Bay assemblies for the F-35. The contract calls for Elbit Systems to supply assemblies for the F-35's Forward Equipment Bay – made from composite materials and the associated structures – for all F-35 aircraft variants. Elbit Systems will deliver more than 1,400 components to Lockheed Martin during the contract period.

IAI's Heron Landing at BG Airport via Remote Control

The Heron, a UAV developed and built by Israel Aerospace Industries (IAI), landed at Ben Gurion International Airport, becoming the first UAV to land in an international airport alongside commercial flights occupying civilian air space. The UAV took off from Ein Shemer airfield, landed at Ben Gurion, and flew back to Ein Shemer. The entire takeoff, flight, and landing were operated from the Ein Shemer control station

IAI expands tactical UAV activity

Israel Aerospace Industries Ltd. has signed an agreement to acquire 50% of the equity of BlueBird Aero Systems. Bluebird, a UAS developer and integrator in the small tactical arena, has been providing its solutions to Israeli forces and worldwide customers for close to two decades. As part of the transaction, IAI is acquiring the holdings of Piramal Technologies SA from India, as well as additional shares from Fiberless Access and Ronen Nadir.

Israel MoD delivers Rafael's Iron Dome to the US Army

The Israel Missile Defence Organisation (IMDO), in the Directorate of Defence R&D (DDR&D), of the Israel Ministry of Defence, has delivered the first of two Iron Dome Defence System batteries to the US Army. In August 2019 the United States and Israel signed an agreement for the procurement of two systems and the first battery was delivered in record time, and the second battery will be delivered in the near future within the framework of the agreement.

UVision Air and Milrem Robotics for Loitering Munitions

UVision Air Ltd. and Milrem Robotics have recently joined forces. The joint solution - two of Milrem Robotics' Robotic Combat Vehicles (commonly known as Unmanned Ground Vehicles, UGV's) which are now mounted with Loitering Munition Multi-Canister Launcher, is a new step in the deployment of combat unmanned remotely operated systems.

The new operational concept, presented by the two companies, is designed to offer frontline forces with a new independent ability to locate, track and accurately eliminate heavily armoured targets from large distances in challenging battlefield conditions, including

GPS denied environment and communication jamming, without the need for a headquarters' support. It provides small light forces with advanced ISR capabilities combined with highly accurate long-range heavy fire power that were achieved until now only with complex cooperation between several units and echelons.

Elbit helicopter systems for the US Army

Elbit has been awarded an Indefinite Delivery/Indefinite-Quantity (ID/IQ) contract with a maximum value of approximately $50 million to produce spare parts in support of the Aviators' Night Vision Imaging System Head-Up Display system (ANVIS HUD) for the US Army. The ANVIS HUD is a day and night display system that connects to the helmets of Army helicopter pilots, allowing the pilots' heads to remain upright and looking out of the aircraft, with all applicable information presented in front of the pilots' eyes, instead of looking down or inside the cockpit to view information from various sensors.

Latvia installs new SPIKE missiles team trainer

Latvian National Armed Forces have completed the installation of a new state-of-the-art Team Trainer for SPIKE Missiles. The new system will train Latvian forces to use Rafael Advanced Defense System's SPIKE LR2 and SR missiles, procured from EuroSpike (a joint venture between Rafael, Diehl Defence, and Rheinmetall Electronics). The STT provides the SPIKE LR2 and SPIKE SR gunners, squad and section commanders, fully-simulated battlefield training, improving both gunnery and command and control proficiency levels, leading the gunner through all stages of the firing sequence from VIS or IR surveillance of a simulated image up to target impact.

Elbit Support for the US Navy V-22

Elbit has been awarded an approximately $35 million five-year firm-fixed-priced contract by the US Naval Supply Systems Command (NAVSUP) for repair of line-replaceable units in support of the V-22 aircraft.

Czech Republic selects Rafael's SPYDER ADS

The Czech Ministry of Defense has informed the Israel Ministry of Defence of its decision to equip its military with an Israeli air defence system produced by Rafael Advanced Defense Systems. Spyder (Surface-to-Air Python & Derby), is a quick reaction, low-to-high surface-to-air missile system designed to counter attacks by a variety of aerial threats including aircraft, helicopters and UAVs. The system provides effective protection of valuable assets, as well as first-class defense for maneuvering forces located in combat areas. The Spyder system includes a radar system produced by IAI Elta.

Flying the MiG-35

The pilot's perspective

The MiG-35 multirole light fighter, considered as 'flagship' of the 'MiG' Corporation aircraft family today, is also the most flexible opportunity for development of cooperation between Russia and India in this area. In this article, Chief Pilot of the 'MiG' Corporation, Hero of Russia Mikhail Belyaev talks about attributes of the MiG-35 and his impressions of flying one of the most modern Russian combat aircraft.

The MiG-35 is an excellent aircraft, with excellent aerodynamic characteristics and high thrust-to-weight ratio which makes it possible for the pilot to always be at the peak of performance and optimally select options while on combat missions.

The aircraft is controlled using HOTAS with all critical switches on the powerplant control levers and the aircraft control column. All data is displayed on the HUD, full colour cockpit MFDs and the pilot's helmet mounted display (HMD). With this the pilot has all the information needed without looking inside the cockpit during flight missions.

During development of the MiG-35, its designers took advantage of experience accumulated over the past decades.

Essentially in the sphere of "pilot-aircraft friendly interface", new and contemporary technologies were used to optimise pilot interaction with the avionics. Maximum possible extent of tactical data is provided to the pilot to control his aircraft without being distracted by subordinate switches and buttons.

Firstly, flight mission effectiveness must be ensured. We reduced the number of essential actions, so as to reduce the time for situation assessment. The pilots interaction with avionics – the interface – has been logically worked on, with a large multi-function display dominant in the aircraft cockpit. This gives great advantages to the pilot for carrying out various combat flight missions, be they: air-to-air, air-to-surface and air-to-sea, or reconnaissance. Virtually the entire range of weapons used in Russian inventory can be employed, as also integration of foreign systems by Indian forces in cooperation with MiG.

Extreme climatic testing

After design and development of the aircraft, including all required equipment, a very large number of flight tests are performed, in various climatic conditions with temperatures ranging from -50oC to +60oC in increased humidity. The MiG-35 prototype underwent tests, first in normal conditions of Russia, then in the more extreme southern and northern latitudes. The experience we accumulated during development of earlier aircraft types confirmed the MiG-35 demonstrated very reliable results within the entire range of climatic conditions: from the very cold artic north, down to warmer southern latitudes close to the equator and also high humidly sea conditions. The MiG-35 would perform perfectly throughout the varied Indian conditions from the blazing heat to freezing cold, and in sandy desert conditions, all well proved in flight tests.

Another important aspect of tests concerns air combat simulation. In modern air warfare, there is a need for high level of situational awareness, close interaction and constant data exchange between friendly forces participating in the action. We have worked on making interaction of the pilot with systems in the cockpit in such manner that the pilot, while looking out of the cockpit for most of the time, accurately monitors the situation and is fully aware of the tactical situation. For this, the designers firstly, increased size of cockpit canopy which now gives the pilot an almost 360 degrees view. Secondly, it is possible for the pilot to change inclination angle of the ejection seat, because of which comfortable position is ensured for viewing outside. The MiG-35's canopy design provides maximum view for close air combat or, as our foreign colleagues call it, "dog fights" when the pilot's full attention is on the outside.

During flight tests, we continuously checked and proved the entire designed performance of the MiG-35's on-board systems and weapons, both guided and unguided, at ranges from minimum admissible to maximum possible against air, ground and also sea targets.

The pilot-aircraft interface

Despite the scope of data being received by the pilot having significantly increased and missions that aircraft should perform becoming more complex, we tried to maintain the previous level of simplicity, convenience and comfort for the pilot when flying the aircraft and during combat missions. Due to the 'succession principle', we have raised to the higher levels all earlier attributes of the MiG-29 family. Indian pilots are very familiar with MiG aircraft and will surely vouch for this.

In the development of new generation fighters, it is impossible to not be a part of this network–centric warfare. And of course, MiG designers are working not only on autonomous operation of individual aircraft, but also network linking with others. Because of this, even in a single-seat aircraft, the pilot is fully aware of the tactical situation around him: where he is, where friends and foes are, but primarily how would the mission be performed in the most effective way.

It is always difficult to design relatively small and light aircraft with limited cockpit space to become powerful fighters. This is where design school mastery comes into play, which makes the pilot's plays in the cockpit comfortable, and aircraft controls convenient and straightforward.

The MiG-35 certainly has all the attributes to take its place in the series considered as amongst the world's best fighters. It is hoped very much that the MiG-35 will be also assessed as such by Indian pilots and thus continue in the glory of its predecessors.

Courtesy: MiG

Drawing: Amartya Mitra

First Gripen E for Brazil

The Gripen E, named F-39E Gripen by the Brazilian Air Force (FAB), was officially presented on 23 October 2020, during the celebrations of Aviators' Day and the Brazilian Air Force Day, at Wing 1, in Brasília. The aircraft flew over the air base after an air display of the Brazilian Smoke Squadron.

The ceremony was attended by Brazilian President Jair Bolsonaro, Brazilian Defence Minister Fernando Azevedo e Silva; the Swedish Ambassador to Brazil, Johanna Brosmar-Skoogh; the Brazilian Air Force Commander, Air Lieutenant Brigadier Antonio Carlos Moretti Bermudez; Commander of the Swedish Air Force Major General Carl-Johan Edström; Chairman of the Board of Directors of Saab, Marcus Wallenberg; and President and CEO of Saab, Micael Johansson, among others.

"It is a great honour to see Gripen E at the ceremony in celebration to the Aviators' Day and the Brazilian Air Force Day. I do not believe that there is a more appropriate occasion for this presentation, as it certainly means a lot to all Brazilian aviators to have the aircraft flying in the skies of Brazil", stated Micael Johansson, CEO and President of Saab. "This is the result of a successful collaboration between Brazil and Sweden, and a great opportunity to further strengthen ties between the two countries".

Lieutenant Brigadier Bermudez pointed out that the new fighter is soon ready to begin operations by the FAB. "The development and manufacture of the smart fighter has also been closely monitored by members of the Brazilian Air Force and involves professionals from several national companies. Therefore the 23rd of October is even more special this year, as we have the official presentation of the first F-39 Gripen that arrived in Brazil".

The aircraft arrived in Brazil on 20 September and three days later made its first flight in the country, from Navegantes (Santa Catarina State) to Gavião Peixoto (São Paulo State) to continue the flight test programme.

In Brazil, the activities include tests of the flight control and climate control systems, as well as tests on the aircraft in tropical climatic conditions. In addition to the tests that are common to a Gripen E programme aircraft, unique characteristics of the Brazilian aircraft will be also tested, such as armament integration and the Link BR2 communication system - which provides encrypted data and voice communication to the aircraft.

The first fighters will be delivered to the Brazilian Air Force at Wing 2, in Anápolis (Goiás State), at the end of 2021.

The partnership with Brazil began in 2014, with the signing of contract for the development and production of 36 Gripen E/F aircraft for the Brazilian Air Force, including systems, support and equipment. An extensive technology transfer programme, which takes place over a ten year period, is already promoting the development of the local aviation industry through partner companies participating in the Brazilian Gripen Programme.

During this period, more than 350 Brazilian technicians and engineers will also participate in theoretical and practical training in Sweden in order to acquire the necessary knowledge to perform the same tasks in Brazil. So far, more than 230 professionals have completed the training and most of them are back in Brazil, working at the Gripen Design and Development Center (GDDN).

The Gripen E/F fighters that will be delivered to the Brazilian Air Force will be developed and produced in collaboration with the Brazilian technicians and engineers. From 2021 onwards, the complete assembly of 15 aircraft will begin locally. The development of the two-seat Gripen F is advancing with numerous activities at the GDDN.

Developments at Saab

Second GlobalEye delivered

Saab has delivered the second GlobalEye Swing Role Surveillance System to the United Arab Emirates on 30 September 2020. This follows Saab's delivery of the first GlobalEye aircraft in April 2020 to the UAE, which has ordered three GlobalEye aircraft. GlobalEye is Saab's new airborne early warning and control solution. It provides air, maritime and ground surveillance in a single solution. GlobalEye combines Saab's new Erieye Extended Range Radar and a range of additional advanced sensors with the ultra-long range Global 6000 aircraft from Bombardier.

Anti-ship missiles for Germany

Saab has received an order from its German partner Diehl Defence for the RBS15 anti-ship missile for provision to the German Navy with deliveries between 2022 and 2026. This order is part of a framework agreement between Saab and Diehl Defence, which offers the possibility for additional procurement in the future. The RBS15 missiles and launcher systems provided in this order will be placed on the German Navy's *Braunschweig*-class corvettes. In addition to the missile systems, the order also includes associated equipment and services. The German Navy has been a user of RBS15 since 2011.

Saab Radar System Components for the USMC

Saab has received a US $36.7 million order for the US Marine Corps' AN/TPS-80 Ground/Air Task Oriented Radar G/ATOR; Saab received the order from Northrop Grumman Systems Corporation, the prime contractor for G/ATOR. The order includes components and subsystems in support of the Full Rate Production phase. Saab's deliveries relating to this contract will take place between 2020 and 2021 from its facility in Syracuse, New York, USA.

Order for Combat Training Centre support from Norway

Saab has received an order for service and maintenance of the Norwegian Combat Training Centre. Saab's commitments in the contract covers operational system support and setup of an additional site in the northern part of Norway. Saab has worked together with and supported Norway with training and simulation systems since 2004.

UAE requests 50 F-35s and 18 MQ-9Bs

Government of the United Arab Emirates (UAE) has requested procurement of some fifty F-35A Joint Strike Fighter Conventional Take-Off and Landing (CTOL) aircraft, 54 Pratt & Whitney F-135 Engines and related equipment, at a total estimated cost of $10.4 billion. Additionally, the UAE has requested 18 Weapons-Ready MQ-9B Remotely Piloted Aircraft and AIM-120C8 Advanced Medium Range Air-to-Air Missiles (AMRAAM).

MQ-9B for Taiwan

The State Department has made a determination approving a possible Foreign Military Sale to the Taipei Economic and Cultural Representative Office in the United States (TECRO) of four Weapons-Ready MQ-9B Remotely Piloted Aircraft and related equipment at an estimated cost of $600 million.

Israel opposes F-35s for Qatar

Israel will oppose Qatar's request to buy F-35s from the US, "even at the price of preventing the normalisation of ties with the Gulf Arab country", according to Israeli Minister Eli Cohen. According to reports, the United Arab Emirates (UAE), which signed a US-brokered normalisation pact with Israel in September, has similarly requested America's most sophisticated fighter and the Trump administration was expected to submit the request to Congress, where it is likely to generate considerable opposition about how this affects Israel's security.

Rafale F3Rs in action

French Air and Space Force's Dassault F3R standard Rafales carried out air strikes against ISIS targets operating from Prince Hassan Air Base (also known as H-5) in Jordan. The strike marked a significant milestone for the Rafale, as it was the first operational weapons launch of the latest F3R standard variant (recently delivered to the Indian Air Force). All four fighters were from the 30e *Escadre de Chasse* (30th Fighter Wing) at Mont-de-Marsan. The F3R is the latest variant of Rafale able to carry the Meteor BVRAAM missile, the TALIOS advanced targeting pod and new air-to-ground weapons such as the GBU-16.

Final Eurofighter Typhoon for Italy

(Image Credit: Gian Marco Anzellotti from Roma, Italia)

The Italian Air Force has officially taken delivery of its final Eurofighter Typhoon during a ceremony held at Leonardo's plant in Caselle (Turin) in north-western Italy. The delivery completes an order for a fleet of 21 Typhoon aircraft to boost the country's air defences. In 2009, a total of 112 aircraft were ordered under a Tranche 3A contract for Germany, Italy, Spain and the UK.

Germany orders 38 more Typhoons

Airbus has signed a contract to deliver 38 new Eurofighter Typhoons to the Luftwaffe, making Germany the largest operator of this fighter. The order, also known by its project name *Quadriga*, covers the delivery of 30 single-seater and 8 twin-seater Eurofighters. Three of these will be equipped with additional test equipment as Instrumented Test Aircraft for further development of the Eurofighter.

BAE awarded ECRS Mk.2 radar contract

A contract to develop next generation radar for the RAF's Eurofighter Typhoons has been awarded to BAE Systems and Leonardo. The contract is for development of the European

Common Radar System Mark 2 (ECRS Mk.2), to a standard ready to be integrated onto the fighter. This will involve work developing the sensors at Leonardo's sites in Edinburgh and Luton, together with integration services at BAE Systems' facility in Lancashire. The ECRS2 is a multi-functional array (MFA) that will give the RAF Typhoons much improved electronic warfare capability, in addition to traditional radar functions, including wide band electronic attack.

RFI issued for Japanese F-X

The concerned Japanese authority has issued an RFI for their F-X future fighter programme. Of the seven international companies initially expressing interest, only BAE Systems, Boeing and Lockheed Martin have formally responded, the latter also involving Northrop Grumman. The selected company will team with MHI (Mitsubishi Heavy Industries) whose conceptual design is as per image above. The F-X is to replace the Mitsubishi F-2 with the JASDF in the 2030s.

GE F110 engines for USAF's F-15EX

GE Aviation has delivered its first F110-GE-129 engines for the USAF's F-15EX advanced fighter. In June, the Air Force Life Cycle Management Center (AFLCM) had awarded GE Aviation

a Lot 1 contract to produce 19 F110-GE-129 engines, including installs and spares and modernised engine monitoring system computers for the F-15EX.

30th F-35A Lightning II for RAAF

The Royal Australian Air Force has recently received its 30th F-35A Lightning II from Lockheed Martin. Significant work is undertaken before Australia can formally accept each aircraft, with pre-acceptance testing involving multiple checks on the production line at Lockheed Martin's facility in Texas, as well as several flight tests to ensure each F-35A meets the requirements of the RAAF.

BAEs IFF for F-22 Raptor

BAE Systems has received certification for its *Identification Friend-or-Foe* (IFF) transponder for the F-22 fifth genertion fighter. The IFF transponder waveform integration is part of a US Navy contract to upgrade the Multifunctional Information Distribution System Joint Tactical Radio System (MIDS JTRS) terminal for the US Air Force.

(photo: Vayu)

BAE Systems EW for F-35 Lightning II

BAE Systems has been contracted by Lockheed Martin for the production of additional electronic warfare (EW) systems for Lots 15 and 16 long lead, sustainment spares and retro fit kits for the F-35 Lightning II, "providing advanced situational awareness and threat response capabilities that support critical missions in contested airspace".

Boeing Australia's 'Loyal Wingman'

Boeing Australia has "powered up" the commercial turbofan engine on the first *Loyal Wingman* aircraft as part of ground testing and preparations for first flight. This milestone comes after completing the first unmanned *Loyal Wingman* aircraft for the Royal Australian Air Force earlier in 2020, a major step forward for this unmanned vehicle serving as the foundation for the global Boeing Airpower Teaming System, an artificial intelligence-powered aircraft developed for the global defence market.

Japan orders more KC-46 tankers

The Japan Air Self-Defense Force (JASDF) has ordered its third and fourth Boeing KC-46 tanker through the Foreign Military Sale (FMS) process. These will carry out air-refuelling of US, allied and coalition military aircraft compatible with international aerial refueling procedures and can also carry passenger, cargo and for Casevac.

First C295 in Canada

The first Airbus C295 aircraft for the Royal Canadian Air Force's (RCAF) Fixed Wing Search and Rescue Aircraft Replacement (FWSAR) project, has recently being delivered to No.19 Wing, Canadian Forces Base Comox, in British Columbia, Canada. This is the first of 16 C295s contracted for in December 2016 to meet the RCAF's fixed-wing search and rescue (FWSAR) requirement.

Gulfstream G280 for Phil AF

A Gulfstream G280 command and control (C2) aircraft was inducted into the Philippine Air Force at Clark AF Base in Pampanga on 21 September 2020. This is to be used for transportation of senior personnel and also be operated as an airborne post for C2 operations, both by the military and the civilian government. Aside from C2 missions, the aircraft will

be used for airborne early warning, medical evacuation, high altitude atmospheric research and intelligence, surveillance and reconnaissance missions.

12 Beechcraft T-6C Texan II for RTAF

Textron Aviation Defense has won a contract from the Royal Thai Air Force (RTAF) to deliver 12 Beechcraft T-6C Texan II advanced military training aircraft. The contract also includes the supply of ground-based training systems, a mission planning and debrief system, ground support equipment and spare parts. It will support RTAF Flying Training School operations at Kamphaeng Saen airbase.

A-29 Super Tucanos for Phil AF

All six Super Tucano aircraft ordered by the Philippine Air Force (Phil AF) have now been handed over. The aircraft will be deployed for close air support, light attack, surveillance, air-to-air interception, counter-insurgency missions, advanced training and are part of PAF's ongoing modernisation plan. These aircraft will be operated and maintained by the Phil AF's 15th Strike Wing.

First NH90 delivered to Spanish Air Force

The partner companies (Airbus Helicopters, Leonardo and Fokker) have delivered the first NH90 to the Spanish Air Force for search and rescue (SAR) and combat search and rescue (CSAR) missions. The Spanish Air Force will receive 12 NH90s intended to replace its aging fleet of AS332 Super Pumas. Spain has ordered a total of 45 NH90s in the tactical transport version.

MD 530Fs for Afghanistan and Lebanon

MD Helicopters have received two independent contract awards from the Army Contracting Command-Redstone to support allied operations of the MD 530F Cayuse Warrior helicopter. The first contract, requires MDHI to retrofit 18 legacy MD 530F helicopters operated by the Afghanistan Air Force with ballistic-tolerant crashworthy fuel systems (CWFS). Under the contract, MDHI will perform the retrofit of the CWFS for each helicopter in Afghanistan. The second contract modifies MDHI's original 2018 indefinite-delivery/indefinite-quantity production contract to supply six aircraft to the Lebanon Air Force.

US Marines retire Bell AH-1W

The United States Marine Corps (USMC) have officially retired their Bell AH-1W Super Cobra after 34 years of service. Originally designated as the AH-1T+, the Super Cobra first flew on

16 November 1983 at Bell's Flight Research Centre in Arlington, Texas. Bell delivered the first AH-1Ws to the Marines on 27 March 1986 and delivered the final aircraft in 1999, making a total fleet of 179 attack helicopters. The AH-1Ws remanufactured as AH-1Z Vipers will continue to serve with the United States Marines.

Airbus reveals new zero-emission concept airliners

Airbus has revealed three concepts for the world's first zero-emission commercial aircraft which could enter service by 2035. Each of these concepts represent a different approach to achieving zero-emission flight, exploring various technology pathways and aerodynamic configurations in order to lead the way in decarbonisation of the aviation industry. All of these concepts rely on hydrogen as a primary power source.

FAA clears Boeing 737MAX

On 18 November 2020, the Federal Aviation Administration (FAA) rescinded the ban on Boeing 737MAX aircraft, paving the way for this airliner to resume commercial services. The US aviation regulator issued an airworthiness directive specifying design changes to be made before the airliner returns to service and has notified training requirements for pilots. Changes have also been proposed to flight control software to protect against malfunction of Maneuvering Characteristics Augmentation System (MCAS) of the aircraft.

Etihad flies to Israel

Etihad Airways national airline of the UAE, became the first GCC carrier to operate a commercial passenger flight to and from Israel. Flown in partnership with the Maman Group, the Etihad Boeing 787 Dreamliner aircraft was employed for this historic service from Abu Dhabi to Tel Aviv on 21 October 2020.

1,500th A330 delivered

The 1,500 A330 delivery took place on 21 September to Delta Air Lines. The application of 'incremental innovations' since its service entry, "has resulted in the A330's ongoing versatility, functionality, increased payload-range, class-leading economy with state-of-the-art Airspace cabin comfort and 4th generation IFE".

Civilian flying training in Tibet

Of late there have been reports of young Tibetans learning to fly from select locations in Tibet, in the region long regarded as a "no-fly zone". According to a news release, one of the helicopter training schools for civilians is at Lhasa's Secondary Vocational and Technical School which leads to a commercial helicopter flight license. In the photograph is Jianre Yixi who has recently obtained a commercial helicopter flying license and has begun operating helicopters on medical evacuation duties.

GE9X turbofan certified

The GE Aviation GE9X engine which powers the Boeing 777X has been certified by the Federal Aviation Administration, with nine GE9X test engines carrying out 5,000 hours and 8,000 cycles to obtain the Federal Aviation Regulation Part 33 certification. Having 490kN thrust, the GE9X, also has the largest fan diameter of any commercial turbofan extant. This powerplant is developed

to achieve a 10% lower specific fuel consumptions compared with that of the GE90-115B on the 777-300ER. GE has produced eight GE9X test engines and two test spares, delivering them to Seattle for the 777X test fleet of 4 aircraft.

Raytheon StormBreaker Smart Weapons

Raytheon Missiles & Defense's StormBreaker smart weapon has been approved for operation by F-15Es of the US Air Force's Air Combat Command. The smart weapon's initial fielding on the F/A-18E/F Super Hornet for the US Navy will be later this year and followed by the F-35 Joint Strike Fighter.

GA-Europe takes over RUAG Aerospace Services

General Atomics Europe GmbH at Dresden are taking over RUAG Aerospace Services at Oberpfaffenhofen near Munich, this Swiss company having assumed ownership of Fairchild Dornier in 2002. RUAG restarted production of the Dornier 228 light transport aircraft, albeit importing 'green' aircraft from HAL at Kanpur, then completing and customising the aircraft for export. RUAG were also responsible for the after sale support and maintenance of all Dornier 228s excluding India.

Boeing, Honeywell, Rolls-Royce Deutschland in partnership

Boeing, Honeywell Aerospace and Rolls-Royce Deutschland Ltd. have formalised an agreement to provide in-service support of the T-55 engine should the government of Germany select the H-47 Chinook for its *Schwerer Transporthubschrauber* (STH) heavy-lift helicopter requirement. Under the agreement, Honeywell will license Rolls-Royce Deutschland as its partner in Germany to perform depot-level maintenance of the Chinook T-55 engine operated by the Luftwaffe.

36 Leonardo TH-73A for USN

The US Department of Defense has awarded AgustaWestland Philadelphia Corp. a $ 171 million modification to the previously awarded firm-fixed-price contract for the US Navy's Advanced Helicopter Training System. This exercises options for the production and delivery of an additional 36 TH-73A with work expected to be completed in December 2022.

6 more CH-53K for USN

Sikorsky will build six additional production CH-53K King Stallion helicopters for the US Navy, to further support the US Marine Corps in its mission to conduct expeditionary heavy-lift assault transport of armoured vehicles, equipment and personnel to support distributed operations deep inland from a sea-based center of operations. The six helicopters are part of the 200 aircraft Programme of Record for the US Marine Corps and their addition makes a total of 24 CH-53K production aircraft now under contract.

MBDA MAST-F for the Tiger helicopter

French Minister for the Armed Forces Florence Parly has announced that MBDA will develop the Future Tactical Air-to-Surface Missile (MAST-F) as the main French Army air to ground armament for the Tiger combat helicopter. This has a range of over 8 km, even when fired from a stationary platform at low altitude, its multi-effect warhead targetting a range of targets, from modern battle tanks to hardened combat infrastructure.

Boeing to co-develop SPEAR

Boeing has been awarded a $30 million contract by the US Navy to co-develop the Supersonic Propulsion Enabled Advanced Ramjet (SPEAR) flight demonstrator along with US Navy's Air

Warfare Centre Weapons Division. This follows the Department of Defense's RFI to determine technical requirements of future carrier-based land and sea strike weapons systems.

Trans Atlantic ferry of NATO RQ-4D Phoenix

Northrop Grumman have ferried the fifth NATO Alliance Ground Surveillance (AGS) aircraft, in a non-stop transatlantic flight. The aircraft departed from Palmdale, California and landed nearly 20 hours later at Sigonella Air Base in Italy.

Transformation of C-130s

The US Air Force Strategic Development Planning and Experimentation (SDPE) Office has awarded Lockheed Martin a $25 million contract to support the Service's *Palletized Munitions*

Experimentation Campaign. The fourth phase includes a system-level demonstration in 2021 which continues to assess the potential to deliver large volumes of air-launched weapons via airlifters.

"PLA to be on par with US Army by 2027"

During the recent conclave of the Communist Party of China (CPC), plans have reportedly been finalised "to build a fully modern military on a par with the US by 2027", that year marking the centennial of founding of the People's Liberation Army (PLA). The plenary session of the ruling CPS headed by president Xi Jinping, which held a four day meeting, adopted proposals for formulation of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-Range Objectives through the Year 2035.

Chinese-origin SAMs in PoK

There are reports of Chinese-supplied surface-to-air missiles being installed at various locations in Pakistan occupied Kashmir (PoK). These include a location near Lasadanna Dhok where Pak Army personnel and civil engineers have been working, close to the brigade headquarters at Bagh. Other locations are at Chinari and Chakoti, close to the LoC. Some 10 Chinese personnel are also reportedly stationed at the sites, according to reports. The IAF Chief has recently stated that India was "aware that China and Pakistan are cooperating closely, and Pakistan is now increasingly dependent on China for their defence supplies, doing a lot of exercises together and this activity is on the increase".

US Army orders Stryker IM-SHORAD vehicles

General Dynamics Land Systems (GDLS) has been awarded a $1.219 billion contract to produce, test and deliver Interim Maneuver Short-Range Air Defence (IM-SHORAD) systems to the US Army, with on initial order for 28 Stryker IM-SHORAD.

Pak Navy adding 50 warships

According to Admiral Zafar Mahmood Abbasi, outgoing CNS of the Pakistan Navy, his service will add more than 50 new warships, including 20 major combatants, to the fleet as part of an ambitious modernisation plan. These will include four Chinese frigates and an equal number of Turkish–origin frigates between 2023 and 2025. Meanwhile, the *Hangor*-class submarine project in collaboration with China was progressing according to the plan which involves a total of eight submarines, four each built in Pakistan and China.

Largest investment in UK Defence

The biggest programme of investment in British Defence since the end of the Cold War was announced on 19 November 2020 by UK Prime Minister Boris Johnson. This is a £16.5 billion increase above the manifesto commitment over four years "that will protect our citizens, help us build back better from coronavirus by creating thousands of new jobs and demonstrate to our allies they can always count on the UK". This is over and above the manifesto commitment, the UK Government having already pledged to increase defence spending by 0.5% above inflation for every year.

The UK PM also stated that, "In the last year alone HMS *Enterprise* has come to the aid of Lebanon following the explosion in the Port of Beirut, RFA Argus and Army personnel have delivered disaster relief to Central American countries ravaged by Hurricane *Eta*, and the RAF has transported vital medical supplies to communities struggling against coronavirus in West Africa and the UK's Overseas Territories".

BAE *Archerfish* for US Navy

BAE Systems has been awarded a contract worth up to £87 million by the US Department of Defence (DoD) to manufacture and deliver *Archerfish* mine neutralisers for the US Navy.

This is the fourth consecutive Archerfish contract awarded to BAE Systems since 2003 and will have the company deliver these over the next seven years. *Archerfish* is used by the US Navy's MH-60S helicopter squadrons for Airborne Mine Neutralisation, deployed from Littoral Combat Ships.

Suffren fires MdCN

On 20 October 2020, the *Suffren*, first-in-series of the six nuclear-powered attack submarines (SSNs) in the *Barracuda* programme, carried out test firing of an MdCN (*Missile de Croisière* Naval) naval cruise missile from the sea near the DGA missile test centre at Biscarrosse.

The firing completes qualification phase of the integration of all *Suffren*'s weapon systems, as part of its sea trials, conducted by the DGA (France's Defence Procurement Agency). The *Suffren* will be delivered to the French Navy by the end of 2020, entering operational service in 2021.

Columbia-class submarines for USN

General Dynamics Electric Boat have announced that the US Navy has awarded it a $9.4 billion contract modification option for construction and test of the lead and second ships of the *Columbia*-class, as well as associated design and engineering support. Electric Boat is the prime contractor on the *Columbia*-programme, which will replace the aging *Ohio*-class of ballistic missile submarines.

USN's Stingray squadron

A new United States Navy unmanned carrier launched multi-role squadron 10 (VUQ-10) equipped with the Boeing MQ-25A Stingray aerial refueling unmanned air vehicle, was formed in October 2020. This will be a Fleet Replacement Squadron based at Naval Air Station Point Mugu, part of Naval Base Ventura in California, to train operators on the new system. Also assigned would be detachments to carrier air wings to provide aerial refueling services until additional squadrons are formed. The US Navy has a requirement for some 72 Stingrays and hopes to reach initial operational capability with the type by 2024.

BAE Naval Guns for RN Type 31 frigates

BAE Systems will produce and deliver Bofors 40 Mk4 and Bofors 57 Mk3 naval guns for the UK's Type 31 general purpose frigate programme. The contract includes five Bofors 57 Mk3 medium caliber guns and 10 Bofors 40 Mk4 small calibre guns, both close-in weapon systems designed to protect ships against modern and future complex threats. The guns also offer the Royal Navy optimised ammunition, including the cost-efficient programmable Bofors 3P all-target munition.

LM2500 Gas Turbines for Pak Navy's MILGEM Corvettes

GE Marine have signed a contract with STM (*Savunma Teknolojileri Mühendislik Ve Ticaret A.S.*) of Turkey, to provide LM2500 marine gas turbines to power the Pakistan Navy's new MILGEM multipurpose corvettes. In July 2018 the Pakistan Navy had contracted for 4 MILGEM corvettes with ASFAT (*Askeri Fabrika ve Tersane Isletme* AS), two of these to be built in Turkey and the other two in Pakistan. Recent milestones for the Pakistan Navy's MILGEM programme include keel laying of the first ship in Istanbul, and the steel cutting ceremony for the second corvette in Karachi.

Japan requirement of RAM Block 2 tactical missiles

The US State Department "has made a determination approving a possible Foreign Military Sale to the Government of Japan" of RAM Block 2 Tactical Missiles and related equipment for an estimated cost of $55.311 million. Japan has a requirement for up to fifty-one RIM-116C Rolling Airframe Missiles (RAM) Block 2 Tactical Missiles.

MBDA launches VL MICA NG

MBDA has announced the commercial launch of its new VL MICA NG air defence system, based on integration into the existing VL MICA system of the MICA NG (New Generation) anti-air missile, which began development in 2018 essentially to equip the Dassault Rafale. The VL MICA system family has now been adopted, in its naval or land-based versions, by 15 armed forces around the world, and will consequently benefit from enhanced potential to counter future threats.

'3 hours and 3 minutes' to ISS

In mid-October 2020, a Russian Soyuz spacecraft, carrying a crew comprising an American and two Russians were launched from the Baikonur Cosmodrome in Kazakhstan reaching the International Space Station (ISS) in the fastest ever time of just over 3 hours. As stated by Roscosmos a new record for flights to the International Space Station was set the total time from launch to docking of the Soyuz MS-17 was three hours and three minutes, some half the time of previous such journeys.

SpaceX to ISS

Three Americans and a Japanese astronaut were onboard the SpaceX capsule launched from Cape Canaveral in Florida headed for the International Space Station (ISS) in mid-November 2020. The Crew-1 mission marks a crucial milestone in development of a space industry in which private-sector companies provide business and tourism services in low-earth orbit. Following the retirement of the Space Shuttle in 2011, NASA awarded Elon Musk's SpaceX and Boeing nearly $7 billion in contracts to build new transport systems to the space station on part of the agency's Commercial Crew Programme.

War in the Caucasus: sharp - and decisive!

The 44-day war in the Caucasus during October-November 2020, had some surprises for the world. Azerbaijan's advanced warfare technology (especially its armoured drones purchased from Turkey and Israel) completely turned the tide to overwhelm Armenian armed forces deployed in the Nagorno-Karabakh region. Drone strikes targeted Armenian and Karabakh soldiers and destroyed tanks, artillery and air defence systems, which is an 'eyeopener' on how futuristic battlefields could be shaped by relatively simple and inexperienced crew using unmanned attached drones.

For long, the disputed Nagorno-Karabakh region has been recognised as being part of Azerbaijan, but for several decades was controlled by Armenian separatists. When the Soviet Union began to disintegrate in the late 1980s, Armenia's regional parliament voted for the region's transfer to Armenia and years of clashes followed between Azerbaijan forces and Armenian separatists. Despite a Russian-brokered ceasefire agreement in place since 1994, violations took place at regular intervals, the most significant being in 2016 and July 2020.

From July to September 2020, Azerbaijan conducted a series of military exercises with participation of Turkey's ground and air forces, which likely strengthened Azerbaijan's perceived power and resolve to end the Karabakh conflict in its favour. Apart from imparting high quality military training and advanced combat equipment, Turkey also exported high-tech drones to the Azerbaijan's armed forces and concurrently trained them to use these in the most effective manner on the battlefield. Armenian soldiers faced this new reality on 27 September when Bayraktar TB2 UCAVs started releasing Roketsan MAM-L Smart Munitions over Armenian positions, decimating at least three 9K33 Osa and three 9K35 Strela-10 mobile surface-to-air missile systems. The Armenians appeared just as unaware and incapable of tackling the drone threat overhead as did the Russian Pantsir-S1s in Syria and Libya, all being destroyed without ever knowing what had hit them. Turkey's highly efficient use of drones and supporting electronics warfare systems has boosted its increasingly assertive international role and growing political and military weight.

Armenian forces were shocked that that their air defence systems in Nagorno-Karabakh, many of them veteran Soviet systems, were impossible to defend against drone attacks, and losses quickly mounted. Also, adopting a very clever war tactic, Azerbaijan's forces converted very elderly An-2 biplanes into a single use drone. These slow moving aircraft were flown over Armenian defences deployed on the battle ground. Armenians activated their radars and electronic warfare systems, hence giving away their locations to Azerbaijan's armed drones and loitering ammunitions (Bayraktar TB2 and Harpy 2) deployed in that region to neutralise these targets.

The war was over on 10 November 2020 after Armenia accepted a cease-fire on punishing terms to end the latest round of battle over Nagorno-Karabakh. In Azerbaijan, the victory was described as "historic" and that Armenia had been forced to negotiate because of Azerbaijan's military successes. Meanwhile, the Russian's have deployed some 2000 soldiers with tanks to act as peacekeepers for the next five years, positioned along the frontline in Nagorno-Karabakh and in the corridor between Armenia and Nagorno-Karabakh.

The BayraktarTactical UAS

The Turkish-origin Bayraktar Tactical UAS or Bayraktar TB1 is a surveillance and reconnaissance unmanned aerial vehicle (UAV) initially developed for the Turkish Armed Forces in a joint venture between the Kale Group and Baykar Technologies. While the Turkish Armed Forces describes Bayraktar as 'Tactical UAV Class' international classification of it would be a medium-altitude long-endurance UAV. With its 650 kg MTOW and 12 metre wingspan and powered by an internal combustion engine, Bayraktar has a ceiling of 22,500 feet and loitering for more than 24 hours.

Armament carried on four hard points includes laser guided smart munition, Roketsan Cirit 70mm missile and L-UMTAS Long Range Anti-tank missiles, and other smart munitions.

The Caucasus

The Caucasus is a region between the Black Sea and the Caspian Sea and comprises Armenia, Azerbaijan, Georgia, and some of southern Russia. Including the Greater Caucasus mountain range, this has historically been considered a natural barrier between Eastern Europe and Western Asia. The Lesser Caucasus mountain range in the south is occupied by several independent states, namely Armenia, Azerbaijan, and Georgia, but also extending to parts of northeastern Turkey, northern Iran and the partially recognised Artsakh Republic.

Map from the internet

The Caucasus have long also been the area of another 'Great Game', including that during the 19th Century between Russia and Britain to prevent ingress towards India and during the Second World War when the Germans were finally stopped at Stalingrad by Soviet armies. In the event of a German breakthrough then, the Caucasus were vulnerable for German advance to Persia and Iraq and eventually to the frontiers of the Indian subcontinent.

The Allies had then assembled troops to defend the area (PAI FORCE), consisting essentially of two Indian Infantry Divisions and an Armoured Division. In the event, the German 6th Army Group were defeated at Stalingrad and any threat of advance towards India was over.

VAYU Interview with

Hamad Salem Al Ameri,
Chief Executive Officer, CARACAL, Abu Dhabi

VAYU : *In CARACAL's understanding, what is the current stage of procurement of the CAR 816 deal with the Indian Government?*

Caracal: CARACAL was selected to supply the Close-Quarter Carbine to the Indian Army in 2018, following a rigorous selection process. CARACAL has additionally fulfilled all the requirements and procedures laid out in the Defence Procurement Procedure (DPP), with CAR 816 undergoing extensive trials across different terrains in India, as well as outside the country, to ensure that it is fully customised to the requirement of the Indian soldier. The company surpassed global competitors in terms of performance and technicalities to win the bid and we are expecting the Ministry of Defence to take the process of awarding the contract to its logical conclusion.

We would like to reiterate our commitment to the 'Make in India' initiative and the fast-tracked supply of the CAR 816 assault rifles - we remain on standby to supply the product to the customer.

VAYU : *What are the various steps and investments you are taking as part of the deal?*

Caracal: We are committed to fulfilling all obligations under the 'Make in India' initiative and will make sure that CARACAL oversees technology transfer. We have already identified the required land, facility and are in talks with potential local partners to be able to commence production. We remain completely invested in this deal and await for a formal communication to commence supply.

VAYU : About the contract, how do you propose to discharge it while meeting the 'Make in India' norms?

Caracal: CARACAL is committed to enhancing India's defence preparedness through the 'Make in India' Initiative. We have already identified the required land and facility to be able to commence production immediately. CARACAL has been in touch with potential partners in India who have the capability and capacity to manufacture components of the weapon. We will phase in the manufacturing fully in India, once the contract is awarded officially. We strongly affirm that CARACAL remains committed to its bid and is fully aligned to the 'Make in India' initiative.

VAYU : *Has there been a response from the Indian government regarding the deal?*

Caracal: We await an official confirmation from the Government of India to start up manufacturing. We remain on standby and will commence production immediately once we receive the formal award.

VAYU : *The Indian Army has a very urgent requirement for the carbines - how quickly can the first lot be delivered by CARACAL?*

Caracal: On the technical side, we are fully equipped to supply the CQBs to the Indian market in 12 months as per the fast track procurement terms. We await an official communication from the Indian Ministry of Defence to commence the process of supplying the carbines. Our focus remains on delivering a product which is best in quality and tailormade as per the requirements of the Indian soldier.

We reaffirm our commitment to the 'Make in India' initiative, the fast-tracked supply of the CAR 816 assault rifles, and remain on standby to supply the product to the customer upon instruction.

VAYU : *What are the specifications of the CQB?*

Caracal: The CARACAL CAR816 is a centre-fire, gas-operated tactical rifle, chambered in 5.56x45mm NATO. The CAR816 is a tactical weapon, available in semi-automatic and select-fire configurations, operated by a short-stroke pushrod gas piston with a rotating bolt system. Unlike previous technology utilised in the direct gas impingement systems,

the CAR816, due to its advanced piston system, remains clean and cool even after rapid succession firing. The CAR816 is capable of firing up to 900 rounds per minute in full-automatic mode. The rifle is also available in various barrel lengths and has an effective range of 550 metres. It has a weight of approximately 3.0kg without the magazine and enables soldiers to accessorise for various missions. Depending on the customer's requirements, the weapon can be completely ambidextrous, with all controls operational for both right-handed and left-handed shooters.

VAYU : In a recent press release, CARACAL said it is ready to manufacture the guns in India with a local partner. Can you please share details of the partner, what sort of local arrangement for division of work is expected and where would such a manufacturing plant come up?

Caracal: CARACAL has been in touch with potential partners in India who have the capability and capacity to produce the required parts of the weapon. We are well equipped and committed to fully manufacture this product in India. More details about the partner and the manufacturing plant will be revealed once the contract is awarded.

VAYU : CARACAL is a wholly UAE govt owned company - what other projects are on for discussion between India and the UAE and what cooperation for the future is planned? What is the larger plan of CARACAL for the Indian market?

Caracal: Presently, the completion of the CAR 816 deal with India is our primary focus. CARACAL has a wide portfolio of 17 products of various calibre, and we are always available to engage with the Indian Ministry of Defence on new projects.

Also, India shares a strong bilateral relationship with the UAE. Mutual cooperation and understanding in the area of defence manufacturing will enhance and strengthen our existing ties. In fact, the completion of the CAR 816 deal will be a great and positive development for us, at CARACAL.

VAYU : Can you share details regarding the EDGE Group, which CARACAL is a part of?

Caracal: EDGE is an advanced technology group for defence and beyond, and CARACAL falls within its Missiles & Weapons cluster. Dedicated to bringing innovative technologies and services to market with greater speed and efficiency, EDGE invests in advanced technologies such as autonomous capabilities, cyber-physical systems, advanced propulsion systems, robotics and smart materials, with artificial intelligence embedded across all of its products and services.

EDGE has 12,000 employees working across 25 entities and offers expertise in five core clusters: Platforms & Systems, Missiles & Weapons, Cyber Defence, Electronic Warfare & Intelligence and Mission Support. EDGE's operating model focuses on building collaborative opportunities. It is open to co-invest and co-develop new ideas, concepts and platforms. And CARACAL is proud to be part of a conglomerate that is reimagining capabilities through technology leadership, with research and development at its core.

CARACAL is an entity within its own rights and has wholly owned subsidiaries in Germany and the USA, with a production legacy spanning more than 15 years. Our company designs, engineers, innovates and manufactures battlefield-proven firearms for law enforcement, security and military forces and we continue to enhance and update our products, incorporating the latest technological advances, changing customer needs and evolving mission requirements.

General Atomics: Developments and Contracts

UK MoD contract for Protector RPAS

After a successful development phase the Protector is set to enter service by mid-2024, this the Remotely Piloted Air System (RPAS) delivery a step-change in capability for the RAF.

Protector is the world's first certified RPAS, enabling it to fly in busy, unsegregated airspace, including civilian airspace, thanks to its ground-breaking 'detect and avoid' technology. Its ability to fly consistently for up to 40 hours will offer the RAF vastly improved armed intelligence and reconnaissance sorties. Protector also comes with enhanced data links and will carry next-generation, low collateral, precision strike weapons: the UK-made Brimstone missile (MBDA) and Paveway IV Laser Guided Bomb (Raytheon UK).

It also includes an option to build 13 more aircraft and four ground control stations, which will complete the current planned fleet of 16 aircraft, more than doubling the capability currently provided by the Reaper.

GA-EMS for US Army missile programme

General Atomics Electromagnetic Systems (GA-EMS) has been selected as a prime contractor for the US Army Combat Capabilities Development Command (CCDC) Aviation and Missile Centre's (AvMC) Digital Guided Missile (DGM) prototype programme under the Aviation and Missile Technology Consortium (AMTC). GA-EMS will develop advanced missile conceptual designs in direct support of the Multi-Domain Operations (MDO) for the Army Modernisation Campaign.

GA-ASI and Skyborg Vanguard Development

General Atomics have been awarded an indefinite-delivery/indefinite-quantity (IDIQ) contract by the US Air Force Life Cycle Management Center (AFLCMC) for the Skyborg Vanguard Programme. Skyborg is an autonomy-focused capability that aims to integrate attritable, autonomous unmanned aircraft with open mission systems to enable manned-unmanned teaming.

Strategic Industry Engagements

General Atomics will engage Canadian companies to participate in the development and success of the MQ-9B SkyGuardian RPAS. "GA-ASI is always looking to build on our existing Canadian industry relationships," stated Linden Blue, CEO, GA-ASI. "A strong North American industrial partnership contributes to the growth and success of our domestic and international endeavors. Team SkyGuardian Canada is aimed at building long-term relationships that advance Remotely Piloted Systems and Autonomous Technologies (RPS-AT) and developing sustainable jobs in Canada."

SkyGuardians for Belgium

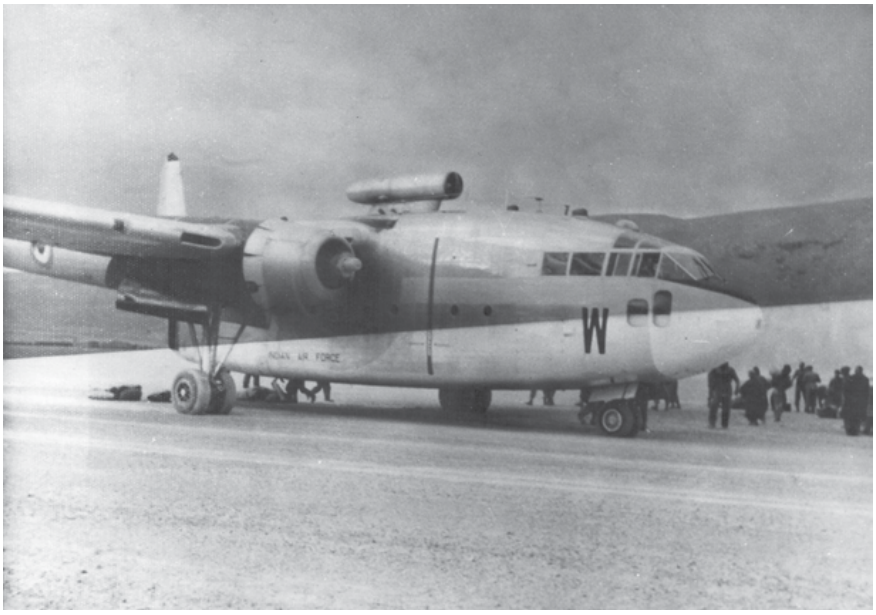
General Atomics has signed a Foreign Military Sales contract with the U.S. Air Force for the Belgian Ministry of Defence to acquire the MQ-9B SkyGuardian Remotely Piloted Aircraft System (RPAS). The contract covers the design, development, integration and production of the RPAS with its EO/IR video and SAR/GMTI surveillance payloads, as well as Certifiable Ground Control Stations (CGCS), Portable Pre-Flight/Post-Flight Equipment (P3E), ground support equipment and spares. First delivery is expected in 2023.

DBO, Fulcrum of the Karakorams

British-formulated boundaries for Ladakh.

Operationalising the world's highest airfield

On 23 July 1962, well over half a century back, an Indian Air Force Fairchild C-119G Packet piloted by Squadron Leader (later Air Marshal) CKS Raje and fitted with an auxiliary jet engine fitted on its dorsal fuselage, made a historic landing at Daulat Beg Oldi (DBO), the highest airstrip in the world. Located at an altitude of nearly 16,800 feet, DBO is at base of the Karamoram Pass and a mere 8 km south and 9 km west of the Line of Actual Control (LAC) being of great strategic importance.

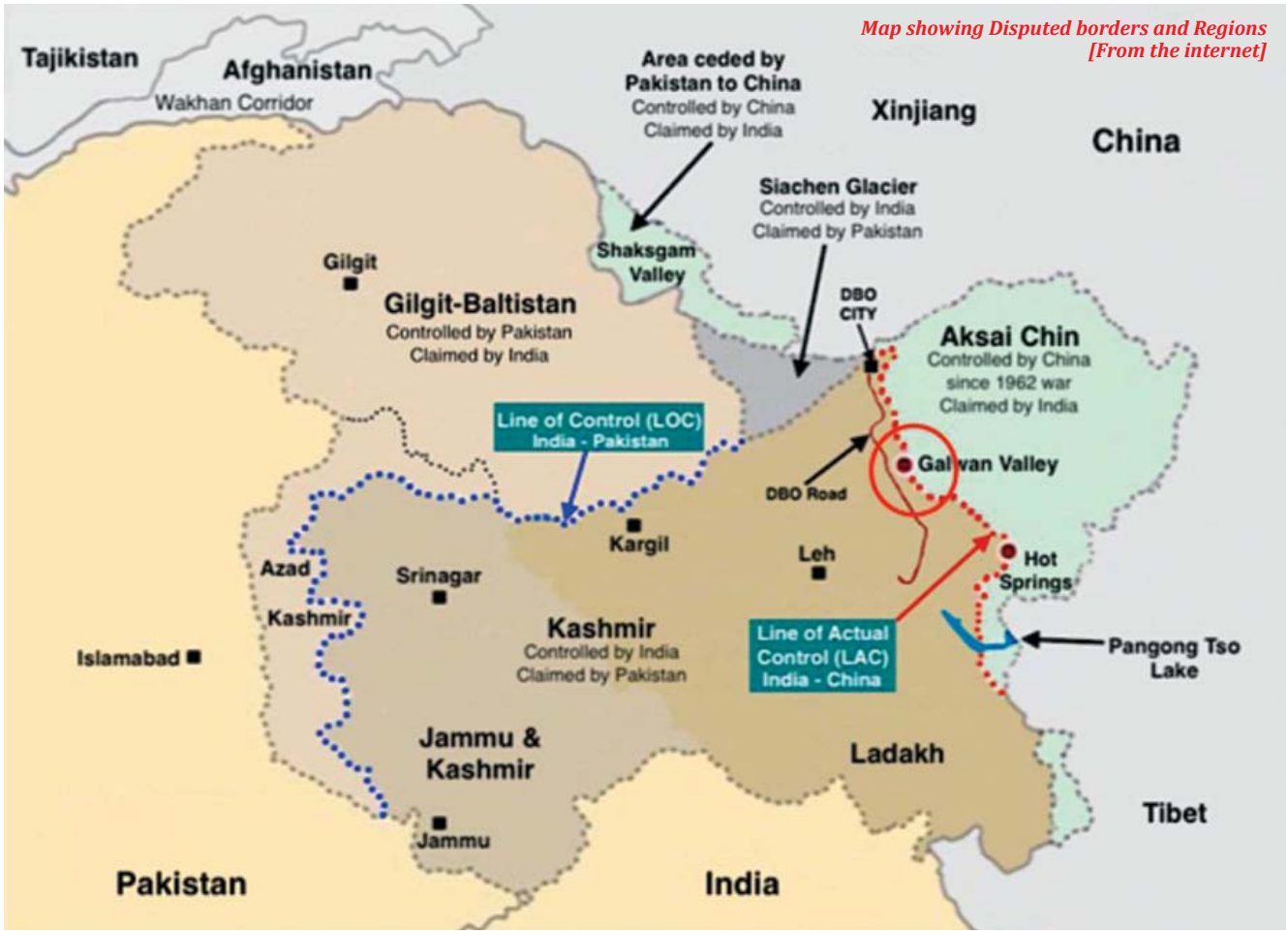


Not that the general populace of India was then really aware of this place or was really interested in matters military. Such indifference and elected representatives of India was soon enough to result in a military drubbing at the hands of an expansionist Chinese Army in 1962. 68 years later DBO

remains even more strategically relevant, indeed is considered as the fulcrum of India's defence in this theatre.

The Karakoram range which includes some of the highest mountains in the World, is about 500 km in length and considered as the most heavily glaciated part of the world outside the polar regions. This also includes the Siachen Glacier, in contention between India and Pakistan since the mid-1980s. The Karakoram is bounded on the east by the Aksai Chin plateau, northeast by edge of the Tibetan Plateau and on the north by the river valleys of the Yarkand and Karakash rivers beyond which are the Kunlun Mountains. About centre of the Karakoram range is the Karakoram Pass, which was part of the historic trade route between Ladakh and Yarkand, on the base of which is Daulat Beg Oldi (DBO).

Back to 1962: The Fairchild C119G Packet of No.19 Squadron IAF making the pioneering flight to DBO was powered by two Wright R-3350-85 radial engines of 2,500 h.p. each plus a HAL-built Orpheus 701 booster turbojet of 4,700 lb.s.t. Forty-six years later, history was repeated when on 31 May 2008, an Antonov An-32 of No.48 Squadron, powered by two AI-20M turboprop engines, of 4195 ehp each landed at DBO, with Group Captain Suryakant Chafekar at the controls. Quite unknown to most public, that the then AOC-in-C Western Air Command was on board the Packet in 1962 and again on the An-32 in 2008.



Map showing Disputed borders and Regions [From the internet]

This article is about Daulat Beg Oldi, then and now, and how that extremely hazardous operation was accomplished then – and continues today.

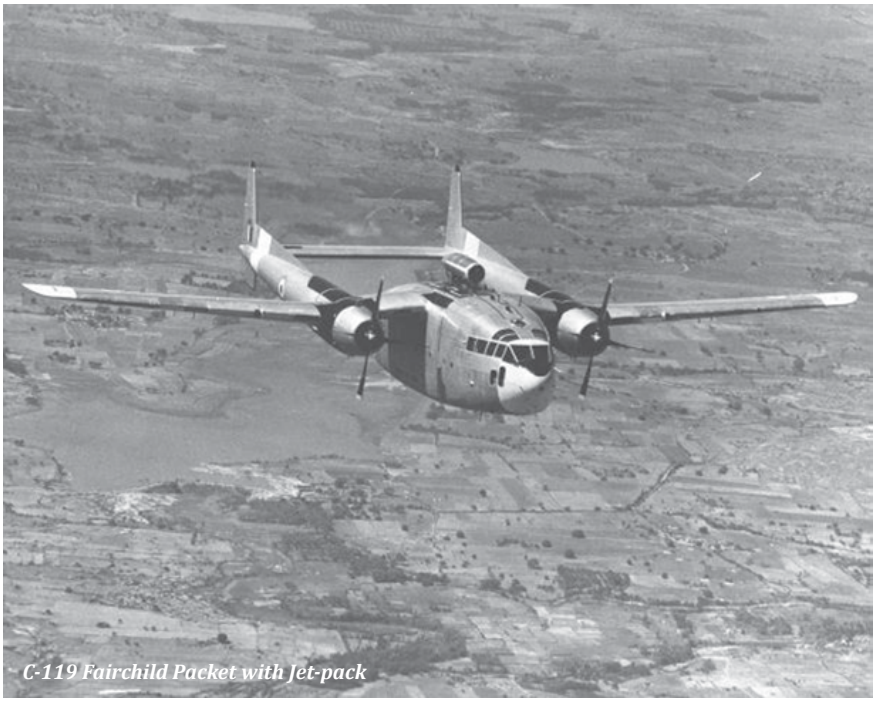
Daulat Beg Oldi: its strategic and operational relevance

Daulet Beg Oldi is a small, nondescript campsite just below the Karakoram Pass. Travellers of lore along the ancient *Silk Route* may well have rested at DBO on their arduous journey to Constantinople from China, and on their return journey. Nesting at base of the Karakoram Pass, DBO has immense strategic implications, with the Indian Army present there over the past half century. Defences are adjacent to the Chip Chap river, with the Karakoram pass just ten kilometers away, as the bird flies. The landscape is bleak, of light brown earth, blinding white snow in the upper reaches, the area bereft of any wildlife. The Indian troops at DBO (which have been reinforced from a rifle company in the past to reportedly now a Brigade Group) must be maintained by air, all the year-round.

After China occupied Tibet in 1950, they brought their frontiers to India for the first time in over a millennium. Boundary delimitation became the primary issue of disagreement and from 1960, grew into becoming a formidable dispute as the Government of India soon discovered that the Chinese had occupied the Aksai Chin and constructed a highway connecting Tibet with Xinjiang through the Aksai Chin. In 1962 the Indian government decided to establish Advanced Landing Grounds (ALGs) in forward locations that could serve to maintain border posts in the inhospitable and high altitude locations at the region. DBO became the northernmost and the highest such ALG in the Himalayas.

Decision to Operationalise DBO – then and now

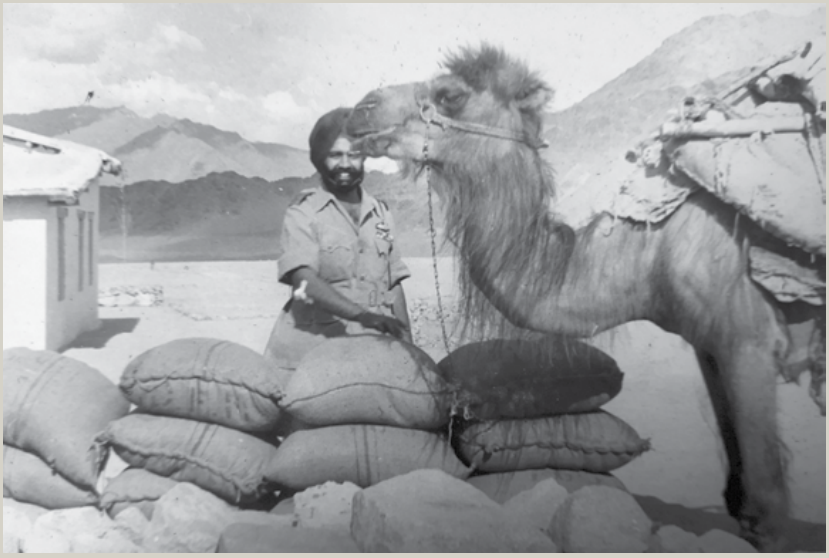
In 1962, DBO was just as strategic as it is today. The C-119 Packets had good performance up to about 14,000 feet, but with increasing altitude power decreased appreciably. If DBO was to be supplied by air, the aircraft would need a "boost". To begin with, the Indian Air Force decided to fit a J-34 jet engine on top of the Packet, with HAL to do necessary modifications. However, even with this engine, the aircraft still did not have adequate power for operating at such high altitudes. The



C-119 Fairchild Packet with Jet-pack

Orpheus 701 jet engine, which powered the HAL Gnat, was thus chosen and precise data recorded during operational trials at Palam. Extrapolations using the recorded data indicated that with such a jet pack, the C-119 could land and take off from DBO, with some useful load.

After the first C-119 landings and the 1962 border war soon after, DBO did not receive any more fixed-wing aircraft landings for the next four decades. In 1996, an earthquake had damaged the DBO airstrip on which the Packet had landed 34 years earlier, thus restricting operations to only by helicopters or supply drop by An-32s. Then in 2018, the IAF's Western Air Command considered reactivating DBO, landing of An-32s there. Why was this necessary ? Firstly, its strategic position remained critical. Second, expeditious



From the Archives: (then Gp Capt) Shivdev Singh who had earlier raised and commanded No.12 Squadron RIAF with C-47 Dakotas and was later Station Commander AFS Agra where No.48 Squadron with C-119G Packets was raised, is seen in this evocative picture with a camel at Chushul in the 1950s.

induction and extraction of troops from DBO was vital and necessary. Thirdly, landing by fixed wing aircraft such as the An-32 at DBO would supercharge the morale of troops who were virtually isolated during the severe winter months. Lastly, in the case of engine failure during a supply drop and if crossing the mountains on one engine was not possible, validation of An-32 landings at DBO had to be proved.

No.48 Squadron 'Camels' were charged with this challenge. The squadron had a storied history, raised on Dakotas on 19 November 1959 at Srinagar, later converting to Packets and then, in 1985, transitioning to the Antonov An-32. The 'Camels' had been flying the Ladakh routes for more than 20 years, and were fondly regarded as the Army's 'Himalayan Lifeline.' The Squadron had also been involved in numerous operations, the wars of 1962, 1965 and 1971, IPKF operations in Sri Lanka, *Operation Cactus*, *Operation Safed Sagar*, *Operation Parakram*, as well as relief operations following the Bhuj earthquake in 2001 and the Indian Ocean tsunami in 2004.

The Soil Engineering & Material Testing Division of the College of Military Engineering at Pune visited DBO to assess if the landing strip would be safe for An-32 landings and found that the soil was not compact enough. Engineering solutions to make the runway safe for An-32 operations were then taken up, notwithstanding the challenges of loose soil, short runway, the menacing mountains and the proximity of enemy troops on the LAC and LOC.

The Fairchild C-119 Packet has had many uncharitable things said about it, both by the USAF and the IAF. However, it was a gem of an aircraft. Of unusual configuration, with its twin booms, powered by the most powerful piston aero-engines extant, with four blade propellers, during its heydays, at any given time between 0400 hrs and 2300 hrs, an Indian Air Force Packet was airborne somewhere in India. The garrisons in Ladakh subsisted and flourished because of the Packets and till the An-12s arrived in 1961, they, along with the C-47 Dakota, were an aerial lifeline to Ladakh and Arunachal Pradesh. But, vibrations of the propellers were awful ! Sitting in the cargo hold, in line with the engines, the noise and vibrations truly made one wonky by the end of a flight. However, the paratroopers loved the Packet. Exit was sweet and steady, with minimum tumble, and assured deployment of the parachute. So it was in keeping that it a Packet should be the first to land at DBO – and also prove a point.

An-32 over the Himalayas

The Packets were finally phased out from the IAF in 1985 and replaced by the ubiquitous (and also noisy) An-32, with its powerful turbo-props generating 5180 eshp at sea level. Its vibrations matched those of the Packet, the propeller noise snuffing out any attempt to speak, while the whine of the jet is well beyond permissible decibels ! The engines are located on top of the wings for good ground clearance, having a swept up tail for easy loading, and the An-32 was perhaps the most appropriate replacement for the IAF's C-119. Today, An-32s fly all over Indian skies just as the Packets had done during their time. However, the essential difference is that the An-32 flies much faster than the Packet, climbs much higher and is fully pressurised. Truly a worthy successor.

Crew and Aircraft Selection

How the IAF allot tail numbers to various aircraft types is a mystery to most of us. It is rumoured that the initials of engineering officers or logistics officers involved in the technical discussions and actual procurement are usually adopted. In 1962, a C-119 Packet with tail number BK 511 was selected to pioneer the landing at DBO. It was a well tested aircraft had done many flights in and out of airfields in Ladakh, the engineers had tirelessly (and lovingly) fine-tuned its Cyclone 3500 and Orpheus 701 engines. At the controls was Sqn Ldr CKS Raje, with Sqn Ldr Phillipose as second pilot, Wg Cdr Mukherjee as navigator and W/O Yadav as Flight Engineer. Adding to this robust and self-assured crew were Air Commodore Ananthanarayanan – and Air Vice Marshal Erlic Pinto, then AOC-in-C, Operational Command, later re-designated Western Air Command.

It was decided not just to land BK 511 at DBO, but because of the prevailing politico-military imperatives, 32 soldiers were also to be on board along with the AOC-in-C. In those days, technology and simulation was primitive compared to that today. So the Packet parameters had to be worked out, based on what had been experienced during landings and take-offs at Leh, Thoise, Fukche and Chushul, with intelligent extrapolation, to ascertain if BK 511 would stop on the strip and then take-off safely. The reverse thrust on the Packet was very effective, the landing speed would be about 110 knots IAS, the gross weight well below the max 72,000 lbs, while the single engine performance with the jet pack was definitely a safety factor.

Forty-six years later, the choice for trial landing with the An-32 fell on Gp Capt Suryakant Chafekar, CO No.48 Squadron. With him were Wg Cdr Mahesh Aserkar, Wg Cdr Ray and JWO Ram Niwas Verma. This time around Air Marshal Pranab Barbora, AOC-in-C WAC, was on board for this resurrected landing at DBO. Actually, it looked exactly as it had 46 years earlier.

The particular aircraft selected for the DBO landing was K2755. Extrapolation of performance graphs to 16,500 feet altitude and for the short runway length revealed limitations. Since the auxiliary power unit (APU), used for starting main engines,

would not perform above 14,000 ft, the engines would have to be kept running while on ground, fuel for which was to be factored. Tyre pressure was reduced for the soft soil conditions and that the landing speed would be about 280 km/hr was kept in mind. This was much higher than the usual speed of 200 km/hr, and higher than Max Braking Speed of 250 km/hr. The higher True Air Speed (TAS) because of the high altitude increased the turn radius of the aircraft. DBO runaway remained unprepared and 'kutcha', and a bumpy landing followed by an equally bumpy take-off was expected. The An-32, being heavier than the Packet, raised further questions: what damage would occur to the soil? How would the Single Isolated Wheel Loading (SIWL) impact the airstrip? High mountains surround DBO on all but the eastern side, and after take-off in a southerly direction, an immediate right turn is the only way out To keep weight as low as possible, it was decided that K2755 would take-off from DBO and land at Thoise for refuelling. Finally, strong winds with mountain waves, unpredictable weather, sudden gusts on the ground remain perennial problems in the hilly regions and these have to be studied and catered for. For Chafekar and his crew, these were the factors that would determine how they executed the trial landing and even more so, the "trial take-off".

DBO landings: then and now

On 23 July 1962, Squadron Leader Raje had gently lifted BK-511 off from Srinagar on a crisp Kashmiri morning with AVM Pinto and 32 soldiers on board. One wonders what these jawans were told about the trial landing, and how they were as much pioneers as the Packet and its crew were.

A right turn towards Zoji La, and thence along the roaring Indus past Dras, Kargil, Nimo, Leh, Thoise, the Tri Junction, past Siachen base and into the DBO bowl. Those who have not flown into Ladakh, will find it difficult to picture the speed with which the sun ascends. The author has had the privilege of flying into Ladakh for more than 15 years on flights originating from Chandigarh and Sarsawa. The colours are vivid, the sky a beautiful azure, snow-capped peaks quickly turning from white to gold and then white again.

Raje and his crew were soon planning their approach and landing, listening intently for the slightest change in engine noise, willing the engine instruments to remain steady and true. From 22,000 they descended to 18,000 ft, Raje circled DBO with its cross airstrips at nearly 17,000 ft and made a dummy approach to finally come in for that moment of truth. As he recalls, "We were now on finals with wheels and flaps down, the edge of the airstrip rushing up towards us, I throttled back, touched down, reverse thrust applied and I wondered whether we would stop within the length and we did". Bless the Packet ! In typical understated exhilaration, the crew heard, "Good show" from their AOC-in-C.

BK-511 was the first aircraft to land at 16,500 ft in the Himalayas, unmatched anywhere. Engines were kept running, soldiers disembarked, hot tea was served by the local Army unit, and just to make the event as routine as possible, a few sick jawans were loaded onto the Packet for the return journey. Full power opened on all three engines, brakes released and BK-511 lumbered forward not accelerating as desired because of the soft ground but engine parameters were normal and as she hit hard surface, the aircraft sprang forward, speed built up, Raje lifted her gently, turned right almost immediately, to avoid the hill in front and smoothly started climbing back towards Srinagar. Aviation history had been made by the Indian Air Force. But this was July 1962, cameras were prohibited during forward area operations, satellite imagery was non-existent, digital photography was 30 years away, visuals of that momentous event are sadly unavailable with anyone – just memories and written words. *(Actually 'The Society for Aerospace Studies' has these rare B+W bromides, provided by the late Gp Capt JC Malik, later PRO AF: Ed).*

Four decades later

Four decades later, Group Captain Chafekar and crew were to repeat this historic landing, event this time in an An-32. However, Chafekar had carried out five trial flights in and around DBO. Circuit patterns were checked, terrain clearances from all directions were proven, single engine performance during approach and landing were simulated, escape routes in emergencies were determined. The ground reconnaissance showed that the airstrip, 2200 metres long and 53 metres wide, had an unpaved surface with loose pebbles at many places, the strip had no markings, and the chosen parking area needed strengthening. At many places PSP sheets would have to be hammered in to obviate a tyre burst. Landing would then be possible after the engineers repaired and strengthened the air strip and the parking area, something that 235 Engineering Regiment of the Army assured would be done. Accordingly, the centre line was painted, jerry cans installed and numbered as the Distance To Go Markers (DTGM) along the western edge, drained engine oil liberally sprayed and at times poured to bind the soil and harden it.

On 31 May 2008, K-2755, along with a second An-32 took off from Chandigarh. To

reach DBO within acceptable temperatures and get as much power out of the engines, Chafekar had planned take-off from Chandigarh at 0450 hrs. The second An-32, piloted by Air Commodore Nair AOC Chandigarh, was a last minute addition. This was for several reasons. Firstly, to orbit at about 500 ft above DBO and monitor activity from across the LAC. Secondly, to be able to report any emergency with the trial landing, and finally, to record on video the approach and landing for posterity and training of aircrew.

Forward area weather reported cloudy skies but fit for landings and air drops. It is pertinent to appreciate that weather forecasting facilities in Ladakh are still quite unreliable despite the technology available. It is the first flight from Chandigarh, called ' Weather Recce' that transmits the actual conditions being experienced and it is the captain of the weather recce who clears further flights for landings or supply drops.

Both An-32s were now airborne in quick succession, climbing into a grey-navy blue sky over Chandigarh, heading north to the Himalayas. Bright sunshine greeted the aircraft as they made their way past Tso Moriri, Kar Tso, across the Indus heading northwards, east of Leh, over Khardung La, at Tri Junction, past the terminal moraines of Siachen glacier and into the DBO bowl. With the landing gear now extended and flaps down, Chafekar and his crew brought K-2755 on final approach for RW 01 at DBO. As calculated, the rate of descent was twice that at Chandigarh. The aircraft roared across 01 dumbbell under his steady hands at 280 kmh, throttles were chopped

and exactly 0614 hours, history had been re-written when the 27,000 kgs An-32 touched down at DBO.

Air Marshal PK Barbora then stepped out and sweets presented to the Army unit on the ground in full appreciation of a most magnificent job done. Barbora would later tell the media that, "This place is so high and bereft of oxygen, my cigarette lighter refused to light up". But after about 15 minutes it was time to return. Chafekar had kept the engines running, and now lined up on 19 dumb-bell, opened full power which generated just 65% of sea level torque, brakes off, a huge cloud of dust churned up and a not too encouraging acceleration ensued. Air Speed Indicators register late at altitude and is well known to pilots, but Chafekar wanted a speed to lift off, he got it, and gently eased K-2755 off DBO, and like Raje had 46 years earlier, immediately turned right to avoid the hill in front and climbed away, with Nair now leading the way to Thoise ALG.

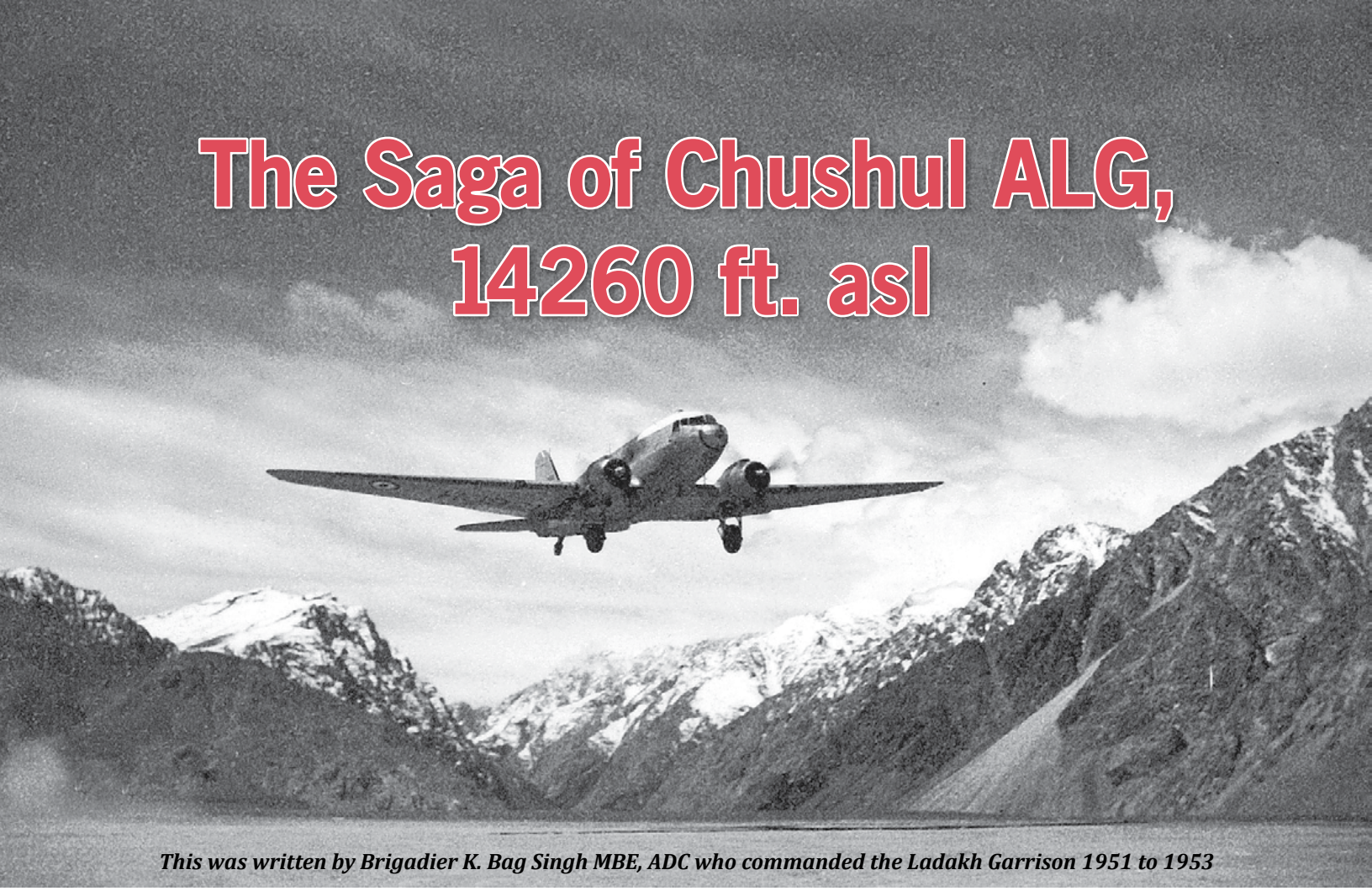
Representative image of an IAF Antonov An-32

Annabattis at DBO

Jubilations were in order and were indulged in. What is pertinent is that a scientific, truly professional methodology was prosecuted in planning and execution of the trial landing of K-2755 at DBO. From the initiation of the idea of activating DBO for An-32s, through reconnaissance, ground inspections, rebuilding of the air strip, establishing a monitor aircraft overhead, selecting the crew and extrapolating performance graphs, everything was planned and deliberated. For the Army jawans at DBO, the '*Annabattis*' as they have christened the An-32s, were now right at their doorstep instead of just flying overhead and dropping loads by parachute. Soon regular flights would be flown into DBO, confirming that reinforcements could be inducted swiftly and assuredly, a morale booster for the Army and strategists. For the student of matters military, this trial landing was to be noted not as an aggressive posture, but as a confirmation of India's consistent policy of defending its territory with certainty and determination. DBO is not a launching pad for offensive operations as some may aver, is not so. But maintaining DBO by operating An-32s to and from these indeed a fulcrum for the defence of that sector, which is what the Indian Air Force ensures in support of the Indian Army.

Gp Capt A G Bewoor VM (Retd).

The Saga of Chushul ALG, 14260 ft. asl



This was written by Brigadier K. Bag Singh MBE, ADC who commanded the Ladakh Garrison 1951 to 1953

My first posting with the Indian Army from the Rajasthan State Forces was as Commander of the Ladakh Garrison, which I took over on 2 August 1951. The very next day intelligence sources reported the presence of a brigade of Chinese Nationalist Cossacks (Chiang Kai-shek Government) at Rudok in Tibet, being chased by Communist forces. I immediately got in touch with Major General Thakur Mahadeo Singh DSO, GOC 19 Div and requested him to provide additional troops to garrison Chushul to meet the likely threat. He very kindly airlifted one company of 1 Sikhs under Major Sardara Singh to Baltal and from there, I arranged for over one thousand ponies to force march the column to Chushul via Kargil and Leh, crossing the Fotula (13400 ft) and Changla (18370 ft) over a distance over 200 miles. This column reached Chushul without any mishap by 25 August 1951 and was placed under the command of Lt Col Karve of 7 J&K Militia, with instructions to take up defensive position beyond the Spangur Lake to stop any incursions of the Cossacks into Ladakh.

By 28 August 1951, Major Sardara Singh took up defensive positions, well dug in, on the route towards Rudok. The Cossack regiment was reported to be fighting a rear guard action against the Communists, to safeguard lives of their wives and children, also their herds of sheep and yaks. The families of Cossacks came in contact with our troops on 29 August and requested entry into our territory, which was refused. Next day Major Sardara Singh reported that the Cossacks were seen digging defensive positions about two miles away. A large number of troops were on ponies. The situation looked very critical and I flew

to Div HQ to discuss with the GOC. Thereafter, myself with Brig Billimoria, Commander J&K Militia, flew to Leh on 30 August to give instructions to Lt Col Karve for meeting the situation, ordering him to immediately proceed to Chushul.

The hourly sitreps reported skirmishes between the Cossacks and Communists. Commander of the Cossacks again pleaded with Major Sardara Singh to allow their families safety on humanitarian grounds but he refused. By now fierce fighting had started and machine guns and mortars were being used by both sides.

I flew back to Srinagar on 3 September 1951 to report the latest situation to the GOC and surprisingly found him at the airfield itself. I reported the evolving situation. He told me that, fortunately, the Prime Minister of India was just arriving "and we will discuss the whole affair with him".

After his arrival the GOC introduced me to Prime Minster Jawaharlal Nehru and I explained to him the Cossack situation. The PM then invited us to Chashme Shahi gardens for discussions where we immediately proceeded. After detailed discussions, the Prime Minister ordered that we give political asylum to the Cossacks and I immediately passed on the message to Major Sardara Singh to admit the Cossacks in our territory. This took place during the hours of darkness, so allowing the Cossacks to enter against violent protestation of the Communists. The same story was to be repeated twice to test our nerves but we managed to contain the situation.

This convinced me that one day we will have to reckon with the Communists of China.

On return, Lt Col Karve reported that there were long stretches of plain grounds in the Chushul valley, where air landing by transport aircraft was possible. To maintain a garrison of just one company from my HQ at Kargil, 200 miles away, was a herculean task and to solve the logistic problems, the answer obviously was for an airfield!

I consulted Air Commodore Arjan Singh about the length a Dakota would need for landing at the height of 14,000 ft. He was of the definite opinion that this should not be less than 3000 yds. I then asked the company commander at Chushul to carry out a recce of suitable areas where such an airstrip could be constructed, with minimal effort. The Company Commander selected such a site and started working on it.

In May 1952, I decided to visit Chushul but was caught in a blizzard storm on Changla pass and was nearly buried in snow on 19 May and had to return to Sakti after walking for nearly 22 hours. Air Commodore Arjan Singh then himself visited Kargil on 25 May and enquired about progress of the ALG at Chushul. Because of bad weather, I could not cross the Changla but went the next month to find out the exact situation. I crossed the Changla on 17 June and reached Chushul some days later. I inspected the airstrip which was about 1300 yds long, went where beyond Spangur Lake, we had earlier encountered the Cossacks. After that, I roamed around in the Chushul valley and chanced upon excellent flat land, measuring 4000 yds long and 100 yds wide, fit for aircraft landing without removing a stone! My joy knew no bounds. Capt PS Kler, my orderly Sangrup and myself then personally marked the four corners of the field erecting stone cairns about 4 ft high.

On return to Leh, I flashed the news to HQ 19 Div and to Air Commodore Arjan Singh, who immediately dispatched Sqn Ldr Dhawan to inspect the site. He reached Leh on 27 July, trekked to Chushul and inspected the grounds on 3 August 1952, fixed the air-sock as well and declared the airfield as "fit for landing"!

Meanwhile, the Prime Minister of India visited Srinagar again on 27 August and had dinner with Major General Mahadeo Singh. I spoke with the GOC to request the Prime Minister to perform the opening ceremony at Chushul ALG but he asked me to do so myself. I humbly requested the Indian Prime Minister that on behalf of the Indian Army, "I want to present the highest airfield in the world to you". Mr Nehru showed great interest and immediately agreed to do so! On hearing this, there was great excitement and all VIPs present wanted to accompany the Prime Minister. It was then decided that I should go in the first aircraft on 29 August 1952, followed by two other Dakotas with the VIPs on board.

In almost perfect weather, we took off at 0800 hours from Srinagar airfield in Dakotas and after a flight of two hours, flying at the height of 27000 ft, landed safely at Chushul, I was the first person to land at on the highest airfield in the world! Pandit Nehru as in the second aircraft which landed, was received by me, to be followed by the third aircraft which also landed safely.

It was wonderful to see three IAF Dakotas and so many distinguished persons roaming in this most remote valley of Chushul, where there was nothing to be seen apart from some wild horses. The VIPs were Pandit Nehru, Mrs Indira Gandhi, Yuvaraj Karan Singh, Sheikh Abdullah, Sardar Surjit Singh Majithia, Major General Digambar Singh Brar, Major General Mahadeo Singh, Air Vice Marshal Subroto Mukherjee, Mr Gopi Handoo, and Air Commodore Arjan Singh.

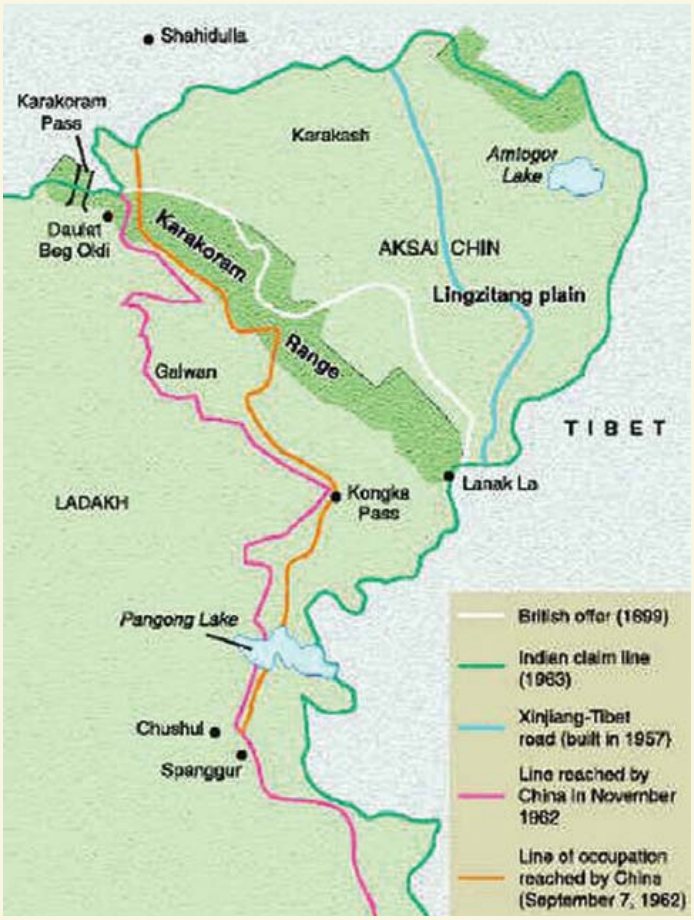
With this historical landing on 29 August 1952, the name Chushul was to become known all over, as the (then) highest airfield in the world.

First Chinese Communist troops in Aksai Chin

In a CIA note dated 15 July 1953, there was reference to 'Chinese Communist Troops, West Tibet' and 'Road Construction, Sinkiang to Tibet and Ladakh.' According to this, in late 1952, the 2 Cavalry Regiment, commanded by Han Tse-min, with headquarters at Gartok (the main trade centre in Western Tibet) had 800 camels and 150 men garrisoned at Rudok in the vicinity of the Panggong lake in eastern Ladakh. The same report had another PLA regiment stationed on the Tibetan side of the Tibet-Ladakh border, near Koyul in the Indus Valley.

According to the document, the 2 Cavalry's Commandant announced the Chinese intention to build new roads in the area:

- A road from Rudok to Keriya, south of the Taklamakan desert in Xinjiang, on the eastern edge of the Aksai Chin.
- A motorable road from Khotan to Suget Karaul ending at Vanjilga (at the western end of Aksai Chin.
- A road from Khotan (or Hotan) to Rudok to be completed in June 1953.



The latter road is clearly the Aksai Chin road (now Highway 219), though the alignment may have been slightly different from the present one and was probably not usable by heavy vehicles (only four years later, heavy trucks would be able to ply on the road).

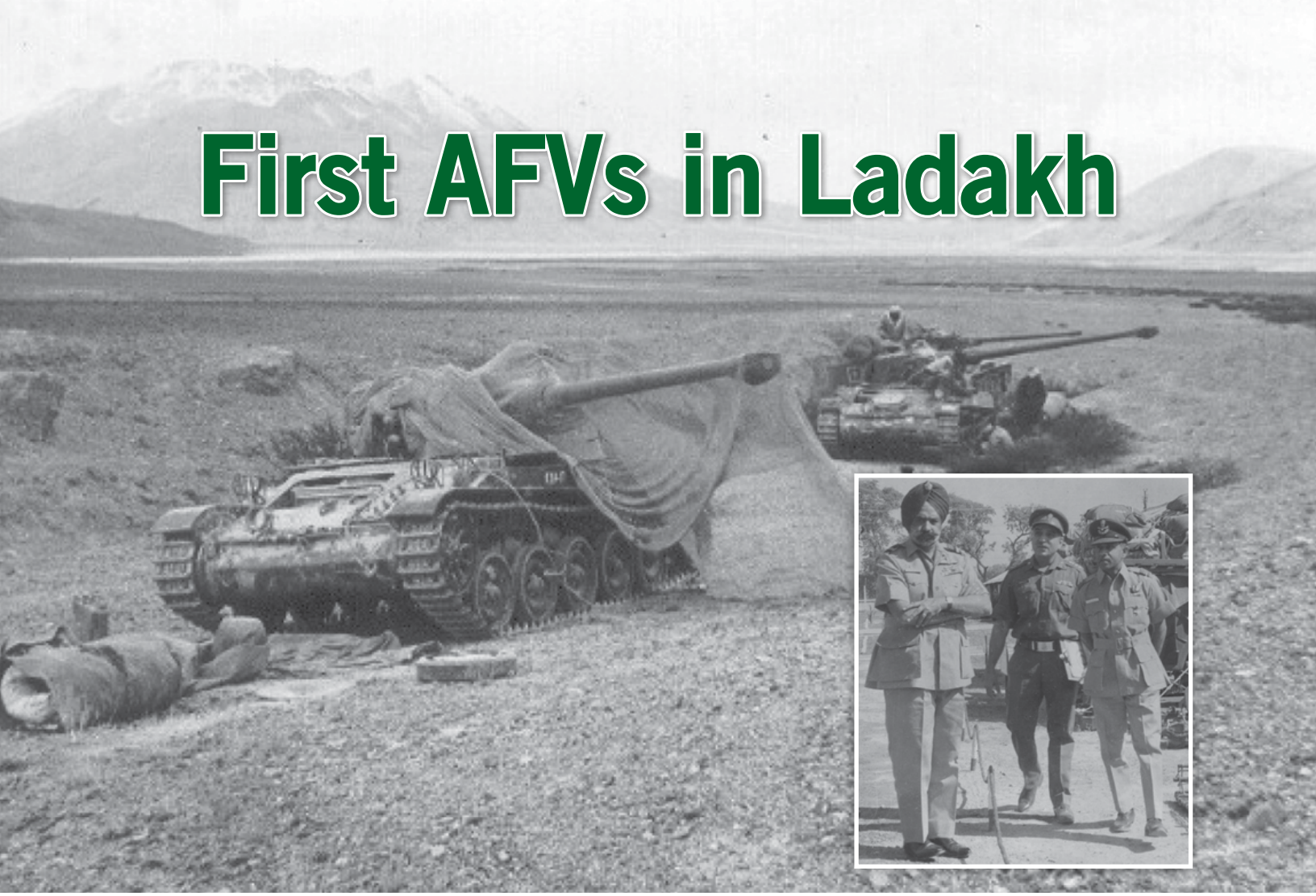
The Indian Air Force Knew !


Photo by Peter Steinmann

It is difficult to believe that the information available with the US intelligence agency was not known to its Indian counterpart. In any case, by 1959 Indian Air Force Canberra strategic reconnaissance aircraft from No.106 Squadron had 'discovered' the road and the images were given to the highest authority. It is well documented that then Sqn Ldr Jagmohan Nath had repeatedly flown in his Canberra PR Mk.57 at low level over the Aksai Chin Road, with Chinese workers scattering on his approach, the clear images shared with Prime Minister Nehru, Defence Minister Krishna Menon and Lt Gen BM Kaul who continued to be in denial.

Sqn Ldr JM Nath was again tasked to fly over the Aksai Chin Road, this time with Sqn Ldr AIK Soares of No.5 Squadron as 'escort', with very clear images again taken. Although 'Jaggi' Nath later got an MVC, the delay in political reaction would cost the country dearly.

First AFVs in Ladakh



At this time when heavy armour in Eastern Ladakh, both Indian and Chinese, are facing each other, it is instructive to recall that nearly six decades back the Indian Army deployed a troop of light tanks which were airlifted to Chushul and thereafter played a vital role in the severe fighting during November 1962.

To 20th Lancers goes the honour of first deploying tanks at the world's highest battleground, Eastern Ladakh in 1962, their troop of AMX-13 tanks having been airlifted to Chushul, just south of the Pangong Tso the world's highest lake (*image above*). The story of their airlifting from Air Force Station Chandigarh has been recorded in official history but this personal story has never been told – till now.

In February 1962, then Air Commodore Shivdev Singh (later Air Marshal and Vice Chief of the Air Staff in inset above) was AOC Advance Headquarters attached with Western Army Command at Simla, whose GOC-in-C was Lt Gen Daulat Singh. The GOC XV Corps at Udampur was Lt Gen Bikram Singh while Air Vice Marshal Erlic Pinto was AOC Western Air Command.

Defences in Ladakh were thin, just the 114 (Independent) Brigade at Leh, with two battalions of the Jammu & Kashmir Militia responsible for the entire 480 km long front from Demchok to Daulet Beg Oldi, at foot of the Karakoram Pass. With rising tensions, 1/8 Gorkha Rifles were inducted in April 1961 to defend the sector between the Galwan river and Chushul.

Early in 1962, the Indian Army initiated the first 'war games' in this front, with then Maj Gen PP Kumaramangalam (formerly Commandant of the Staff College and later COAS) and Air Commodore Shivdev Singh 'acting' as Chinese commanders to attack and capture Indian Army forward posts in the sector. Their report was alarming in that there was very little defence and so 114 Brigade, commanded by TN Raina (later

Indian Air Force C-119G Packet at Chushul

Army Chief) was reinforced in April 1962 by the 5 Jat Regiment and later, just before the war, by 13 Kumaon Regiment.

After World War II, the Indian Army had been given the responsibility for logistics and transportation of all stores to forward areas. Considering the precarious situation of 114 Brigade, it was directed that there take place rapid buildup of troops, artillery, weapons and ammunition including landmines and other defence equipment. The Air Force undertook to fly all these to the advance landing ground (ALG) at Chushul, at some 12,000 feet above sea level. The ALG was critical for the buildup of troops, artillery, stores and equipment but initially defended only by a platoon. Along with the reinforcements to be flown there were a troop of AMX-13 tanks of 20 Lancers commanded by Lt Col Gurbachan Singh ('Butch') and a battery of 25-pounder guns of 13 Field Regiment (Sikhs).

25-pounder field gun of 13th Field Regiment deployed at Chushul

Air Vice Marshal Erlic Pinto and Air Commodore Shivdev Singh personally directed this operation, bending many rules as they examined the options including many 'out of the box', carrying out reconnaissance in Fairchild C-119G Packets of No.12 Squadron from Srinagar which included trial landings at Chushul. The C-119s were at their performance limits although some fitted with dorsal jet packs, could operate with margins of safety.

However, the AMX-13 tanks could only be airlifted by the much more capable Antonov An-12 four-engined turboprop tactical transport aircraft, the first of which had just been procured from Russia.

As extracted from the book '*Aircraft of the Indian Air Force 1933-73*' by Pushpindar Singh: Operations in and out from the high mountain regions had put a strain on the C-119Gs supporting the consolidation of ground forces in Ladakh for although the Packets were successfully operating from advance landing grounds upto 14,000 ft (4,267m) above sea level, their Wright piston engines lost efficiency at these levels. This led to the provision of a jet engine, fitted in a dorsal booster pod. The first C-119G, suitably modified by the Overhaul Division of HAL, Bangalore with technical participation by Steward-Davis Inc, of Long Beach, California, made its initial flight on 9 November, 1961 but twenty seven C-119Gs were eventually retrofitted with HAL Orpheus 701 turbojets. This jet pack doubled safety margins, augmenting performance in difficult terrain and in poor weather conditions. On 23 July 1962, a boosted C-119G created a world record by successfully transporting 32 personnel to and from the forward landing strip at Daulet Beg Oldi, 16,800 feet (5,120m) above sea level in the Karakorams (*see article in this Issue).*

The C-119Gs carried the responsibility of logistic support to the Himalayan front till supplemented by the An-12s. In the third week of October 1962, the Indian Air Force flew in troop and artillery reinforcements from Pathankot and Srinagar to 114 Infantry Brigade at Chushul and, on 24 October, flew in a troop of AMX-13 tanks for the defence of Chushul against Chinese advances.

The first few Antonov An-12s were received by No.44 Squadron IAF in March 1961 and were fully committed during the frontier war with China in October-November 1962. Transporting men and material to the isolated front, An-12s operated around the clock, supply dropping in Ladakh, where they were subjected to Chinese ground fire, as also airlifting troops and equipment to Assam. Pivoting their efforts West to East and back, the An-12s proved rugged and capable of the strenuous operations involved in the four grim weeks of fighting, airlifting urgently required field guns and light tanks to Ladakh.

This first person account was related to the author by Air Marshal Shivdev Singh himself. As the first AMX-13 was being loaded in the An-12 at Chandigarh, the aircraft jacks had collapsed perhaps because of jerky driving up the ramp into the cargo hold. Nose of the aircraft itself lifted up and the process was stopped. An EME Major from Pathankot suggested that sand bags be placed under the front landing gear as the tank was eased out. More sand bags were placed at suitable places so that the aircraft was not damaged and thereafter the AMX-13 tanks were safely loaded and then airlifted to Chushul.

The rest is history.

Pushpindar Singh
Images: MoD

IAF Antonov An-12 at Chushul

Air Maintenance in the Tangdhar Valley

RIAF C-47 Dakota of No.12 Squadron supply dropping in the Tangdhar Valley of Tithwal Sector in June 1948. (Historic photograph taken by Col Harwant Singh).

During the last week of May and first week of June 1948, the (Royal) Indian Air Force made heroic sorties to supply Indian Army troops who had recaptured Tangdhar in the Tithwal Valley during the summer offensive. The spearhead was 163 Infantry Brigade of Sri Div (later 19th Infantry Division) which under the stout leadership of then Brigadier Harbaksh Singh covered some 45 miles through very difficult hilly jungle terrain which included the crossing of the Nastachhun Pass (10264 feet) covered with dense snow. 1st battalion of the Sikh Regiment, (which had already secured Srinagar in the initial battles of October-November 1947), led the advance against major resistance. The capture code was 'Eagle', and flashed on 23 May 1948.

It was indeed a remarkable military operations- a test of physical endurance and fighting qualities of the troops. Only a jeepable track then existed from Kupwara to Chokibal and supplies were carried by porters, ponies, buffaloes, donkeys, even goats, to transport vital supplies at Chokibal, over the Nastachhun pass to 163 Brigade headquarters at Chhamkot, close to Tithwal, the effort taking 3-4 days. As the troops deployed at Tithwal area were running short of ammunition, rations and medical supplies, air drops were then carried out by Dakotas of No.12 Squadron RIAF which continued for weeks till the jeepable road from Chokibal to Tangdhar was completed by 3 Field Engineers and 3 Pioneer Companies of the Indian Army in September 1948. Till then Indian troops were supplied continuously by the RIAF.

Maps by KBK

Commodore Sujeet Samaddar on

Recycling Aircraft: The Opportunity Ahead*

Air transportation has, in the last few decades, grown at a scorching pace. Experts believe the worldwide passenger traffic will grow by an average of 5.1 % and the cargo traffic will grow by an average 5.6 % per year until 2030. To meet this increasing demand about 33,500 aircraft would be introduced over the next 20 years, thus doubling the existing aircraft fleet in this period. Given the production and demand numbers from Russia, East European Countries and China have not been factored in most Western/European calculations and studies, potentially the global aircraft fleet may double a few years earlier if these aircraft are also counted in. That is a very large number of flying machines in our world.

The growth of the aviation sector brings considerable benefits in terms of connectivity, and communications which in turn improve commerce and business. But its adverse social and environmental impacts cannot be overlooked. Public concern is on the rise on the unfettered growth of aviation and its impact on GHG emissions, noise pollution, use of Rare Earths, scarce materials, societal resources, land use, fuel bills, and the environment. Whilst a large number of aircraft are being built there are also a large number of aircraft being retired from service.

The estimates for the number of aircraft that would be retired in the same period varies significantly. Aircraft manufacturers estimate that up to 44 percent of the global fleet will reach end-of- life in the next two decades, amounting to more than 13,000 commercial, military and private aircraft. The Aircraft Fleet Recycling Association (AFRA) estimates that, by 2030, 12,000 aircraft could be retired. Avolon's World Fleet Forecast predicts 13,000 aircraft while Flight Global's estimations touch 17,000. Bombardier believes that 5,000 aircraft in the 60 to 150-seat categories will retire by 2034.

The exercise to determine 'End of Life' of commercial aircraft is not so difficult. Usually, an aircraft is designed, developed and produced with a calendar life span of about 35 years or a fatigue life span of about 85-100,000 flight hours with periodic recertification of air worthiness basis the mandatory D Checks etc. whichever is earlier. At the end of this defined period it is uneconomical or unsafe to operate the aircraft and therefore should be retired or paid off. Whilst a detailed calculation at this stage in not feasible, a prudent estimate could be that about 800-1000 aircraft would be available for scrapping per year. This does not include helicopters, private jets and military aircraft. For India, from a military perspective, the MiG-27 aircraft fleet of about 150 aircraft has been de-commissioned over the last few years, the Avro replacement program will result in scrapping of about 60 aircraft, various helicopter replacement programmes of the Navy would see about 100 aircrfat being retired sooner than later. Even so, the commercial segment alone throws up a large number of aircraft that would be scrapped. Further, being "a luxury industry," it's turnaround for livery and cabin interiors, requirement of ever lighter and stronger alloys, quieter and more fuel efficient engines, better on board electronics, etc are pushing various systems into early obsolescence of aircraft equipment and systems which all finally feed into the recycling industry. With these growing numbers of retired aircraft, increased environmental awareness and rising interest of civil society, industry, pollution and environmental agencies and authorities the recycling of end-of-life aircraft is becoming increasingly important.

However, being few and far between out of sight and therefore out of mind, the end-of-life treatment of aircraft has been neglected for a long time. Growing concern about its impact on industry, environment and society is triggering this sector towards gaining social and economic recognition. End of Life aircraft, after their final flight, find themselves stored randomly besides airports or in deserts around the globe and allowed to decay due to wind and weather, misuse, theft and pilferage reduce the intrinsic residual value of aircraft parts and materials, which can feed back into future production and contribute towards materials conservation.

Recycling end of life aircraft comprise a series of sequential and simultaneous operations which need to be well planned

*** This was written before the Covid-19 pandemic impact on the industry**

to derive its full latent potential. The key challenge is in collecting, segregating and sorting various type of alloys and materials as each part is made of a specific metallurgical composition. Bundling them all together will completely devalue the scrap. The problem is not easy as there are hundreds of different types of alloys and materials available in *End of Life* aircraft, and this number continually increases, based on economic and technological developments in metallurgy and material science.

The Boeing-supported AFRA has led the initiative to inform educate and communicate the best practices in Aircraft Recycling in the United States. It was established in 2006 to ensure the sustainable management of end-of-life aircraft engines and airframes. In Europe, Airbus put together the PAMELA project (Process for Advanced Management of End-of-Life Aircraft) for developing a business template and process for recycling of aircraft.

The Recycling process has been defined under the PAMELA project which has broken down the aircraft recycling process into three steps. Decommissioning is the first step which includes cleaning, draining of fuel and fluids, removal of pyros and cartridges, batteries, and various safety procedures followed up with detailed record keeping. The second step is disassembling, which is defined as a "systematic physical separation of a product into its constituent parts, components or other groupings". An efficient disassembly requires a disassembly planning sequence and requires an intimate knowledge about the specific aircraft type, such as it design, structure, material and part composition. This helps to optimise the material recovery. Re-usable and re-sellable parts and equipment on the basis of demands in the spare parts market are segregated, selected, catalogued and thereafter offered for sale as pre-owned spares. As the aircraft is progressively dismantled different tools such as water jet cutters, grinders, shears are brought into play and a variety of technical talents are brought into play. Next, the materials are grouped by metal composition and potential customer segments and requirements of the recovery channels. Finally, the treatment process ends with the comprehensive and systematic deconstruction of the aircraft.

The worldwide demand for aerospace grade materials continues to increase. The production of new aircraft parts requires raw materials, capital, energy and labour. Through recycling or reuse, a great amount of material and parts can be recovered, recycled, re-used after refurbishment and consequently primary and natural resources can be saved.

Therefore, as the foregoing analysis reveals both the supply and demand side of the business equation for aircraft recycling seems to be balanced. However, the lack of interest in developing this vertical of the recycling industry is surprising. This may be due to several reasons. Firstly, it is not readily realised in the recycling community that end-of-life aircraft contain a lot of valuable materials and parts that can be recycled and hence its latent value should be recovered for pure economic benefits.

Another factor that is impeding sustainable end-of-life treatment of aircraft is the deficiency of knowledge and lack of a total lifecycle 'cradle to grave 'management approach for the aircraft. We have seen that business growth in the automobile sector saw tectonic changes once software driven Intelligent Systems catalogue pre-owned refurbished parts for sale to users across the world. Aircraft have a similar requirement. Therefore, developing a conceptual framework for total life cycle management of aircraft and the after-market

opportunities is essential for achieving true sustainability and closing the recycling loop in the aircraft industry.

Finally, the production of secondary raw material requires significantly less energy than the production of primary raw materials particularly Rare Earths, titanium and complex alloys that require substantial investments. Instead a 'cradle to ladle' approach by directly feeding into foundries rather than furnaces also offers sizeable economies and cost benefits. Aircraft manufactures must also take note that recycling leads to a reduction of emissions to air, water and soil, reduction of waste, and finally a reduction of land use in landfill sites. Therefore, aircraft manufacturers should integrate with aircraft recyclers to their common advantage.

Aircraft are composed of a number of different materials, equipment, assemblies and parts. The Airbus A380, for instance, has over one million parts. These may be made of carbon and glass fibre composites; cabling wires; plumbing, hydraulics and pneumatics; aluminium, titanium and steel alloys parts and components; foam, textiles and carpet; engines and landing gears; variety of fuel and fluids; substantial amount of electronic devices and various types of power and lighting sources and equipment and other rubber and neoprene parts. The subsequent processing of aircraft material into alloys requires mechanical, electro-chemical as well as metallurgical processes which are usually undertaken by secondary producers.

The most valuable part of an aircraft is the engine and the power train. At *End-of-Life*, the engines are the first thing to be removed and tested for ascertaining if these can go to serve another aircraft either as is or refurbished by a certified agency. Others are scrapped for valuable metals such as titanium, stainless steel etc. Detailed maintenance records are necessary for trading in such critical parts and components. The goal is to optimise material recovery through multiple product use cases. For example, aluminium alloy could be reclaimed and used to produce new aircraft structures made out of the same aluminium alloy. Similarly Nickel and Cobalt, which go into manufacturing diverse products such as aircraft turbines and battery, can be recovered because recycling the turbine blades avoids the need to produce primary nickel and is reused to best efficiency. Between 40% and 50% of the weight of most dismantled aircraft finds its way back to the parts distribution pipeline.

The safe and responsible recycling of commercial aircraft is one of the main challenges facing the global aviation industry. With around 12,000 commercial aircraft to be decommissioned over the next 20 years, manufacturers and operators are working towards the development of the 100% recyclable aircraft system. Currently, 80-85% of an aircraft is recycled against about 50% only a few years ago. AFRA aims at increasing this number to 90% by the end of the decade as technologies develop to recycle carbon fibre, plastics, smart alloys etc. Some aircraft OEMs are already working towards aircraft designs that would permit 100% recycling and in future could possibly include the dismantling procedure to maximise material recovery. However, to derive the full value of recycling aircraft a certain level of technical competency, tooling, occupational health and safety issues need to be addressed. In this arena, recyclers can smell the money. However, whilst the opportunity abounds some minor challenges cannot be brushed off.

First is the availability of a suitable airfield or recycling area. Fortunately in India, that is not a big challenge as several airfields are available for use. Transportation is another issue. So long as the aircraft can fly into the dismantling airport it is workable. But obtaining end-of-life aircraft from distant airports, deserts etc can be a daunting expenditure. Thirdly, the right skill set is required. Fourth, an appropriate *Regulatory and Compliance* framework, along the lines of the *Vehicle Scrapping Policy* under issue by the Ministry of Road Transport and Highways and the *Ship Recycling Policy* issued by the Ministry of Shipping, as part of the nations consolidated industrial policy, together with an appropriate regulator is necessary to energise this sector. Perhaps the Director General of Civil Aviation could be entrusted this responsibility along the same lines as the treatment of end of life vehicles and ships.

The European Commission is very active to introduce the principle of Extended Producer Responsibility into legislation for aircraft manufacturers and their supply

(photo: circulary.eu)


(photo: circulary.eu)

chain. For example, the European Directive 2000/53/EC on treatment of end-of-life vehicles was inspired by the principle of EPR and is now followed worldwide. Similarly, in 2009, the IMO adopted the *International Convention for Safe and Environmentally Sound Recycling of Ships*, to which India is a signatory since December 2019. Though the handling of end-of-life aircraft has not been legally regulated yet but the day is clearly not far.

Finally, a more sophisticated market needs to be created for the recycling of aircraft parts but such a market will get generated once the business gets traction.

In conclusion, the recycling of aircraft has come into greater prominence only in recent years, due in large part to the increase in the number of aircraft which are reaching the end of their working life and becoming publicly visible. Discarded aircraft provides a large source of valuable material.

(photo: circulary.eu)

Landfilling/letting to rot naturally is hardly the efficient solution to the treatment of end of life aircraft any more. With expanding numbers of retired aircraft, increasing environmental awareness and growing interest of societies and authorities, the handling of end-of-life aircraft is becoming ever more important and inescapable necessity. It also presents a new business opportunity for enterprising entrepreneurs and established entities.

India has much potential to become one of the world's largest aero recycler as it has achieved excellence in the ship recycling sector and has also taken steps in automotive recycling. Logically, aircraft recycling is the next step. This requires apex level policy intervention, setting up procedures, establishing appropriate standards and a regulatory and compliance mechanism for the promotion of the industry leading to high technology jobs, larger revenues, cleaner environment and a more sustainable aerospace industry. India should target at least a 10% market share of the multi-billion dollar aircraft recycling market – which is reasonable and eminently doable in the next few years.

Ocean Sky 2020

Emblem

A legacy FA-18A Hornet from Ala 46 takes off from Gando

Canary Islands organised the Ocean Sky 2020 an air combat exercise from 19 to 30 October 2020. Geographically separated from the Spanish mainland and located just off the coast of Morocco, the Canary Islands provides a unique airspace for a large-scale exercise. Home of Ala 46, Gando Air Base on the Island of Gran Canaria, hosted the exercise for the second time under its current name. To carry an exercise like Ocean Sky, a series of sanitary measures had to be implemented to mitigate the risk of Covid-19, such as the creation of bubble groups, limitation of capacity, daily temperature controls, as well as the supply of masks and hydroalcoholic gel. In addition, teams of trackers were made available to monitor and control possible cases.

An Ala 11 Eurofighter returns to a full flightline, with all types of jets captured, after a morning mission

Goal

The purpose of Ocean Sky 2020 is to train and evaluate skills of combat and support units, as well as maintaining the high level of preparedness of Command and Control capabilities and also integrating invited foreign units in an air superiority campaign. This allows to increase preparation for air-to-air combat level of the Spanish Air Force and NATO allies. These principles are inherited from the DACT (Dissimilar Air Combat Training) exercises which were used to be held at Gando Air Base till 2017. In the year 2018, DACT exercise was cancelled and the new name Ocean Sky was adopted in 2019. Originally, Ocean Sky was born to test the combat level of the Spanish combat squadrons through their chain of command. Today, it has become a primarily air-to-air exercise, based on three missions modelled on NATO tactics: the protection of the area, the escort of major aircraft and the Entry Force. During this year's exercise, the Spanish aircraft focused mainly on defensive missions, while the French aircraft on offensive missions.

Escuadron 802 AS.332C takes off from Gando Air Base on a SAR mission

Back after 8 years of absence, the EAV-8B Harriers from Esquadrilla 009 enabled young pilots to train in a dynamic environment to test their skills

The exercise was carried out in four phases:

1. A first phase of 'Generation and deployment of forces' was aimed to carry out all personnel and force preparation tasks, as well as the deployment of participating units
2. Theoretical phase included a series of 'force integration conferences' which were intended to impart knowledge about the participating aircraft, Flight Safety, Combat Tactics, etc.
3. A practical phase comprised of missions with DACT and Mixed Fighter Forces Operation (MFFO) in a wide variety of scenarios and with a large number of aircraft, which allowed increasing interoperability between the different participating units, as well as evaluating and improving the tactics, techniques and procedures used in this type of missions.
4. A final phase of 'withdrawal'.

Rafale C 118 30-IW from Mont-de-Marsan was 1 of 13 Rafales that participated in this year's exercise

An overview of all participants participating in this year's Ocean Sky exercise

Mission scenarios

The participants also operated form Delta 79 operating area which is located 46 miles (74km) from Gando Air Base and is one of the largest air combat training areas in Europe – stretching for 186 miles (300km) by 230 miles (370km) – which allows for unrestricted air combat training without speed or height limitations.

Overlooking the exercise and the scenarios is the Combat Air Command (Mando Aéreo de Combate or MACOM). The Combat Air Command is a unit of the Spanish Air Force that oversees the supporting and preparing of air units for combat, as well as constituting the command and control system of the offensive activities of the Air Force. To this end, it has the possibility of operational deployment both in missions with other units of the Spanish Armed Forces and in the international areas. Operationally and organically, it reports directly to the Chief of the Air Staff (Jefe del Estado Mayor del Aire or JEMA). Located inside Torrejón Air Base, all units related to the attack and defence capabilities of the Air Force depend on it.

The Amree de L'Air Rafales had a good opportunity to test and simulate their tactics around with new Meteor missile

To allow full evaluation of the command and control structures, a wide range of scenarios were integrated into the exercise. Each of these scenarios was met with an impressive opposition force drawn from the participants. With a unique airspace, Ocean Sky exercise allows the participants to carry out missions of extreme complexity and to recreate all kinds of scenarios.

Text and photos: Erik Bruijns

The Delta 79 area South of the Canary Islands provides a 110.000 square kilometer airspace with no limitations in height and speed

Sharpening skills for SEAD

Italian Tornados practice EW in German ranges

For two weeks from 28 September to 9 October 2020, six Italian AF Panavia Tornado ECR fighters operated from the German airbase at Nörvenich, the aircraft from 6 ° *Stormo* which is based at Ghedi in north Italy. The Italian Tornados mainly practiced on the Polygone Range in south west Germany, with an average of four Tornadoes per flight. This was not the first time that the Italians practiced at Nörvenich, the Italians of the 6 ° Stormo often operates from this German airbase.

The Polygon Range is a unique training location in Europe for SEAD missions (Suppression of Enemy Air Defence). The *Multinational Aircrew Electronic Warfare Tactics Facility Polygone* is an Electronic Warfare Tactics Range located on the

border between Germany and France, a tri-national facility operated by France, Germany and the United States. During the training mission, so-called Smoking SAMs were used to create realistic training scenarios. A 'Smokey SAM' is an unguided simulation missile which produces smoke trail.

SEAD operations are also referred to as *Wild Weasel* in the United States, during these missions, the participating unit destroy targets such as surface-to-air missiles (SAMs), anti-aircraft guns (AAA), radar installations for early warning and command, control and communication functions etc. by air strikes. Suppression can be achieved physically by destroying the systems or by disrupting and misleading them through Electronic Warfare.

In modern warfare, SEAD missions can make up as much as 30% of all sorties launched in the first week of battle and continued at a reduced rate for rest of the action. SEAD missions are particularly dangerous for flight crew, as they penetrate enemy territory during the first offensive wave of a military campaign. SEAD missions disable the enemy's air defences enabling other fighters to attack strategic targets, unseen and unhindered.

Report by: Alex van Noije and Joris van Boven

Airbus A400M for Luxembourg and Belgium Armed Forces

On 7 October 2020, Minister of Defence François Bausch and the new Chief of Staff General Steve Thull formally welcomed the new Airbus A400M transport aircraft for the Luxembourg Armed Forces at Luxembourg-Findel main airport.

In 2001, the Belgian and Luxembourg governments had formalised procurement of eight Airbus A400M aircraft, one for Luxembourg and seven for Belgium. All eight aircraft will be based Melsbroek Air Base in Belgium with the Belgian 15th Wing. The Luxembourg Armed Forces will also post crew members for the two-national A400M fleets; the A400Ms replacing the aging Belgian Air Force C-130 Hercules fleet.

The A400M can land and take off using a short runway and can operate from difficult terrain, including a beach or from

grass runways. The aircraft can be used for military as well as humanitarian purposes, according to the new Chief of Staff of the Luxembourg Armed Forces, Steve Thull, "In any event, it can fly people as far as to Mali as its operational range is larger than the current C-130 Hercules. Above all, it equips us to expand our transport capacity."

The estimated cost of the A400M project is around 420 million euros which includes initial procurement and maintenance charges. Minister of Defence François Bausch stated, "This is a lot of money, but it would be worth it, because the aircraft could be lent to other Europeans to carry out both defence as well as civil operations. Then we have the MRTT (Multi-Role Tanker & Transport) programme, where we've been discussing with other European countries, on sharing costs."

The Airbus A400M is the first Luxembourgian military aircraft since 1968 at that time, three Piper PA-18 Super Cubs were retired from service. The Luxembourg Armed Forces received two Eurocopter H145 helicopters in 2019.

Text and photos by Joris van Boven & Alex van Noije

BACCARAT 2020

War in the (Alpine) Mountains

Organised by 4th Air Combat Brigade (BAC), 4th edition of the *Baccarat 2020* exercise took place in mid-September 2020 in the French Alps. The 24th Infantry Regiment (24e RI), the only Army unit composed exclusively of operational reservists, took part and, like the previous *Baccarat* exercises, focus was on high-intensity combat, this time in a mountainous environment.

The Regiment mobilised 38 aircraft (7 different types) from the 1st, 3rd and 5th Combat Helicopter Regiments as well as 1,600 soldiers, mainly from the 27th Mountain Infantry Brigade (BIM). This edition, like previous ones, also had an allied dimension. From the UK, three WAH-64D Apache attack helicopters from the 4th Army Air Corps Regiment and a detachment of 45 soldiers participated. The WAH-64D Apache helicopters were operating from Valence-Chabeuil Airport.

The exercise took place on a quadrilateral area of over 250 kilometers and included a live-fire zone in the Mailly and Sissonne training areas and an exercise zone in the region of Valence – Grenoble – Gap – Briançon. Although its format has been reduced compared with previous exercises, this pursued the same objective.

During 2020, we visited Grenoble Le Versoud airfield, which had been turned into a temporary air base, with around 20 helicopters based here. The 5th RHC from Pau had sent EC665 Tigre and NH90 Caïman helicopters, the 1st RHC from Phalsbourg had sent NH90 Caïman and SA 342M Gazelle, the 3rd RHC from Etain had sent SA 342M Gazelle and Puma helicopters and the EALAT (French Army Aviation School) had positioned AS555UN Fennecs which were used for training and liaison.

Beside these helicopters stationed at Grenoble Le Versoud airfield, the other helicopters were operated from various sites, including several forward arming and refueling points (FARPs) in the mountains.

Apart from Grenoble Le Versoud airfield, we also visited the army base of Varces-Allières-et-Risset, home to the 27th Mountain Infantry Brigade, where a complete mobile military camp had been set up. It was the central operations centre from which the entire operation was coordinated and managed.

We spoke with Lt Laurent of the 1st RHC, normally based at Phalsbourg-Bourscheid, located in North-East France, about experience gained throughout his career and from the recently concluded Exercise *Baccarat*. Lt Laurent has been flying the NH90 Caïman for about four years and has around 500 flight hours on this type. As Lt Laurent stated, "I chose to fly on the NH90 Caïman because it was brand new in the French Army. I have to say that the

NH90 Caïman is a fantastic machine and much better than its predecessor, the Puma, on all fronts. To conduct combat exercises in the French Alps is a tough nut to crack because of the rapidly changing weather, the steep slopes and powerlines."

During Exercise *Baccarat*, NH90 Caïman helicopters flew different profiles, and all routine troop duties tested, again in the high mountains. Versatility of the NH90 Caïman came in very handy, with or without a door-gunner, fast-roping from the side doors or via the ramp at the back, SPIE (Special Purpose Insertion Extraction) and rigging, which is a rapid extraction procedure in which several commandos hang on a rope under the helicopter. Depending on the configuration, the NH90 can embark up to 16 fully equipped commandos.

The NH90 Caïman can fly in most difficult conditions, thanks to its modern sensors and electronics, the Forward Looking Infra-red (FLIR) on the integral display in the pilot's helmet which gives him/her all the necessary information needed. Lt Laurent: "This helmet gives our NH90 pilots just that little extra!"

Some 20% of the '4e' BAC helicopters took part in the Exercise *Baccarat* with the Tigre, NH90 TTH and Gazelle from the 1'er and 5'ème RHC plus Gazelle and Puma from the 1'er and 3'ème RHC.

For a relatively young formation, Exercise *Baccarat* was a real test to check their operational capabilities and their combat skills. Air mobility is not unique to the 4ème BAC and working with its European allies is an opportunity to develop tactics and learn from each. Every exercise of this scale provides units with the opportunity to implement realistic scenarios combining rotary and ground manoeuveres, taking advantage of the changing pace offered by the helicopters.

We would like to thank Press Officer Gabriel, Captain Sandra, Captain Nathalie and the crew of the 1'er RHC NH90 Caïman for their hospitality and all their help during our visit.

Article and photos: Roelof-Jan Gort & Bjorn van der Flier

FalconLeap 2020

Every year, the 'MarketGarden' parachute airdrop exercise is conducted in September at the Ginkelse Hei near Arnhem, in the Netherlands. However, this year, because of outbreak of Covid-19, the exercise was restructured and was held in two parts.

Part 1: FalconLeap 7-11 September

First part of this exercise involved the air dropping of cargo from various military transport aircraft above Deelen and Oldebroek training areas. But visitors were not allowed to witness this. For this exercise, a USAF C-130 and a French C-130 had flown to Eindhoven Airbase at beginning of the week to practice along with C-130 Hercules of the Royal Netherlands Air Force. Owing to bad weather, no missions were flown in the first few days of the week, causing the American C-130 to return prematurely. The French C-130 left for France on 11 September after having flown several missions alongside Dutch Hercules aircraft.

Part 2: FalconLeap 14-18 September

Part 2 of this exercise consisted of dropping paratroopers from various military transport aircraft above training areas, again where no spectators were allowed. These practice areas include Renkum, Deelen and the Ginkelse Hei, all around the city of Arnhem. For this second phase of the FalconLeap exercise, transport aircraft from the Netherlands, Belgium, United States and Germany flew two to three missions per day.

Overflight Eindhoven, 18 September

On 18 September 1944, the city of Eindhoven was liberated by Allied troops.

Every year this day, there is commemoration in Eindhoven, where one or more C-130s of the Royal Netherlands Air Force fly above the city at 20:00. This year too there was a unique flight with number of military aircraft flying over Eindhoven. The "Fly By" is coordinated by the European Air Transport Command (EATC), with its headquarters at Eindhoven. Participants in the Fly By were a Dutch C-130, a Belgian C-130, a French A400M and a German C-160 Transall. Additional aircraft included a Supermarine Spitfire and a B-25 Mitchell, from the Dutch Air Force Historical Flight based at Gilze-Rijen AB.

Report by: Joris van Boven and Alex van Noije

MH-60R/S Seahawk at NAS North Island

MH-60S on platform

Indian Navy in line for 1st MH-60R deliveries soon

The Indian Navy has selected the MH-60R Seahawk to replace its aging Sea King helicopters, with first deliveries expected by the end of 2020. They will become the fifth operator of the type globally. The first and largest operator of the MH-60R is the US Navy and the Naval Air Station North Island is home base of the US Navy West coast MH-60 helicopters.

Patrick Dirksen and Frank Mink were invited to visit two squadrons at NAS North Island to learn more about this backbone of the US Navy helicopter fleet, one operating the 'S' or *Sierra* and the other flying the 'R' or *Romeo* version.

MH-60S

The MH-60S version is successor of the CH-46D helicopter and helicopter sea combat squadron HSC-14, *The Warriors* are equipped with the latest model MH-60S block 3B Knighthawk. MH-60s deployed on the carrier performs various naval operations including SAR, vertical replenishment tasks within the Strike Group and medical evacuation from ships as needed.

However, the MH-60S is primary defence for the carrier around the two mile zone. To deal with any threat, the helicopter is equipped with various weapons, including a fixed M197 20mm Gatling gun or M299 launchers with a four pack Hellfire missiles to door mounted M240D machine guns and GAU 21 20mm guns.

For Naval Special Warfare (NSW) operations, the spacious MH-60S cabin can accommodate a team trained to neutralise ships or oil rigs. These teams can be inserted by fast rope attached to the hoist. A small Combat Rubber Raiding Craft (CRRC) can also be placed under the helicopter to be used by the team whenever needed for operations. The MH-60S is also used for parachute operations by SEAL teams and as a sniper platform. During NSW missions, the MH-60S also provides close air support and casualty evacuation.

To fight fires, the MH-60S can be equipped with a Bambi bucket which contains 530 gallons of water. When operated for fire fighting missions, the helicopter is given clear markings for recognition by the fire fighters.

MH-60R

Helicopter Maritime Strike Squadron HSM-75, *Wolfpack*, has anti-surface, anti-subsurface, Command & Control, magnetic detection and early warning tasks as its primary mission. The SH-60B Seahawk was predecessor of the MH-60R Seahawk and was exclusively deployed on Navy frigates and destroyers but with introduction of the *Romeo*, HSM-75 now is also deployed on carriers.

The MH-60Rs of HSM-75 are equipped with the APS-153 multi-mode radar system, a major improvement over the previous APS-147 system. The APS-153 is mounted in the radome beneath the cockpit and is the primary sensor for surface warfare in maritime operations.

Another key sensor is the AQS-22 Advanced Airborne Low-frequency dipping sonar, used for anti-submarine warfare (ASW). The acoustic information is interpreted by the sensor operator at his workstation in the cabin. A sonobuoy launcher is situated on the aft left side in the cabin. Containing 25 buoys, these

MH-60S taxies in after landing

Nose of MH-60S

MH-60R with external fuel tank on hardpoint

MH-60S of HSC-14 Chargers

are launched by an air pressure system, depending on the mission, the sensor operator choosing from three types of buoys. The SSQ-53 is a passive buoy that has a hydrophone to locate targets, the SSQ-62 Directional Activated Sonobuoy System (DICASS) is an active buoy which can be remotely operated, the third type is the SSQ-36 environmental buoy which monitors the water temperature versus the depth. The MH-60S can also carry up to three lightweight ATK Mk.46 or Mk.54 torpedoes to attack sub-surface targets.

Both the cockpit crew and the sensor operator have mission displays which show all acoustic info, camera and radar images and early warning information. The MH-60R can communicate through UHF, VHF, maritime radio and SATCOM and it can also share sensor data via Link 16.

The MH-60 *Romeo* and *Sierra* both have the same Lockheed Martin cockpit avionics suite. Four multi-functional displays provide flight and tactical data, the cockpit equipped with dual hydraulically boosted flight controls. To gain situational awareness at night, the crew have helmet mounted ANVS-9 night vision goggles and the cockpit is NVG capable.

As the basic H-60 model is an army design, many systems are made redundant. Fuel is stored in two separate self-sealing bladder tanks and additional fuel can be stored in external fuel tanks which give the helicopter an additional flying hour per tank. Two General Electric T700-GE-401C engines are each rated at 2000HP. The helicopter is able to fly in light icing conditions with a heated rotor blade system and an engine anti-icing system.

For self defence, a Countermeasures Dispensing set contains an AAR-47 missile and laser warning set, ALQ-144 infrared jammer and ALE-39 chaff and flare dispensers. The ALQ-210 Electronic Support Measures system provides situational awareness and threat warning. Engine exhaust deflectors decrease the heat signature of the helicopter while the dull grey paint scheme also absorbs radar energy.

We would like to thank the Naval Air Force Pacific Fleet PAO and the crews of HSM-75 and HSC-14 for their assistance.

Text and photos: Patrick Dirksen and Frank Mink from Tristar Aviation

Exercise Frisian Lightning II

On 9 November 2020, the exercise Frisian Lightning II started at Volkel Air Base and during this exercise, the new Dutch F-35A Lightning II fighter aircraft from Leeuwarden Air Base were sent to a domestic deployment and by the end of the afternoon, the four brand new F-35A Lightning II fighters landed at Volkel Air Base. The exercise lasted a few days with the aircraft flying two waves per day. The first wave took place in the afternoon (flying in daylight) while the second wave exercised in the evening during darkness.

The intention was that during these flights as many F-35s as possible would be launched in order to train as many pilots as possible. The entire detachment from Leeuwarden consisted of about 150 men and women. The pilots who participated in this exercise were all qualified; they are all trained on the F-35 and have years of experience on the F-16. Previously, the logistics, IT and security departments of the squadron already practiced at Leeuwarden Air Base during the exercise Frisian Lightning I. Here they trained in packing and preparing ground equipment and spare parts, therefore this exercise was a dry run in preparation for a real move.

During this exercise, the 322 Squadron from Leeuwarden was temporarily based at Volkel. This exercise focused on the logistical relocation of the unit and was part of the step-by-step plan that will lead to an initial deployment capacity of the squadron at the end of 2021. The exercise, called Frisian Lightning II, is the second in a series of exercises. The exercise is therefore part of the so-called "Road To Initial Operational Capability" (R2IOC).

The facets of flying such as night flying ops, loading and dropping training bombs are also part of the R2IOC. If the unit achieves Initial Operational Capability (IOC) by the end of 2021, it means that the 322 Squadron will be able to deploy a unit of four F-35s including personnel and equipment for a short period of time anywhere in the world. The next step is a similar deployment exercise abroad.

Text and photos:
Joris van Boven & Alex van Noije

Historical aircraft at Dutch National Military Museum NMM

Flying through the skies, aircraft always have a prominent and noticeable presence when in operation. After their active flying career, the majority of aircraft disappear completely out of sight; most of them are cannibalised for spare parts and the remaining demolished and materials recycled.

Fortunately, there are still societies and individuals who are devoted to maintain some species of aircraft and showcase them in public. In this way, national and international developments in aviation history are kept alive and saved for future generations to tell their stories, often in museums.

One of them is the Dutch National Military Museum (NMM) in the centre of The Netherlands, about 30 kilometres from Amsterdam. The museum gives a general military overview, however without naval aspects, which are at display at the naval harbour in Den Helder.

Built in 2014, NMM is relatively new. Due to the lack of space in the previous museum, it was decided to build a new museum which is centrally located and has extra space. It is for this purpose, Militaire Luchtvaart Museum (MLM = Military Aviation Museum) was selected and its collection became the part of newly build National Military Museum.

Inside the NMM building, one can find several aircraft that played a major role in Dutch aviation history such as Fokker or Koolhoven propeller fighter aircraft of the period up to 1940. The timeline continues with jet engine powered aircraft like the Thunderjet, the Hawker Hunter, NF-5 Freedom Fighter, F-104 Starfighter and the current F-16. All these aircraft had been in service in the Royal Netherlands Air Force over several decades. Furthermore, an international aspect can be found in the collection with F-102 Delta Dagger and an F-15 Eagle. These aircraft were in service

with the United States Air Force in Europe (USAFE) and operated out of Soesterberg air base, or "Camp New Amsterdam", as named by the Americans. From 1954 till 1994, the USAFE had 32nd Tactical Fighter Squadron based here at Soesterberg. After the fall of the "Iron Curtain" and consequently the cold war in the Eastern Europe was over, the USAFE decided to withdraw various units out of Europe, including the 32nd TFS which had "CR" tail coded F-4E Phantoms flying and in the final years until closure.

Building the NMM facility at Soesterberg has a symbolic background, as the Dutch military aviation came alive

at this place in 1913. Apart from serving aircraft of the USAFE, the base was also an important station for various Dutch Air Force squadrons until its closure in 2008. The years before, Soesterberg was home base of 334 squadron with Fokker F-27 Troopship transport aircraft, 298 Squadron with CH-47 Chinooks and 300 Squadron with Cougar helicopters. 300 Squadron also had a few Alouette III's but used mainly for VIP flights including use for the Royal family living in the nearby royal palace of Soestdijk. Upon the air base closure, the 334 transport squadron was re-located to Eindhoven air base and the helicopters were moved to Gilze-Rijen air base.

The complete collection of NMM aircraft is larger than the ones that can be seen inside the museum. To meet the aviation interest of the visitors, a small static display line of aircraft including an F-84 and F-102 (both still wearing 32nd TFS markings) was showcased outside the museum within a year after its opening. The surplus collection is kept in storage in a nearby depot. For special occasions, mostly once a year, several aircraft are taken out of the depot and added to the static display outside the museum for few weeks. Among all the showcased aircraft, the main attraction for many visitors is a F-4E Phantom II in original unit markings when active for USAFE at Soesterberg. Fine detail includes the orange coloured tail tip, connected to the Royal Dutch Family of "Orange".

Recently, extra space for the storage aircraft was given, when all were moved out of the depot to make way for Catalina amphibious flying boat which was kept in a very poor state right at the end of the depot. The Catalina will be a part of a rebuilding project to bring it back into its original, but non-flying condition in the coming years. This will become a new centre of attraction for visitors apart from F-4, also a short display for a Grumman Tracker, Fokker S.14, Cessna T-37, Hawker Hunter, F-86K, RF-84 Thunderflash, Canadair NF-5B and F-104 Starfighter.

Text and photos: Peter ten Berg

Forget the Boom!

Fly at Mach speeds

The relentless march of humanity has pushed the travel dimensions across time and distance. The early modes of intercontinental travel were through maritime route; however the Wright Brothers were instrumental in changing the face of travel forever. The rapid expansion and technology growth, post the World Wars helped the air travel sector to connect airports and continents quicker. The increase in the range of commercial aircraft transformed a historic transatlantic event to a day-to-day event. The continued quest for reducing the time taken resulted in rapid research and development funding in the area of increasing the speed of travel.

The result of multiple attempts to reduce the travel duration was showcased in 1969, wherein the world witnessed first flight of the Concorde. The Aérospatiale/ BAC Concorde was a Anglo- French supersonic aircraft. It could travel at twice the speed of sound, which resulted in halving the time between transatlantic destinations. The average cost per ticket to save a few hours was around 25-30 times higher than the cheapest airfare option. This was one of the key reasons that the airline which operated these aircraft could maintain profitability in the routes it operated, despite high maintenance costs.

The total programme cost was around $ 10 billion (adjusted to 2017), the unit cost was around $ 160 million. Around 20 units were built between 1965- 1979 and the two key operators were Air France and British Airways. The Concorde was retired in 2003, the fatal crash of Air France Flight 4590 and the withdrawal of support by Airbus drivers for the early retirement.

There has been a lot of discussion on the relaunch of Super Sonic Aircraft, however the high maintenance and the availability of multiple low-cost options are challenging factors to the programme and an airline. A simple example of the maintenance cost would be the possibility of the tyre of a supersonic aircraft to burst is 30 times higher compared to a sub-sonic aircraft. These factors makes supersonic jets only viable for the small population of High Net Worth Individuals which has helped in shifting the focus of supersonic jets development to the business jets market.

There are around seven business jets which are now in various stages of development, around which around 4-5 are from the United States. The aviation sector is an ecosystem, which means the dependency on the adjacent link is high. The business jet manufacturers need to work in tandem with the airport authorities and their suppliers in the areas of maintenance, fuel efficiency, noise levels and the sonic boom.

The sonic boom would prevent the full performance of supersonic aircraft over- populated area. This means that

Boom Makes History with Supersonic XB-1 Rollout

Boom Supersonic, the aerospace company building the world's fastest airliner, unveiled its supersonic demonstrator XB-1 in mid-October 2020, history's first independently developed supersonic jet. To design and build XB-1, Boom recruited a team of experts from around the industry and forged relationships with key suppliers. XB-1 is slated to fly for the first time in 2021 and will undergo a 100% carbon-neutral flight test programme.

After rollout, XB-1 will complete its ongoing, extensive ground test programme before heading to Mojave, California in 2021 for flight test. At the same time, the company will finalise Overture's propulsion system and conduct wind tunnel tests to validate aircraft design. When XB-1 breaks the sound barrier in flight, Boom will be finalising the design of Overture, whose own rollout is on track for 2025.

Boom Supersonic and Rolls-Royce in collaboration

Boom Supersonic and Rolls-Royce have an engagement agreement to explore the pairing of a Rolls-Royce propulsion system with Boom's flagship supersonic passenger aircraft, *Overture*. The aim of the new agreement is to work together to identify the propulsion system that would complement Boom's Overture airframe.

the supersonic aircraft can be flown at its optimal performance over sea, like on a transatlantic route.

Boeing has partnered with Aerion to develop a supersonic business jet and it is expected to demonstrate its first flight in 2023- 2024. The AS2 aims at a speed of around 1000 mph with the aircraft as the first ever aircraft designed for carbon-neutral operations. The other significant aspect includes 100% biofuel capability and no afterburners.

It is expected that the aircraft could be certified by 2026. The company has around 300 staff and its order books are for around 20 aircraft. The estimated price is around $ 120-160 million and it expects to manufacture around 300 aircraft in the first ten years. The key suppliers of the programme include GE Aviation, GKN Aerospace, Aernnova Aerospace, Safran and Potez Aerospace.

Meanwhile, Lockheed Martin's X-59 is designed to reduce the sonic boom which could allow the operability of supersonic business jets over land. The X-59 is expected to conduct its first flight in 2021. The experience of SR-71 is expected to help Lockheed Martin in their quest for supersonic business jet, the SR-71 having exceeded Mach 3 in 1971. The other promising aircraft programmes are involve countries like Japan and Russia. The Russian SSBJ, a variant of Tu-160 bomber is also a possible contender in this market.

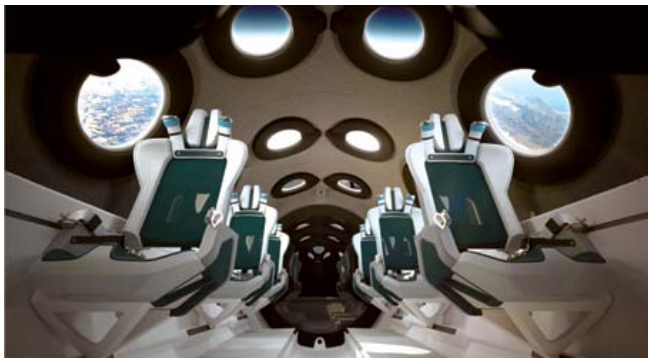
The introduction of some new business models in this market, like air taxis and fractional ownership has helped to entice new operators. However, it is important to note that the cost of travel in a supersonic jet would be much higher compared to a sub sonic business jet, and it would not be easy to estimate the demand for business jets based on the Post Covid business jet operators market. The Covid has positively impacted this market, where there is a surge in demand for business jet travel compared to Pre- Covid times.

Having considered the small market demand and the current supersonic business jet in development, we will wait and watch on the outcome. The first launched supersonic business jet would definitely have the advantage of higher market penetration, provided the brand represents a symbol of safety and trust.

Virgin Galactic unveils Mach 3 aircraft & signs MoU with Rolls-Royce

Virgin Galactic Holdings, Inc, a vertically integrated aerospace and space travel company, which includes manufacturer of advanced air and space vehicles, *The Spaceship Company*, has announced the first stage design scope for its high speed aircraft design, and the signing of a non-binding Memorandum of Understanding (MOU) with Rolls-Royce to collaborate in design and development of engine propulsion technology for high speed commercial aircraft. This follows the successful completion of its Mission Concept Review programme milestone and authorisation from the Federal Aviation Administration's *Centre for Emerging Concepts and Innovation* to work with Virgin Galactic to outline a certification framework.

Virgin Galactic reveals cabin interior



Virgin Galactic Holdings, Inc, a vertically integrated aerospace and space travel company, have revealed the cabin interior of its first SpaceShipTwo vehicle, VSS Unity.

Aspiring astronauts and space enthusiasts around the world now have the opportunity to explore the Virgin Galactic cabin design and spaceflight experience through an augmented reality enabled mobile app, which launches after the live event, and is available to download (for free) at both the App Store and Play Store.

One of the defining hallmarks of the Virgin brand over 50 years, has been the use of inspired and bold designs to transform the customer experience, such ethos successfully applied across industrial sectors and design disciplines: from aircraft cabins and hotel bedrooms to fitness classes and personal banking.

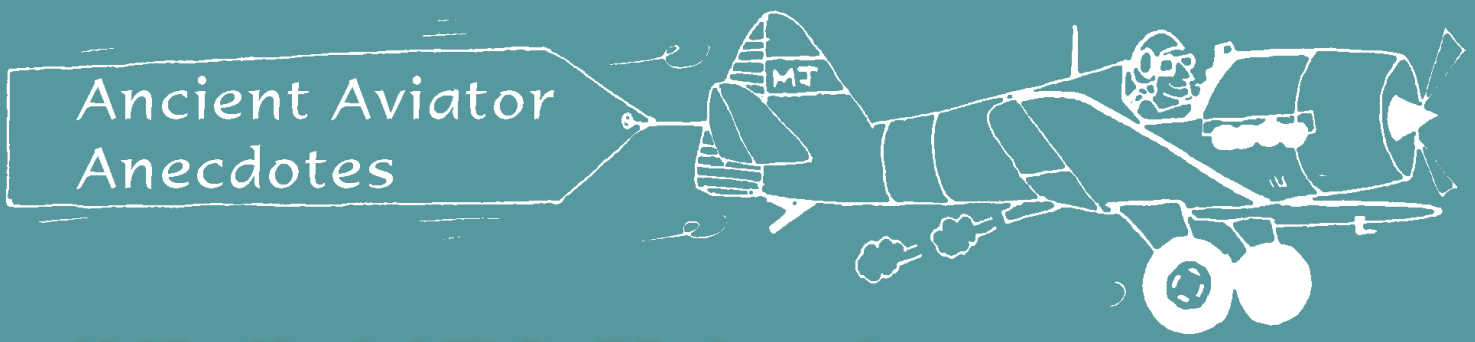
Virgin Galactic, in collaboration with London design agency *Seymourpowell,* has striven to remain faithful to that tradition by developing an elegant but progressive, experience-focused concept for the cabin of its spaceship. While this has been created to integrate seamlessly with every other aspect of the Virgin Galactic astronaut journey, the cabin is also the design centrepiece; providing safety without distraction, quietly absorbing periods of sensory intensity and offering each astronaut a level of intimacy required for personal discovery and transformation.

Individually sized seats, created using the highest-grade aluminium and carbon-fibre manufacturing techniques, reinforce this sense. The importance of astronaut comfort to optimise performance is accentuated by the use of engineered foam and technical fabrics. Virgin Galactic's partner Under Armour developed the astronaut spacesuits and also the fabric technology featured in the cabin seats. The colour palette of the cabin has been carefully curated so that it complements the architecture of the seat, the cabin itself and spacesuits. The golden metallics resemble luminous desert sands, blues conjure celestial spaces and teals inspired by the ocean ground travelers back to Earth.

Each seat has been engineered to match dynamism of the flight. A pilot-controlled recline mechanism, optimally positions astronauts to manage G- forces on boost and re-entry and frees up cabin space to maximise an unrestricted astronaut float zone when in zero gravity.

SpaceShipTwo's cabin was deliberately sized to allow for an out-of-seat weightlessness experience for the astronauts on board. The interior design focusses on this critical part of the experience. Soft cabin surfaces and elements become intuitive hand and footholds, allowing astronauts to explore the cabin freely and fully. The 'Halo' surrounds to twelve large windows have soft extended edges, which allow astronauts to perfectly position themselves for 360 degrees of awe-inspiring views, from the infinity of outer space to the beauty of our home planet.

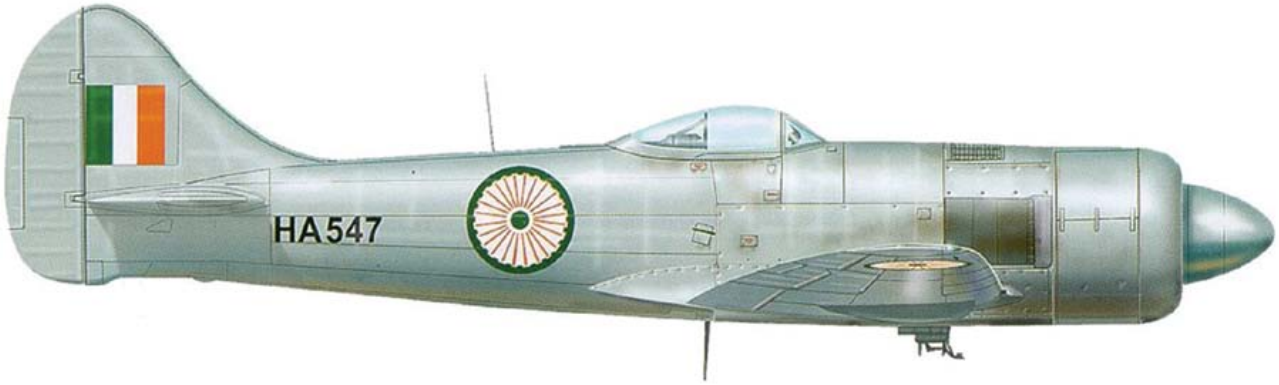
Richard Branson, Founder of the Virgin Group stated, "When we created Virgin Galactic, we started with what we believed would be an optimal customer experience and then built the spaceship around it. We will continue with that ethos as we expand our fleet, build our operations and underpin Virgin Galactic's position as the Spaceline for Earth. This cabin has been designed specifically to allow thousands of people like you and me to achieve the dream of spaceflight safely – and that is incredibly exciting."



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

OCTOBER REVISITED

The month of October has two dates of commemorative significance, one professional and the other personal. On 8 October 2020, our air force marked its 88th anniversary and 28 October 2020 was the 68th anniversary of my bale-out from a blazing Tempest aircraft.



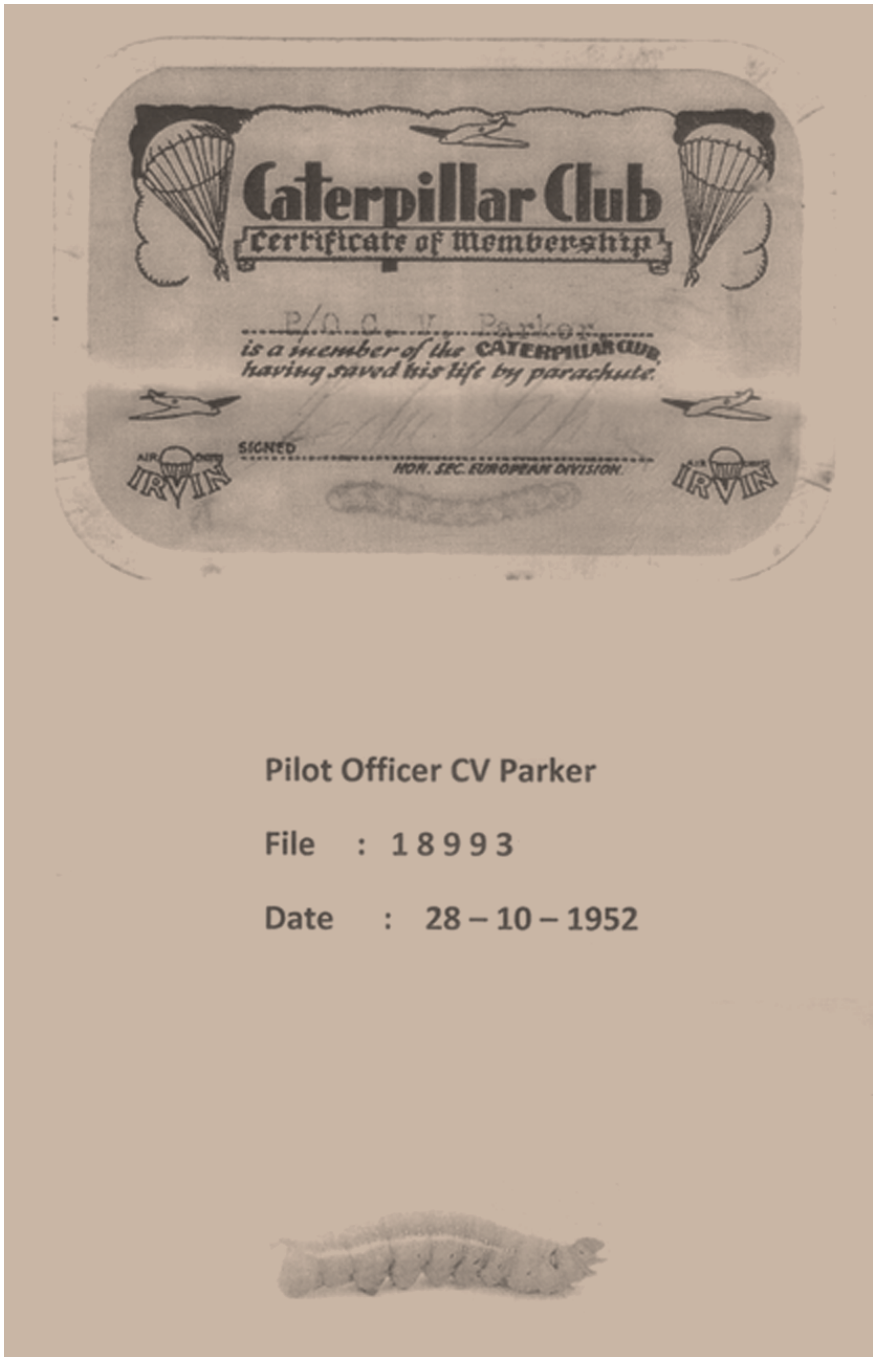
I share a year of birth with the IAF which was born by Govt. sanction on 8 October 1932. It actually came into being on 1 April 1933 when the first Indian officers and airmen were inducted into 'A' Flight of No 1 Squadron alongside the RAF which itself had been born on 1 April 1918. Since the IAF grew out of the RAF, like so many other procedures/traditions initially adopted, it also continued celebrating Air Force Day on 1 April. In early 1951, much against my father's wishes, I joined the IAF as I had a keen boyhood desire to fly.

While under training and as young officers we were taught the significance of Air Force Day which in early years comprised a station parade, small flypast of locally based aircraft, a glass of beer with the SNCOs followed by a *Bara Khana* in the Airmen's Mess or Squadron hangar. In the evening there was a formal dinner at the Officers Mess; all the functions were attended by both serving and locally resident air veterans. In mid 1970s the observance of Air Force Day was changed to 8 October, its legal birthday. Post 1986, when I took premature retirement, I still feel privileged to receive an invitation to the Air Force Day function from all four local IAF establishments, two of which I commanded and the other two I trained at. This year of course, Covid 19 sanctions involved a 'virtual' celebration at home!

On 28 October 1952, as a newly commissioned young pilot officer still short of my 20th birthday, and undergoing fighter conversion at the CTU Hakimpet, the engine of the Tempest aircraft I was flying caught fire and, after a great struggle, I just about managed to bale out safely with some minor burn injuries. It was a traumatic, near-death experience for a new pilot with just under 200 hours of flying. On hearing the news my father flew down from Calcutta intending to take me back home but was surprised to learn that this was not possible and that I would shortly recommence flying – which I did. Many years later, while researching for an article on the *Caterpillar Club*, available Flight Safety records indicate that there was only one successful bale-out from the Tempest IIA in the (R) IAF which operated it from 1946–54.

On 28 October of every year my wife never fails to remind me by organising something special wherever we were posted. In October 1971 my parents (in their sixties) paid us a visit in Pathankot where I was in command of No.20 Squadron then flying the Hunter Mk.56A. They were very impressed with their first visit to an operational air base. On 28 October 1971, just before they left, we invited all my squadron officers and their wives to dinner and my parents were delighted to meet the lively bunch of air warriors and their families. In December 1971, back in our family home in Madhya Pradesh, they heard from AIR about the award of MVC to their son.

In October 1972 I received a very last letter from my father now diagnosed with terminal cancer. It dealt with instructions regarding his finances, family, property and so on. It terminated with an admission that, despite his opposition to my joining the air force he was very proud of me; seven months



later he passed away. October continued to be another month when I am reminded how fortunate I have been in both my professional and personal lives.

A FAMILY GROWS

A normal human life span covers five generations, extending from grandparents to grandchildren. Born in 1932, my parents ensured that my early nomadic years included regular visits to my grandparents on both sides. In 1951, I was a direct entry into our air force thus fulfilling my boyhood dreams of becoming a pilot. My next 35 years as a fighter pilot were even more nomadic but most rewarding both in the air and on the ground. During this period I met and married a young teacher in 1956 and our son (b. 1958) and daughter (b. 1960) were both able to interact with their grandparents and great grandparents. Their upbringing and education taught them to be independent and to take their own decisions in life. While I was still in service, each of them chose their own professions and life partners.

In fact, by the time I took premature retirement in 1986, my wife and I were already grandparents!

The first decade of our post air force years was equally rewarding as new learning and its application generates job satisfaction whether employed in national defence or generating revenue in the corporate sector or disseminating knowledge in academia. Of course my air force experience was invaluable in my civilian commercial activities. The last 25 years of retirement have been stable and given us control over our time and choice of activities while living in the comfort of our own home we built in 1976. We still travel regularly but now out of choice and not compulsion. Most of our travels have been to visit our children in whichever country they were settled or based. Each of them has added one son and two daughters to our growing family.

Like many other elderly couples we live alone but digital technology keeps us in touch with our children and grandchildren almost daily. The advent of Covid 19 has now however curtailed our outings and confined us to our home. From time to time we do need a little help and this is readily provided by friends and neighbours in the air force officers co-operating housing society we are members of. Thanks to the visuals provided by the internet, our sense of physical isolation from the family is somewhat reduced; two recent examples will help illustrate.

On 23 June 2020, courtesy of our elder grandson and wife in the UK, we became great grandparents. Of course we do not know if and when we will get to meet-and-greet our very first great grandchild but are delighted to receive photos and videos of a beautiful little baby girl – the first member of the sixth generation of our family. Independence Day this year was also made special for us. On the evening of 15 August 2020, kind young friends helped my wife and I to watch the live stream of the wedding of one of our granddaughters in London. It was of course a "masked / socially distanced" marriage for the 27 attendees who comprised immediate family and close friends from the medical world as both bride and groom are doctors. It was a very emotional viewing for both of us.

Soon after, my pilot course (No. 58) marked its 68th anniversary on 30 August 2020 and our generation, now in its twilight years, will soon make its final take-off for the aviators *valhalla*. But life will go on and our family will continue to grow.

25 Years Back

From Vayu Aerospace Review Issue VI/1995

BJP's Defence Manifesto

The BJP will initiate a nuclear weapons programme and not give in to foreign pressure to freeze the country's missile production and development projects "if it comes to power at the Centre." A resolution to this effect was adopted by the party at the concluding day of its national executive meeting at Poona on 8 November, 1995.

Stressing that the country was facing a hostile and unstable geopolitical environment, the BJP resolution said the emerging defence scenario called for urgent action to redress the deteriorating military balance in the region. The BJP later adopted a resolution stating that it would give priority to upgradation of weapons systems and structure a phased induction programme for new weapons, ships and aircraft from both indigenous and foreign sources. Pakistan's defence expenditure accounted for 6.88 per cent of its gross domestic product (GDP) as against India's 2.39 percent. India in the past eight years had not inducted any major weapon systems, the resolution said.

Parliament Committee criticises LCA project

In a severe criticism of the DRDO, Parliament's Standing `Committee on Defence has called for a "review" of the Light Combat Aircraft (LCA) project which, according to it, was taken up without proper ground work. The Committee noted that despite India undertaking aircraft design and development since the early '60s, the LCA project was taken up without ascertaining the (DRDO) organisation's competence and expertise in the field. The relentless criticism of the project cannot but have far reaching implications: The Committee feels that the LCA, which was a monumental project to develop state-of-the-art combat aircraft, should have been undertaken with proper ground work and attainment of requisite technology levels.

India-Russia close to Su-30MK deal?

According to usually reliable "inside Government" sources in New Delhi, India is close to formalising a major defence deal with Russia which involves the purchase of 40 Sukhoi Su-30MK tandem-seating multi-role combat aircraft and six Type 636 submarines. However, no agreement has been reached on the purchase/lease of the 38,000 ton aircraft carrier. *Admiral Gorshkov* which is presently under refit and has been offered to the Indian Navy as an "interim" replacement for the 19,000-ton light fleet carrier INS *Vikrant*.

The induction of Sukhoi Su-30MKs by the Indian Air Force will represent a major departure from the IAF's operational plans which had envisaged the expansion of its MiG-29 and Mirage 2000 fleet by another two and one squadrons respectively IAF test pilots and engineers have evaluated the Su-30MK in Russia, the last team being led by Air Vice Marshal S Krishnaswamy,

First IAF Women helicopter pilots

The Indian Air Force has notched another "Asian first" when the first batch of women helicopter pilots were commissioned at a ceremony at the Air Force Academy on 16 December 1995. The IAF had created a history of sorts when the first batch of women short service commissioned officers were inducted in June 1993. So far, two batches of women pilots have been commissioned into the transport wing of the IAF.

Indian participation in Asian 100-seater airliner?

According to reports from China, India plans to be the third partner (along with China and South Korea) for development of the 100 plus-seater 'Asian Express' jetliner. On 27 August 1995, at a ceremony in Shanghai the Chairman of HAL signed a MoU with President of the Aviation Industries of China (AVIC) on the US $ 2 billion project with India likely to invest $ 200-500 million as its share. China and South Korea already have a MoU and these three Asian countries would seek a western partner for appropriate technology, with decisions to be taken in the next few months. Though the equity sharing details were not immediately available, indications are that India would be a minority partner while China would assume the leadership role for the project.

10 more MiG-29s

An additional batch of 10 such fighters are scheduled to arrive from Russia in January 1996 and will be among the last Russian military hardware to be bought under the $830 million credit terms extended to India by Russia for the purchase of military equipment and spares. The terms of the MiG-29 deal were finalised in November 1994. The MiG-29s will come with a complete set of spares support and will augment the inventory of IAF's MiG-29 squadrons.

Insat-2C in Geo-Synchronous Orbit

Insat-2C, the first Indian satellite to offer Asia-wide television coverage and two- way business communication was launched on 7 December 1995 aboard an Ariane launcher from Kourou in French Guyana. The satellite was put into a geo-synchronous transfer orbit 27 minutes after lift off and the master control facility (MCF) at Hassan in Karnataka acquired the telemetry signal two minutes later.

Pakistan considers ex-Spanish Mirage F.1s

The purchase of 22 ex-Spanish Air Force Dassault Mirage F.1 fighters by Pakistan is awaiting tacit 'clearance' by the French Government, according to official sources in Madrid. The Mirage F.1s have been stored at the Spanish Air Force's Torrejon de Arjorzair air base, near Madrid, and a total price of $29 million has been mentioned for the lot. Simultaneously, a contract with Thomson-CSF and Sagem for major upgradation of the avionics has been negotiated, the additional cost being quoted at $ 148 million, making it just over US $ 8 million-per aircraft for the Pakistan Air Force.

Tale Spin

Punjabi songs on the LAC

After facing resolute Punjabi fists (and more) in the Galwan Valley, the Chinese have resorted to playing Punjabi songs, recalling the tactics employed by Chinese Han Generals some 2200 years back during the 'Battle of Gaixia'. According to legend the opposing Chu soldiers had then got homesick which weakened their resolve, and the war was done.

Not ours! The Punjabi soldiers up in the freezing heights would probably break into Bhangra to taunt today's Han soldiers.

Yaks and Worms

More on the PLA deployed in Eastern Ladakh: sources have it that the Chinese troops are heavily dependent on Yaks not only for patrolling but (shamelessly) eating them! What is more repugnant is that a real delicacy for them is to first mix worms with the Yak meat and then feast on it.

Ugh! Enough to make one vegetarian!

Cartoon image from Times of India

manufactured by Rajkot-based Shrijee Gaushala.

And it is available in abundance – for free!

Rafales sans potholes

Pride of the Indian Air Force are their new Rafales, steadily being flown in from France to India, with AFS Ambala as their first home base. This is possibly the oldest Cantonment in northern India (after the Partition) and houses not only the IAF's first and finest but is headquarters of a Strike Corps as well. Pity then that potholes on the roads of Ambala Cantonment make motoring so very tedious:

But the Rafales are secure and remain at jet speed (cartoon courtesy Amul)!

Anti-Radiation dung chips

As explained to the *Indian Express*, "cow dung is anti-radiation", stated the RKA Chairman as he unveiled a 'chip' made of cow dung and claimed that this significantly reduced radiation from mobile handsets. The chip named *Gausatva Kavach is*

… uber Alles!

9 years late and far beyond its original budget, this international airport could well have been planned in the third (or fourth) world – but amazingly this was actually in Berlin, the capital of Germany! Work began in 2006 and should have been completed 5 years later. But a series of technical and planning goof ups forced abandoning of six successive six opening dates. The project became a national joke and greatly embarrassed the Germans who have traditionally been *uber Alles*.

The Berlin Brandenburg Airport Willy Brandt is now open for business (Covid willing).

Afterburner

VAYU

Aerospace & Defence Review

47th year of Vayu

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