

VAYU

III/2019

Aerospace & Defence Review



Bison vs Falcon
Tejas at Langkawi
Air Power Issues

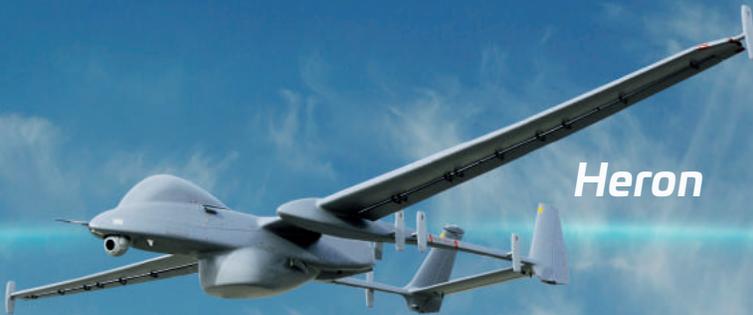
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Balakot Lessons

Two months after the Indian Air Force conducted the air strikes against a terror camp in Balakot following the Pulwama terror attack, it has conducted a detailed review and analysis of the operations on 26 February. After the unpublicised air operations in Machil sector in J&K in 2002, this is the first time IAF had been used against Pakistan — in fact, in the Pakistani mainland and not Pakistan Occupied Kashmir (PoK) for the first time after the 1971 War.

The significance of these operations can be gauged from the high level of global interest and sustained international coverage for weeks following the air strikes, which lent an extra edge to the review which is *de rigueur* for any military operation.

As with any military review, this one has also flagged the successes and failures of the operation, while highlighting the lessons to be learnt by IAF for the future. IAF was able to achieve strategic surprise in the manner it was chosen to be employed after the Pulwama terror attack, the selection of a madrasa at Balakot in a secluded area provided the operational surprise while deception provided by the IAF decoy being deployed towards Bahawalpur allowed the IAF to hit the targets without entering into an aerial combat with Pakistani fighter jets which were more than 150 km away.

The accuracy of Israeli Spice2000 precision-guided munition (PGM) was proven beyond doubt, even when multiple PGMs hit the same target at short intervals. The review also found that pilot proficiency was of the highest level. But it also brought home certain shortcomings in the operations: One of the Spice2000 PGMs did not leave the Mirage aircraft because of the mismatch caused by the drift in inertial guidance mechanism of the vintage jet, and the Crystal Maze AGM 142 weapon — which would have provided video of the hit — could not be fired by the pilots because of cloud cover. In an attempt to find a line of sight to fire Crystal Maze, the pilots in fact crossed the Line of Control which was violation of a major rule of engagement, laid down by the political leadership for the IAF.

The lack of evidence of hitting the target and causing destruction is one of the biggest lessons learnt from a military operation with huge political import. This could have happened with better weapon-to-target-matching and sending another mechanism to send the proof, which would have quelled all doubts that have been raised since. With this review, the IAF has discovered the lack of its technological asymmetry with Pakistan, which tied its hands after Pakistani jets targeted Indian military installations on 27 February.

IAF had first asked for more modern aircraft after the Kargil War, and two decades later, it is still awaiting the first Rafale. This lack of modernisation has happened under both the NDA and UPA governments, and unless that is redressed on priority, any government will find it tough to use the IAF against Pakistan in a similar scenario in the future.

From *The Indian Express*

Personalising the Army

Uttar Pradesh CM Yogi Adityanath has a knack for renaming places. Now, he has gone a step further by referring to the Army as ‘Modiji ki sena’, as if it’s the Prime Minister, not the President, who is the Supreme Commander of the armed forces. Adityanath made the remark while campaigning for none other than former Army Chief VK Singh, a minister in the NDA government. He said: “The Congress leaders would feed biryani to the terrorists, while ‘Modi’s army’ gives them bullets or bombs.” This brazen personalisation of the Services has expectedly drawn a sharp reaction from retired officers as well as opposition parties. Former Navy Chief Admiral L Ramdas has asserted that the armed forces don’t belong to any individual but to the nation, while Lt Gen HS Panag has said such comments could lead to politicisation of the Army.

The government has been quick to extract political mileage from the exemplary work done by the defence personnel, be it the surgical strikes after the Uri attack in 2016 or the recent Balakot airstrikes in the wake of the Pulwama carnage. The ASAT missile test, a landmark in defence research, was announced with great fanfare and touted as an achievement of the ruling dispensation, but the Election Commission (EC) did not consider it a violation of the model code of conduct. The EC went by the rule book. But these are political minefields open to diverse interpretations.

Such lacunae embolden politicians to ‘appropriate’ national institutions for electoral gains. The EC needs to crack the whip — while acting within the ambit of the model code’s provisions — so as to discourage such practices. Irresponsible statements that denigrate the defenders of the nation can have a disturbing effect on their morale, besides straining ties between the military and political leadership. The Army, the Air Force and the Navy know their job pretty well and are known for taking decisive action for the sake of national security, no matter which party is in power. Piggybacking on the forces’ feats is not only unfair, but also unethical.

From *The Tribune*

Lessons from Jet

No promoter can be treated bigger than the company. The last flight of what once was India’s second-largest private airline landed in Mumbai at 12.30 am 17 April 2019, the pilot’s message said: “We hope to fly again soon. When we do, do book with us.” It was a poignant moment for 25-year-old Jet Airways, but the indefinite suspension of operations was hardly surprising for an airline that had only five functional aircraft after starting the year with 119. With Rs 28,400 crore of debt, and the failure to receive a stopgap loan from its lenders as part of a rescue deal agreed in late March, Jet’s wings had not only been clipped; they were simply taken away. The airline is now clearly staring down the barrel. It is not difficult to figure out why Jet’s lenders developed cold feet after announcing on 25 March a resolution plan that envisaged stake sale and “priority funding”. It became simply impossible to extend the funds for two reasons: One, the airline’s cash flow was severely impacted and two, the Supreme Court quashed the Reserve Bank of India’s 12 February, 2018 circular on stressed assets resolution.

The resolution plan was built on the premise of that circular. The fear of witch-hunt by investigative agencies must have also weighed on the bankers' minds. Even a reduced amount of Rs.2400 crore as requested by the airline was an unviable option, as most of the funds sought were for the payment of salaries and dues to lessors.

But this does not absolve banks of the blame for the mess that Jet finds itself in. They gave a long rope to Naresh Goyal, the promoter of the airline, even though Jet was trapped in a vortex with seemingly no end in sight for months. There were many signals of protracted mismanagement before Jet defaulted on its repayments at the end of 2018. The airline was careening out of control with continuing losses and a severe cash crunch, and Jet's auditor raised questions over its survival in August last year. Yet, the banks did not think it was necessary to save the airline by forcing Mr Goyal to bring in strategic investors. Instead, they convinced themselves that they could convert their debt into equity and keep it going, even though past experience with such endeavours has been hardly encouraging. Banks also refused to take the Insolvency and Bankruptcy Code route, which was enacted precisely to handle situations such as what Jet found itself in.

What prompted banks to treat Mr Goyal with kid gloves for so long is unknown, but it is probably because the Jet promoter had many important friends on speed dial. The fear of annoying the political powers who would be wary of the nasty optics of large-scale job losses and spike in airfares seems to have also played a part, though it must be said that the government appears to have stayed out of the picture and left it to bankers and the airline management to sort things out, and minimised disruption by temporarily re-assigning airport slots to other airlines. At this point, however, it does appear that a miracle will be needed for Jet to take vying again. Finding an investor is hardly going to be an easy task, given that nothing much remains of the airline, except for some flying rights, a few landing and parking slots, an eroding talent base, and a shrinking brand value. The important lesson from the Jet saga is that no promoter should be treated bigger than the organisation.

From Business Standard

Omission Shakti

There is one thing you have to hand to Prime Minister Narendra Modi: His vast marketing skills. They were evident when he took a routine, if significant, step in India's strategic programme, and inserted it into the campaign for the general election that was just weeks away.

Naturally, he did not say that he was doing so, and even now the Election Commission is probably tying itself into knots to see how to play this one. The promotional skill was evident in the naming of the event as 'Mission Shakti', an attempt to conflate the importance of India's first anti-satellite (A-Sat) test with the far more consequential and game-changing nuclear tests of 1998 which were code-named 'Operation Shakti'.

A PM taking credit for an achievement during his tenure is not unusual, neither is the use of a national security event to seek a boost in the polls. But there are some other troubling issues that need to be considered as well. The test where a missile destroyed a

satellite in low-earth orbit (LEO) was essentially a technology demonstration exercise, akin to the test of the Agni technology demonstrator in 1989, or that of the first Ballistic Missile Defence (BMD) test in 2006. Neither of them saw an over-the-top prime ministerial response. Instead of deterring the adversary, you end up alarming them, well before your own system has matured. Given the as yet limited range of the Indian radar and the capability of its hit-to-kill missile, we have some way to go before we can claim to have an effective A-Sat system. The Indian way of broadcasting capabilities yet to be fully developed varies sharply with the Chinese who hide theirs for as long as they can.

On the other hand China has not only demonstrated in 2007 that it can knock out a satellite as India has done, it has also established several other technologies to "kill" satellites. Among these are satellites that come close to "inspect", refuel and repair other satellites. This ability means they can also harm them and so they are seen as A-Sat systems. China is also quite advanced in the area of directed energy weapons like high powered microwaves, radio frequency weapons and ground based lasers to dazzle optical satellites and fry the electronics of the others. They carried out a successful experiment in blinding one of their own at an orbit of 600km as far back as 2005. Americans suspect that a 2013 test of a sounding rocket going up 30,000 km was, in fact, related to threatening GPS and communications satellites which are in medium and high earth orbits. It's one thing to knock out a satellite in LEO, but destroying or disabling those in the geostationary orbit 36,000 km away is different by orders of magnitude.

Technology demonstration has its value. It is often the sensible means of warning off adversaries, without needlessly destabilising the environment. Also, it is much cheaper. The problem is that it doesn't work when the adversary to be deterred is a neurotic neighbour called Pakistan. As for China, it will be some time before it actually feels threatened by an Indian A-Sat capability. Far from deterring, India's civil nuclear programme in the 1950s and 1960s encouraged Pakistan to initiate its military nuclear programme well before the Indian nuclear test of 1974. Likewise, following India's technology demonstration of the Agni in 1989, Pakistan got M-11 missiles from China in 1991, along with a factory to manufacture the M-9, which were ready to use well before India had a ready to deploy missile. And when India tested nuclear weapons in 1998, Pakistan responded within weeks with its already pre-tested Chinese bomb.

So don't be surprised if India's A-Sat technology demonstration is followed by one in Pakistan. The technologies to destroy LEO satellites are not all that complicated, especially since Pakistan's "iron brother" China has all of them. It has a tested SC-19 missile which is both a BMD system and a satellite killer. The resulting situation will not be particularly comfortable for India which has, according to one count, 94 satellites in orbit today, as compared to just six for Pakistan.

Dr Manoj Joshi in The Times of India

Security & Governance

Admiral Arun Prakash writes on crucial challenges for the new Government

As readers get this Issue, India will have a newly-elected government in place. But as far as national security goes, all party manifestos appear equally insipid and unfocused, confirming fears that the recent hoopla about security was superficial and election-driven. Therefore, as a concerned citizen, one feels obliged to offer advice - albeit unsolicited - to the incoming government on three areas of national security; all of them “old chestnuts”.

The seven decades since Independence have seen numerous analysts, scholars and researchers — foreign as well as Indian — bemoaning the absence of a “strategic culture” in India and the consequential disregard of national security by its rulers. Historically, India suffered a succession of invasions over its north-western passes by Persians, Greeks, Arabs, Turks, Afghans, Mongols and Mughals, and landing on its shores, by Europeans. While we failed to defeat any of these invaders, let us note that those who came overland were assimilated into India’s rich cultural fabric and became “Indians”. The European seaborne invaders, not in the least interested in assimilation, stayed for four centuries, only to exploit, plunder and establish empires.

The lacunae that, historically, enabled foreigners to violate our sovereignty and deprive us of freedom were not only lack of internal unity but absence of strategic thinking and planning, and technological backwardness. Proof that lessons of history have remained unlearnt is to be found in the Indian polity’s sustained indifference towards national security issues, despite five major conflicts, ongoing internal insurgencies and frequent terror strikes. Rarely in the past 72 years, has India’s Parliament found the inclination to discuss the defence budget, address national security issues or demand a defence review/security strategy from the government. Not only does Parliament ignore the annual recommendations of its own Standing Committee on Defence, the government is seen showing displeasure when the Committee presents unpalatable facts.

The 1999 near-disaster of Kargil brought home to the political establishment that there was a great deal wrong with national security. Consequently, both the NDA and UPA regimes that followed constituted high-level expert

groups mandated to undertake national security reviews and propose reforms. The crucial recommendations of both bodies, however, disappeared into the bureaucratic maw of the Ministry of Defence and Ministry of Home Affairs and national security reform has remained in limbo thereafter.

The historic void in strategic thinking and planning apart, India’s indecisiveness and vacillation in the face of repeated provocations were suggestive of timidity, masked by the fig leaf of “strategic restraint”. While this display of forbearance did garner international applause, it was frustrating and demoralising for the Indian citizen.

All this changed on 29 September 2016, when the NDA government deployed special forces to deliver a punitive strike on terrorist camps across the LoC, thereby breaching the self-imposed taboo that had paralysed previous regimes. Some years later, the February 2019 air-strike on a terrorist facility in Khyber Pukhtunkhwa, re-affirmed this government’s resolve that cross-border terrorism by Pakistan would not go unpunished.

While these resolute actions have earned well-deserved public approval, two important aspects need to be highlighted. First, while the government deserved full credit for initiating long-overdue military action, clumsy use of these operations by party apparatchiks for election propaganda has embarrassed the military, trivialised its achievements and undermined India’s “perception management” campaign. Then September 2016 became a “missed opportunity” for promulgating a national security doctrine — with the objectives of signalling red-lines for adversaries, providing guidelines for own forces, conveying a clear message that cross-border terrorism would invite guaranteed retribution, thereby boosting national morale and confidence.

Importantly, India’s most crucial security challenge is not external, but relates to maintenance of domestic harmony and unity. With every major religion represented, and with thousands of ethnic groups co-existing harmoniously, India remains a brave but fragile experiment, but one that has stoutly upheld the citizenship rights accorded to everyone by its Constitution.

Once the elections are over, our politicians need to reflect on whether India can afford to have religious majoritarianism dominating the political discourse.

Without stepping into this minefield, we need to remind ourselves that the Indian state can never consider itself truly secure unless it assures safety and freedom from fear and intimidation for each of its citizens. A fact unknown to most is that the Indian armed forces, as currently structured, are the embodiment of *sarva dharma sama bhava*. Our newly-inducted soldier-politicians must explain to their parties how the unit cohesion and fighting efficiency of our armed forces would suffer unless they can pursue their tradition of religious tolerance and co-existence.

Clearly, India’s half-empty arsenal and heavy dependence on arms imports make a mockery of its claims to “growing power” status. A complacent and unaccountable scientific community entrusted with defence R&D and a languid MoD bureaucracy, charged with defence production and acquisition, has stalled India’s military modernisation. “Make in India” remains an inspiring slogan that needs to be fleshed out and underpinned by a 50-year vision-cum-action plan. Its implementation must be accompanied by a drastic re-structuring of India’s military-industrial complex and the creation of a new “Ministry of Defence Production & Acquisition”.

Finally, but the most crucial national security flaw lies in sequestration of India’s armed forces from a MoD run exclusively by a generalist civilian bureaucracy, and its failure to integrate the armed forces with each other. Consequently, India is unique amongst major military powers in persevering with a bloated military and an outdated higher defence organisation of dubious utility in this age of cyber, nuclear and space warfare.

The media tends to fret about China’s sky-rocketing defence expenditure. But the two things that should keep our politicians awake are China’s recently downsized, integrated and modernised regional military commands, and the visionary White Papers that its defence ministry issues biennially. 🦋

Brigadier Gurmeet Kanwal prioritises tasks for the next Government

Managing National Security

Electoral manifestos of the BJP and the Congress have both mentioned national security challenges in passing but neglected to touch upon their plans for revitalising the core issue of decision making at the apex level and measures to enhance defence preparedness so as to manage future threats and challenges. These issues merit informed debate.

The manifestos do not point out there is an urgent requirement to formulate a comprehensive *National Security Strategy* (NSS), including on internal security. The NSS should be formulated after carrying out an inter-departmental, inter-agency, multi-disciplinary strategic defence review. At present, the procurement of weapons and defence equipment is being undertaken through *ad hoc* annual procurement plans, rather than being based on duly prioritised long-term integrated plans that are designed to systematically enhance India's combat potential.

The next government must commit itself to supporting long-term defence plans or else defence modernisation will continue to lag and the growing military capabilities gap with China's People's Liberation Army will assume ominous proportions. This can be done only by reviving the dormant National Security Council as defence planning is in the domain of the NSC. The Cabinet Committee on Security (CCS) deals with current and near-term threats and challenges and reacts to emergent situations.

Today, the concept of national security encompasses many more facets of security and is much more wide ranging than merely the defence of territory. While there is a Defence Minister of Cabinet rank, all other aspects of national security are responsibility of the NSA. However, the NSA is only an advisor to the Prime Minister and has no executive authority, and is also not answerable to Parliament. It is necessary to upgrade the post of NSA to that of a Minister of State (MoS), in the PMO and he should be directly answerable to the PM. The NSA should be the chief coordinator between the three key ministries responsible for national security: the MoD, MEA and MHA. He should be given

executive control over the external and internal intelligence agencies. He should also be nominated as India's cyber Tsar and given the responsibility to coordinate cyber security as well as offensive cyber operations.

The government must also immediately appoint a Chief of Defence Staff (CDS) or a permanent Chairman of the Chiefs' of Staff Committee to provide single-point advice to the CCS on military matters. Any further dithering on this key structural reform in higher defence management on the grounds of the lack of political consensus and the inability of the armed forces to agree on the issue will be extremely detrimental to India's interests in light of the dangerous developments taking place in its neighbourhood. The logical next step would be to constitute tri-Service integrated theatre commands to synergise the capabilities of individual Services. International experience shows that such reform has to be imposed from the top down and can never work if the government keeps waiting for it to come about from bottom up.

While internal security challenges are gradually gaining prominence, preparations for conventional conflict must not be neglected. Major defence procurement decisions must be made quickly. Large-scale ammunition shortages have been pointed out in several Comptroller and Auditor General (CAG) reports during 2015-17. These must be made up quickly. Many tanks and infantry combat vehicles are still 'night blind' and lack suitable night vision equipment. The army is still without towed and self-propelled 155mm howitzers for the plains and urgently needs new utility helicopters, anti-tank guided missiles (ATGMs). It also needs to acquire weapons and equipment for counter-insurgency operations. The navy waited for long for INS *Vikramaditya* (ex-Admiral *Gorshkov*) aircraft carrier, which was refurbished in a Russian shipyard at exorbitant cost. Construction of the indigenous aircraft carrier and *Scorpene*-class submarines is behind schedule.

The plans of the air force to acquire 126 medium (weight) multi-role combat aircraft (MMRCA) in order to maintain its edge over the regional air forces remains

stuck in the procurement quagmire except that a contract has been signed for the acquisition of 36 Rafale fighter aircraft. The LCA project continues to lag way behind schedule. Meanwhile, the MiG-21 and MiG-27 fleets are long obsolescent. The IAF needs force multipliers, more AWACS aircraft and air-to-air refuellers, besides additional transport aircraft.

All three Services need a large number of light and medium lift helicopters. India's nuclear forces require the early operational deployment of Agni-4 and Agni-5 missiles and nuclear-powered submarines with suitable ballistic missiles to acquire genuine deterrent capability against China. The armed forces do not have a truly integrated C4I2SR system for network-centric warfare, which will allow them to optimise their individual capabilities and enable the conduct of 'effects-based' operations. Force multipliers such as combat drones (UCAVs) are yet to be introduced into service. The central armed police forces (CAPFs) also need modernisation as they are facing increasingly grave threats while continuing to be equipped with sub-standard weapons.

Of course, all these high-priority acquisitions will require extensive budgetary support. With the defence budget languishing at less than 1.5 per cent of India's GDP at present – compared with China's 3.0 per cent and Pakistan's 4.5 per cent – it will not be possible for the armed forces to undertake any meaningful modernisation or make up equipment and ammunition deficiencies. The funds available on the capital account at present are inadequate to suffice even for the replacement of obsolete weapons systems that are still in service, well beyond their useful life cycles.

It is imperative that India's defence budget be substantially enhanced to enable the armed forces to meet future threats and challenges, as also to discharge India's obligations and fulfil the country's responsibilities towards making a positive contribution to peace and stability in the Indo-Pacific region. Only then will the environment be conducive to rapid socio-economic development. 

Army should be kept out of politics

Admiral Arun Prakash urges that for the survival of democracy, it is vital to keep our military apolitical. Exploiting it for fleeting political advantage carries the real risk of creating a Praetorian monster in our midst.

Egregious neglect of India's security by successive governments has been a perennial target of censure by commentators for decades. Independent India's politicians considered this matter unworthy of their time because, so far, it was not a 'vote-catching' issue for a public preoccupied with roti, kapda, makan and lately, jobs and agrarian distress. Political survival their priority, politicians were happy to leave the higher management of defence and security almost entirely to the bureaucracy and devote themselves to electioneering.

But the past few months have seen a dramatic shift, with national security taking centre stage in election rhetoric. Since party manifestos provide little reassurance, it remains to be seen whether the show of concern for national security is genuine and enduring or merely a vote-garnering device. Having been thrust into the spotlight, the military must find itself puzzled and discomfited, given decades of political neglect and the current state of civil-military relations.

The crux of civil-military relations, universally, is to ensure that soldiers remain in their barracks and refrain from interfering or participating in domestic politics and governance. This is best achieved by implementing "civilian control" of the forces, exercised directly by elected representatives. Unfortunately, this principle was subverted post-independence. According to American scholar George Tanham, "The role and status accorded to the military in India, is a clear manifestation of an unbalanced civil-military equation." He traces its roots to Prime Minister Jawaharlal Nehru's pacifism and an anti-military attitude. Nehru also nurtured a phobia of military coups and neglected the military, downgrading its leadership vis-à-vis the police and civil servants.

This Nehruvian legacy has survived successive regimes. Regardless of the party in power, national security has stayed at the bottom of priority lists and the military leadership continues to be deliberately excluded from decision-making. Reforms have been stalled and military modernisation hindered by meagre budgets and a languid bureaucracy.

The past five years have, however, seen the emergence of some new and seemingly contradictory phenomena. On one hand, the process of downgrading the status of the armed forces has accelerated, overturning the well-established relativities with the bureaucracy, police forces and even subordinate services, not just embarrassing the military but also hitting morale and operational effectiveness. At the same time, hints of political patronage have served to unsettle the officer corps with misgivings about *quid pro quo* bargains being struck.

The most serious development, however, relates to the assumption of ownership and credit for military operations and their inclusion in election campaigning by political parties. Customarily, military operations—especially those by the Special Forces—speak for themselves and are rarely publicised. While governments may legitimately take credit for ordering military operations, it is when political parties brazenly exploit them for votes and personal aggrandisement that the plot starts unravelling.

The puerile and ill-informed political and media debate about the 2016 cross-border raids and the February 2019 air strikes not only trivialised serious issues but also diluted the message of punitive-deterrence that India intended to convey. Equally damaging was the public perception that serving officers were making statements to comply with a 'party line'.

Our professional and, so far, apolitical military serves the Constitution through obedience to democratically elected civilian office-holders, without showing preference for any political party or taking partisan positions. Internalised by the Indian military, this principle is a pillar of India's democratic system and has ensured a peaceful transfer of power after each general election. A politicised military, loyal to one political party or the other, could well start participating in partisan politics. Appropriation of military achievements by politicians could trigger a reverse process, whereby ambitious generals start initiating military operations to please politicians – a frightening possibility.

As far as veterans are concerned, they have the same rights and privileges as private citizens. They may serve with think tanks, engage in public debate and even contribute military expertise to political campaigns. But, they need to remain conscious of two facts: the Constitution accords them the privilege of using military ranks in perpetuity and a strong umbilical cord connects them to serving soldiers. So, when bemedalled veterans, sporting star-studded caps, are seen saluting or genuflecting before politicians, they send a message of subservience that runs contrary to our proud martial tradition.

Similarly, political parties, eagerly enlisting veterans, without a long-enough cooling period, cannot but send negative signals to serving personnel about the benefits of acquiring political 'connections' early in one's career.

For the health and survival of the Indian democracy, it is vital to keep our fine military apolitical and non-partisan. Exploiting the military for fleeting political advantage carries the real risk of creating a Praetorian monster in our midst. 

Air alerts along Indo-Pak border



Following the 26-27 February air actions in Khyber Pakhtunkhwa and then over north-west Kashmir, with subsequent closure of air space over Pakistan, the Air Forces of both countries have remained on high alert with occasional 'scrambles' as air defence radars detected aircraft and drones close to the international borders. In early April reports had IAF Su-30MKIs being vectored towards Pak UAVs near the Khemkaran sector of the Punjab and in turn, PAF F-16s being scrambled. A PAF spokesman confirmed that F-16s were deployed, stating that it "had the right to use any aircraft for its self defence".

In early April, Pakistan's Foreign Minister had claimed that they had "reliable intelligence" that India was planning another military action against its western neighbour even as the Indian Government rejected this, calling it "irresponsible and preposterous" and aimed at "whipping up war hysteria". Still, in the run up to national elections, senior politicians, including Defence Minister Nirmala Sitaraman referred to the Balakot air strikes as "striking a chord with people".

CAS : "Technology on our side"



Referring to the IAF's air strikes against terrorist targets in Balakot on 26 February 2019, the CAS Air Chief Marshal BS Dhanoa said that "we had technology on our side, and we could launch precision stand off weapons with great accuracy. In the subsequent

engagements, we came out better because we had upgraded MiG-21Bisons and Mirage2000 aircraft". However, referring to next generation fighters, the Air Chief said that "the results would have been further skewed in our favour had we inducted the Rafale aircraft in time". The CAS was giving the keynote address at the CAPS Seminar on *Aerospace Power in the 2040s : Impact of Technology* to mark the birth centenary of Marshal of the Air Force Arjan Singh.

In related news, select Indian media apparently had access to after action IAF reports on the Balakot operation, giving details of the action where "five of the six designated targets were hit directly" and that during the mission, a strike element of Su-30s made feints, flying in direction of Bahawalpur in Pakistani Punjab, forcing the PAF to scramble fighters from Sargodha, Shorkot, Kamra and Murid.

Claims and counterclaims on PAF F-16 "loss"



Media reports have continued even two months after the brief air combat action on 27 February 2019, with claims and counterclaims. According to a US magazine (*Foreign Policy*), US personnel did a count of PAF F-16s and "found none missing". Official spokesman in New Delhi however refuted the US Journal's report with "conclusive circumstantial evidence" cited. In fact, according to the IAF, the evidence marshaled by IAF ranged from "electronic signatures" captured by an Indian Phalcon AWACS aircraft and ground radar stations, which showed the blip of an F-16 suddenly vanishing from the screens, to intercepted radio transmissions and "physical sightings" of two parachutes coming down in the Sabz Kot and Tander areas in PoK.

On 27 February 2019, "IAF fighters successfully thwarted a strike package of 11 F-16s as well as 13 JF-17s and Mirage-III/Vs from striking at Indian military installations in J&K....the Army confirmed sighting ejections at two different places, separated by at last 8-10 km. One was a MiG-21 (Varthaman was captured in Tander) and the other a PAF aircraft (Sabz Kot) Electronic signatures gathered by us indicate the PAF aircraft was an F-16", stated ACAS (Ops Space) Air Vice Marshal RGK Kapoor".

Two more AWACS for IAF



After remaining dormant for nearly a decade after the first three Phalcon AWACS were received by the Indian Air Force in 2009-2011 under a \$1.1 billion contract between India, Israel and Russia in 2004, the MoD has reportedly moved the procurement case for three more such aircraft. Integrated in the Beriev A-50, based on the Il-76 by Israel Aircraft Industries is the EL/W-2090 airborne early warning and control (AEW&C) radar system developed by IAI and Elta Electronics Industries of Israel, with the primary objective of providing intelligence for air dominance and long range airborne surveillance. The EL/W-2090 is a further development of EL/M-2075 and EL/W-2085, which uses an active electronically scanned array (AESA) radar. The first A-50 (Phalcon) AWACS aircraft was received by the IAF in May 2009 going into service with No.50 Squadron.

'Final' IAF C-17A in August



Boeing has confirmed that the eleventh (and final) C-17A for the Indian Air Force is scheduled for delivery in August 2019. The IAF initially purchased ten Globemaster IIIs under a deal which included options on a further six. Although India intended to exercise these options, Boeing terminated production of the type before the GoI approved purchase. All the 'white tails' that Boeing built in anticipation of more orders had been sold already apart from the one aircraft (c/n 50273/F272, FMS/14-0003), the IAF was able to order. On 30 March 2018, Boeing was awarded a contract to modify this to the India-specific configuration at its facility in San Antonio, Texas, where it had been in storage awaiting sale since November 2015. The aircraft (CB 8011) will join No.81 Squadron 'Skylords' at AFS Hindon.

Air Force Commander's Conference



The first bi-annual IAF Commanders' Conference for 2019 was chaired by Air Chief Marshal BS Dhanoa who also welcomed Raksha Mantri Nirmala Sitharaman at the venue. The Raksha Mantri stressed on a proactive role of the IAF in the Indian Ocean Region and relationships through military interactions and HADR. She added that "the IAF will play a vital role in enhancing the defence manufacturing capabilities of the nation through its acquisitions in the form of Strategic Partnership Model and added that she was aware of the critical requirements projected by the IAF" and assured that "as a Nation we need to build those capabilities". The CAS later addressing the Commanders emphasised on further enhancement of the IAF's capability in the field of Space, Cyber, Information, AI and Drone technologies.

First Apache Helicopter formally handed over to IAF

The first AH-64E (I) Apache Guardian helicopter was formally handed over to the Indian Air Force at Boeing production facility in Mesa, Arizona, USA on 10 May 19. Air Marshal AS Butola, represented the Indian Air Force and accepted the first Apache in a ceremony at Boeing production facility, representatives from US Government were also present. IAF had signed a contract with US Government and Boeing in September 2015 for 22 Apache helicopters. The first batch of these helicopters is scheduled to be shipped to India by July this year.



SpiceJet to induct five more Q400s



SpiceJet will add five 90-seater Q400 aircraft so taking its Bombardier fleet size to 32. The 90-seater variant is part of SpiceJet's second purchase order for up to 50 Q400 turboprops placed in September 2017, the largest ever single order for the Q400 turboprop aircraft and valued at up to US \$1.7 billion. Besides the Q400 fleet, SpiceJet has a fleet of 48 Boeing 737s and one B737 freighter, and will induct six more Boeing 737-800 NG aircraft on dry lease, in addition to the 16 B737s in the pipeline. SpiceJet operates 516 average daily flights to 60 destinations, including 51 domestic and 9 international ones with a fleet of 50 Boeing 737s, 27 Bombardier Q-400s and one B737 freighter.

Northern India growth in passenger traffic

Srinagar International airport recorded a 12.2% growth in passenger traffic during 2018-19, followed by Amritsar at 8.8% while Chandigarh actually had a 2% marginal decline. The latter is attributed to disruptions owing to runway repairs and extension, its only international destinations being Dubai and Sharjah. In addition to the three main civil airports in northern India, there are seven other domestic airports including Bhatinda and Ludhiana in Punjab, Jammu and Leh in J&K and Gaggal, Bhuntar and Shimla in HP.



Disinvestment of Pawan Hans



The Government of India's plan for disinvestment in Pawan Hans has still to attract a bidder. The last date for submitting financial bids for the public sector helicopter company ended in March, "without success." Even though the Government would divest the entire 100% shareholding, this has not attracted bidders. While the Centre Government holds 51%, the Oil and Natural Gas Corporation has the balance 49% in Pawan Hans, with the Government even offering an ONGC stake without attracting an offer so far. Pawan Hans has a fleet of some 50 helicopters, operating both for domestic flights and offshore operations, charter services, med evacuations, corporate and special charters. According to sources, Mumbai-based Global Vectra Helicorp and Heligo Charters had expressed some initial interest but this was not followed up.

Meanwhile, Pawan Hans and Himachal Tourism have offered helicopter flights from Chandigarh to Jubberhatti (Simla), the 30-minute flight with fare of Rs 2,880 per passenger.

464 more T-90s for Indian Army



The Indian Army is to induct an additional 464 Russian-origin upgraded T-90 'Bhishma' main-battle tanks at a cost of Rs 13,448 crore in the 2022-2026 time frame.

According to MoD sources, the "indent" to manufacture the additional T-90 tanks would soon be placed on the Avadi Heavy Vehicle Factory (HVF) under the Ordnance Factory Board following the Cabinet Committee on Security clearance of the acquisition in March. The Indian Army has some 1,070 T-90 tanks as well as 2,400 of the earlier T-72 version equipping 67 armoured regiments. After the first 657 T-90 tanks were imported

for Rs 8,525 crore from Russia from 2001 onwards, another 1,000 are being progressively licence-built by the HVF.

This decision is relevant at a time when the Indian Army is engaged in re-formatting its entire war-fighting machinery towards a “Cold Start” or “Pro-Active Strategy”, which envisages fast mobilisation to strike hard across the border with multiple offensive thrusts. This task will primarily be carried out by restructured and agile integrated battle groups (IBGs) centred around the T-90 tanks, along with integrated infantry, artillery, air defence, signals and engineers, backed by attack helicopters. The Army’s new Land Warfare Doctrine itself notes that the “action along the western front will be sharp and swift, with the aim to destroy the adversary’s centre of gravity and secure spatial gains”.

Ammo storage in Himalayan caves



According to news reports, the National Hydro Power Corporation (NHPC) are to construct underground caverns for storage of ammunition at four locations in the Himalayas, along the extensive borders with Pakistan and China, both in northern and north eastern India. A memorandum of understanding to this effect was signed on 25 April, “the NHPC having great experience in making dams with underground tunnels in the mountains.” The Army’s requirement for such ammunition storage caverns would be virtually the same strength as tunnels made by NHPC for dams.

Zojila pass reopened



The Indian Army’s Northern Command and XV Corps have honoured a hearing and speech impaired bulldozer driver, Anayatullah, for leading clearance of the snow bound Zojila pass which links Srinagar in the valley and Leh in Ladakh, via Dras and Kargil. Employed by the Border Roads Organisation (BRO) for snow clearing operations at the 11,575 ft pass, the redoubtable Anayatullah was personally felicitated by Lt Gen Ranbir Singh, GOC-in-C Northern Command and Lt Gen KJS Dhillon, Commanding XV Corps (in photograph).

Record landings in Ladakh



On 30 April, 2019, Group Captain Sandeep Singh Chhabra, IAF achieved the distinction of completing 1,000 incident-free landings of Ilyushin Il-76 heavy lift transport aircraft at Leh and Thoise in Ladakh. Commissioned into the transport stream of the Indian Air Force in June 1992, he initially flew An-32s in the narrow valleys and ALGs of North-East India and Uttarakhand Hills. He subsequently flew Il-76s of No.44 Squadron from Chandigarh, which type has capacity for 25 tonnes of payload, air lifting personnel and equipment, including AFVs, artillery guns and construction equipment to the difficult airfields in Ladakh, having elevations above 10,000 feet and surrounded by high mountains.

Naval Commanders’ Conference

The first edition of this years’ bi-annual Naval Commanders’ Conference began on 23 April 2019 in New Delhi where the RM addressed Naval Commanders and “appreciated the Navy’s efforts in areas of indigenisation, self-reliance and support



to the 'Make in India' initiative of the Government". Chairing the conference, Chief of the Naval Staff Admiral Sunil Lanba addressed the Commanders on various important issues pertaining to operational readiness, capability enhancement, maintenance, op logistics, infrastructure development and human resource management. 'Functional Reorganisation of Indian Navy towards improving Operational efficiency' and 'Optimal Manning' formed the core of discussions relevant to long term road map of the Navy. "In keeping with the Navy's ethos of harnessing niche technologies, concrete plans to incorporate 'Big Data Analytics' and 'Artificial Intelligence' for solutions in the domains of naval combat, convergence of networks/information, logistics, administration and equipment health monitoring for sustained operations" were also discussed.

Indian and French Navies' Bilateral Exercise Varuna 19.1



First part of the Indo-French joint naval exercise, *Varuna 19.1* was conducted off the Goa coast from 1 to 10 May 2019. The edition includes participation of the French Navy's aircraft carrier FNS *Charles de Gaulle*, two destroyers FNS *Forbin* and FNS *Provence*, the frigate FNS *Latouche-Treville*, the tanker FNS *Marne* and a nuclear submarine. From the Indian Navy, the aircraft carrier INS *Vikramaditya*, destroyer INS *Mumbai*, the *Teg*-class frigate, INS *Tarkash*, the *Shishumar*- class submarine, INS *Shankul*, and the fleet tanker INS *Deepak*, participated in this exercise, conducted in two phases. The second part of *Varuna 19.2*, is to be held end May in Djibouti.

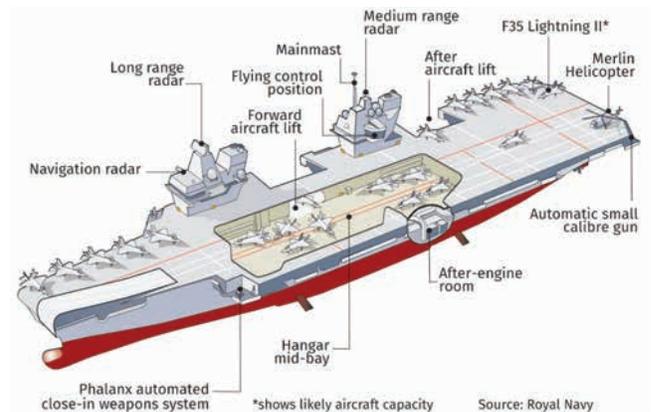
Launch of INS Vela, fourth Scorpene submarine

INS *Vela*, the fourth *Scorpene*-class submarine being constructed by Mazagon Dockyard and Shipbuilders for the Indian Navy, was launched on 6 May 2019 by Mrs Veena Ajay Kumar, wife of the Secretary Defence Production. The submarine was towed to Mumbai Port Trust for separation from the pontoon, after which she will undergo rigorous trials and tests, both in harbour and



at sea before delivery to the Indian Navy. The contract for series construction and Transfer-of-Technology for six *Scorpene* class submarines has M/s Naval Group (formerly DCNS) of France as 'Collaborator' and built by MDL at Mumbai.

UK involvement in IAC-II ?



Reported for some time, increasingly in recent months, Rare discussions taking place between the Indian and UK Governments on the design and construction of the Indian Navy's future indigenous aircraft carrier-II. The IAC-II is projected to be of the 65,000 tonne class, with electric propulsion and EMALS for conventional launch and recovery of aircraft. Speculated to be named INS *Vishal* (although after retirement of INS *Viraat* some years back, it would be traditional that the Navy's next carrier be so named), the Indian Navy has for several years been engaged with the US on the IAC-II, but UK ship builders are now offering detailed designed based on Royal Navy's recently commissioned aircraft carriers HMS *Queen Elizabeth*.

24 MH-60R helicopters for IN under FMS

The US State Department has made "a determination" approving a possible Foreign Military Sale to India of twenty-four MH-60R Multi-Mission helicopters for an estimated cost of \$2.6 billion.



On 1 May 2019, the MoD approved procurement of 10 additional Kamov Ka-31 Airborne Early Warning and Control helicopters for the Indian Navy, the contract at approx. Rs 3,600 crore. The Ka-31s are to be embarked on board various warships including the INS *Vikrant* and *Grigorovich*-class frigates and will join the nine Ka-31s presently in service with the Indian Navy's INAS 339 (*Falcons*).

Launch of INS *Imphal*



As per details given, the Government of India has requested procurement of twenty-four MH-60R Multi-Mission helicopters plus the following: thirty APS-153(V) Multi-Mode radars (24 installed, 6 spares); sixty T700-GE-401C engines (48 installed and 12 spares); twenty-four Airborne Low Frequency System (ALFS) (20 installed, 4 spares); thirty AN/AAS-44C(V) Multi-Spectral Targeting Systems (24 installed, 6 spares); fifty-four Embedded Global Positioning System/Inertial Navigation Systems (EGI) with Selective Availability/Anti-Spoofing Module (SAASM) (48 installed, 6 spares); one thousand AN/SSQ-36/53/62 sonobuoys; ten AGM-114 Hellfire missiles; five AGM-114 M36-E9 Captive Air Training Missiles (CATM); four AGM-114Q Hellfire Training missiles; thirty-eight Advanced Precision Kill Weapons System (APKWS) rockets; thirty MK 54 torpedoes; twelve M-240D Crew Served guns; twelve GAU-21 Crew Served guns; two Naval Strike Missile Emulators; four Naval Strike Missile Captive Inert Training missiles; one MH-60B/R Excess Defense Article (EDA) USN legacy aircraft.

CNS Admiral Sunil Lanba launched the Guided Missile Destroyer INS *Imphal* on 20 April 2019 at Mazagon Dock, Mumbai. As part of *Project 15B*, the new destroyer will have “cutting edge advanced technology and comparable to the best ships of similar class anywhere in the world”. Designed indigenously by the Indian Navy's Directorate of Naval Design, each ship is of 163 metres length and 17.4 metres at beam and displaces 7,300 tonnes. These ships will be propelled by four gas turbines to achieve speed in excess of 30 knots. The P15B destroyers incorporate new design concepts for improved survivability, sea keeping, stealth and manoeuvrability, and will have two multi-role helicopters embarked.

Also included are seventy AN/AVS-9 Night Vision Devices; fifty-four AN/ARC-210 RT-1990A(C) radios with COMSEC (48 installed, 6 spares); thirty AN/ARC-220 High Frequency radios (24 installed, 6 spares); thirty AN/APX-123 Identification Friend or Foe (IFF) transponders (24 installed, 6 spares); spare engine containers, etc. All the above are at an estimated cost of \$2.6 billion.

GRSE delivers 100th warship

10 more Ka-31s approved for IN

Garden Reach Ship Builders and Engineers Ltd., (GRSE), delivered its 100th warship to the Indian Navy on 30 March



2019, which makes GRSE the first Indian shipyard to build and deliver 100 warships to the Indian Navy, Indian Coast Guard and the Mauritius Coast Guard. This 100th warship, a Landing Craft Utility (LCU) *IN LCU L56* was formally handed over by Rear Admiral VK Saxena, Chairman & Managing Director, GRSE, and is sixth of an order for eight such vessels for the Indian Navy. Complete design and development of these LCU Mark IV ships was in-house by GRSE. The LCU Mk-IV ships primary role is sea transportation and deployment of MBTs, AFVs, troops and equipment from ship to shore. Based with the Andaman and Nicobar Command, these would be deployed for multirole activities including beaching operations, search and rescue, disaster relief operations, supply and replenishment as also evacuation from distant islands.

India-Indo CORPAT at Port Blair



Indonesian Naval Ship *KRI Sultan Thaha Syaifuddin* and a CN-235 MPA led by Cmde Dafit Santoso were deployed at Port Blair, Andaman & Nicobar Islands, for 33rd edition of the India-Indonesia Coordinated Patrol (CORPAT) held from 19 March to 4 April 2019. Warships and aircraft from both countries carried out various patrol exercises on respective sides of their 236 nautical mile long International Maritime Boundary line, followed by a closing ceremony at Belawan in Indonesia on 4 April 2019.

IN participation at PLA (N) Fleet Review



The Indian Navy's missile destroyer *INS Kolkata* and Fleet support ship *INS Shakti* visited Qingdao in China to participate in the International Fleet Review (IFR) during 70th Anniversary Celebrations of the PLA (Navy) on 21 April 2019. The ships were welcomed into harbour by officials from PLA (N) North Sea Fleet with Naval Bands playing at the welcome ceremony. Participation of the Indian Navy in such PLA(N) international fleet reviews, for the third consecutive time (2009, 2014 and 2019), "demonstrates the Nation's commitment to enhance maritime cooperation between the two navies and bolster bonds of friendship between the two Countries".

AUSINDEX-19



Third edition of **AUSINDEX**, an acronym for *Australia India Exercise* was held at Visakhapatnam in early April 2019. *HMAS Canberra* (L02), a Landing Helicopter Dock *HMAS New Castle* (06) and *HMAS Paramatta* (154), both frigates; *HMAS Collins*, a conventional submarine and *HMAS Success* (OR 304), a *Durance*-class multi-product replenishment oiler were part of the exercise "to strengthen and enhance mutual cooperation and interoperability between the IN and RAN, providing opportunities for interaction and exchange of professional views between the personnel of the two navies".

AUSINDEX is the cornerstone of a wider INDO PACIFIC ENDEAVOUR deployment which will see the Task Force conduct port visits to Indonesia, Malaysia, Singapore, Sri Lanka, Thailand and Vietnam. This edition of the exercise had participation of the highest number of units, with four frontline ships with integral helicopters, a submarine and aircraft including P-8I and P-8A long-range Maritime Reconnaissance Anti-Submarine Warfare aircraft from both navies.

"Virtual Reality Centre"

CNS Admiral Sunil Lanba inaugurated the Virtual Reality Centre (VRC) at the Directorate of Naval Design (Surface Ship Group), on 12 April 2019. "This centre is a major boost for indigenous warship design capabilities of the Indian Navy, providing impetus to self-reliance and greater fillip to warship construction.

During his address Admiral Lanba complimented the Directorate for their “untiring efforts, foresight and initiatives to conceptualise design and execute the project.”

The Directorate of Naval Design (Surface Ship Group) had its initial beginning in the 1960s and has since then has made major contributions towards indigenous warship design capabilities of the Indian Navy, the multi-disciplinary team successfully developing 19 warship designs on which more than 90 platforms have been constructed to date.

ICGS Veera Commissioned



Indian Coast Guard Ship *Veera*, third in the series of 98 metre-long Offshore Patrol Vessels (OPVs), was commissioned at Visakhapatnam by the COAS General Bipin Rawat, on 15 April 2019 in presence of Director General Rajendra Singh, Indian Coast Guard. This OPV has been designed and built by Larsen & Toubro Ltd. and fitted with advanced technology navigation and communication equipment, sensors and machinery. The vessel has a 30mm naval gun and also equipped with an Integrated Bridge System (IBS), Integrated Platform Management System (IPMS), Automated Power Management System (APMS) and high power external firefighting (EFF) system. The ship is designed to carry one twin-engined helicopter plus four high speed boats and two inflatable boats for boarding operations, search and rescue, law enforcement and extended maritime patrol.

ICGS Priyadarshini commissioned

First of the new class of Fast Patrol Vessels (FPVs), ICGS-*Priyadarshini* and built by Garden Reach Shipbuilders and Engineers Limited (GRSE), Kolkata was commissioned at Kakinada, on 26 April 2019. ICGS *Priyadarshini* is first in the series of



remaining four ships in advanced stages of construction. The FPV is a medium range surface vessel developed in-house by GRSE as per requirements of the Indian Coast Guard, designed for a maximum speed of 34 knots with an endurance of more than 1500 nautical miles, and powered by 3 main engines.

Cochin Shipyard contract for eight ASWSWCs

Cochin Shipyard Limited (CSL), Kochi have been contracted for construction and supply of eight Anti-Submarine Warfare Shallow Water Crafts (ASWSWCs) for the Indian Navy, the first ship to be delivered within 42 months from contract signing date with subsequent delivery schedule two ships per year. These Anti-Submarine Warfare Shallow Water Crafts (ASWSWCs) are designed for a deep displacement of 750 tonnes, speed of 25 knots and complement of 57, being capable of full scale sub surface surveillance of coastal waters and co-ordinated ASW operations with aircraft.

GRSE also gets ASWSWC contract

Apart from Cochin Shipyard which will build eight anti-submarine warfare shallow watercraft (ASWSWC), Kolkata-based defence shipyard Garden Reach Shipbuilders & Engineers (GRSE) signed a Rs 6,311-crore contract with the MoD on 29 April 2019 for a similar number of such craft. According to Defence analysts, the ASWSWCs “will fill a worrying capability gap to the navy the ability to detect enemy submarines in the Arabian Sea, where the unusually shallow sea bed reflects sonar signals emitted by submarine hunting vessels, masking the signals reflected off an enemy submarine, making it difficult to detect.” The ASWSWCs are to be equipped with sophisticated sonar, with an algorithm that differentiates the signals reflected off the enemy submarine from those bouncing off the sea bed. The first vessel is to be delivered within 42 months from the contract, by October 2022, and then two more ASWSWCs annually, completing delivery by April 2026.

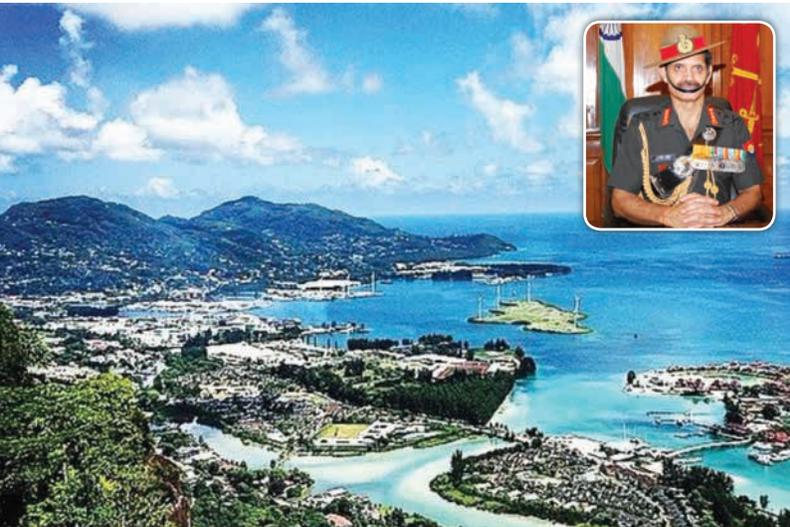
Naval radar chain in Maldives

Work has resumed in an Indian-assisted programme to establish a chain of 10 coastal surveillance radars in the Maldivian Islands. Manufactured by Bharat Electronic Limited, phase II of the project is now underway with 7 new radar stations being installed and the three earlier ones being upgraded. All 10 radar



stations will be linked to a central control station at the Maldives Maritime Rescue Coordination Centre at Vilingilli island near Male to give the Maldives Coast Guard an integrated maritime picture. The Government of India is setting up the 'chain of radars' to link it with the 46 coastal surveillance radars installed all along its 7,519 km coast, Sri Lanka hosting six radars, Mauritius eight, Seychelles one while the Maldives will have 10. These will present comprehensive images of ship movements in the Indian Ocean Region (IOR). This feed will then be used by the Indian Navy and its allies through the Indian Information Fusion Centre – Indian Ocean Region (IFC-IOR).

General Dalbir Singh appointed HC to Seychelles



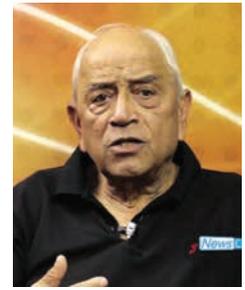
General Dalbir Singh Suhag, former Chief of the Army Staff, has been appointed as India's High Commissioner to the Indian Ocean Island nation of the Seychelles. The Government of India is reportedly developing Assumption Island in the Seychelles as a naval base to expand its footprint in the strategically-key region where China has been trying to enhance its military presence. An agreement to develop the island was signed in 2015 between India and Seychelles.

India has given two HAL-built Dornier 228 maritime patrol aircraft (MPA) to Seychelles, the first in 2013 followed by a second June 2015. The Seychelles President Danny Faure had stated that "the Dorniers have been assisting the Seychelles Coast Guard in rescue operations, air surveillance and securing our EEZ".

Former Chiefs object to "politisation of India's Armed Forces"

A large number of retired senior officers have strongly objected to remarks recently made by politicians claiming that the Indian Armed Forces were "theirs" Admiral L Ramdas, former

CNS, protested to the Chief Election Commissioner against UP Chief Minister Yogi Adityanath's remarks on "Modi ji ki Sena" even after EC had issued guidelines advising political parties to refrain from using pictures or images of armed forces in their campaigning for the General Elections. Then Prime Minister Modi's reference to India's nuclear arsenal in an election speech at Barmer, evoked much reaction both within the country and internationally, many commenting on such "irresponsible rhetoric".



INS Ranjit decommissioned



One of the Indian Navy's earlier missile destroyers of Soviet-origin, INS *Ranjit* was decommissioned on 6 May after 36 years of service. The warship was built in the Ukraine in the late 1970s, its original name being *Lovkly* (agile) and was commissioned in the Indian Navy in September 1983. This *Kashin*-class destroyer, Soviet designation project 61 was designed as an anti-aircraft guided missile destroyer, five of which were modified for service with the Indian Navy as *Rajput*-class destroyers.

HAL turnover over 19,400 crore in FY 2018-19

State-owned Hindustan Aeronautics Limited achieved a turnover of over Rs. 19,400 crores (provisional and unaudited) for the financial year ended 31 March, 2019 (*corresponding figure for the previous year was Rs 18,284 crores*). The Company has posted a revenue growth in excess of 6% during 2018-19 as compared to 3.8% during 2017-18. "Performance of the Company in 2018-19 has encouraged us to focus more on design & development of indigenous products and technologies, develop aerospace and defence manufacturing eco-system and to be more dedicated towards meeting the current and future requirements of customers" stated R Madhavan, CMD-HAL. "This strategy will also help HAL to be on the growth track in meeting expectations of the shareholders", he added.



In FY 2018-19, HAL produced 41 new aircraft / helicopters and 98 new engines and carried out overhaul of 213 aircraft / helicopters and 540 engines. HAL has produced 12 new ALHs against the contract of 40, out of which six were produced ahead of schedule for the Indian Army (*image above*).

HAL to bid for NUH requirement



HAL has submitted its response to the Indian Navy's *Expression of Interest* (EOI), to identify an Indian Strategic Partner (SP) to build 111 Naval Utility Helicopters (NUH) to meet the Service's requirement. The SP model, which project is estimated at Rs 21,738 crore, envisages the indigenous manufacture of major defence platforms by Indian firms (SPs), in collaboration with a foreign original equipment manufacturer (OEM) for technologies and production expertise. Indian private defence manufacturers who have been awaiting progress of the NUH programme have reportedly been surprised by HAL's move, the public sector undertaking to submit two responses, one for an indigenous helicopter and the other for the Kamov 226T which is to be built by the Indo-Russian Helicopters joint venture.

HAL HJT-36 flight testing recommences

After several years, the dormant HAL intermediate jet trainer programme has been revived with first flight of a modified HJT-36 taking place at Bangalore on 17 April 2019. Flight testing



of the IJT, designed and developed by HAL for stage-II training of IAF pilots was put on hold after the aircraft had experienced some spin-test problems during 2016. "HAL continued its R&D efforts and undertook modification of IJT LSP4 aircraft based on extensive and comprehensive wind tunnel studies", stated Mr R Madhavan, CMD, HAL.

The HJT-36 is planned as successor to the earlier HAL HJT-16 Kiran basic jet trainer for which HAL was given go ahead in 1999 for development, testing and certification of two prototype IJTs, the first of which flew in March 2003. After further development and extensive testing, the Indian Air Force placed an order for 73 aircraft. After over 280 test flights, the aircraft entered limited series production in 2009 with an initial batch of 12 aircraft to be delivered. The first flight test for the limited series aircraft occurred in January 2010, and initial operational capability was expected by July 2011, the total requirement for both the IAF and Navy being over 200 aircraft. However, there were issues associated with critical stall and spin characteristics and after some consultancy inputs, the airframe was modified leading to resumption of flight testing.

Indra ATM for HAL Airport

Indra of Spain will equip the HAL Airport at Bengaluru with "most advanced technology to strengthen safety and efficiency in air traffic management". Indra is the main supplier of air traffic management systems in India, having equipped more than 38 airports, and has deployed radar systems that cover over 80% of Indian airspace. "Indra will provide HAL's air traffic control centre with new-generation en-route, approach and tower control positions that will enable and boost air traffic management efficiency." The contract also includes provision of a simulator to reinforce controllers' training, voice recorder, surveillance ADS-B, Aeronautical Information System AIS/ASBS and D-ATIS.

Cruise missile 'Nirbhay' test-fired

India's first indigenously designed and developed long-range sub-sonic cruise missile *Nirbhay* was launched on 15 April 2019 from the Integrated Test Range (ITR) at Chandipur in Odisha. Describing the trial as "successful", DRDO stated that the missile,



which is capable of loitering and cruising at 0.7 Mach at altitude as low as 100 metres, covered the designated target range in 42 minutes and 23 seconds.

BEL turnover of Rs. 11,700 crore

Bharat Electronics Limited (BEL) achieved a turnover of Rs.11,700 crore (Provisional & Unaudited) during the Financial Year 2018-19, sustaining double digit growth (an increase of 16%) over the previous year's turnover of Rs.10,085 crore. Some major orders during the year are for Long Range Surface-to-Air Missile Systems, Electronic Fuzes, L 70 Gun upgrade, weapon repair facility for Naval Ships, Kerala-Fibre Optics Network (K-FON), Smart City Projects, Integrated Perimeter Security Solution (IPSS), Video Surveillance System, Naval Airfield Integrated Security System (NAISS), Real Time Information System, etc.

Some major projects executed during FY 2018-19 include the Integrated Air Command & Control System (IACCS), Weapon Locating Radar (WLR), Cdr TI Sights, Schilka upgrade, Tropo upgrade, Integrated Communication System (ICS), Long Range Surface to Air Missile System (LRSAM), Ground Based EW System, L-70 Gun upgrade, Electronic Voting Machines (EVM), Voter Verifiable Paper Audit Trail (VVPAT), and others.

BEL receives 'Green Channel' Certificate

Bharat Electronics Limited has received the first 'Green Channel Status' certificate from the Directorate General Quality Assurance (DGQA) for supply of spares for a particular radar being manufactured by Military Radar Strategic Business Unit (SBU) of BEL's Bangalore Complex. The Ministry of Defence had earlier promulgated the Green Channel Policy for promoting ease of doing business as part of its 'Make in India' initiatives, such mechanism set up to award Green Channel Status to firms with pre-defined financial and quality credentials for broad categories of items having continuous requirement in the Defence Forces. Responsibility of inspection of goods is given to the firms, after their credentials are verified by the Green Channel Committee (GCC), comprising of various stakeholders from DGQA and the procurement ecosystem.

Tata Power SED ship-borne 3D Air Surveillance Radars

Tata Power Strategic Engineering Division (Tata Power SED) have signed contracts with the Ministry of Defence to supply 23 ship-borne 3D Air Surveillance Radars to the Indian Navy over the next 10 years. The contract, estimated at Rs 1,200 crore, was signed under the *Buy & Make (India)* category of the Defence Procurement Procedure (DPP) 2013 that will be offering the Indian Navy a proven solution, with a production arrangement in India under Transfer of Technology (ToT). The contract will be executed by Tata Power SED as the prime contractor with the foreign OEM (Original Equipment Manufacturer) partner Indra Sistemas of Spain.

Tata's combat management system for IAC-I

Combat Management System (CMS) for the Indigenous Aircraft Carrier (IAC), developed by Tata Power Strategic Engineering Division (TPSED), in collaboration with Weapon and Electronics



System Engineering Establishment (WESEE) and MARS of Russia was handed over by Sukaran Singh, CEO and MD, Tata Advanced Systems Ltd. to the Indian Navy's Chief of Materiel, Vice Admiral GS Pabby on 28 March 2019. This event assumes great significance, being the first CMS developed by Private Industry for the Indian Navy.

The Kalyani Group and Thales in collaboration



The Kalyani Group and Thales have formalised collaboration for the design, development and manufacture of next generation weapons systems for defence law enforcement sectors in India and abroad. "The collaboration between KSSL and Thales will leverage Thales's more than 100 years' of experience in the design, development and manufacture of world leading defence systems in Australia". The agreement was signed onboard HMAS *Canberra* on a call in India by MKK Iyer, Vice President (Defence), Kalyani Group and Emmanuel de Roquefeuil, VP and Country Director India, Thales.

Cyient MOU on Remote Pilot Training

Cyient has signed a tripartite MoU with the Government of Telangana and Telangana State Aviation Academy (TSAA) to develop and conduct Remote Pilot (Drone Pilot) Training and Certification Programmes. Cyient will provide the training tools while TSAA will provide training services and infrastructure to conduct the courses, developed as per DGCA curriculum guidelines. Cyient and TSAA will work toward setting up a drone pilot training infrastructure at TSAA, which will include a variety of rotary and fixed-wing drones along with simulators to train the pilots.

BAE Systems India Annual Supplier Summit

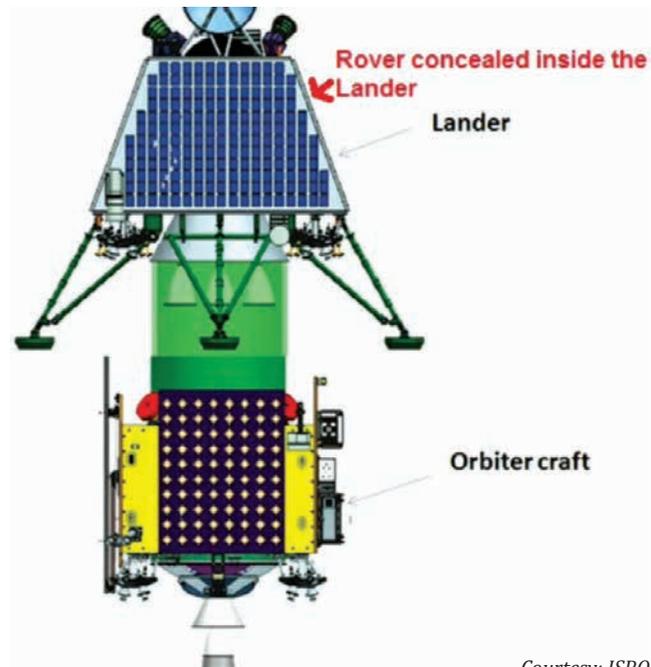
BAE Systems hosted its second Annual Supplier Summit in New Delhi where some 100 vendors from Indian firms attended at Aerocity. BAE Systems shared viable new business opportunities



with delegates, who were addressed by senior executives from the company, representatives from the Government of India, and Indian vendors that have already joined the BAE Systems global supply chain network. As Nik Khanna, Managing Director of BAE Systems India (*image above*) said: "BAE Systems continues to take substantive steps in our Make in India commitment. The company is proud to support the development of Indian suppliers as well as the creation of a self-sustaining industrial base in this country."

India's Moon mission

Indian Space Research Organisation (ISRO) is working on the launch of *Chandrayaan II*, the country's second lunar mission in the launch window 9-16 July 2019. *Chandrayaan II* has three modules : the orbiter, lander (*Vikram*) and rover (*Pragyan*). "The orbiter and lander modules will be interfaced mechanically and stacked together as an integrated module and accommodated inside the GSLGV MK.III launch vehicle. The rover is housed inside the lander," stated an ISRO spokesperson. Once *Chandrayaan II* reaches lunar orbit, the four legged *Vikram* will and soft land at the predetermined site close to the south pole, "which has not been explored by other space research missions."



Courtesy: ISRO

ISRO's PSLV-C45 launches EMISAT and 28 customer satellites



On 1 April, 2019 India's Polar Satellite Launch Vehicle (PSLV-C45) successfully launched EMISAT and 28 international customer satellites from the Satish Dhawan Space Centre (SDSC) SHAR in Sriharikota. This flight marked first mission of PSLV-QL, a new variant of PSLV with four strap-on motors. PSLV-C45 injected India's EMISAT into a 748 km sun-synchronous polar orbit, 17 minutes and 12 seconds after lift-off. After separation, the two solar arrays of EMISAT were deployed automatically and the ISRO Telemetry Tracking and Command Network at Bengaluru assumed control of the satellite, the satellite thereafter brought to its final operational configuration.

Following the separation of EMISAT, the vehicle's fourth stage engines were restarted twice to place the 28 international customer satellites precisely into a sun-synchronous orbit at 504 km. The 28 international customer satellites together weighed about 220 kg, and were from four countries, being Lithuania (2), Spain (1), Switzerland (1) and the USA (24).

Air Marshal Rakesh Kumar Singh Bhadauria is VCAS

Air Marshal Rakesh Kumar Singh Bhadauria took over as Vice Chief of the Air Staff on 1 May 2019. The Air Marshal was commissioned in fighter stream of IAF and won the coveted 'Sword of Honour'. He has over 4250 flying hours on twenty six types of fighters and transport aircraft, is an Experimental Test Pilot, a Cat 'A' Qualified Flying Instructor and Pilot Attack Instructor. The Air Marshal has held a number of important appointments, which include command of a Jaguar Squadron and a premier Air Force Station, Commanding Officer of Flight Test Squadron at Aircraft & System Testing Establishment, Chief Test Pilot and Project Director of the National Flight Test Centre on Light Combat Aircraft (LCA) project.



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Air Marshal SK Ghotia takes over as AOC-in-C Training Command

Air Marshal SK Ghotia took over as Air Officer Commanding-in-Chief of Training Command on 1 May 2019. He was commissioned in the fighter stream, is a Qualified Flying Instructor, has undergone the Air Staff Course, Higher Air Command Course and holds two Masters Degrees. He has served as Directing Staff at the Defence Services Staff College Wellington. He has also served in a number of Staff appointments, which include Director Intelligence at Air HQs, Ops 1 A of Western Air Command, Principal Director Training (Flying) at Air HQs, Air Attache at Embassy of India, Paris, was AOC of the COBRA Group and ACAS (Intelligence). Prior to assuming the present appointment, he was the SASO Training Command.



Rear Admiral Suraj Berry is FOC Eastern Fleet

Rear Admiral Suraj Berry took over Command of the Eastern Fleet on 30 March 2019. He was commissioned on 1 January 1987 and is a specialist in Gunnery and Missile Warfare, his sea



commands includes the missile vessel INS *Nirbhik*, missile corvette INS *Karmuk*, stealth frigate INS *Talwar*, and the aircraft carrier INS *Vikramaditya* of which he was the commissioning Commanding Officer. His Staff and Operational appointments include those as Principal Director Strategy, Concepts and Transformation at Naval Headquarters.

Vice Admiral MA Hampiholi is Director General Naval Operations

Vice Admiral MA Hampiholi assumed charge as Director General Naval Operations on 27 March, 2019. A graduate of the National Defence Academy and commissioned in the Executive Branch of the Indian Navy on 1 July 1985, the Flag Officer is a specialist in Anti-Submarine Warfare and has held important assignments both afloat and ashore. In the initial



years of his career, he served on board IN Ships *Himgiri*, *Agray* and *Ganga* as ASW specialist officer and subsequently was instructor at ASW School. His Command tenures afloat include INS *Nashak* (missile vessel), INS *Magar* {Landing Ship Tank (Large)} and INS *Talwar* (stealth Frigate) and Second in-Command of INS *Khukri* (Missile corvette). He commanded the National Coast Guard, Mauritius for two years (2003–05) and was also Commandant, Naval Academy and Commanding Officer of INS *Mandovi*.

IN participates in 'Group Sail' exercises



In the first week of May 2019, the Indian Navy carried out 'Group Sail' exercises with warships of Japan, the Philippines and the US in the South China Sea. The six-day long 'Group Sail' had six combatants from the four participating countries and included the Guided Missile Destroyer INS *Kolkata* and Fleet Support Ship INS *Shakti* from India, Helicopter Carrier JMSDF *Izumo* and Guided Missile Destroyer JMSDF *Murasame* from Japan; frigate BRP *Andres Bonifacio* from the Philippines and *Arleigh Burke*-Class Destroyer USS *Williams P Lawrence* of the US Navy.

Apart from these, the IN ships took part in various other exercises en route to Qingdao in China (*see associated item*) and on the return passage visited Cam Ranh Bay in Vietnam and Busan in South Korea. On departing Busan, both IN warships participated in ADMM-PLUS MS FTX Phase I exercises off South Korea with the Navies of Brunei, China, Malaysia, Philippines, Singapore, South Korea and the US. On completion of Phase II, all participating ships including *INS Kolkata* and *Shakti* participated in the International Maritime Defence Expo (IMDEX) 2019 off Singapore.



Flagging the

Emerging Issues of Air Power

Excerpts from the Workshop on 29 March 2019



Organised by The Society for Aerospace Studies and the Observer Research Foundation, and held at the latter's Conference Hall on 29 March 2019, this workshop was planned under the compelling circumstances in which the Indian Air Force finds itself today, with predicted depletion of combat squadrons taking place without credible replacements in the foreseeable future.

The Backdrop

The score of MiG-21 variants and MiG-23/27 squadrons, which constituted bulk of the IAF combat force for decades, are predictably and relentlessly being phased out. Their intended successor, the Light Combat Aircraft (LCA) programme has had a prolonged gestation period and the very first operational squadron will achieve unit establishment (still of IOC standard) by 31 March 2019, at least a decade after that planned. The next tranche of 20 (FOC standard aircraft) will only commence delivery from late 2019, and the improved Mk.1A will follow after a decade.

Genesis of the MMRCA programme is well known, which began at start of this Century and after due procedure, was virtually short closed with only 36 Rafales ordered, far from making up the numbers required. Even with additional LCAs, Su-30s and Rafales, by 2021-22 the IAF's frontline combat strength will have been alarmingly reduced to some 26 combat squadrons, or just 60% of the force levels required.



Dr Manoj Joshi

There were over 25 persons at the workshop, including the present Deputy Chief of the Air Staff, IAF Air Marshal VR Chaudhry and a number of officers from the Air War Strategy Cell at Air Headquarters. The first Session was chaired by the former CAS Air Chief Marshal Arup Raha who had specially flown to Delhi from Calcutta for the workshop and the second by Dr RK Tyagi, former Chairman HAL and current President of the Aeronautical Society of India. The sessions were chaired by Dr Manoj Joshi and Mr Pushpinder Singh Chopra respectively.



Air Chief Marshal Arup Raha

Dr Manoj Joshi, Distinguished Fellow with the ORF made his introductory remarks and introduced Air Chief Marshal Arup Raha, former Chief of the Air Staff, who began with the observation on the topic itself 'Emerging issues of air power' as he felt it is an aerospace power because air and space is a one continuum.

The former CAS emphasised that capabilities of the Indian Army, the Indian Navy, the Indian Air Force, ISRO, DRDO and Civil Aviation rely heavily on aerospace assets, and Network Centric Warfare (NCW), communications, intelligence, surveillance etc. can all be performed only with the help and support of an aerospace network. Any operational contingency in future is going to demand extra control of aerospace to perform multiple operations including intelligence, awareness, robust NCW capabilities, intelligence surveillance and reconnaissance (ISR) and, most importantly, the precision strike capability

which he felt, the Air Force must able to deliver.

"Relevance of aerospace power in current and future conflict cannot be over emphasised because it is the aerospace elements which are transforming the entire armed forces with a strategic force with multi spectrum capabilities which is also increasing strategic footprints of the nation in terms of power projection, not only military power but Comprehensive National Power (CNP)".

Air Chief Marshal Raha flagged some issues at conceptual and strategic levels, military strategy of the nation and the national security strategy "where there are huge challenges military strategy has been taken out within the cantors of the national security strategy and this military strategy is reflected through the directive issued by the Government. This directive which is supposed to depict the environment in terms of threat to India, that is our threat perception and how we are going to tackle all these threats in future be it from sub-conventional or non-conventional threats, is formalised by the Defence Minister. The draft is basically prepared by the armed forces then it is worked and fine-tuned by the Chief of the Staff Committee, that is the IDS Headquarters and once all agree on how the military strategy should be, the directive is prepared and sent to the ministry". The former Chief regretted that this has just remained there "since bureaucrats over there don't understand what it contains and how it is to be affected."

He continued that despite preparing the draft on time and sharing it with the MoD, there is some reluctance at both political and bureaucratic levels to formalise the documents. "The capabilities of the armed forces to tackle and mitigate the incoming security threats are heavily dependent on ministry's directives but due to lack of understanding and knowledge on security matters, most of these remain unnoticed for a long time at the MoD".

Air Chief Marshal Raha's other concern was on the National Security Strategy (NSS). Unfortunately this is not implemented by the experts... it is the domain which needs to be handled by those people from the armed forces, and not by the bureaucrats.

"The other point that I would like to highlight is the budgetary allocations as armed forces across the globe require

adequate amount of funds to maintain their capabilities. Especially when we have two neighbours (Pakistan and China) who are constantly engaging in challenging our capabilities, we need to have enough financial backing to neutralise the incoming threats from our neighbours."

Challenges for the IAF

Deputy Chief of the Air Staff, Air Marshal



Air Marshal VR Chaudhry

VR Chaudhry made his focused presentation on what was termed as challenges for the Indian Air Force in terms of regional threats, the way they will shape up in the years to come and how to tackle them. The DCAS projected the Indian Air Force's mission statement, 'The Indian Air Force aspires to be a responsive, credible and adaptable aerospace power with strategic reach and full spectrum capability to safeguard our national interests and provide a decisive instrument for power projection'.

He referred to contemporary war history with the realisation that the manner "we fought wars in the past, the way we are prepared to fight today and the manner in which we will fight in the future, relies heavily on the technology we acquire." He focused on the imperatives of technological dominance over adversaries. "The geopolitical landscape I don't need to elaborate upon, the future threats are likely to be diverse, varied, will be requiring an integrated and rapid response, threats posed by non-state actors, terrorist group and left wing extremists are likely to be increase and the spectrum of conflict will range from air



symmetric to high intensity and to total war. So we need to enhance the strategic deterrence potential, attain full spectrum dominance capabilities”.

The Indian Air Force, on its part must have the construct to meet its diverse roles, needing to diversify from traditional roles of the past, this fact being emphasised. The DCAS alluded to shape of the future battle space. “We will be facing very dense and integrated defence environment, there will be regions and areas which will be very difficult to penetrate, multilayer air defence capability existing with our adversaries presently and we have to find ways both hard and soft of beating the enemy’s air defence systems. Stealthy platforms are being acquired by our adversaries which are going to be difficult to detect and engage. This is where we need to enhance our capability to detect low RCS objects such as cruise missiles or weapons that are released from standoff ranges”.

On the criticality of enhanced electronic warfare capabilities, which will finally determine the winner in any conflict, he said that “future combat systems will need to operate effectively in the most congested, contested and complex environment that we have ever known, facing new threats that probably do not currently exist. Thus, the debatable point whether our doctrine is driving the technology or vice versa. This is the conundrum that we keep facing and discussing to realise that both tactics and

technology do not exist in a vacuum, technology would influence tactics and vice versa”. The Air Marshal referred to recent war history which is replete with examples where technologically inferior forces claimed victory through superior tactics, giving the instances of what happened in Vietnam, in Afghanistan even where technological inferior forces used good tactics, which may not be workable every time but then had and could defeat a technologically superior force.

“The IAF needs to focus firstly on network centric warfare (NCW), space and cyber and more importantly, we need to enhance our indigenous defence production capability so that we will not rely on imports for bolstering our technological advantage. That this technological advantage be gained through indigenous roots, is our *mantra* for the Indian Air Force today”.

The IAF needs to exploit artificial intelligence, big data, handling cyber capability etc. to plug the existing voids. He listed four areas of dominance which is sought to be acquired in the coming decades: networking, space based assets, ISR, EW & Cyber and new generation weapons. “We have integrated air command and control systems which ride right at the back of AFNet, the fibre-based net which is used by the Indian Air Force and is very secure and reliable, the ground network fairly robust and will fulfil are requirements in coming decades”.

However, where the IAF remains short is on its airborne network and operational data links, which capability must be built up very rapidly, and could be achieved by procurement of software defined systems. “Finally of course is the space segment, and the need to merge all of these to give us the functional operational datalink that can link the ground, airborne and space network to give seamless picture of the air battle to everyone involved”.

Concerning space, “we need to have more space assets to provide first signs of an impending attack, which forms critical part of the ballistic missile system as also for conventional use such as for ISR and communication, promoting network centricity. Electronic and cyber warfare cannot be viewed in isolation as all fighter acquisition and fighter upgrade programmes focus on robust EW systems”.

In conclusion, the Air Marshal emphasised that modernisation is a continuous and ongoing process so as to have technological advantage over the adversaries. Importantly “We also need to bring in the private sector and give them an impetus on ‘Make in India’ as part of maintaining our operational edge against adversaries”.



Dr Tara Kartha

The DCAS was followed by Dr Tara Kartha, formally with the National Security Advisory Board, who made references to the recent precision air strike at Balakot by the IAF calling that “an exercise of coercion”. She stressed that “Balakot was basically a demonstration intended to coerce Pakistan into desisting from cross border terrorism.”



Mr Pushpinder Singh Chopra

Chairing the next Session, Mr Pushpinder Singh Chopra, President of *The Society for Aerospace Studies* reiterated that the key reasons behind this workshop were to address prevailing issues of the Indian Air Force, flagging these as the need to ‘fast track’ the process of replenishing IAF combat squadrons, particularly the process of acquisition. Also, whether yet another MMRCA-type competition was practical at this critical juncture, or was there a more rational, speedier process to arrest the steadily declining combat squadron levels of the IAF ?

He introduced Dr RK Tyagi, former Chairman, HAL and present President of the Aeronautical Society of India who in his candid address, cautioned the need for pragmatism in reaching the IAF’s desired force levels. “When we talk about 2025, which is some six years from now, we are looking at some major targets to be achieved including self-reliance in major systems comprising aircraft, helicopters, radars etc. followed by augmenting indigenous infrastructure to meet the major requirements. All these objectives would be achieved only when there are adequate funds allocated by the Government for defence. There are persistent reports on the continuing financial crisis which means that the government must commit funding to enhance IAF force levels if it really wants to accomplish its defence vision by 2025.”

Alluding a “two front war”, Dr Tyagi said, “We are still living in the myth of being technologically superior than our neighbours, which is why we are still hoping to touch the figure of 45 squadrons to simultaneously tackle both Pakistan and China whereas, the



Dr RK Tyagi

reality is that, for this contingency, the IAF must have a force level of some 60 combat squadrons to achieve credible air defence”.

On the role of Hindustan Aeronautics Limited, he said that “much has been discussed in the public but the fact is, as a nation, what do we really want HAL to do ? Option one, close HAL and give it to private sector; option two have a joint relationship with HAL and private sector. We have already disinvested HAL by 10%, so expand this further to 40% and invite major players and let HAL, emerge as a national integration company”.

On the need for synergy amongst various air arms, Dr Tyagi gave an example of Russia where planners from all three defence forces plan for and implement acquisition of standard equipment. “I think it is time that we take a similar national call. I feel the IAF should not only plan for wars on the western and the northern fronts, but

consider that future wars could certainly also take place in the high seas. If so, are we going to have separate air forces for the Indian Navy and the Indian Army”?

Concerning the light combat aircraft (LCA) Dr Tyagi questioned as to what the Air Force and Navy really wanted Indian R&D and the industry to do. He stressed that Hindustan Aeronautics Limited is a national strategic asset and there was need for continuity over the next 10 to 15 years involving all levels, be they political, bureaucratic or industrial, of course keeping requirement of the Services as paramount.

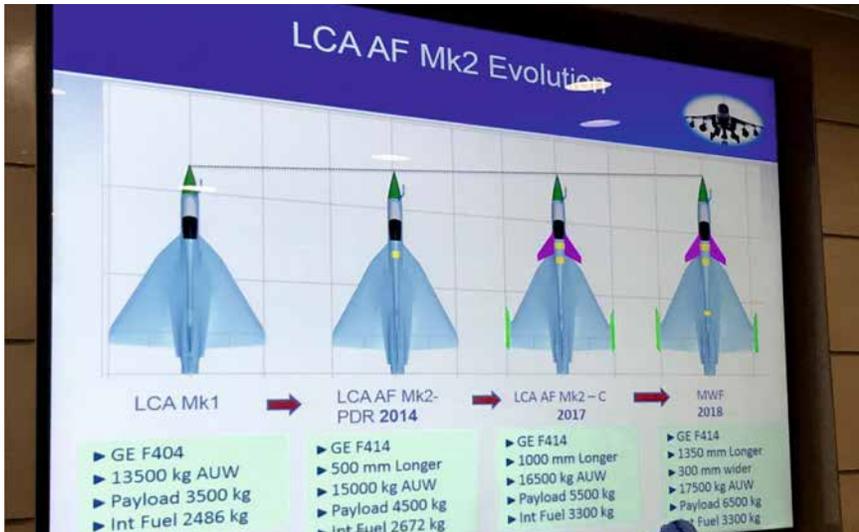
However he was candid in his remarks that “the LCA is not going in the right direction and the reason is that after manufacturing 40 LCA Mk.1s, if there is delay on further orders (Mk.1A) Air Force is right that there will be technological advances, and currently the IAF has asked for four upgrades. However, the fact is that ADA does not have the funds for all these so according to what I heard, work on the LCA Mk.1A has not really started and the way it is going, I will not be surprised if this gets delayed further for some more years. Who owns the LCA anyway ? We must have a national supervisory committee to handle this national, strategic programme”, he stressed.

The Indian R&D and Industry

Representing the Indian aerospace industry were Dr Praveen V Ayachit from the Aeronautical Development Agency (ADA) and Mr G Syam Nath, from Hindustan Aeronautics Limited (HAL). The former made a first-time public presentation on the LCA Mk.II project, with graphics to illustrate how the LCA Mk.I has evolved



Dr Praveen V Ayachit



Mr G Syam Nath

into becoming a Medium Weight Fighter (MWF), which is 1350 mm longer, 300mm wider than the baseline LCA having a 17.5 tonne AUW, with payload of 6.5 tonnes and internal fuel of 3.5 tonnes.

Featuring canard foreplanes, powered by the GE F.414 turbofan engine, first flight of this aircraft is aimed for in 2024, with induction into service from the early 2030s, to supplant present legacy types such as the Jaguar, Mirage 2000 and MiG-29.

He also briefly made an overview of the AMCA programme which, powered by 110kN class engines, “could go into service in 14 years”. (Details in future Issues of the Vayu Aerospace Review)

The General Manager from HAL concentrated on development of the LCA Mk.IA, the RFP for which was issued by Air Headquarters on 20 December 2017, with commercial negotiations on at present. However, first deliveries of the 83 aircraft

required by the IAF will realistically not take place before 2024 (which is also the reason for the ‘stop gap’ requirement for 114 multi-role fighters as per the IAF’s RFI issued in April 2018).

A spirited open discussion followed with several senior (retired) Air Marshals, Generals and Admirals participating. These included Air Marshals KK Nohwar, Ajit Bhavnani, Jimmy Bhatia, Amit Aneja, Vice Admiral Shekhar Sinha and Major General Ashok Mehta (seen below). 



The Tejas at Langkawi




LIMA '19
THE LANGKAWI INTERNATIONAL
MARITIME & AEROSPACE EXHIBITION
26 - 30 MARCH 2019

And other highlights of LIMA 2019

The Langkawi International Maritime and Aerospace Exhibition (popularly 'LIMA') takes place every two years at this attractive tourist destination on Malaysia's western periphery. The 15th edition took place during 26-30 March 2019 and witnessed some 'unusual' aircraft sales contests, including those between Indian, Russian and Korean aircraft types, all vying to meet the Malaysian requirement for new light combat aircraft. However, according to industry observers, a string of other manufacturers also responded to the requirement of the Royal Malaysian Air Force (RMAF) for this requirement, including Saab which reportedly submitted its proposal to the RMAF in late February, offering the latest Gripen C MS20 sub-variant, with access to the MBDA Meteor beyond-visual-range air-to-air missile and other improved weapon systems. The Swedish National Export Credits Guarantee Board (EKN) could well offer export credit support and be the possible solution for the budgetary issues faced by the RMAF.

Russia's Rostec and South Korea's Korea Aerospace Industries (KAI) are both hoping that earlier regional exports in Southeast Asia would be a good report



card for the Yak-130 and FA/T-50, respectively. The former has exported Yak-130s to Bangladesh, Myanmar and Laos. Speaking to the media during LIMA, Sergey Gorbenko, Rosoboronexport's Chief of Directorate, said it will be proposing 18 Yak-130s for the first phase with an option for 36 more in the second phase.

A no-so-dark horse is the Chengdu/PAC JF-17 Thunder which although not present at LIMA 2019, was subject of

official discussions during the Malaysian Prime Minister's visit to Islamabad a week earlier.

There was understandable excitement in India that the Tejas LCA was being displayed and demonstrated at this international airshow. Two series production LCAs from No.45 Squadron IAF, commanded by Gp Capt Samrath Dhankhar had been ferried from Sulur in South India via Kalaikunda in Bengal and Yangon in Myanmar to

Langkawi in Malaysia. The IAF contingent comprised 27 officers, 42 airmen and 11 HAL personnel, the LCAs accompanied by a C-130J and Il-76 of the IAF for logistics and spares support.

According to reports from Langkawi, Malaysian Prime Minister Dr Mahathir Bin Mohamad and Defence Minister Mohamad Sabu visited the Show and interacted with

Indian Air Force officials, sat in the cockpit of a Tejas and sought some information on this aircraft.

Other highlights at LIMA

Other flying displays at LIMA 2019 included performances of aerobatic teams from the Republic of Korea 'Black Eagles' and Indonesia's 'Jupiter'.

Airbus was much in evidence at the show, which included static display of an A320neo operated by Malaysian low-cost carrier AirAsia, the new-generation tactical airlifter A400M and a CN235 medium aircraft. This company's rotorcraft display consisted of H225M, a Malaysian Navy AS555SN Fennec and an AS365 Dauphin operated by the country's maritime

United Colours of the RMAF



For real ? RMAF A400M, with PC-7s in unlikely formation over a pair of Su-30MKMs flying lower in the opposite direction at start of LIMA 1019



The RMAF have a small batch of Boeing F/A-18 Hornets and.....



....Sukhoi Su-30MKMs in their present fighter inventory



The 'Jupiter' formation aerobatic team at LIMA

enforcement agency. Airbus Helicopters also showcased their H145 in emergency medical services configuration.

RMAF evaluates MPAs

In recent years, the Royal Malaysian Air Force (RMAF) has placed maritime surveillance as one of its top procurement priorities, even ahead of other requirements including the light combat aircraft programme, so as to protect the country's extensive maritime frontiers, especially in the contested South China Sea and pirate-infested Malacca Straits. The RMAF is considering procurement of some four maritime patrol aircraft (MPA), according to Elfen Goentoro, the President Director of Indonesia's PT Dirgantara Indonesia (PTDI). Options include PT DI's CN235 MPA variant, and two more to be converted from the RMAF's current CN235 transport fleet. In addition, the RMAF is also looking at acquiring a CN235 converted for VIP transport.

In this context, PT DI issued the Certificate of Completion and Certificate of Competency to the RMAF for the CN235 Rewiring Programme, completing such transfer of technology to the air force. RMAF's seven CN235s will undergo a Service Life Extension Programme (SLEP), under which the first three airframes will go through processes such as structural inspection, rewiring, and replacement of obsolescent equipment by the end of 2019, with the remainder following in 2020.

Meanwhile, Boeing is hopeful that the P-8 Poseidon's successful campaign

around Asia-Pacific will continue to spill into Southeast Asia, and has offered the P-8 Poseidon to the RMAF.

Y-12 production in Malaysia

A joint venture between Malaysian company UA Aerospace and the investment arm of the government of Kedah, Menteri Besar Kedah Incorporated (MBI Kedah), signed a partnership contract with China's biggest defence enterprise, the Aviation Industry Corporation of China (AVIC) during LIMA 2019. Foong Peng Hoong, the president of UA Aerospace, stated, "Under the new partnership contract, UA Aerospace and MBI Kedah will receive technologies and training from AVIC to facilitate the Malaysian production of two

major Chinese platforms. These comprise the Y-12 light transport aircraft, developed by AVIC subsidiary Harbin Aviation Group, and the AC312 light twin-engine civilian helicopter, developed by subsidiary AVICopter. The Y-12 and AC312 have been designed by AVIC for commercial and military applications."

Although the HAL-built Tejas LCA was one of the stars at LIMA 2019, why did the Government of India and the mandarins at its Ministry of Defence not follow up the Malaysian interest in maritime patrol aircraft? The HAL-built Dornier 228 is arguably the world's most cost-effective maritime patrol aircraft, with well over 60 aircraft serving in this demanding (and other) role with the Indian Navy and Coast Guard. Why is it that the Malaysians are looking at the far less capable Chinese Y-12 to meet its requirements?

The Maritime Dimension

Amongst a number of warships of various Navy's was the INS *Kadmatt*, a Stealth Anti Submarine Warfare (ASW) corvette, which was in Langkawi waters for seven days. Vice Admiral Karambir Singh, FOC-in-C, Eastern Naval Command headed the Indian Navy Delegation.

The largest presence was that of the Americans, both the USAF and US Navy at LIMA 2019. "LIMA is a phenomenal multinational event which also showcases the military-to-military ties between the US and Malaysian armed forces," said Col Scott Humphrey, US Mission Commander with the Washington Air National Guard. 



INS 'Kadmatt' at Langkawi

Tejas vs Thunder vs Golden Eagle vs...



On arrival at Langkawi : pilots of the two Tejas LCAs with other IAF officers

In his well read column, Ajai Shukla writes that many aviation experts believe Malaysia will choose between three light fighters: India's Tejas, the South Korean FA-SO Golden Eagle, and the Chinese-Pakistani JF-17 Thunder.

Since the RMAF is still deciding between a supersonic LCA and a subsonic lead-in fighter trainer (LIFT), three additional jet trainers are also regarded as contenders, including the Leonardo M-346FA aircraft, the South Korean T-50 Golden Eagle and the Russian Yakovlev Yak-130.

In January 2019, Malaysia issued requests for information (RFI) under its LCA/LIFT procurement programme, expressing interest in acquiring an initial 12 fighters by 2021-22, with an option for 24 more in the future. This would be under a its 'Capability SS' modernisation programme, which envisages adding

a single-engine, supersonic fighter to the current RMAF fleet, which consists mainly of twin-engined fighters, including the Boeing F/A-18D Hornet and the Russian Sukhoi-30 and MiG-29.

The Government of Malaysia has projected that the procurement would cost some \$300 million, or \$25 million per aircraft. That is the estimated cost of the JF-17 Thunder, with the Tejas and the Golden Eagle priced slightly higher at about \$30 million each. However, there are apprehensions over the JF-17's engine, the Russian Klimov RD-33, which requires heavy maintenance and is rather 'smoky' which the RMAF is well aware of since its MiG-29s have the same engine.

In contrast, the Tejas and the Golden Eagle both use the highly reliable General Electric F-404 engine, which also powers the RMAF's F/A-18s. In design and materials, the Tejas is the most advanced of the three light fighters, having an unstable design and a quadruplex fly-

by-wire system controlled through a sophisticated mission computer. While the JF-17 and FA-50 are mostly metallic, the Tejas's fuselage and wings feature advanced composite materials, which reduces the aircraft's weight and allows it to carry more weapons and fuel.

However, the Tejas's big drawback is the IAF's 'lukewarm' attitude. In contrast, the JF-17 and FA-50 are strongly backed by the Pakistani and Korean air forces, respectively. The PAF already flies six squadrons of JF-17s.

"It would be a travesty if the Malaysian Air Force likes the Tejas, but decides against it because it sees IAF reluctance to back the fighter. The sooner the IAF throws its weight behind the Tejas, the earlier it will crack the international market, where there is already significant interest," said strategic affairs expert Bharat Karnad.

“Mission Readiness”: Boeing and Indian’s Armed Forces



Over the past few years, Boeing has exponentially strengthened and grown its partnership with the Indian armed forces. From the C-17 Globemaster III to the P-8I and now, the soon to be inducted AH-64 Apaches and CH-47 Chinooks, Boeing platforms and services are actively aiding the Indian armed forces missions to protect the country’s sovereign borders.

Boeing’s commitment to deliver capable platforms that meet the Indian armed forces modernisation and mission requirements spans across the present. Its portfolio has a range of proven products that can fulfill a number of roles in present and future theatres of operations.

With the F/A-18 Super Hornet, Boeing can help the Indian Navy and the Indian Air Force modernise their fleets with a fighter that offers true multi-role capability and a distinct combat advantage.

As India expands its air force and increases its defensive capabilities, the KC-46 Pegasus is the perfect choice for a multi-role tanker-transport aircraft. The most reliable and economical tanker to operate, the KC-46 can provide India with the combat capability it needs for sovereign operations. Pegasus is the best choice for today and the decades to come. The brand new KC-46 is designed from the ground-up to be a combat-ready tanker. This means that unlike other tankers, it can operate closer to the fight, covertly and with the ability to protect itself. In India’s crowded neighbourhood, it means it can be closer to action to fuel the fight.

Boeing has the right platforms and capabilities to match the evolving mission requirements of the Indian armed forces. Ranging across the entire gamut of strategic

airlift, combat operations and Intelligence, Surveillance and Reconnaissance (ISR) roles, Boeing platforms provide warfighters with the capability to dominate combat areas.

As this partnership progresses, Boeing sees an opportunity to continue to provide the Indian armed forces with the capability with cutting-edge platforms that will prove to be an asset in protecting the sovereign borders of the country.

Boeing sees an opportunity to provide both the Indian Navy and the Indian Air Force with the F/A-18 Super Hornet, one of the world’s preeminent multi-role fighter aircraft. The F/A-18 Super Hornet is a combat proven, supersonic, all weather multirole fighter with a defined flight plan to outpace threats into the 2040s. The Super Hornet Block II is the most advanced aircraft of its kind in operation today with designed-in stealth (and best stealth performance), an AESA radar and many other advanced technologies. The AESA radar in particular is an expedient leap in technology needed for current and future missions. The Super Hornet not only has a low acquisition cost, but it costs less per flight hour to operate than any other tactical aircraft in US forces inventory. Part of its affordability is because the Super Hornet is designed to need far less maintenance, which translates into the high mission availability it is synonymous with.

Over 160 Indian suppliers have been providing parts and assemblies covering aerostructures, wire harness, composites, forgings, avionics mission systems, and ground support equipment for some of Boeing’s most advanced defense platforms. Boeing’s sourcing from India has quadrupled in the past few years and now stands at \$1 billion. As part of this journey, Boeing’s

joint venture with Tata Advanced Systems Limited, Tata Boeing Aerospace Limited (TBAL) has already begun deliveries of fuselages for the AH-64 Apache, the world’s most lethal combat helicopter. This centre is becoming the sole source of the fuselage globally.

Committed to evolving these partnerships and investments further, Boeing is proposing a world class advanced manufacturing facility in India for the F/A-18 Super Hornet with the very latest technologies in place. Furthermore, the Super Hornet is the best aircraft as a step to India’s Advanced Medium Combat Aircraft (AMCA) programme. Boeing will work closely with India industry to ensure they have the very latest technologies, applying lessons learnt from the current Super Hornet production line.

The Indian Navy and Indian Air Force can be assured of achieving exceptional operational capability and readiness of their P-8I and C-17 fleets. Boeing aircraft have high mission readiness rates of >85%. Boeing’s investments in services infrastructure, the build-up of local capability and workforce and local partnership models will accelerate the strategy. C-17 GISP programme has become a model for the future of sustainment. The C-17 Simulator Training Centre, established by Boeing and Mahindra Defence Systems to provide training services to the Indian Air Force, completed over 1700 hours of training for aircrews and loadmasters that operate the C-17 Globemaster III.

With imminent induction of the Apache and Chinook, Boeing anticipates additional opportunities in rotorcraft training and support centers.

 *Courtesy: Boeing*

Safran and the Indian Defence Sector



Safran maintains a very long association with the Indian Army, since the 1950s, offering aerospace and land solutions.

The company is the leading supplier of inertial navigation systems for Indian combat aircraft. Sigma 95N navigation systems equip the Sukhoi Su-30MKI, Tejas LCA, MiG-27, MiG-29, Jaguar and the Hawk advanced jet trainer. The company develops and supplies the Automatic Flight Control System (AFCS) of the Dhruv helicopter, comprising APIRS Attitude and Heading Reference Systems, Autopilot Computers and actuators, all of which are manufactured and maintained in India.

More than 500 combat aircraft deployed by the Indian Air Force and Indian Navy are equipped with the Inertial Navigation Systems. Safran is a major contributor to the 36 Rafale fighters acquired by India in 2016. Safran companies provide a wide variety of systems and equipment on the Rafale, including the aircraft's M88 engines, power transmission system, landing gear, wheels and carbon brakes, ring laser gyro inertial navigation system, gyros for the fly-by-wire system, the auxiliary power unit (APU) and all wiring. In addition, Safran is prime contractor for the AASM Hammer modular air-to-ground weapon.

A key element of Safran's partnership is the Shakti / Ardiden 1H1. Certified in 2009, the 1,400 shp engine was co-developed by Safran and HAL and is now built in Bangalore, under the Shakti designation, mainly with Indian-made components. This engine was first selected to power HAL's Dhruv, now in service, and powers the Light Combat Helicopter (LCH) in final stages of qualification. Today, more than 350 Shakti engines have been produced. Most recently the Ardiden 1U, a derivative of the Ardiden 1H1 specifically designed to power single-engine rotorcraft, was selected to power



the Light Utility Helicopter (LUH), a new and unique three-ton, single-engine, multipurpose rotorcraft. This engine has a compact architecture featuring a gas generator made up of two centrifugal compressor stages, coupled to a single-stage high-pressure turbine and a two-stage power turbine. The first technical flight of the Ardiden 1U in the LUH took place in September 2016, in Bangalore, and met all its performance targets.

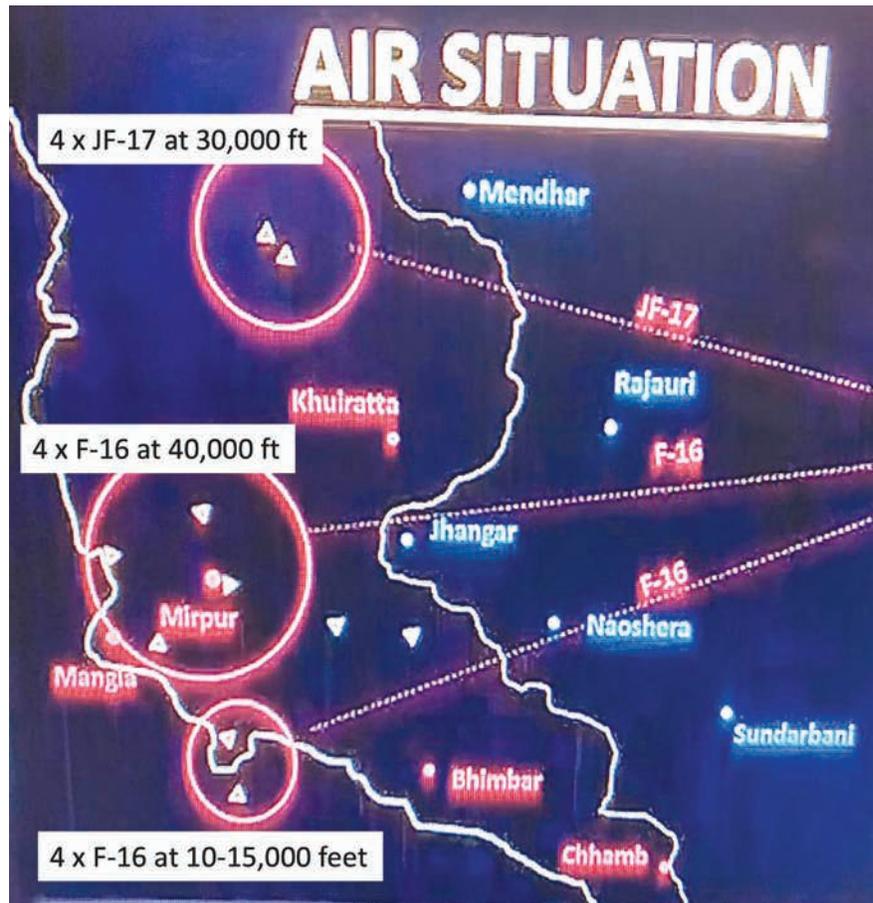
Inaugurated in October 2016 in Goa is the *Helicopter Engines MRO Pvt. Limited* (HE-MRO) a Joint Venture of Safran and HAL, dedicated to supporting of helicopter engines operated by national and international operators, and primarily the Indian Air Force and Indian Army. It will be operational by early 2020, and provide maintenance repair and overhaul (MRO) services for both TM333 and Shakti engines installed on HAL-built helicopters. 🦋

Courtesy: Safran

Bison vs Falcon

Sameer Joshi analyses 'that' air combat over Kashmir

Wing Commander Abhinandan Varthaman of the Indian Air Force's No.51 Squadron flying a MiG-21 Bison, made aviation history around 10.00 hrs on 27 February 2019, when he targeted a formation of Pakistan Air Force F-16s who were engaging IAF Sukhoi Su-30MKI fighters with their AIM-120 AMRAAM beyond visual range missiles. Closing in, he launched a Vympel R-73 heat seeking air-to-air missile at the target over the Lam valley in Nowshera sub sector of south western Jammu and Kashmir, which resulted in the shooting down of a PAF F-16. This was vigorously denied by Pakistani spokespersons, but this brief air combat has since been reported and analysed ad infinitum, well beyond the sub-continent, with claims and denials continuing till today.



What is undeniable is that Abhinandan's MiG-21 was also hit by an AMRAAM missile as he was heading back towards India, having crossed the LOC in pursuit of the F-16 just tens of seconds earlier. He ejected from the stricken aircraft and parachuted to safety, landing 4 km away from the LOC near Horan Kotla village in POK. He was brutally attacked by some locals, before being dramatically handed over to the Pakistan Army.

Abhi's ordeal made him focal point of the developing crisis, when in gross violation of the Geneva convention, the footage of his battered face was intentionally released on Pakistani television and social media by Pakistan Army affiliates shortly thereafter.





Pak Army troops next to the fallen IAF MiG-21Bison in POK

Just after Abhinandan's ejection on 27 February, the Indian Air Force first reported through the ANI's Twitter handle that they had shot down a F-16 over the Lam valley and also acknowledged the loss of one of its MiG-21s. At the same time, Major General Asif Ghafoor, Director-General of Inter-Services Public Relations (ISPR) and chief spokesperson of Pakistan Armed Forces, tweeted on the ISPR handle that two Indian jets had been shot down by the PAF in POK, with one pilot arrested by the Pak army and two still in the area. Even as facts were being ascertained and before the IAF could give any statement, Pakistani handles on social media started talking about the shooting down of two IAF jets and capture of their Indian pilots.

While addressing a press conference at noon, an hour or so after his first significant tweet, Maj Gen Ghafoor said that another pilot has been arrested. "Our ground forces arrested two pilots; one of them was injured and has been shifted to CMH (Combined Military hospital) and, God-willing, he will be taken care of," said the army official and reiterated that "The other one is with us." Maj Gen Ghafoor also assured all that no F-16 of the PAF had been shot down, since the F-16s were 'not' used in combat

in that sector at all. Interestingly, the Pak PM Imran Khan also stated that Pakistan had two Indian pilots in custody. Post that press conference, the ISPR chief informed that the pilot in their custody in the military hospital had passed away.

At 6:19 PM in the evening, the last tweet on the subject from Maj Gen Ghafoor clarified that the Pak Army had just 'one' IAF pilot in its custody, who was Wing Commander Abhinandan Varthaman.

During the time between his first and last tweet, the social media, particularly on Twitter, spiked up with a virtual war

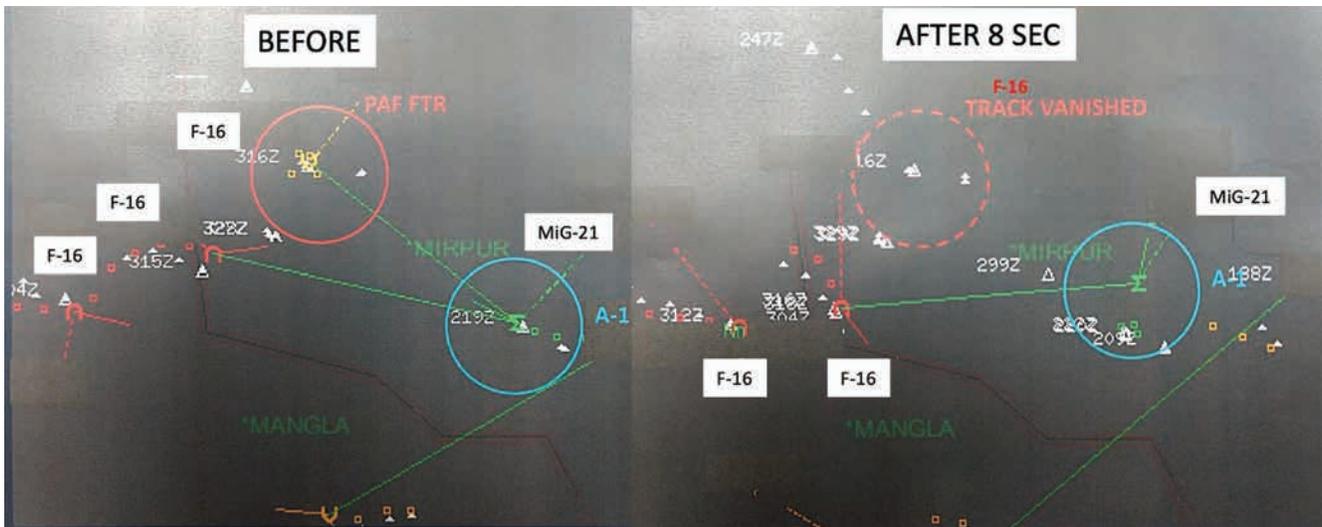
between Indian and Pakistani tweeter posting a barrage of messages, videos and photos to bolster their claims, nudged by the ISPR showing the travails of Abhinandan Varthaman as their POW, in a clear effort to shift the focus of attention away from the shooting down of a PAF F-16 and fate of the other downed pilot.

Electromagnetic evidence on the Air Situation

Let us take a look at the OSINT info and the evidence that the Indian Air Force has officially revealed on the shooting down of



The IAF's PRO and his team displaying part of an AMRAAM missile fired by PAF F-16s against IAF Su-30MKIs on 27 February 2019



the PAF F-16. That F-16s had engaged with the IAF near Poonch-Naoshera sub sector on 27 February has been proven beyond doubt by the electronic signatures, as well as various video and visual sightings from both sides of the Line of Control.

The IAF's A.50 Phalcon AWACS, which while not on station and not controlling the IAF vs PAF air situation, had adequate radar pick up on the aerial engagement unfolding via its powerful airborne AESA radar. In addition, the Phalcon was able to map the large force engagement (LFE) from 10,000 to 40,000 feet, distinguishing and identifying the various PAF fighters taking part through their electromagnetic emissions (radars, navigational equipment and other active sensors), duly picked up, processed and analysed by the powerful Electronic Intelligence (Elint) systems. It identified F-16, JF-17 and Mirage 5s as part of the PAF package, spread out from north to south J&K on three main axes near the Line of Control in the POK.

The lead image shows the fused radar and Elint signatures accurately depicting the presence in time and space of the F-16's APG-68 V9 radar signature over Lam valley, along with 4 different blips between 10–15,000 feet. The data proves beyond doubt that F-16s were operating against the IAF that morning, further confirmed by the remains of the AMRAAM missile found in Naoshera sector by the Indian military.

The IAF's Integrated Air Command & Control System (IACCS) had initially missed tracking the ingress of these four F-16s towards the LOC since they maintained below the radar horizon of the IAF's ground based radars, picking them

only once they approached north of Poonch, where they lay in wait to ambush IAF Su-30MKIs who were being 'pushed' towards them by another formation of 4 F-16s north west of Poonch at 40,000 feet. This formation had fired 4–5 AMRAAM missiles at IAF Su-30 MKIs as they approached south of Rajouri.

Having identified the lower formation of F-16s and seeing that the Su-30MKIs were effectively being checked by the higher formation of F-16s, the IACCS vectored two MiG-21 Bisons to prevent these 4 F-16s from breaking through towards Srinagar-Awantiport. Wg Cdr Abhinandan was the lead in this two aircraft MiG-21 pair, the approach of which was missed by the F-16s who were busy scanning for the Su-30MKIs, but reportedly a Saab 2000 ERIEYE Airborne Early Warning & Control (AEW&C) operating in depth near Islamabad, tracked the MiG-21s over Naoshera, warning the F-16s. The IAF's ground controller saw the defensive maneuvering of the F-16s, warning the MiGs in turn. While his No 2, who was lagging behind, turned 'cold' or away from the F-16s which were going 'hot' or facing the MiGs, Abhinandan chose to ignore this threat and continued towards the F-16s.

Both the IACCS and Phalcon AWACS registered the radar signature of one MiG-21 cross the Line of Control and engage a F-16 with a R-73 missile. Abhinandan's call on R/T of a missile launch was monitored by the AWACS, being 8–10 km away from the F-16, which was turning towards him, aiming for a frontal aspect launch with high closing speed between the missile and the incoming F-16. The R-73 is a heat seeking

air-to-air missile with a sensitive, dual band cryogenic cooled seeker with a substantial off-boresight capability. The seeker can see targets up to 40° off the missile's centreline. Minimum engagement range is about 300 meters, with maximum aerodynamic range of nearly 30 km at altitude.

The IAF Phalcon AWACS air situation snapshot

Abhinandan fired his R-73 well within the range and tracking capabilities of the R-73 missile, with a high closing speed of more than 3500 kmph between the missile and the F-16, which was at 15,000 feet. At those ranges, the missile would have closed into the target in less than 20 seconds, its proximity fuse activating the 7.4 kg warhead to explode and engulf the F-16 in frontal quarters with flame and high velocity shrapnel, in all probability grievously injuring the pilot. The 'splashed' F-16 fell towards the earth with the pilot ejecting out of the stricken aircraft as reported by eyewitnesses.

The F-16 'kill' was recorded by the Phalcon's radar, with the said blip vanishing from the radar scope in the radar picture processed 8 seconds after the previous one, which had shown the blip in place. This is the first hard evidence on the F-16 kill based on a concrete electronic signature recordings. The same is corroborated by a Thales GS-100 Low Level Targeting Radar (LLTR) deployed in that area and integrated into the IACCS. The GS-100 is an AESA radar with low-altitude search capability that can track targets up to 180 km range with high accuracy. The post event milking out of radar data from the GS-100

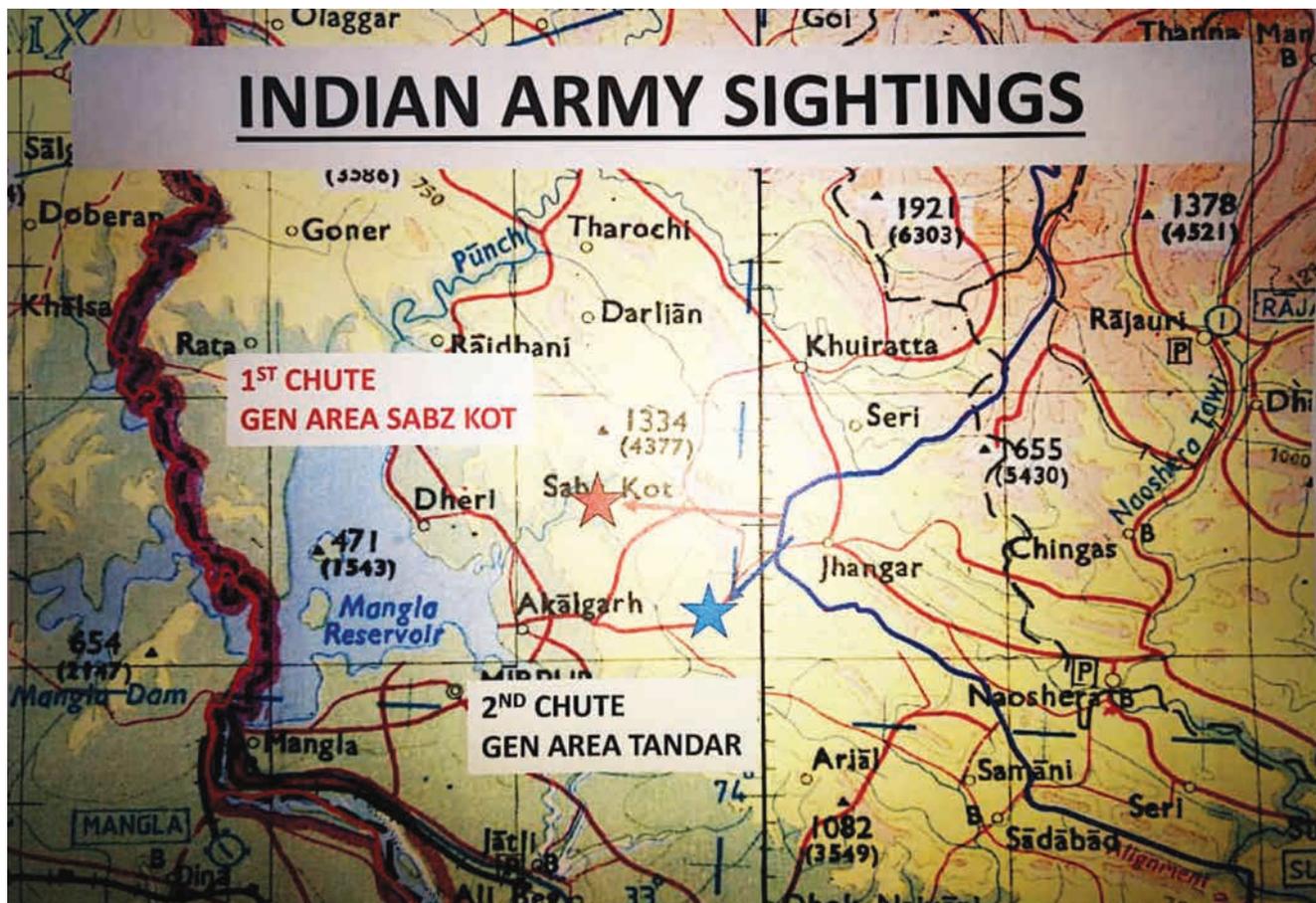
clearly has shown the MiG-21 closing into the F-16s, which were higher, between 15–25,000 feet.

The overlapping time and place of the missile launch and the subsequent ‘splash’ with the blip vanishing is registered very accurately, matching with the Phalcon

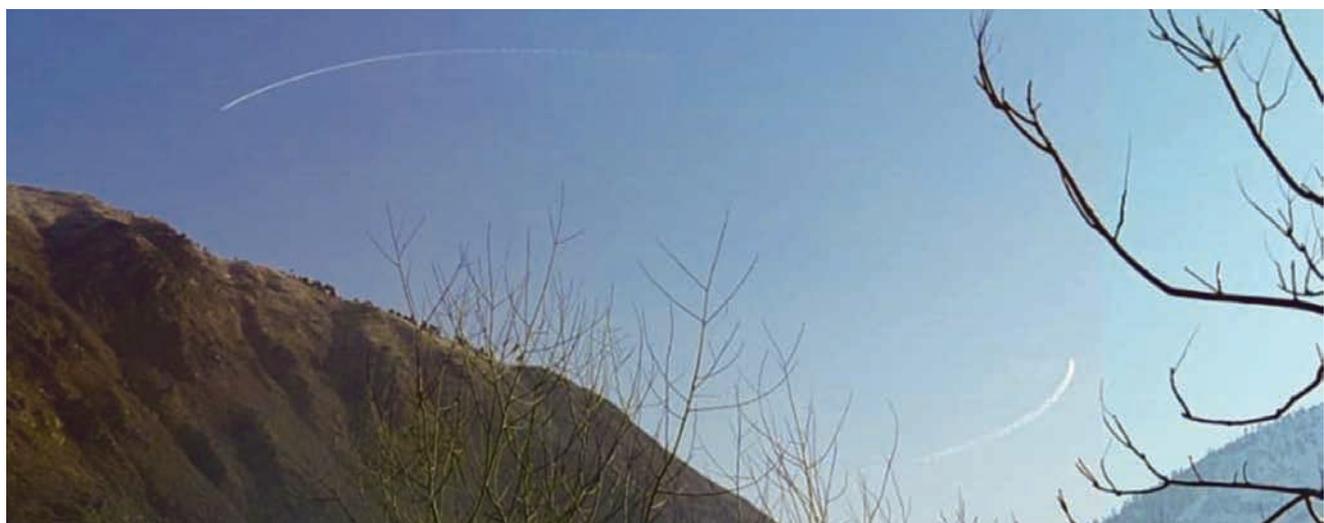
data. This is the second hard evidence on the F-16 kill.

The same LLTR had clearly registered a PAF F-16 manoeuvring towards Abhinandan’s MiG-21, as he turned northwards post his missile launch. Guided by the Saab ERIEYE, it was a classic Type

III converting into a Type IV interception by the F-16 which fired an AMRAAM to shoot down the IAF MiG-21. The LLTR noticed the MiG-21 blip vanishing after nearly a minute post the F-16 kill, matching with the account from Abhinandan’s debrief after his repatriation back to India.



Indian Army sightings of two different aircraft crashing as released by the IAF



The ensuing air combat as viewed from the Pakistani side of line of control

Visual Sighting

Actually, the air battle was visible in great detail on both sides of the Line of Control in J&K, thanks to the contrails formed at the altitudes where the jets were operating on most occasions.

As the F-16 fell to the ground after being hit by the MiG-21, its downward trajectory with parachutes in proximity, was recorded by at least 2 different geographically apart Indian Army posts, which accurately estimated that the wreckage would have fallen 7–8 km in POK close to Sabzkot in Bhimber. About 40–50 seconds later, the same army posts noticed and tracked Abhinandan's MiG-21 going down and his ejection in general area Tandar 6–7 km inside POK, which through OSINT is close to the village of Horan Kotla where the wreckage was seen vividly on social media.

The sightings and the time of the aircraft (and parachutes), match up with the electronic signatures from both the AWACS and the LLTR. This is irrefutable proof of the F-16 being shot down by the MiG-21. Post this, radio transmission picked up by the Indian military around 1145H shows Pakistan soldiers from Northern Light Infantry talking about two '*parinda*'

(aircraft) and two '*parinde wale*' (pilots), and having bagged one in their custody. While the first parachute was seen in General Area Sabzkot, the second parachute was spotted in General Area Tandar. The distance between the two locations of the F-16 and MiG-21 wreckage is about 6–7 kms.

In an intercept at 1242H, a soldier of 7 Northern Light Infantry, Tandar area, mentions soldiers from 658 Mujahid battalion having picked up a second pilot, which actually was Abhinandan as seen with the Mujahid soldiers in the various social media grabs. The NLI soldiers already had one pilot in custody at the time : at 1520 hours, another intercept says that "while one pilot is in custody, another has been sent to the military hospital".

This clearly shows that a second pilot was also in the Pak Army custody as also being mentioned in the parralel narrative by the ISPR chief. So if one was Abhinandan with the Mujahids, who was the second pilot with the NLI battalion — obviously none other than the F-16 pilot ?

Besides the initial video of locals who said two pilots were caught, the sighting by the Indian army and videos showing two parachutes coming down, all indicate that a Pakistan jet was shot down.

A case of two wreckages and three parachutes: OSINT data analysis

After sifting through a large volume of social media videos, images and posts, some very interesting OSINT data emerges. With over 10 different videos of the aerial engagement and the subsequent aircraft crashing into the ground accessed, there are at least two videos which show two different aircraft falling towards the ground. These can be distinguished by their rapidly falling trajectories towards the ground and the vapour trails created in the skies. Clearly two different aircraft had crashed in the Bhimber area of POK on 27 February.

A detailed analysis of Abhinandan's crash site by geospatial experts and eyewitness accounts places it near the village of Horan Kotla in Tandar area. Working backwards from the location of the MiG-21 wreckage, one can plot the approximate area where the F-16 wreckage might have fallen.

After the tirade of videos on the MiG-21 wreckage surfacing on the social media, there was an initial rush to brand the MiG-21's R-25 engine, as seen in the wreckage as the F-16's General Electric Engine. However, it petered down when experts stepped in to debunk these theories.



In all probability, just like they tried to lynch Abhinandan when he landed, the POK locals clearly mistook the F-16 parachute to be Indian and lynched the possibly injured PAF pilot. Owing to extreme injuries, the PAF pilot would have been taken to the Pak Army CMH where he would have passed away due to the wounds sustained. Eyewitness accounts from POK civilians also confirm that the second pilot was taken to a Pak army hospital.

So why didn't the Pakistanis recognise their own pilot before lynching him? For this we need to go back to the exact moment when Abhinandan fired his R-73 against the PAF F-16. As per Abhinandan's debrief after his return, the R-73 missile was fired when the PAF aircraft was turning towards the IAF MiG-21, about to roll out towards him in its frontal quarter. This means when the R-73 missile, with a massive closing speed of over 3500 kmph, would have reached the calculated range for its proximity fuse to explode the warhead, the PAF jet would be still be travelling towards the explosion.

Let us try to understand how the R-73 warhead would have exploded : The R-73 has a continuous rod warhead weighing 7.4 kg which is activated by a proximity fuse when it senses an aircraft in close quarters. When detonated, the high explosive imparts momentum to the rods, thrusting them outward in an expanding circle. The pressure wave from the explosive acts evenly on the rods over their length. The rods are sufficiently soft to allow the expansion without breaking the rods or the welded joints, and the detonation velocity is limited to approx. 1000 m/s, allowing the rods to bend at these locations instead. At some intermediate point the ring will have a zig-zag (alternating direction) appearance within a cylindrical envelope. Upon ultimate expansion the ring is circular and contained within a plane.

This rapidly expanding ring, when hitting the aircraft, is more effective than an equivalent fragmentation warhead the ring's effectiveness decreasing as $1/R$, rather than $1/R^2$ for fragments.

Portions of the aircraft intercepted by the expanding ring of the continuous rod warhead will receive a continuous cut through the skin, light structure, underlying cables, hydraulic lines, and other plumbing if present. This may cause a structural failure, or, if not, can be sufficient for

defeating the redundancy of aircraft systems. The effect is only pronounced as long as the ring is unbroken, so multiple layers of rods are employed in practical weapons to increase the effective radius.

Now when the R-73's warhead would have exploded and expanded 'outwards' 'towards' the front at over 1000 m/s, the closing speed of over 3500 kmph would have ensured that the F-16 itself would be coming towards the explosion at 972 m/s. So if we assume that the proximity fuse would have initiated the explosion in frontal quarters at around 300m, there would hardly be any time between the effect of the explosion taking shape, expanding the flame and shrapnel at high velocity outwards and the closing in F-16 to absorb the explosion effectively. What that means is that most of the frontal section of the F-16 would have flown in through the expanding shockwave, with damage mostly limited due to shrapnel, rather than the explosive effect.

Hence the pilot would have survived the heat and flame effects of the explosion, but would have in all probability been effected by the shrapnel effect of the explosion, grievously injuring his upper body, with the flying helmet preventing fatal injuries, but not able to prevent rampant injuries to the face, neck and chest level.

In contrast, the AMRAAM hit on Abhinandan's MiG-21 was from right 7 o' clock position, mostly damaging the rear portion of the MiG-21, as is visible during the post-crash analysis of the wreckage.

Hence when the PAF F-16 pilot ejected, he would in all probability have been injured in the upper torso and facial region. He may or may not have been conscious due to his injuries. After his landing in Sabzkot, the POK civilians may not have found the classic traces of PAF flight overalls and livery/ patches, which would have in all probability been ripped off due to the high velocity shrapnel and may not have displayed any name indicating he was a Pakistani because of bloodied appearance. They would not have recognised him as a PAF pilot and assessing from the Indian coloured parachute would have mobbed him like Abhinandan, before being handed over to the NLI soldiers injured, and battered.

Though circumstantial, this relevant evidence proves that a Pakistani pilot was apprehended and injured by a mob after landing and would later have been taken

to a Military hospital where he may have succumbed to his injuries as claimed by the ISPR.

Interestingly, post the aerial melee over South Western J&K on 27 February, the Pakistani Foreign Minister on 6 March spoke in the parliament about two PAF pilots who had shot down IAF aircraft. These pilots were Squadron Leader Hassan Siddiqui and Wing Commander Nauman Ali Khan. His statement needs to be analysed objectively for the message it conveys. The FM said when interacting with the other members, "One clarification—Bilawal paid tribute to Hassan Siddiqui as he's absolutely a national hero, But I would like to clarify that two Indian planes were shot down. The other one was shot down by Wg Cdr Nauman Ali Khan," he added, asking that "the second pilot also be given due credit."

Why did Bilal Bhutto and other parliamentarians praise the younger SqN Ldr Hassan Siddiqui? Why was his heroism more significant than Nauman Ali Khan? Why in the first week of March 2019 did the PAF chief urgently visit all PAF bases, particularly those housing the F-16 squadrons? While Wing Commander Nauman Ali Khan was seen being congratulated by the PAF chief, Air Marshal Mujahid Anwar Khan in a recent PAF video, why has there been no photo or video released of SqN Ldr Hassan Siddiqui post the aerial engagement?

There is an interesting story of Pak TV channels rushing to Hassan Siddiqui's parental house in Karachi on 27 February, who spoke to his friends and neighbours. However, after that there is complete radio silence on his status. It is my belief that Squadron Leader Hassan Siddiqui may be the pilot who was shot down by Wing Commander Abhinandan on 27 February. The fact that his heroism is widely recognised by the Pak parliament and ISPR is covering his presence with fake information, strengthens my theory. Even if I am wrong, the fact of the matter is that a nameless PAF F-16 fighter pilot has sacrificed his life for Pakistan.

While any independent viewpoint on the subject is worth a discussion the IAF will need to watch out for articles based on false claims and twisted data, such as the recent Foreign Policy media piece by Lara Seligman. Ms Seligman claimed in her post that two US government sources has confirmed to her that 'no' F-16s had been lost by the PAF, based on a head count of



PAF chief personally congratulating Wg Cdr Nauman Ali Khan for shooting down an IAF MiG-21

all Pakistani F-16s by the USG as part of the end user compliances post 27 February.

The FP piece created a furore in Indian media circles because of the damning information it contained. While the IAF countered this by showing crystal clear proof in the form of the electronic signatures and call intercepts in its possession on the subject, Indian agencies were clearly seeing the hand of ISPR in this unwarranted spin to the MiG-21 vs F-16 air combat on 27 February 2019. 🐦

For the record : a US Government spokesman later denied any such F-16 count having taken place at all.



PAF F-16B of No. 11 Squadron (Arrow)

According to open sources, the Pakistan Air Force currently has some 85 F-16s in service, including 66 earlier Block A & Bs plus 19 new Block C & Ds. These include 13 F-16s which were earlier in service with the Royal Jordanian Air Force and which are of the same F-16A/ B Block-15 variant already in service with the PAF.

Some initial reports had it that the PAF F-16s involved during the 27 February action included a twin-seat aircraft, which was the one reportedly shot down that morning. Hand held mobile videos taken then showed two parachutes descending which would have been the pilots of the F-16 two-seater.

While much remains speculative, the well regarded international magazine *Air Forces Monthly* has published the following in its brief analyses 'Air War over Kashmir'.

Amid the confusion, it remains possible that two fighters in total were downed – one each from the IAF and PAF. According to a spokesman from the Indian Ministry of External Affairs, one PAF aircraft was shot down during attacks on installations on the Indian side of Kashmir, the wreckage falling across the LoC in Pakistan-occupied Jammu and Kashmir. The Indian MoD claimed that a two-seat PAF F-16B was downed by a Bison using an R-73 air-to-air missile. Both crew members were reported as having ejected. However, Pakistan denies losing any aircraft.

The F-16 vs MiG-21bison imbroglio



Air Marshal Harish Masand queries why there are More Questions than Answers

An analysis of the much-reported air combat between the IAF and PAF on 27 February as a fall-out of the Balakot strike the previous morning, has thrown up a number of theories, conjectures and scenarios particularly with regard to the brief but sharp dogfight between an F-16 against a vintage although upgraded, MiG-21 Bison. Claims and counter-claims have flown thick and fast, perhaps as thick and fast as a modern day aerial engagement between high-speed jets in some numbers.

Very little has been confirmed by the officials concerned on both sides, except for the claim of an F-16 shot down by the IAF as per India's Defence Minister, Ms Sitharaman at a Conclave on 12 March. From the Pakistan side, Prime Minister Imran Khan initially claimed two Indian aircraft as shot down, with two pilots in their captivity. Shortly this turned out to be just one aircraft and one pilot, the newest "hero" of India, Wing Commander Abhinandan Varthaman whose capture and interrogation were soon flashed on social media and TV.

Thereafter, no further information emerged from Pakistan on its claim of the second IAF aircraft and the mysterious second pilot. However, just as I was writing this, I received pictures of some damaged but unfired missiles reportedly carried on Abhinandan's aircraft, as put out by

Pakistani sources. From the Indian side, little has been in public domain, except for the early display of an AIM-120C-S AMRAAM which can only be fired from the F-16, thus confirming the use of this type in this engagement but little to confirm any downing of any F-16.



PAF F-16 of No.9 Squadron ('Griffins')

Finance Minister Arun Jaitley reiterated the claim and chase of the F-16 some days later in an interview on CNN News 18 and supported this with the story about a retired PAF Air Marshal's son being that F-16 pilot, something earlier negated on social media. However, Mr Jaitley rightly commented on the issue of "space-filler" information versus "scientific evidence" while stating that "our intelligence and imagery cannot be put out in public domain for obvious reasons". However, in my opinion, that should not prevent us from going ahead to confirm such an important claim with some hard facts which do not compromise national security.

To be sure, this was the first such air combat between the two air forces since the 1971 war, over 47 years earlier. Thus, this engagement was bound to generate much interest and comment worldwide, to push home pet theories, glorify one side or denounce the other but very few to genuinely derive some important lessons. The first western report on 3 March had raised doubts on the efficacy of India's vintage fighters, perhaps erroneously criticising the use of MiG-21s in this encounter (www.nytimes) while a later one by Joseph Trevithick actually rubbished claims of the MiG-21 Bison shooting down the Pakistani F-16, in some pretty strong language. However, the latter article then reluctantly listed some attributes of the upgraded MiG-21, the Bison, and summarised its 4th generation capabilities in avionics and weapons after the upgrade, including the R-77 BVR & R-73 close combat missiles, the helmet mounted sight and, most importantly, in the modern air battle with both sides having a BVR capability, the carriage of self-protection electronic warfare systems in this case the Israeli ELTA 8222. Such capabilities give the MiG-21 Bison the ability to take on more modern aircraft including the F-15 Eagle, as demonstrated during various *Cope India* exercises with the USAF, particularly when operated in a numerically stronger package with some support from more advanced aircraft like the Su-30, Mirage2000 and MiG-29 in the IAF's inventory.

However, while admitting such capabilities of the MiG-21 Bison, the writer does question the absence of hard facts supporting our claim of the F-16. Certainly, this was not a one-on-one fight



Large numbers of the Sukhoi Su-30MKI equip the Indian Air Force, this 'air dominance' fighter having long range capability and carrying several BVR air-to-air missiles including the Vypel NPO R-77 missile (export designation RVV-AE) missile seen above



between the two aircraft so the question is not about which aircraft is superior but which air force used its resources in more effective manner.

Be that as it may, the loss of one of our MiG-21 Bison in this encounter raises certain questions. Quite obviously, even reasonably knowledgeable outsiders cannot answer these questions without full information on the manner in which this air combat took place. Again, very obviously, we should not even expect such full information from either of the air forces. However, it is hoped that these issues or questions have been addressed by the IAF in order to draw the right lessons for the future.

Having carried out the pre-emptive strike at Balakot predawn on 26 February (see *Vayu Issue II/2019*) it must be assumed that the IAF was fully prepared for any retaliatory action by the PAF. Thereafter, the first question obviously is whether we used adequate numbers of MiG-21 Bisons with a mix of the other more modern 4th generation fighters like the Su-30MKI and MiG-29 to ensure requisite numerical and qualitative superiority on the intruding force to not just deter but shoot down maximum number of enemy aircraft. Just imagine the situation thereon if we had paraded 8 or more Pakistani pilots in our captivity as against one of ours! Some reports suggest that while the Pakistanis had a posse of



220 numbers of the MiG-21bis (Type 75) were received by the IAF, bulk of which were produced by HAL at Nasik, the last being delivered in March 1987. 125 of these were extensively upgraded to the 'Bison' standard, with first flight taking place in 2000 and subsequently equipping six fighter squadrons of the IAF

between 18-24 fighters (of various types), we launched just 6 MiG-21s with some 4 Su-30s on air dominance patrol. Surely with our air defence systems on full alert, we could have launched a far larger number of fighters to overwhelm the intruders.

Since an AMRAAM BVR missile reportedly shot down the MiG-21 fired from an F-16, the second question arises on whether Wing Commander Abhinandan's aircraft was carrying the ELTA EW pod to thwart such a missile attack. If indeed it did carry such a pod, did the pod fail to function or is it inadequate to counter the threats of today? A capable EW and counter-measure systems are absolutely critical elements for a fighter aircraft in air engagement in today's environment. But a related issue concerns the limited number of hard points on the MiG-21 which carry fuel, weapons or other stores such as this EW pod. An internal EW system, therefore, would have made eminent sense so as to release external hard points for extra fuel or various ordnance. As Director of the MiG-21 Bis Upgrade project till contract signing in 1996, I had continuously tried for such an internal EW system but for reasons beyond my control, the IAF settled for an external EW pod which lost the IAF a precious external station (or 25% of the capacity). However, that is another story for another time.

Nevertheless, it does need to be emphasised that if we had an internal EW system on the Bison, even the possibility of the pod not being carried in this engagement would not have arisen.

Another issue worth consideration introspectively is on the relative positioning and presence of other aircraft

in this interceptor group. Where were other formation members when Wing Commander Abhinandan was engaging or chasing the F-16 and what did they do and observe? Surely, the transmission calls between them and from/to the situation controller would substantiate our claim of downing the F-16? Also, if the MiG-21 was shot down immediately after the F-16, surely the F-16 wreckage should also be close to where the MiG-21 came down to earth, just a few kilometers across the LoC. If that be so, why is it that we have not been able to acquire the imagery of that crash site? Also, why did Abhinandan not launch the longer range R-77 BVR missile instead of choosing to chase the F-16 for an R-73 CCM launch, as has been reported. It is emphasised that training in the IAF teaches us that a good fighter pilot never leaves a formation member behind and even stays with the downed teammate till he is rescued, fuel and other conditions permitting. So, did Abhinandan's other formation members not stay with him, at least till his MiG-21 was shot at and could they not have collectively threatened the attacking aircraft?

Certainly, the IAF must have closely analysed these issues based on the facts known only to them but hopefully someday, one will hear the whole story, even in a box-office movie, without politicisation of this entire episode! 🇮🇳



IAF MiG-21Bison with both R-77 BVR and R-73 CCM missiles seen underwing

Lt Gen Kamal Davar urges

The Sharpening of our Defence Intelligence

India is located in one of the most geo-politically stressed and violent expanses in the world, with two adversaries in its neighbourhood having collusive convergence to deter India from its trajectory of economic growth and a peaceful, secure existence. The challenges India thus faces are diverse in their magnitude and unfortunately, on the ascendant.

India's strategic domain spans a vast geographical realm from the Straits of Malacca in India's east to the Gulf of Aden in the west, running southwards along the eastern African coastline and down to the southern reaches of the Indian Ocean. In addition, the Asia-Pacific region, now being referred to as the Indo-Pacific also impacts our security calculus. India's land borders are more than 15,000 kms and these borders are shared with seven nations, being China, Bangladesh, Nepal, Myanmar, Bhutan, Sri Lanka and Pakistan. In addition, India has a coastline which is 7,683 kms long and around its 1197 islands, India has an exclusive economic zone that is over 2 million sq km in size. India also has to be alive to both overt and covert threats in the immediate neighbourhood and adjoining regions.

The Indian Armed Forces have not only to be well up on credible and traditional military threats from an adversarial Pakistan and China but also aware of the diverse internal security challenges existing in the country. Terrorism, which has emerged as the major scourge of these times, is sponsored, aided and abetted by Pakistan in J&K and other parts of India. It has to be dealt with firmly as the terror attacks have become frequent. The security situation existing in the North-East region, in J&K and even in the Naxal-affected region in India's hinterland calls for hard, actionable and a seamless flow of intelligence to the armed forces. Not only are the armed forces required to be self-sufficient in intelligence inputs they also have to establish adequate linkages and coordination with the civil intelligence agencies including the local police set-ups for obtaining information for operational actions.

Significance of Intelligence

The art and science of intelligence is the first line of defence for any nation and has been, unquestionably, a vital ingredient of statecraft down the ages.



Notwithstanding significance of the truism that “being forewarned is being forearmed”, the criticality of intelligence generally comes to the fore only when there is a major military lapse, a terrorist strike or any other cataclysmic event which causes devastating damage to the nation.

Since independence, India has been combating numerous challenges, both internal and external, has progressively

augmented and streamlined its intelligence institutions, added teeth to their capabilities and prowess. The Indian Armed Forces, mandated to defend the nation, have their responsibilities cut out, remaining aware of the myriad and emerging threats to the nation and ensuring victory over adversaries. Such outcomes are only possible if the armed forces have the intrinsic capabilities to speedily and seamlessly acquire, collate,



South Block, in New Delhi, headquarters of the Indian Army, MoD, PMO and IDS

analyse and disseminate optimal intelligence inputs that would help military decisions at the strategic, operational and tactical levels.

In India, intelligence as a constituent of statecraft has been known to be in existence since the Maurya Empire with the legendary master strategist, Chanakya, expounding his views on this strategic requirement. The roots of the Indian intelligence structure as existing today, lay in the British intelligence organisation in India of the late 19th Century. After independence, the Central Intelligence Bureau that oversaw all intelligence activities was re-organised into the Intelligence Bureau (IB). Subsequently, vast changes have been effected and newer intelligence organisations established.

Today there are as many as 14 intelligence agencies in India, the result of many intelligence reforms committees that came up after the 1962, 1965 wars and Kargil 1999 operations. The IB, in its initial years, looked after both internal and external intelligence and in the early 1950s, also set up the Subsidiary Intelligence Bureau



Aircraft of the ARC, reporting to the Cabinet Secretariat

(SIB) at the state level particularly for helping counter-insurgency operations in the North-East. After the 1962 conflict with China, the need was felt for to creating capabilities for electronic intelligence (ELINT) and imagery from aerial based platforms in airspace. Thus, under the Directorate General of Security (DGS), the Aviation Research Centre (ARC) was created and initially placed under control of the IB. In September 1968, the then PM, Indira Gandhi, ordered the establishment of an intelligence agency exclusively for external intelligence to be called the Research and Analysis Wing (R&AW). The DGS and ARC were put under the R&AW which itself was put under the Prime Minister's Office as part of the Cabinet Secretariat.

Kargil Review Committee (KRC)

The KRC was set up in aftermath of the Kargil Conflict in 1999 in which glaring deficiencies were detected in regard to the nation's intelligence agencies including the military intelligence. The KRC conducted an in-depth analysis of the higher defence management (HDM) as prevalent at that time and suggested many improvements. Since large scale intrusions by Pakistan Army personnel along the Kargil heights were later on attributed to lack of intelligence across the board, the KRC proffered some sound suggestions for streamlining the intelligence set-up in the country including Intelligence inputs for the armed forces.

The KRC had succinctly observed that "..... the resources made available to the Defence Services are not commensurate with the responsibility assigned to them. There are two lines of intelligence collection and reporting with a rational division of functions, responsibilities and areas of specialisation..... Indian intelligence structure is flawed since there is little back-up or redundancy to rectify failures and

Directorate General of Military Intelligence (DGMI) and other Service Intelligence Directorates (SIDs)

India's military intelligence set-up was established in 1941 and initially tasked to generate field intelligence for the Indian Army. Its original geographical mandate was to operate sources up to 50 kms from the international border/line of control. The DGMI was tasked with generating specific intelligence for small-scale operations and counterterrorism responsibilities in the North-East and J&K. However, for bulk of its intelligence requirements, the army has largely depended upon the R&AW and the IB. The Indian Navy and the Indian Air Force have their own service-specific intelligence directorates which have been augmented over the years with additional capabilities.

shortcomings in intelligence collection and reporting."

Based on the recommendations of the KRC, duly vetted by the high powered Group of Ministers (GOM), four Task Forces were set up to carry out an in-depth analysis of the entire gamut of national security. The Task Force on Intelligence's recommendations were approved by the then Vajpayee government and orders were issued for the raising of the Defence Intelligence Agency (DIA) and the technical intelligence acquisition agency called the National Technical Facilities Organisation, later renamed as the National Technical Research Organisation (NTRO).

Defence Intelligence Agency

The DIA was established in March 2002, again based on the recommendations of the KRC and the GOM Report. The primary role mandated for it has been to "coordinate the functioning of different services intelligence directorates." It was created to ensure better integration of the intelligence collected by the three service directorates and also to serve as the principal military intelligence agency for collecting, analysing and disseminating all defence-related information. Weaknesses existing in intelligence acquisition, analysis and interpretation, as also in the speedy dissemination of inputs to the three services, are being rectified by the DIA.

The DIA controls the strategic intelligence assets of the services namely the Signals Intelligence Directorate and also the Defence Image Processing and Analysis Centre (DIPAC) for imagery intelligence.

Additionally, it also coordinates the functioning of all military attaches posted in various diplomatic missions abroad. The DG DIA is the principal military intelligence advisor to the Raksha Mantri and to the Chairman Chiefs of Staff Committee (COSC). This role will be extended to the Chief of Defence Staff as and when this post is created.

TECHINT : surmounting technological obsolescence

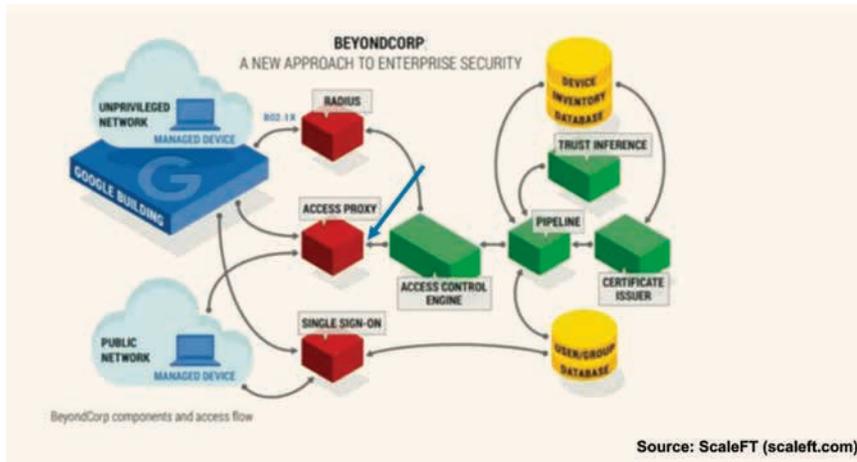
One of the major aids for intelligence gathering in today's world is TECHINT which encompasses signals, electronic, aerial and spatial (imagery) and cyber intelligence among other emerging TECHINT innovations. As a result of the recommendations of the KRC, the Technical Coordination Group (TCG) which incorporates both military and civilian technical intelligence gathering agencies has instituted measures to overcome technological obsolescence and avoid wasteful expenditure due to duplication of equipment. Better coordination and seamless sharing of inputs between the DIA, NTRO and the ARC is extremely important. Streamlining of certain TECHINT roles is also required as there exists some overlapping and duplication in both COMINT and IMINT of the NTRO, ARC and DIA. It is a considered opinion among intelligence experts that currently the NTRO had too much on its plate and that it might be prudent to take out cyberspace activities for being allotted to another new set-up.



From the Internet

Cyber security architecture

Cyberspace is now as relevant a strategic domain as the other domains of land, air, sea and space. India is becoming increasingly exposed to hostile cyber-attacks that can cause electronic paralysis and telling damage to critical infrastructure like aviation control and compromise the integrity of India's digital networks and data banks. India's Armed Forces have to be geared to fight future wars in cyberspace as the internet is getting overly weaponised. China's prowess in information warfare is giving the jitters even to the US. India is an obvious target for China.



The criticality of both offensive and defensive operations in cyberspace will become more pronounced with the passage of time. India needs both a national cyber security strategy and importantly a National Cyber Security Agency. The armed forces, since some years, have been requesting the government for an Inter Services Cyber Command to prepare for future battles in the cyberspace.

Maritime Domain Awareness

The Indian Navy and the Coast Guard had been living with inadequate intelligence inputs in the maritime domain - a deficiency which came to the fore during the Mumbai terror attacks in 2008. Major restructuring for maritime intelligence was undertaken with the establishment of the National Maritime Domain Awareness (NDMA) and the National Command Control Communication Intelligence (NC3II) network. This led to the setting up of the Information Management and Analysis Centre (IMAC) which is connected to coastal radar stations and India's maritime peripheries and this has augmented Indian Navy and Coast Guard's maritime awareness. The DIA with its TECHINT resources would be further enhancing this awareness.

Strengthening Defence Intelligence

Right since independence, it was strongly felt that the intelligence needs of the armed forces may not be adequately met by the civil intelligence agencies. This void in intelligence coverage was amply highlighted during the Kargil Conflict in 1999 and was, therefore, analysed in-



The Indian Navy's Dornier 228s are filled out with advanced ELINT systems

depth by the KRC and examined by the GOM - whose report was accepted by the GOI. The DIA was thereafter established to coordinate the overall functioning of the SIDs (Signal Intelligence Directorates) and provide strategic intelligence inputs for national security planners besides furnishing intelligence to the three Services. Having

shared real time with the DIA/ NSC. The DIA will have to build up its HUMINT capabilities abroad as well and R&AW and DIA should share all intelligence acquired by themselves abroad with sincerity and despatch.

India must employ, and optimally utilise, its knowledgeable and articulate

of suitable armed forces senior officers for this role is a good idea.

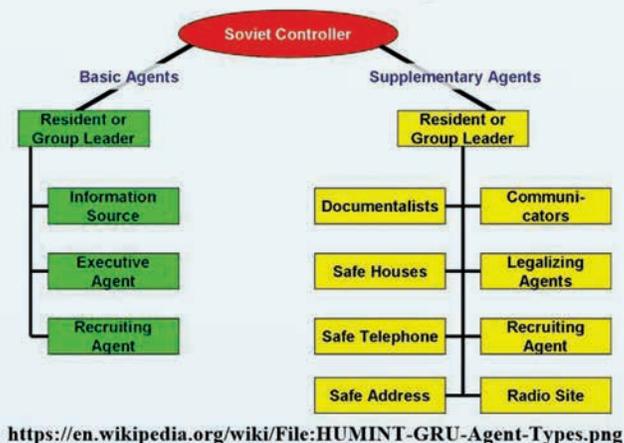
To improve the effectiveness of the military intelligence apparatus, creation of a Defence Intelligence Corps is recommended, with personnel from the three services, who are then suitably trained in the myriad skills of intelligence, namely cyber warfare, intelligence acquisition skills, espionage tradecraft, counter-insurgency operations, overt and covert intelligence operations and also in linguistic skills specially for South Asian languages.

The DIA must make further efforts to have a far larger number of its personnel well versed in various Asian languages like Mandarin, Pashtu, Dari, Sinhalese, Burmese, Uzbeki, Persian etc. The Army Education Corps personnel should be trained in at least one Asian language.

The Military Intelligence School, Pune should be suitably upgraded to becoming a Defence Intelligence School/Academy. Necessary skills should be imparted there in the art and science of intelligence including expertise sought and cooperation solicited with intelligence experts from other friendly nations.

As far as the accretion in TECHINT expertise is concerned, far better coordination is required between the DIA's strategic intelligence assets and the NTRO to avoid expensive duplication. The GOI could order a review to streamline India's TECHINT acquisition capabilities for cost- effectiveness and alignment with the emerging technological threats from India's adversaries. 🦋

Clandestine HUMINT asset recruiting



functioned now for 17 years, DIA is in need of a further review in terms of allocations for its chartered roles and methods to improve its overall functioning.

It is clear that much more needs to be done by the government, MOD and importantly the services headquarters themselves to ensure that the DIA can meet its chartered responsibilities, which, in some areas of intelligence endeavours, has arguably remained under-utilised.

As the premier coordinating intelligence agency for the three Services, the DIA will be able to carry out its chartered role when the SIDs are placed under its command and control. The DIA must be made the single-point contact for the government on all aspects of defence related intelligence. The loose arrangement that exists between the DIA and the SIDs is unsatisfactory and unworkable. The mandate and the charter of the DIA may be legislated by an Act of Parliament. Importantly, the charter for all defence/military related external intelligence acquisition should be handed over to the DIA and all others collecting defence related intelligence : whatever they pick up while acquiring external intelligence, must be

armed forces officers in defence diplomacy to further the nation's diplomatic endeavours in the region and all across the globe. Many governments in the world are military/quasimilitary and these will naturally feel comfortable in dealing with the uniformed community even for diplomacy. Utilisation



Note : all images are for representation purposes only

White Hope or Red Herring ?

Prof Prodyut Das on 'Appropriate Technology Regional Transport Aircraft'



Unlike the design of military aircraft which is led by the “latest” (even if unproven) technology, the design of a successful civil aircraft is more hard headed; it is very closely defined by alternate surface transport speeds, availability, the density of population, distance between population nodules, condition of the economy, connectivity between the airport and the city centre and so on. These factors are quantifiable. The other factors, such as expectations in terms of punctuality, regularity, tolerance to noise, comfort and economy and their relative priorities go beyond statistics and slip into the realms of culture and philosophy. If the ‘East is East’ then its air transport options should also be ‘Eastern’!

However, the air transport scene has, for a century, been dominated by the Western paradigm. Asian countries have used

western equipment to solve part of their air transport needs, there being no ‘perfect’ equipment to provide an end-to-end transport solution and V/STOL aircraft, for instance, are infeasible to the point of being ‘exotic’. Western designs, whilst acceptable, are definitely sub optimal and in fact an imposition on Asian conditions.

The India of the 21st century is evolving, with changing economic conditions now opening up new opportunities. This is becoming a ‘new’ rather than a ‘competition’ area and the prospect of collaboration with the West does make commercial sense. New aircraft designs will be needed not only to meet the expected growth of what the Soviets called the *Selskoe Khozaistanni* (Rural Economy) but also to replace the present genre of Western-origin aircraft which would soon enough be phased out. The market is massive !

Such an emergent market can also be an opportunity for foreign entrepreneurs to invest in India. The cost of skilled labour is the single largest factor in development and production of aircraft. The technology of civil aircraft is considered “lower”, indeed the basic technology is almost a century old and well within the existing capability of India’s Industry, which however still lacks some ‘know why’ of certain aspects. In the mid-20th century, Europe had one or more aircraft manufacturer for every letter of the alphabet, from Avro to Zlin ! However, famous names slowly began to disappear as the cost of aircraft development became prohibitive for most medium and small scale enterprises of Europe. However the ‘seeds’ of that genius still exist. The ‘natural’ Indian enterprise and low labour costs plus exchange rates of the Rupee, together with Western aviation know how would spur

investments to ‘multiply’ in effect, ... the future is exciting!

Whether such potential can be realised will depend on the way the Government of India’s policies evolve. There has been some positive change in recent times but still much remains to do, as has so far been done. Since Independence, India’s political leaders followed policies on strategic industries (weaponry and aviation), that were akin to those of ‘a colonial power’! Just as the then Imperial Government did not allow Lala Walchand to set up his aircraft company on Imperial territory, the blinkered Industrial Policy of 1956 forbade the manufacture of aircraft by India’s private sector.

At the end of World War II, many leading German aircraft companies including Dornier and Messerschmitt moved to Spain and Argentina as the Allied Control Commission forbade the design or manufacture of aircraft in Germany. The vision of Nehru and Nasser resulted in German involvement respectively in the HF-24 and HA-300 fighter programmes. However, India’s ‘liberalisation’ era which began in the early 1990s, sidestepped the aviation sector. So recently, when one of India’s leading industrial houses wanted to enter the light aircraft sector, they found a better opportunity to start in Australia – and Australia is hardly the best example of a nurturing Government in this arena.

Evolution of Civil Aviation

The foundations of today’s civil aviation industry are based on the development of strategic, intercontinental jet bombers following World War II. Amusingly, such technology proved quite amenable transportation of tycoons and the glitterati who previously had voyaged on luxury ocean-going ships, either Cunard or P&O! Whilst the laws of physics restricted aircraft maximum speed to Mach 0.82, advances in engine technology then tempted designers to move into the mass transportation market, thus changing the entire concept of air travel from the earlier one of ‘speed and grace’ (passengers were even gifted overnight bags on booking their flight) to becoming today’s ‘max pax’, airliners with cramped cabins.

A strange paradox has thus unfolded : the early ‘inefficient’ jetliners were profitable enough whereas the latest ones with incredible fuel efficiency, regularly result in many airlines going ‘belly up’. Fuel prices

have been identified as the main reason for unprofitability but the underlying reason is actually that the earlier specifications are being used as ‘template’ for the mass transportation market. An undeniable truth is that fuel burn is exceedingly sensitive to speed. A fifteen percent increase in speed requires fifty percent more power and burns thirty percent more fuel over the same sector. Are airliners for the mass transportation market actually flying a *little* too fast to be profitable? In the West, there is little choice because of the ground conditions but in Asia, we can certainly dare to be different.

The Indian Paradigm

The population density in India is fifteen times that of the USA, with population nodules being relatively close. Agricultural

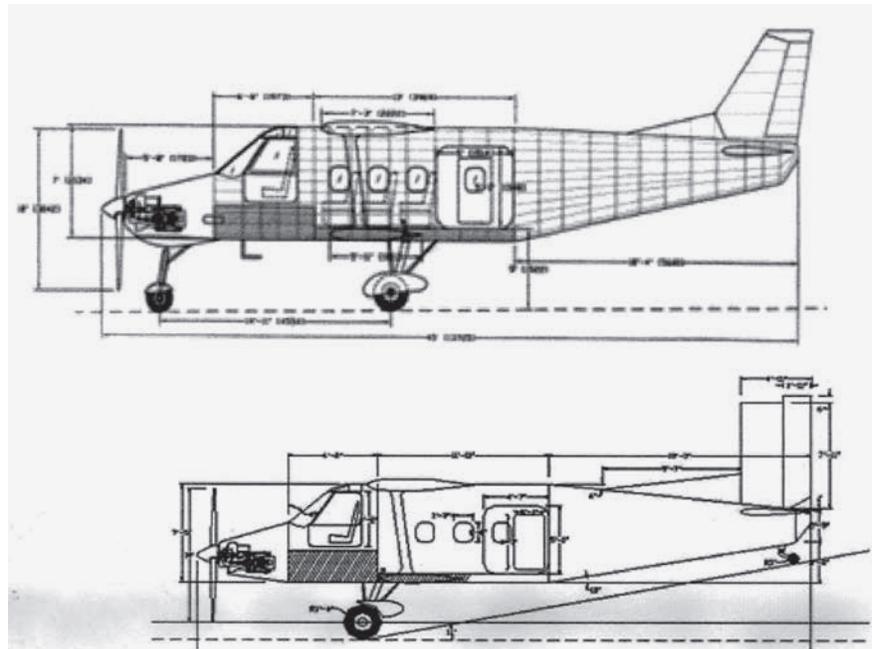


land is at “to die for” premium rates and all new industry perforce must go to areas still considered “remote”. Consider the case of a traveler who wishes to go from

Kolkata to Mokukchung. Mokukchung has a population of about 70,000 and has several excellent schools, the people are highly educated, with a fair population of english-speaking, industrially-trainable people. The hinterland of Nagaland grows excellent pineapples which can literally be had for the asking, because there is no local market! If air transported to Kolkata, a load of say thousand pineapples (1500 kilos, with their tops) can well transform the village. But, nothing much happens in Mokukchung because of the difficulty of getting to or getting from there.

If one uses a turboprop airliner, which takes an hour more than a jet does (but reduces the time by, say, 15 minutes), it does not really matter because once at Kohima, one would take surface transport for the ‘last mile’ anyway! Mokukchung is about 90 kilometers from Kohima which can take rest of the day. Our traveler would have been better served if there was a modern equivalent of the Ford Model AT 5 *Tin Goose* which would have wallowed directly into Mokukchung from Kolkata within the time our traveler had even exited Kohima airport.

I am deliberately being provocative in suggesting the Ford Model AT 5 because I want to emphasise how little is really needed – especially in terms of speed performance – to be cost effective in our sub-continental arenan (see self drawing).



Concept Studies: Mixed Freight Passenger Multipurpose Utility Aircraft
(Figure 1)

Cost of the ticket



Edward Hillman, the owner of a bus fleet in 1932, was also a pioneer of the low cost airline. He started by using the De Havilland Fox Moth (above) which carried four passengers plus a pilot at the astonishing economy of 22kW per person. The Fox Moths operated from virtual open fields and being simple, required little maintenance. Hillman engaged retired RAF Sergeant Pilots who flew for lower pay than did the Officers. As happens in cases of



detailed attention to every aspect of operations, Hillman went from strength to strength and was soon looking for bigger equipment and was in part responsible for development of the twin engine DH Dragon and the Dragon Rapide (below). Mr. Hillman may have lacked much of a formal education but he translated his bus fleet experience to low cost air services and the aircraft he chose did not overwhelm him with their technology. Instinctively but unerringly, he was tackling and controlling the elements of the cost of an air ticket.

These factors remain today and are the cost of an aircraft; cost of amortisation and financing; fuel bill; airport charges; wages of the crew; cost of maintenance; cost of sales, marketing and passenger handling.

These factors are as relevant and significant in shaping the design of our Asian Regional Airliner, a relatively simple aircraft, flying at two hundred knots (360 km.p.h) to be considered, with the probability of significant savings in each of the above areas, resulting in virtually halving the costs of development.

The 'price' of speed

The optimum cruising speed of such an aircraft is dictated by that of surface transport, with a rule-of-thumb calculation giving us five to six times the average surface speed (including *chai* breaks) for a journey. My experience in shuttling between Baroda and Nashik – and similar city pairs – gave me a ground speed of 50 km.p.h. Thus to be competitive, the aircraft *cruising* speed must be between 250 and 300 km.p.h. In the lands of autobahns and freeways, that would be closer to 500 and 600 km.ph. The sky will not fall if a 550 km.p.h aircraft is operated on the Baroda-Nashik sector but it will be burning four times more fuel. The circumventing trick of course is to fly at higher altitude but then the aircraft will need pressurisation, which results in increased weight (the fuselage becomes a *large* pressure vessel, which is the worst in terms of weight) and then there are maintenance problems, seals, barometric units and so on. All this is manageable but the idea of a simple large turbine-engined Dakota concept of an aircraft is lost and puts up the costs on Mr Hillman's list. An interesting fallout is that optimum 'low speed' shapes are more 'blunt' and compact which leads to significant weight savings for the same 'cargo/pax' volume, exemplified by the Dornier 228, designed by Munich-based engineers and continuously since produced by Kanpur-based technicians (*more or this anon*).

The airports

Much of India has many landing strips, largely a legacy of WW2, with West Bengal and Assam literally having scores of them. The Government has initiated a programme to update and upgrade some of these airfields. It would be wise not to rely on such plans, but better to carry out a survey of all the airstrips in the country to assess where matters stand. I am reminded of Ed Heinmann's approach to the US Navy's request for proposals for a nuclear-weapons capable bomber for their planned 100,000-ton super carrier to replace the *Forrestal*-class. Heinmann chose to examine what could best be done within the limitations of the *Forrestal*-class and came up with the iconic Douglas A-4 Skyhawk. As foreseen by Heinmann, those super carriers never came about and the USN learned that whilst the customer has the privilege of always being right, they lose nothing by listening to another person's point of view.

STOL is KING



STOL fairly complements max cruising speeds. The West has produced some remarkable STOL aircraft in the mid-20th century, beginning with the Fiesler Storch and the Westland Lysander. Post war, Dornier produced the Do 27 and the Do 28 Skyservant (above) which were particularly noted for their STOL performance, as was the Polish PZL Wilga. The Hunting Scottish Aviation Twin Pioneer is also interesting because, despite heavy radial engines, it could lift 16 fully equipped troops off a ground run of 80 metres from jungles strips in Borneo and the hills of Nepal. In India where even expansion of existing airstrips may run into local agitations, we should look at STOL capabilities very seriously.

The Fairey Rotodyne of the 1950s (below) gave VTOL capability to airliner sized (40-70 pax) machines and was simpler than the present Osprey whose civil version is yet to be marketed. The Rotodyne project needs a re-look at, as noise is less critical in Asia and collaboration or even purchase of its data could be well examined.



Actually, Western aircraft designs have come with relatively narrow cabins so as to reduce drag and as a result, these designs have a tendency to “cube out” i.e they can lift the load but which cannot be fitted inside the cabin. India being an agricultural country and with increasing stress on ‘exotic fruits and flowers’ type of agriculture, *not* cubing out may become a significant selling point.

“Is naething sacred” ?

Decades ago, a Japanese liquor company applied modern analytical methods, including allegedly gas chromatography, to analyse Scotch whisky and come up with a Japanese equivalent, indistinguishable from “the real stuff.” *The Scotsman* printed such news with a very plaintive “Is naethin’ sacred”?

No, nothing is sacred in the matter of strategic technology development, and the way it is marketed. One must review certification norms for Asian conditions. Are the existing US/European civil aircraft certification agencies being scrupulously – and impartially – fair ? Or are there various hidden agendas ? Consider the following:

- ◆ In the late ‘sixties, there was a huge “to do” on the HAL-built Avro’s inability to meet phase II of the climb out requirements. That this requirement is a safety issue is indisputable. Given India’s high ambient temperatures, that the engine’s power and the wings lift both suffer by about 7%, is also indisputable. However, this resulted in pressure to reduce the MTOW of the Avro 748 which then had direct impact on profitability of the type. I can understand that in Switzerland that requirement would be absolute considering the terrain. But in India? Could not the restrictions have been applied only to select airports, say in mountainous areas ? Or was this an effort to open the market for imported types (also given HAL prices ?).
- ◆ Western regulations have for long insisted on twin engines for any aircraft carrying more than nine passengers and we have nodded in synch. Statistics however show that there were more fatalities when twins lost an engine because the pilot, under stress, often feathered the *surviving* engine and the aircraft then went in! They say more Canberra crews died *practicing* engine out approaches than during actual engine out emergencies.

It is interesting to compare the Russian experience with their Antonov An-2 biplanes. The DOSAAF would allow the single-engined An-2 to amble off with a crew of two plus two jump masters and ten parachutists, each with two parachute packs plus the odd ‘observers’, which was a load equivalent of perhaps 18 passengers. So were the Russians being callous in terms of air safety ? The possible logic is that the An-2 had a controllable minimum speed of 45 kts and so when lost in fog in mountainous terrain, the SOP was just to fly at minimum speed as the impact energy of an An-2 crash was less than half that of Western types ! Secondly the very capacious fuselage of the An-2 meant that getting out was quick and, lastly, Russia being sparsely populated and



Avro (HS/BAe) 748



Antonov An-2

The Junkers Ju-52 and the Curtiss C-46 Commando were worthy contemporaries and need more study. The Ju-52's demise can be attributed to the German collapse and the consequent lack of spares. The C-46's relative obscurity underlines the need to study the needs of each customer closely. The C-46 carried sixty percent more at fifteen percent higher speed than the C-47 but required eighty percent more power (note this well !) but had only fifty percent more fuel : *the design's capabilities was less "harmonised"*.

The C-46 initially also had a reliability problem. The lack of wing fuel tank drain vents meant leaking fuel vapourised and after accumulating, sometimes even

terrain quite flat, chances of a successful emergency landing, were quite high.

Now for a twist in the tale. After collapse of the Soviet Union, many An-2s ended up in the USA. Given their safety record, one would have thought that they would easily get US certification. I heard they did, but it was so restrictive (the aircraft had to return to the takeoff airfield at the end of each sortie) that commercial use except for parachute jumping became ludicrous ! People say that it was done to protect the US light aviation interests but the point I really want to make is that before we quote anybody's flight safety rules as *a Father's unalterable curse*, let us examine the relevance and applicability of such rules.

The Dakota Genre

The Douglas DC-3/C-47 Dakota is a necessary reference point on the subject. The Dakota was successful not because, as



Douglas DC-3s

has been suggested, it was so modern that it stayed relevant for another eighty years but because it was superbly appropriate for the 300 kmph cruise speed. Wherever that speed was relevant, the Dakota earned its living.

exploded. This led to unexplained loss of aircraft which were blamed on the fuel drums being transported, usually 'over the hump' from Assam to China. Little design details mattered greatly.



Junkers Ju-52

Assessing the aircraft

There was an advertisement clip on TV some years ago which depicted the press conference of a pioneering aviatrix (looked like Amelia Earhart and her Lockheed Orion) and then someone in the audience asked 'Mileage kitna deti ?' (How much mileage does the aircraft give ?) We value different things. The aircraft has to be assessed not for speed or comfort or ability to operate in Cat III weather but on profitability, utility, versatility, ruggedness and how much money it would make. Never mind if air services are irregular during the monsoons, the passengers will put up with *that* if the tickets are affordable for rest of the year.

Our Regional Transport Aircraft (RTA)

Our RTA 70 project is planned to *compete* with the ATR and Q400. A snowflake in hell has a better chance ! Suppose *your* fairy Godmother (mine has indignantly refused) were to give us the entire drawings, tooling and the civil certification, would we then be in a position to become a respectable supplier of such class of aircraft ? Immediate questions would arise about the cost of production, delivery rates and their certainty, after sales service and a host

The Baasler BT 67 was a turbine conversion of the Dakota and its acceptance proved correctness of the Dakota concept, plus the advantages and problems of 'turbinising'. Its PT 6A-67Rs were almost a tonne lighter than the Wrights they replaced, which resulted in CG problems, but this was simply restored by putting a 40 inch plug in the fuselage ahead of the leading edge. The changes resulted (as

the Table on page 57 shows) in a more capable aircraft which nevertheless was still a compromise. It had too much wing area : a modern aerofoil would have saved 60kW.h/hr at cruise and the not quite fully circular fuselage cross section precluded pressurisation should the customer have wished that. A new design based on the old Dakota would have been a formidable contender.



Curtis C-46 Commando



ATR72



Bombardier Q400

Dornier Do 228, with emphasis on unprepared field/ high altitude STOL capability. About 3000 kms. of our northern frontiers are around 6000 feet above mean sea level. A biplane, with its large light weight wing area and docile handling in confined airspaces, might surprisingly prove to be the best choice. Figure 1 on page 48 shows two configurations.

- ◆ The second niche exists for a 40 seater, sized between the Dornier Do 228 and the ATR 42/72 series, and we are looking at a kind of a “turbine Super-Dakota”.
- ◆ The third niche exists as a 6-abreast seating 100-150 twin turboprop – say using the cabin of an Airbus 320 or a Boeing 737 but the entire design optimised for a cruise speed of 400 kmph on 200 km sectors. Indian Airlines once used to operate a Boeing 737 on the Calcutta-Ranchi-Patna–Lucknow-Delhi sector. The many stops meant advantages

of such issues. Would Air India/SpiceJet/ IndiGo place big orders? Could we stand the price war that the fully depreciated ATR would probably then unleash? Another example : if the Saras II happens, will this then stand up to the Beechcraft 1900D for private operators ?

Instead of going bald headed into such (mis) adventures, we should look at the niches and the gaps in the product range and develop products that are not possible to be economically developed or produced by the West : simple, labour intensive, appropriate technology aircraft which would break *their* bank if *they* tried to compete. India has some ninety cities of between three million and half a million populations and another hundred with populations between half a million and two hundred thousand, all with rich agricultural hinterland, the mean distance between the nearest two being around 190 kms. This market is ideal for a series of (relatively) high capacity, mixed freight /passenger, near STOL rugged transport aircraft, quite different and not competing with any Western product.

These could be :

- ◆ A small 12-15 seat/two-and a-half ton single engine utility aircraft sized *between* the Cessna Caravan and the



Beechcraft 1900D



Dornier 228

of jet speeds were simply not realised. A large turboprop – partially pressurised, if at all – would certainly have been more closely matched to the profile and would be *significantly* more economical. The target customers are those people who now travel such sectors by Indian Railways AC sleepers. Much of Asia – but not the West – has such a market.

- ◆ Finally there is that heavy lifter (which can be imagined if you are old enough) as a Blackburn Beverly clone, or just a Globemaster II but redesigned for its ability to *through load* a MBT (T-72/90) or a S 400 system and transport that from Babina or Ambala to Leh or *vice versa* and designed for sub continental rather than intercontinental ranges. International air freighting is growing and it makes little sense to air freight equipment from, say the US only to truck it thereafter across the sub-continent. There will be a need for matching heavy (but short range) air freighting capability.

Since the profitability of an operator will depend on how exactly we can meet his needs, an approach for the design team would be akin to that of a lego brick model with various fuselage cabin lengths, wings areas and undercarriage options available so that the design could be tailored to the needs. The customer will have options of pressurised/partially pressurised and un-pressurised fuselages and retractable or fixed undercarriages which would mean hard – but repetitive – work at certification. Here, a ‘pod and twin boom’ layout is a very strong contender.

Nec Quis quam Nisi Ajax

The heading actually means “only Ajax can replace Ajax” or “you can do nothing till Ajax comes along”. The aviation industry is a high risk high profit but ‘full time’ business and requires all the time, dedication, energy attention, knowledge and efficiency that such business needs. The Soviet Union had it absolutely organised. Their political leaders had seen frontline war service; their military held cabinet ministerial rank and their top engineers held military ranks as also senior party positions. It was cohesion, teamwork knowledge and passion at their productive best. No time was wasted in trying to *ab initio* educate an intelligent, powerful but sceptical ignoramus ‘team member’ which explains the excellence and rapidity of Soviet aircraft development. Despite professions of equality *the performers* had no pay bands; all of General Designer Andrei Tupolev’s cheques were unconditionally honoured by the Soviet state (*await apoplexy epidemic in North Block !*).

In such a totalitarian state, it was possible for “the man in charge” – for example Admiral Gorshkov, regarded as father of the Soviet Navy’s renaissance – to stay at the helm for thirty years (he was retired only at his own request at the age of 75.). As a senior ‘cabinet minister’ and political leader, Gorshkov combined job knowledge, national policy and clout all in one person. The result was that the Soviet Navy became a challenge to the mightiest Navy, that of the United States. The magnitude of the achievement can be gauged by the following story. In 1956, the year he took over and seeing Nikita

Khrushchev observing some *Morskoya Flota* sailors in a rowboat on the River Moskva, said half jokingly, “That is our Soviet Navy”. The Russian Navy was then at one of its periodic declines. Gorshkov then went about to build it up to its present size in twenty years, with the pioneering move to also export Soviet naval equipment helping to finance part of his own formidable vision.

Such continuity is not possible in Western Democracies so they, recognising reality, as have handed over the knowledge, passion, and day to day dedication required to run such business to the private sector. An example would be the firm founded by Marcel Bloch, known today as GA Marcel Dassault. Marcel Bloch Dassault (1892-1986) started off as a propeller manufacturer in 1913 and went on to manufacture aircraft during the 1920s. Renaming himself as Dassault during the Second World War (being in the French Resistance) he went on to head *General Aeronautique Marcel Dassault*, which continually achieved brilliant results for its shareholders – and France – by using fairly basic technology with great élan. Dassault’s passion was so great that as long as he was alive, he apparently did not allow his worthy successor and son, Serge, to run the company ! Between the two, father and son, we have seen a century of continuity, job knowledge and passion. From many possible names I have deliberately chosen Dassault and France because France was the European country most affected by leftist ideals and communism and yet the French Communists were knowledgeable enough, pragmatic enough and patriotic enough to realise that certain areas were inviolable



Russia's 'Avro': the Ilyushin Il-114

even to politicians. When they nationalised the French aviation industry they still left Marcel Bloch (Dassault) in charge of his company.

So, what do we get for our Ajax? An IAS; a good student from St. Stephen's or JNU with a degree in History or Economics with perhaps a stint at Imperial College or Cambridge; usually exposed to Leftist Economic philosophies. Who, as a "clod hopping collector", did good work in Gonda district in the regime of rural indebtedness. Articulate, meticulous, hardworking and upright, he is up from a stint at the Ministry of Animal Husbandry where he tied up with the FAO for an important programme in Holstein/Zebu/Illawarra cross breeds and this is his third year in the Ministry and now he is stamping his feet to move into the PMO which was always his lifelong ambition and with his abilities and experience, he deserves it! He has a frequent flyer card with several airlines but prefers Air India. He can lean on his Defence Minister who usually has tenure countable in months not that it matters in any way because he is more interested in the politics of his home state. The passion of Krishna Menon, the stoicism of Yashwant Chavan or the intelligence of Babu Jagjivan Ram happens but rarely. Courtesies apart it is – technically - entirely correct to call our



Fokker F-27 Friendship

Ajax as essentially ignorant. He certainly is no Churchill/Hitler or Stalin who were interfering busy bodies even in the matters of weapons design (the privilege of any comment is that of the readers!).

Right path of the Buddha

The many different ways the British (and the Americans) set about developing passenger airliners for the post-WW2 civil market is relevant. Britain started well in time by forming the Brabazon Committee which was headed by Lord Brabazon of Tara

who was a pioneer aviator. Though the committee was representative, the "say" was concentrated with the Bureaucracy. The Committee recommended simultaneous development of five different types of aircraft, covering the entire spectrum of air transport as was visualised in 1945. Two of the projects recommended were bemusing. These were the Bristol Brabazon (like the Ford Edsel, the West names their disasters after the "promoter"!) and the Saunders Roe Princess mega-amphibian. Mercifully these giants did not progress



Vickers Viscount



Sud Aviation Caravelle

beyond the prototype stage. The elegant Airspeed Ambassador was hugely popular but its slow development, failure to adapt the new Rolls Royce Dart and inability of the designers to stretch it (partly because of its beautiful lines) led to just twenty being built. The aircraft could really have been the Fokker F-27 Friendship success but tardy development did the project in.

The Vickers Viscount was a great success in comparison, with 444 sold worldwide although probably as many more could have been had the company moved faster in responding to the customer's demands. The last of the pentad was the famous De Havilland Comet which entered service in 1952 as the world's first commercial jet airliner only to, unfortunately, pioneer the problem of metal fatigue and had to be withdrawn from service in 1954. The fatal cracks were mainly in the forward escape hatch and the windows for the ADF aeriels. (Over) re-design of the aircraft as the Comet 4 was completed by 1958 when it was re-launched on the Trans Atlantic run, a year ahead of the Boeing 707. There are people who believe that had this "bad luck" not happened, the Comet may well have "swept the board" in terms of orders but this is not borne out by facts.

The French Sud Aviation Caravelle was hugely popular with passengers, had no problems and yet ran out after 280 orders. The problem of both the Caravelle and the Comet was that their development was too slow, as a result of Government involvement in everything – development, rectification, and production and the 'babus' thought too small. Capacity wise, the Comet and the Caravelle ended where

the Boeings – the 707 or the 737 - actually began and thus stood no chance.

American aims were identical to those of the British but their approach was much more "worldly wise". The US Government was never under any compulsion to prove any political philosophy : it knew that it did not know the business. It trusted the US Industry to take the lead as it had ample faith that these people knew more about



Boeing 707

aeroplanes and would move mountains to do what was needed. The Government relegated itself to the role of being a *Vigna Hanta* (destroyer of obstacles) and provider of venture capital. The story of development of the Boeing 707 is a classic example of how this alternate approach worked.

Having earlier developed the atom bomb, there now was need to move “the thing” across intercontinental distances. Of the four contenders who responded to the RFP, Boeing’s proposal formulated from 1943 onwards were for the models 424/432/448/450, the last being submitted in March 1945, hastily revised to incorporate German data on swept wings ‘captured’ during American advance to the Elbe and with six engines mounted under the wing on pylons, an aircraft which emerged as the XB-47.

This new bomber had many technical problems : the slender high aspect ratio wing flexed almost two meters up and down from the datum in flight, unnerving the first crews and there also was reverse aileron effect. At certain speeds and altitudes the stalling speed and the critical Mach number coincided, so appropriately, was called the “coffin corner”. Nevertheless the structural and aerodynamic advantages of the B-47s

podded engine and pylon approach were amply proved in operational service.

Having developed the B-47, Boeing then proposed development of an aerial tanker, capable of matching the B-47’s speeds, thus making FR less of a hazard. The result of such marketing effort led to an order for hundred and thirty five tankers as the KC-135, whose prototype was the famous ‘dash 80’. The KC-135 allowed Boeing to reduce the launch costs and risks of the ensuing Boeing 707 airliner. However their hopes of using the KC-135 fuselage jigs were dashed because they now realised that the fuselage diameter had to increase by another 8 inches (200mm) if the customer was to be satisfied.

Legend has it that the fuselage was just one inch more in diameter than the competing DC 8 but that one inch made a world of difference in the packing of passengers in a six-abreast seat layout. This required investment in new fuselage tooling and Boeing spent \$ 16 million to do so. Boeing could take the decision to invest within the precincts of then offices, there was no need to educate anyone to get the sanction. The short decision chain helped Boeing to move at the rate demanded by the market.

What then for India ?

Asian economics and demographics dictate larger airliner capacities, shorter stage lengths and more primitive field capable aircraft than is in the vision of Western manufacturers. These augur well for the economics of an air ticket. The civil transport market in India has the advantage of a shorter decision chain and so within the existing capability of our Industry. This can truly be the *Great White Hope* : whilst we all wait for the Government to extract digit (i.e. “finger”).

A full discussion on the fascinating subject of appropriate technology air transport is not necessary here. Potential private sector operators and the private sector Industry are those people who use *earned* money and know their business and are both equally interested in coming to a successful result. Between them they know what is needed and how to do it. A comprehensive governmental liberalisation of India’s aviation industry is need of the day and the time to continue with unworkable management is long past. The industry is too dynamic and knowledge-based to be effectively managed by the present system – as the results repeatedly and wearifully – show. 

A comparison of the economics of speed, capacity and STOL

1	2	3	4	5	6	7	8	9	10	10
2	Year	Type	W/We	Econ. Cr. kmph	Installed Power (kW)	Power / Pax. (kW/Pax)	Kw / Cu.M	KG. Payload / kW.	Productivity Kg.Km. / Kwh.	Remarks
3	1926	Ford AT 5	0.80	180	3X298	68	62.5	3.04	547	STOL
4	1937	DC-3 Dakota	0.49	333	2x820	51	34	2.30	765	
5	1990	Baasler BT 67	0.7	405	2x1062	53	52.2	2.9	953	
6	1985	US Single engine Utility	1.046	320	1x503	55	52.2	4.1	1312	
7	1990	50 seat “high speed” Turboprop	0.629	530	2x3100	124	116	1.37	726	
8	1991	19 seat commuter	0.60	418	2x948	99.7	88	2.6	832	
9	1947	Antonov AN-2	0.59	185	1x746	62	61.4	2.75	509	STOL
10	1955	Scottish Aviation Twin Pioneer	0.52	208	2x402	50	45	2.6	548	STOL

Notes:

1. Column 4 gives disposable load/ empty weight. Indicates lifting potential versus buying cost when suitably factored for technology.
2. Columns 5,7,8 establishes the steep rise in cost of speed per passenger or freight volume.
3. The penalty of STOL is indicated. It will be lower for turbine engine designs.
4. Despite (lack of !) 90 year old technology the Ford AT5 ‘s figures are respectable and indicate scope of modernization with old technology. These rugged aircraft served for long under particularly arduous and primitive conditions. A fair number still fly!

Rafale in nuclear strike exercise



A Rafale from the *Armée de l'Air's* (French Air Force's) *Escadron de Chasse 2/4 'La Fayette'* reportedly undertook an operational exercise for the nuclear strike mission in early February 2019. The two-seat Rafale B operated from *Base Aérienne 113 Saint-Dizier* carrying an ASMP-A (*Air-Sol Moyenne Portée-Amélioré*; Air-to-Surface Medium Range – Ameliorated) nuclear standoff missile. The mission lasted more than 11 hours and included refuellings from C-135 and Phénix tankers. The unarmed ASMP-A was launched over the *Direction Générale de l'armement, (DGA)* test range at Biscarrosse.

Finland orders Super Hornets and Growlers



The US Government has granted approval for the sale of an undisclosed number of Boeing EA-18G airborne electronic attack aircraft to Finland. There will be additional to F/A-18 Super Hornets for the Nordic country's HX fighter replacement programme. In this context, Boeing's Vice President of F/A-18 and EA-18G programmes, Dan Gillian, said : "All strike fighter

aircraft rely on Growler escort to increase survivability during high threat missions. The combination of the Super Hornet Block III and Growler would provide Finland with superior technological capability's HX mission requirements.

Finland is the second foreign country to gain approval for the Growler. Australia, currently operates 11 aircraft from RAAF Base Amberley in Queensland. In related news, the final US Marine Corps unit to operate the Grumman EA-6B Prowler, Marine Tactical Electronic Warfare Squadron 2 (VMA-Q) was disbanded at Marine Corps Air Station Cherry Point, North Carolina on 8 March 2019. The US Navy had phased out the Prowler after 45 years, there being no direct replacement for the EA-6B, instead relying on other platforms such as the F-35B, unmanned air vehicles and the Navy's EA-18G Growler-equipped electronic attack squadrons.

Malaysian RFI for light fighters

The Government of Malaysia have issued request for information (RFI) for acquisition of an initial batch of 12 light fighters during 2021-2022 with an option for 24 more in the future. There are reportedly six contenders including India's Tejas LCA, the Russian Yak-130, the South Korean T-50 Golden Eagle, Saab Gripen and Sino-Pakistani JF-17 Thunder. While the Tejas and Golden Eagle took part at the recent LIMA Show (*see article in this Issue*), the JF-17 was displayed during Malaysian Prime Minister Mahathir Mohamad's visit to Pakistan on 23 March 2019. According to analysts, the JF-17 Block-III variant has certain advantages including AESA radar, efficient ECM and advanced avionics, as also its relatively lower cost.

Chengdu J-10 display at Pakistan National Day

Chengdu J-10s of the PLAAF formation aerobatic team took part at the Pakistan National Day parade at Islamabad on 23 March 2019. The strong presence of Chinese-origin aircraft was evident with formations of the Sino-Pakistani JF-17 Thunder also flying over the capital city as also the ZDK-03 airborne early warning and control aircraft. In fact, JF-17s and the ZDK-03 were reportedly in action during on the 27 February 2019 air skirmish over Kashmir (*see articles in this Issue*).



IOC for F-35C Lightning II

The US Navy has declared Initial Operational Capability (IOC) for its F-35C during the ongoing Initial Operational Test & Evaluation (IOT&E) phase. The Type's carrier variant has met all requirements and the IOC announcement made on 28 February by the Commander, Naval Air Forces VADM DeWolfe Miller and the US Marine Corps Deputy Commandant for Aviation Lt Gen Steven R Rudder.



This follows aircraft carrier qualifications by the first frontline F-35C squadron Strike Fighter Squadron (VFA) 147, aboard USS *Carl Vinson* (CVN 70). IOT&E for the F-35C began in December 2018 and is scheduled to be completed in September 2019. By end-2018, the USN had received 29 Low-Rate Initial Production (LRIP) F-35Cs, assigned to VX-9 'Vampires' at Edwards AFB, California, VFA-101 'Grim Reapers' (11 aircraft) at Eglin AFB, Florida, and to VFA-125 'Rough Raiders' and VFA-147 'Argonauts' (11 aircraft), both at NAS Lemoore, California.

USAF orders new build F-15X



The USAF is to include eight new F-15X Eagle fighters as part of a five-year plan that includes purchase of 80 such variants. The first batch of new F-15s likely to be included in the Fiscal Year 2020 budget request. However, the USAF has stated that any new Eagle acquisition will not affect its plans to purchase F-35As, under that 1,763-aircraft programme. The F-15X is based on the latest F-15QA version ordered by Qatar, having expanded ordnance fit, with deliveries to begin in 2022, the aircraft unit cost at \$80m.

Belarusian MiG-29s for Serbia



Belarus formally handed over a batch of MiG-29s to Serbia in a ceremony at the 558 Aircraft Repair Plant (ARZ) at Baranovichi air base, Belarus. While these aircraft has been donated by the Belarusian government, Serbia will pay for a general overhaul, which will take place at the 558 ARZ. According to a statement from director of the plant, timeframe for the work will range from six months to a year, depending on the scope of modernisation. Improvements will be carried out in co-operation with RAC-MiG and will include modifications to the radar and integration of R-27ER and R-77 air-to-air missiles plus air-to-ground missiles.

Polish Air Force modernisation



Recently announced is a *Technical Modernisation Plan* (TMP) for updating Poland's armed forces up to 2026. The *Harpia* programme includes the acquisition of 32 fifth-generation multi-role aircraft to provide an anti-access, area-denial network-centric capability to work with other components of allied forces. Under the *Kruk* programme Poland will buy a modern attack helicopter. While Airbus Helicopters/Heli Invest are offering the EC665 Tiger, Turkish Aerospace Industries and WSK PZL-Swidnik the T129, Bell Helicopter and Boeing are promoting the AH-1Z and AH-64E and Leonardo proposes the AW249. Alongside, some 200 UAVs of different classes are to be obtained under the *Gryf* and *Wazka* programmes. The *Flame* programme consolidates existing plans to purchase maritime patrol and intelligence, surveillance and reconnaissance aircraft.

Switzerland's new fighter programme



Switzerland has announced dates for evaluation of five short-listed aircraft in the latest round of trials for its fighter replacement programme. Each of the fighter types will undergo two weeks of flight tests and other examinations at Payerne Air Base between April and July. First off is Airbus with its Eurofighter, then Boeing and its F/A-18E then Dassault with the Rafale, Lockheed Martin with the F-35A and finally Saab with its Gripen E. The placing of each aircraft in the schedule has been determined by alphabetical position of the manufacturer in the list of contenders. “Each candidate will be permitted to make a familiarisation flight before performing a total of eight missions, one in darkness, using one or two aircraft during four days of flight operations. Upon completion of the tests a second and final request for proposals will be issued to the manufacturers who will then be required to make their best and final offers in the spring of 2020”. The government is expected to announce its choice in the second half of 2020, for consideration by parliament as part of the annual armaments programme for 2022. “Deliveries must begin in 2025 and be completed by 2030”.

Luftwaffe A400Ms



“The German Air Force will operate its A400M transport aircraft from two air bases” stated the German Federal Minister of Defence Ursula von der Leyen, during her visit to Wunstorf air base in northern Germany. Wunstorf is currently the sole Luftwaffe A400M base, where the type is operated by *Lufttransportgeschwader 62* (LTG 62, Air Transport Squadron 62). However, in future the

type will additionally be housed at Lechfeld in southern Germany. The Luftwaffe has 53 A400Ms on order, some 25 of which have been delivered to the Luftwaffe till now, all with LTG 62 at Wunstorf, which will eventually house 40 of this type.

Multi-mission Challenger 650 for UAE

The United Arab Emirates Air Force & Air Defence (UAEAF&AD) is to receive a single Challenger 650 business jet modified to a multi-mission configuration. Aquila Aerospace has received an initial contract to supply the aircraft in a maritime and airborne surveillance and search and rescue (SAR) configuration, with an option to supply a second aircraft. Modification, integration testing and certification of the aircraft will be carried out at Al Bateen Airport in Abu Dhabi by Aquila, with support from Bombardier Specialized Aircraft. Changes to the aircraft will include installation of various sensors, mission operator stations, observation windows and air operable doors.

AH-1Zs for Bahrain

Bahrain will get 12 AH-1Z Vipers by the end of August 2022 after the US Department of Defense (DoD) awarded Bell Helicopter Textron a contract for the attack helicopters. In April 2018, the US State Department had approved the possible sale of 12 AH-1Zs to Bahrain plus spares, support and ancillary equipment. This package also included 14 AGM-114 Hellfire missiles and 56 Advanced Precision Kill Weapon System II (APKWS) rockets. The Royal Bahrain Air Force (RBAF) had earlier received six former US Army AH-1Ps from 1995 and ten AH-1Es that arrived from 1997, the another 17 former US Army AH-1Fs handed over in April 2009.

New batch of MD530Fs for Afghanistan

The latest batch of eight MD530F Cayuse Warriors were delivered to the Afghan Air Force (AAF) in February 2019, delivered by an Atlas Air Cargo Boeing 747. 30 are intended for Afghanistan, the initial five aircraft from this contract being delivered in September 2018 and another five in December. The Afghan AF has received a total of 48 Cayuse Warriors.



AW119Kx for Israel

The Israeli Air Force has selected the Leonardo AW119Kx as its new advanced training helicopter, purchasing seven of the rotorcraft. The new helicopters will be based at Hatzetim where they will replace the Flight Academy's current Bell 206 Saifan training helicopters, which have been in service from 1971.

Moroccan F-16s upgraded



The Royal Moroccan Air Force (RMAF, *Al Quwwat al Jawwiya al Malakiya Marakishiya*) has taken delivery of two F-16 Block 52s after they underwent extensive upgrades including the addition of the AN/ALQ-211 Advanced Integrated Defensive Electronic Warfare Suite (AIDEWS). The upgrades were implemented under a \$91m contract awarded to the American Harris Corporation via the US Army Foreign Military Sales (FMS) programme in November 2016. According to the company, the AIDEWS integrated radar warning system and radio-frequency countermeasures will protect the RMAF F-16s from a wide range of increasingly sophisticated "current and evolving" threats. The RMAF has 15 F-16C and eight F-16D Block 52 variants in service and the last upgraded aircraft are due to be delivered to Morocco in early 2021.

C-295W for Ivory Coast

The C295W acquired for the Côte d'Ivoire Armée de l'Air (Côte d'Ivoire Air Force) is reportedly ready at the Airbus factory in Seville, Spain. Meanwhile, two An-26s were acquired by the Côte d'Ivoire Armée de l'Air last year from the Bulgarian Air Force.

Korea accepts A330 MRTT

A second Airbus A330 Multi-Role Tanker Transport (MRTT) has been delivered to the Republic of Korea Air Force



(ROKAF). While in France, the Korean MRTT received its military paintwork, most of the aircraft's colour scheme being previously applied by Air Livery at Cambridge International Airport, UK.

Rafales fires the Meteor



French Air Force Rafales conducted first test firings of Meteor air-to-air missiles on 13 February in a test campaign at Cazaux, involving two missile launches, one each day and night. These were flown by personnel from the *Centre d'Expertise Aérienne Militaire* (CEAM) flight-test centre and the Navy's *Centre d'Expérimentations Pratiques de l'Aéronautique Navale* (CEPA/10S), in co-operation with the *Direction générale de l'armement* (DGA), the French defence procurement agency).

First upgraded Tu-160M2



Plans on roll out of the first upgraded Tu-160M2 strategic bomber in 2021 have been announced. Under the State Armament Programme for 2018-27, serial production of the Tu-160 for the *Vozdushno-Kosmicheskoye Sily Rossiyskoy Federatsii* (VKS, Russian Aerospace Forces) will be resumed with the extensively modernised M2 version, ten new production Tu-16M2s being ordered last year. It is likely that the new Tu-160M2 will feature equipment and weapons similar to those included in the second-stage Tu-160M upgrade and powered by NK-32-2 engines.

Rostec delivers sixth A-50U AWACS



Vega Concern, a member of Rostec’s Ruselectronics holding company, and Beriev Air Company delivered to the Russian Aerospace Forces a sixth extensively modernised A-50U AWACS aircraft. “The new A-50U can track a greater number of targets and simultaneously control a larger number of fighters. The new variant has a completely new onboard computing system, new electronics with greater performance and computing speed improves versatility of the functional software. The monitoring systems of operators have been updated with new high dimension and resolution LCD-screens, improved ergonomics enhancing the performance of the tactical crew. Satellite communications equipment is significantly more reliable and effective, leading to better signal exchange speeds, volume and quality”.

Nigeria orders Super Tucano



Sierra Nevada Corporation (SNC) and Embraer are executing Nigeria’s contract for 12 A-29 Super Tucano aircraft, to be built at SNC’s Jacksonville, Florida facility and modified in Centennial, Colorado. Work is expected to be completed in May 2024. The initial contract amount is for the aircraft, but the Nigerian Air Force will also get weapons and sensors under separate contracts including AAQ-22F sensors and laser designator turrets. The NAF will also receive Paveway II guided bombs, APKWS rockets, 0.50 calibre (12.7mm) ammunition and various sensors.

PZL-Mielec Skytrucks for Nepal

Poland’s aircraft manufacturer Polskie Zaklady Lotnicze Mielec, is to supply two new M28 Block 05 Skytruck aircraft to Nepal. This is under a \$18.9 million firm-fixed-price foreign military sales contract announced on 1 March and also provides for associated initial maintenance training, technical publications, and ferry flights from Mielec, Poland, to Kathmandu, base of the Nepal Army Air Wing’s 11th Brigade.



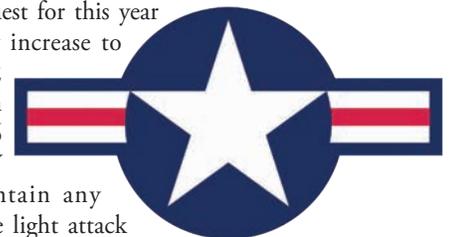
Kazakhstan Border Service orders Airbus C295



The Border Service of the Republic of Kazakhstan has signed a firm order for one C295 medium transport aircraft, which includes training, spares and ground support equipment, increasing the overall C295 fleet operating in Kazakhstan to nine such aircraft. With this new order, the Border Service of Kazakhstan becomes 31st operator of the C295.

US Air Force budgets

The USAF’s budget request for this year does not cater for any increase to its current number of 312 operational squadrons, with its aspirational goal of 386 nor does the Air Force FY 2020 budget request contain any procurement money for the light attack



aircraft programme. The USAF needs 72 new fighters a year, but the total number of F-35A Lightning IIs requested has been reduced to 48 (\$4.9 billion), while research and development spending for the F-35 – especially its Block 4 upgrade – has been increased by over 50% to \$800 million. Eight new production Boeing F-15EX fighters (for \$1.1 billion) are included, of 144 planned with 80 by FY2024. The number of Boeing KC-46A Pegasus tankers, planned at a steady-state of 15 per year has been reduced to 12 and the number of Lockheed Martin special ops AC-130J Ghost Rider and MC-130J Commando II aircraft reduced to eight from a planned 13. General Atomics MQ-9 Reaper unmanned air vehicles, planned at four, are increased to 12. Two types appear in the request as planned, 12 Sikorsky MH-60W combat rescue helicopters and one Gulfstream EC-37B Compass Call II.

US Army Aviation requests

Procurement funding for the US Army Aviation has decreased to \$3.7 billion from \$4.3 billion, although an additional 15 UH-60M Black Hawks have been added, increasing the buy to 73 (64 for the Army National Guard). The number of CH-47F Chinooks has increased from seven to nine but the number of AH-64E Apaches remains at 48. Special Operations Command (SOCOM) require MH-47G Chinook fleet to be upgraded, and the Department of Defence has added this urgent operational requirement to the budget.



US Navy requests 149 aircraft



The US Navy's FY2020 budget requests procurement of 149 aircraft, an increase over the 134 funded in 2019. The fixed-wing aircraft requested include ten F-35B and ten F-35C Lightning IIs for the Marine Corps and ten F-35Cs for the Navy, 24 F/A-18 Super Hornet Block III strike fighters (more fighters than the Air Force gets this time), four E-2D Advanced Hawkeye early warning aircraft, six P-8A Poseidon maritime surveillance aircraft, three KC-130J Super Hercules for the Marine Corps, and a one-time procurement of 22 Northrop F-5E Tiger IIs for Navy and Marine Corps as adversary training aircraft.

The six P-8A Poseidons in the budget will be last for the US Navy's total of 117 production aircraft over the programme. Rotary-wing and tiltrotor aircraft requested in the budget include six CH-53K King Stallion heavy-lift helicopters and six VH-92A presidential transport helicopters for the Marine Corps, 38 new helicopters (of a design to be selected in 2019) to replace TH-57 Sea Ranger training helicopters, and ten CMV-22B Osprey carrier-onboard-delivery aircraft for the Navy. Deliveries of more MV-22B Ospreys for the Marine Corps is set for 2020.

Kratos unveiled—and airborne



Maiden flight of the Kratos XQ-58A Valkyrie demonstrator took place on 5 March 2019, the robotic jet planned to fly alongside manned fighters in future combat scenario as a wingman. The Kratos unmanned aerial vehicle will have long range and high subsonic performance and could be the first step towards the USAF's 'loyal wingman' concept, in which drones operate alongside manned combat aircraft in complementary roles. The US Air Force Research Laboratory is working with Kratos Unmanned Aerial Systems to develop the XQ-58A, as part of the *Low-Cost Attritable Aircraft Technology* (LCAAT) programme, its aim being "to break the escalating cost trajectory of tactically relevant aircraft". The series production Valkyrie could cost \$2m, but not necessarily with limited capability and the next generation of such 'unmanned wingmen' are clearly aimed at the high-end air battle against advanced adversaries.

Boeing's Australian Airpower Teaming System

Boeing has introduced its latest unmanned platform, the Airpower Teaming System (ATS), developed in Australia by the company's Autonomous Systems division and the firm's Phantom Works International. The stealthy ATS is intended to provide multi-mission support for air control missions and is described by the manufacturer as offering "fighter-like performance". Designed for in-country customisation, the drone will be deployed using "smart teaming" to co-operate with existing military aircraft. The 38ft-long (11.7m) single-engined unmanned aerial vehicle will have a range in excess of 2,000nm.



A series of computer-generated images showed ATS ‘swarms’ working with RAAF F/A-18Fs and E-7As. The ATS will use artificial intelligence to fly independently or in support of manned aircraft while maintaining safe distance between other aircraft. As part of the research and development programme, Boeing and the Australian government will produce a concept demonstrator, called Loyal Wingman – Advanced Development Programme, prior to launching production of the ATS. Its first flight is planned for in 2020.

Testing of A-100 AEW&C



According to Russian News agency reports, the new A-100 Airborne early warning and control aircraft has begun a new phase of trials, with first flight in the latest test programme reported on 9 February. Incorporating a new glass cockpit, the A-100 also incorporates a digital navigation system and a new phased antenna array developed by Vega.

GA-ASI's Gray Eagle Extended Range NET

The US Army has completed its *New Equipment Training* (NET) at Fort Campbell, Kentucky for the MQ-1C ER Gray Eagle



Extended Range. The training covered new maintenance procedures, manuals and ground support equipment associated with the MQ-1C ER, which is a new Unmanned Aircraft System (UAS) produced by General Atomics Aeronautical Systems, Inc. (GA-ASI).

Turkish Bayraktar TB2 UCAVs for Qatar



The Turkish company Baykar Makina has handed over six Bayraktar TB2 unmanned combat air vehicles (UCAVs), along with three ground control stations and a simulator, for the Qatar Emiri Air Force (QEAF). The Turkish company has also completed a four-month UCAV training course for 55 Qatari personnel, including pilots and maintenance staff. The order for six TB2s was announced at the Doha International Maritime Defence Exhibition and Conference in March 2018.

Japan to lead its F-3 project

The Government of Japan “favours an indigenously developed combat aircraft to meet its next-generation fighter requirement, as replacement for the Mitsubishi F-2 multi-role fighter from the late 2030s.” The defence ministry prefers the indigenous option over licence-production of an existing foreign-designed warplane, or further development of a foreign type. Mitsubishi Heavy Industries (MH) is expected to develop the stealthy F-3 in collaboration with an external partner either BAE Systems, Boeing, Lockheed Martin or Northrop Grumman as contenders.



Kongsberg JSMs for Japan



Kongsberg Defence & Aerospace has entered into contract with Japan to supply initial deliveries of the JSM (Joint Strike Missile) for their fleet of F-35 fighters. The JSM development started in 2008 and was completed in mid-2018 after a series of successful validation test firings. The JSM is a long-range sea- and land-target missile that can be carried internally in the F-35 thus ensuring the aircraft's low-signature (stealth) capabilities.

4 million flight hours by MQ-1B, MQ-9



The MQ-1B Predator and MQ-9 Reaper remotely piloted aircraft have now flown more than 4 million hours in support of a 24-hour mission around the world conducting persistent attack and reconnaissance, search and rescue and strike and support to civil authority missions with multiple combatant commands. The MQ-1B entered the USAF fleet in 1996 and retired in 2018, while the MQ-9 mission began in 2007.

PLAN marks 70th anniversary

The Chinese Peoples Liberation Army Navy (PLAN) celebrated its 70th founding anniversary on 23 April with a grand fleet review. Ten countries, including India, Russia, Thailand and



Vietnam, sent some 20 vessels to join a naval parade at Qingdao. The Indian Navy was represented by the missile destroyer INS *Kolkata* but surprisingly there was no participation by a Pakistan Naval warship. China's aircraft carrier, the *Liaoning*, and latest nuclear submarines, destroyers and other warships were amongst the 32 Chinese vessels at the review while 39 aircraft took part in the flypast.

Anglo-French FC/ASW Missile progresses

Two years into the FC/ASW (*Future Cruise/Anti-Ship Weapon*) Concept Phase, MBDA has successfully achieved its "Key Review", jointly conducted with Defence Equipment and Support (DE&S) and the *Direction Générale de l'Armement* (DGA), the British and French armament procurement agencies. This Key Review makes it possible to select the most 'promising' missile concepts in order to meet the requirements expressed by both nations' armed forces. More in-depth studies will now be conducted on these concepts with the aim of identifying solutions to be selected at end of the concept phase in 2020 to meet both nations' requirements for long range anti-ship missions, suppression of enemy air defences and deep strike. The FC/ASW aims to replace the Storm Shadow/ SCALP air launched cruise missile in operational service in the UK and France as well as the Exocet anti-ship missile in France and Harpoon anti-ship missile in the UK.

MBDA Brimstone 3 missile firing trials

The Brimstone 3 ultra-high precision missile system achieved a major milestone during first firing trials at the Vidsel Trials range in Sweden. In extreme weather conditions with temperatures



below -30°C, the missile was surface launched against a pick-up truck target. All trials objectives were fully achieved with the missile proving, through a telemetry unit, full closed loop guidance with the seeker progressing into target acquisition and track. Brimstone 3 is the product of the Brimstone Capability Sustainment Programme (CSP), announced in March 2018 that will provide new Brimstone missiles for the UK Armed Forces in order to replenish the country's inventory and "to maintain the UK's battlefield edge into the future".

Record year for Rafael

During 2018 Rafael continued to develop, manufacture and market its systems and capabilities, providing users with end-to-end solutions for various air, land, naval, space and cyber requirements. Some of Rafael's major marketing achievements in 2018 include the US Army's decision to equip its Abrams tanks with Rafael's TROPHY Active Protection systems and its decision to purchase two Iron Dome air defence



batteries. This joins various other wins, including the SPIKE 5th generation missile system to Australia and NATO countries, various domestic and international Cyber projects, teaming agreements with international companies, etc.

In addition, during 2018 Rafael continued investment and professional development of human capital, "while maintaining investment in R&D (8% of sales) and significant cooperation with academic institutions, as well as the opening of new R&D facilities throughout the country, mainly dealing with cyber, intelligence, AI and other emerging technologies".

Record high MBDA order backlog

MBDA recorded another strong year of trading performance in 2018, with a further €4.0 billion in orders which has taken the company's order book to a record of €17.4 billion. Revenue was also ahead year-on-year to €3.2 billion. Strong performance in home markets saw MBDA's domestic order intake of €2.5 billion exceed that from exports at €1.5 billion. Significant domestic orders in 2018 included a contract from the French DGA to develop the next generation MICA air-to-air missile, renewal of in-service support for the Aster missile across France, Italy and the UK, upgrade and maintenance work on the Taurus in Spain, among others. Major export orders included the weaponisation of Eurofighter Typhoon fighters and NH90 helicopters ordered by Qatar, as well as further export orders of the Taurus, MMP and Mistral.

Roll out of Boeing 777X



Boeing has rolled out the first 777-9 at Everett, the aircraft due to undertake its first flights later this year before the first customer delivery to the initial operator, Lufthansa in 2020 following flight and certification testing. The General Electric GE9X-powered aircraft will seat 400-425 passengers and have 7,525 nautical miles range. A second 777X family member, the 777-8, will seat 350-375 passengers with range of 8,690 nautical miles.

British Airways orders 777X

British Airways has selected the Boeing 777X for its long-haul fleet, signing an agreement with the manufacturer for up to 42 777-9s, including 18 on firm order plus 24 options, the airliners due to be delivered from 2022 to 2025. BA had earlier introduced the 787, 777-300ER and A380 even while phasing out its older 747-400s. The 777-9s will be used to serve the carrier's long-haul trunk routes, replacing earlier 777s and the 747-400s the airline to operate on their network. BA will also use 18 Airbus A350-1000s to operate on these routes. The A380 is used for routes with the largest passenger flows and the 787s for network development and routes with thinner passenger demand. With BA's selection of the 777-9 Boeing has sold 344 777Xs, comprising 291 777-9s and 53 777-8s, even though Etihad Airways, one of the 777X launch customers in 2013, had reduced its 777-9 order from 25 to six.



Reduction of USN aircraft carrier fleet



The US Navy's aircraft carrier fleet is to be reduced to ten by 2025 as the USS *Harry Truman* (CVN-75) is withdrawn from service rather than being overhauled for an additional two decades of service, as had been planned. Of the ten remaining carriers, only eight or fewer will be available for operational deployment.

Etihad changes orders



Etihad Airways has restructured its orders for airliners, the Gulf carrier now committed to taking far fewer new aircraft than previously planned. The carrier will buy just 20 Airbus A350-1000s, six Boeing 777-9s, an undisclosed number of 787s and 26 A321neos. These compare with previous order announcements from the airline for 62 A350s, 26 777s, 52 787s and 36 A320neo family aircraft. "Etihad is to optimise its network and rationalize its fleet by phasing out older types", explained the CEO.

Lufthansa orders 20 additional A350-900

Lufthansa has signed an order for 20 additional A350-900 wide-body aircraft, following a decision by the company's supervisory board. This latest agreement brings Lufthansa Group's total orders for the A350 XWB to 45 with 12 aircraft already in operation around the world. Lufthansa's decision reinforces the Group's status as Airbus' largest airline customer and operator, with 674 Airbus



aircraft on order (including the latest A350 order) and 574 Airbus aircraft in the Group's current fleet including 28 A220 Family, 420 A320 Family, 100 A330s / A340s, 12 A350s, and 14 A380s.

Airbus' Skyways drone trials



Airbus has carried out shore-to-ship trials in Singapore with its Skyways parcel delivery drone. This marks the first time drone technology has been deployed in real port conditions, to deliver a variety of small, time-critical maritime essentials to working vessels at anchorage. The maiden shore-to-ship delivery flight was made to the Swire Pacific Offshore's Anchor Handling Tug Supply vessel 'M/V Pacific Centurion', 1.5km from the shoreline of Singapore's Marina South Pier, carrying 1.5kg of 3D printed consumables. Landing safely on the ship deck and depositing its cargo to the shipmaster, the Skyways unmanned air vehicle swiftly returned to its base, with the entire flight taking within ten minutes.

STARLUX Airlines orders 17 A350 XWBs



STARLUX Airlines of Taiwan has ordered 12 Airbus A350-1000s and five A350-900s. The new airline plans to deploy these aircraft on its premier long-haul services from Taipei to Europe and North America, as well as selected destinations within the Asia-Pacific region. The aircraft will be powered by the Rolls Royce Trust XWB engine.

Historic first flight of Stratolaunch aircraft



Stratolaunch Systems Corporation, founded by Paul G. Allen, have completed first flight of the world's largest all-composite aircraft, the Stratolaunch. With a dual fuselage design and wingspan greater than the length of an American football field, the Stratolaunch aircraft took off from the Mojave Air & Space

Port, achieved a maximum speed of 189 mph, flying for 2.5 hours over the Mojave Desert at altitudes up to 17,000 feet. As part of the initial flight, the pilots evaluated aircraft performance and handling qualities before landing successfully back at the Mojave Air and Space Port.

The Stratolaunch aircraft is a mobile launch platform that will enable airline-style access to space that is convenient, affordable and routine. The reinforced center wing can support multiple launch vehicles, weighing up to a total of 500,000 pounds.

Ninth FREMM frigate is launched



On 18 April 2019, Naval Group launched the *Alsace* multi-mission FREMM frigate for the French Navy. This is first of two air defence frigates of the programme for the French Navy with the same ASW capability of the preceding units, but with increased air defence assets. Naval Group teams and numerous partners will deliver the two anti-air defence frigates *Alsace* and *Lorraine*, respectively in the first semester 2021 and the second semester 2022 following the seven FREMM earlier delivered between 2012 and 2018 : *Aquitaine* in 2012, *Provence* in 2015, *Languedoc* in 2016, *Auvergne* in April 2017 and *Bretagne* in July 2018.

Navantia contract for F110 frigates

Navantia have signed contracts for the construction of five new generation F110 frigates for the Spanish Navy, whose construction will be in Ferrol. The design of this new frigate incorporates technological advances, such as the new integrated mast configured with different solutions of sensors and antennas, the incorporation of a multi-space mission that expands capabilities of the ship in all segments of defense and a new hybrid propellant plant. It will also carry UAVs on board and have capacity for future installation of directed-energy weapons.

The frigates will be equipped with a Spanish combat system, SCOMBA, developed by Navantia, which acts as the vessel's "brain" and integrates all the frigate's sensors and weapons, such as

surface sensors, EW and IFF supplied by Indra, Band S radar and Lockheed Martin vertical launcher, AAW-SM-2 from Raytheon, the antisubmarine warfare systems and SAES sonars plus the navigation and communications systems from Navantia Sistemas.

IAI launches the OPAL

Israel Aerospace Industries (IAI) has launched OPAL, an innovative solution that connects all platforms in the battle arena, manned and unmanned. OPAL forms a decentralised communication cloud for all members on the ground, in the air and at sea, to allow real time information sharing, to achieve a comprehensive operational picture of the battlefield. OPAL relies on a secure and proven communication network that connects different networks and platforms without fixed base stations. OPAL is compatible with any platform, including advanced fighter aircraft, tanks, ships or ground troops, which allows for optimal utilisation of available resources to maximise effectiveness for a wide range of missions.



IAI Unveils New Loitering Munition- Mini Harpy



situational picture and closing the attack circle at low cost. The loitering missiles are launched towards the target area. They loiter the sky until the threat is detected. Upon detection, the systems locks in on the threat and attacks it for a quick, lethal closure. The system was designed to provide operators with control up to the last moment, including cessation of attack at any stage. Electrically powered, it is extremely quiet, carries shaped charge of approx. 8 kg, operates in mission range of 100 km for duration of two hours and 45 kg in weight.

Israel Aerospace Industries (IAI) has unveiled the 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



Thales: Networking tomorrow's soldier for battlefield superiority



Soldiers in past conflicts, even relatively recent ones, would not be able to recognise today's – and especially tomorrow's – soldier on the battlefield. Why? Because of the digital technologies that are changing the way the soldier sees, thinks and acts, being connected to other troops and support systems for information superiority over the adversary and precision engagement. “There’s simply no comparison when you look at the next generation of soldiers” states Pascal Secretin, responsible for the imagers and sensors for optronic systems at Thales and a former French airborne combat unit commander himself, “In the past, the soldier on the ground might have wait twenty minutes for the arrival of support or approval to engage. Today, by sharing images instantaneously through cyber-secured communications, decisive moments get immediate response because combat decisions are collaborative, in real-time. And they are more precise because Artificial Intelligence is interpreting what is happening from information sent by the soldier’s sensors and cameras, ground vehicles, as well as from drone, aircraft and satellite ‘eyes in the sky’, and pointing to the best response.”

All this, of course, shortens informed decision time and that means *winning*,

as Pascal Secretin explains, “Information superiority for the soldier’s mind and precision weapons for the soldier’s arms provides the critical battlefield superiority”. Armed forces count on Thales and its technological expertise to empower the vital transition for tomorrow’s more effective fighting force on the ground, the objective being to personalise the information provided to make it the most useful to suit the precise role of each member of the fighting force. And that means personalised tools. “In that way” explains Pascal Secretin, “better understanding of the fast-changing battleground means gaining time for more rapid and more-precise decision-taking and engagement. And with each member of the team having information tailored to his or her needs, by connecting them together you create the most efficient and effective collaborative combat imaginable”

A key reason for Thales leadership in creating such tools for tomorrow’s more effective fighting force is its ability to combine technologies to create unprecedented performance. To take just one example, how do you give a soldier near x-ray vision to “see” what formerly was invisible and precisely a target day or night? Thales does it by superimposing thermal images in Augmented Reality on classic

vision. The tools that Thales is developing for the soldier on the ground also are lighter, more robust, more reliable and provide more autonomy.

Among the tools it is providing today and perfecting further for tomorrow are head-mounted information displays for laser-like focus on the essential, lighter and digitally-empowered rifles for rapid target acquisition and the ‘Sophie’ line of thermal imagers, making formerly ‘invisible’ objects capable of being targeted day and night. Coupled with the other battlefield tools from Thales defence technologies, the connected and augmented soldier becomes key to a more effective fighting force on the ground.

As Emmanuel Sprauel, Director of Strategy & Marketing for optronic and missile electronics at Thales, elaborates, “The armed forces rely on Thales for our ability to apply our expertise in connectivity, big data, artificial intelligence and cybersecurity technologies that are the key their digital transformation. This qualifies us to give the soldier what he or she needs to win on the battlefield today and tomorrow: shared information superiority, precision and speed of decision-making for mobility, firepower and protection.” 

Courtesy: Thales

Developments at Saab

Test flights of Gripen E with Meteor BVRAAM

Saab has completed test flights by a Gripen E aircraft with the Meteor Beyond Visual Range Air-to-Air Missile (BVRAAM). Carrying two Meteor missiles, the Gripen E aircraft (39-8)



operated from Saab's airfield at Linköping, Sweden, this being part of the weapon integration progress and marking an important milestone in the programme with the Swedish Air Force. The Gripen E continues to fly with different configurations to gradually expand the flight envelope.

The Meteor is an active radar guided BVRAAM, and capable of engaging air targets autonomously, day or night, in all weather and in harsh electronic warfare environment. The missile's ramjet propulsion system gives the Meteor high-speed performance and the energy to defeat fast, moving targets at very long range. The Gripen C/D of the Swedish Air Force in 2016 became the world's first fighter aircraft to be operational with the Meteor missile.

Deployable Aircraft Maintenance Facility

Saab will provide enhanced aircraft maintenance capability to the Hungarian Air Force, using the mobile solution Deployable Aircraft Maintenance Facility (DAM) which is a mobile hangar solution that enables 'enhanced aircraft maintenance capacity combined with superior protection'. DAM provides capability equivalent to stationary maintenance infrastructure, but at a fraction of the cost.



The Hungarian Air Force is currently operating 14 Gripens on a lease-purchase agreement with the Swedish government. DAM will provide the Hungarian Air Force with an increased level of flexibility and reduce their dependency on stationary infrastructure for maintenance and protection of their Gripen fleet. The DAM solution can be rapidly deployed (in less than 48 hours) to enable sustainment of self-sufficient operations for extended periods of time, in any location, regardless of whether they are domestic or overseas.

Contracts for Carl-Gustaf M4

Saab has received contracts for the Carl-Gustaf M4 multi-role weapon system for "an undisclosed customer," the total order value being for approximately 492 MSEK with deliveries to take place in 2019-2024. For seven decades, the Carl-Gustaf man-portable multi-role weapon system has been supporting infantry around the world in dealing with a full range of battlefield challenges. The new Carl-Gustaf M4, has all the effectiveness and versatility of the Carl-Gustaf system but its improved and lightweight design, weighing less than 7 kg, offers significant mobility for the infantry soldier.

This is Saab's tenth customer for the Carl-Gustaf M4 version. The new version retains all the effectiveness and versatility of the Carl-Gustaf system while introducing a range of major enhancements, which include a lighter weight design, a fired-round counter, improved safety and intelligent features, such as compatibility with future intelligent sighting systems and programmable ammunition. The weapon is fully compatible with various ammunition types.



FMV orders Giraffe 4A and Arthur radars

Saab has received an order from the Swedish Defence Materiel Administration (FMV) “to develop and maintain the Armed Forces’ artillery and weapon locating capability.” The order includes



Saab’s Giraffe 4A multi-function radar and life extension of the Arthur artillery locating system. The modern ground-based multi-function system Giraffe 4A and the life extension of Arthur will give the Armed Forces’ long-range surveillance capability and provide new possibilities to handle existing and future threats. The production will take place at Gothenburg with deliveries from 2019.

The Giraffe 4A is a multi-function radar that gives the user a range of capabilities, the system used for air surveillance and air defence as well as warning and artillery locating tasks. This is a digital multi-channel system featuring Active Electronically Scanned Array (AESA) technology based on gallium nitride (GaN). Arthur and the Giraffe radar family are produced at Saab’s Gothenburg premises, a centre for microwave and sensor technology, with some of the most advanced radar and sensor systems available produced there.

Saab’s radar and electronic warfare activities include the GlobalEye airborne surveillance solution, sensor systems for the Gripen fighter and the self-protection system family Arexis.

RBS 70 ordered by Ireland

Saab has received an order for RBS 70 BOLIDE missiles from the Irish Defence Forces, at a value of approximately 60 MSEK, with deliveries to take place in 2019-2022. Ireland has been a RBS 70 operator for more than 30 years, this order being for the BOLIDE, the latest missile for the RBS 70 system. The Saab portfolio of short-range ground-based air defence missile systems includes the RBS 70 and the latest version, RBS 70 NG. The RBS 70 system has an ‘impressive’ track-record with more than 1,600 launchers and over 17,000 missiles delivered to nineteen countries.

FMV order new Gripen E equipment

Saab has received an order from the Swedish Defence Materiel Administration (FMV) for new equipment for the Gripen E, supplementary the previous Gripen E contract and valued approximately SEK 430 million. The original contract, regarding development and modification of the Gripen E, signed with FMV in February 2013, required that certain equipment from existing Gripen C/Ds in the Swedish Armed Forces be reused. However, the new equipment will be required for the Swedish order of 60 GripenEs without affecting the current Gripen C/D fleet. 



MBDA capabilities demonstrated

The 5th Generation MMP

Some 15 foreign delegations, as well as representatives of the European Defence Agency (EDA) and the NATO Support and Procurement Agency (NSPA) recently witnessed the full range of capabilities of MBDA's 5th generation MMP (*Missile Moyenne Portée*) ground combat missile during live firing demonstrations. These took place in two phases: a dynamic phase, in which international representatives watched three firings conducted by the French Army Technical Section (STAT) and a static phase, based on presentations and workshops making use of standard operational equipment for simulations, training and support.

The three firings (all of which precisely struck their targets) showcased the missile's various operating modes in different scenarios, against both fixed and mobile targets at ranges from 2.5 km to over 4 km, proving accuracy of the MMP in all conditions, even when fired at hidden targets beyond line of sight.

Marte ER missile success

MBDA's Marte ER anti-ship missile has completed its first firing, successfully passing a major phase in its development. The

multi-platform anti-ship missiles that can be launched by ships, helicopters, coastal batteries and fast jets. The Marte family has a strong and successful history both at domestic and international levels, most recently with Marte ER being ordered earlier in 2018 by the Qatar Emiri Air Force (QEAF) for their new NH90 helicopters. Marte is a single product family that can cover several missions, offering our customers a high level of operational

flexibility in the area of maritime superiority, a domain where MBDA in Italy has been able throughout its long history not only to maintain but also to grow as well as further develop competencies and know-how".

Sea Venom-ANL missile trials

MBDA's Sea Venom-ANL anti-ship missile has successfully conducted further firing trials, passing a significant new milestone for the Anglo-French co-



operation programme. This latest trial has demonstrated the Sea Venom-ANL's lock on before launch (LOBL) capabilities, with images from the missile's infrared seeker being used by the operator to designate the target prior to launch. The Sea Venom-ANL is capable of being launched from a wide range of platforms, and will be used on the UK Royal Navy's AW159 Wildcat and French Navy future HIL (*Hélicoptère Interarmées Léger*) helicopters. 🦋

firing trial was carried out at an Italian test range where the Marte ER missile flew for more than 100 km on a planned trajectory that included several waypoints and the sea skimming flight, successfully testing all flying phases. Pasquale Di Bartolomeo, Executive Group Director Sales & Business Development and Managing Director MBDA Italia, commented: "This test is further confirmation of the robustness of the ER version of the Marte family of



Third MC-21-300 joins flight test programme



Manturov stated, “MC-21-300 flight tests are continuing, the third aircraft has joined them. On this aeroplane, in addition to the special test equipment, a passenger cabin has been included“.

According to Denis Manturov, the MC-21-300 with passenger interior layout will debut at MAKS 2019, the upcoming Moscow international aviation and space salon. “This will allow us to visually demonstrate to potential customers and future passengers one of the most important competitive advantages of the Russian airliner, with increased level of comfort”. Yuri Slyusar, President of UAC and Irkut Corporation, added that in 2019 the fourth MC-21-300 prototype, built at

On 16 March 2019, maiden flight of the third MC-21-300 test aircraft took place at Irkutsk Aviation Plant’s airfield, the duration of flight being 90 minutes and upto an altitude of 3500 meters with speed of 450 km/h attained. The aircraft was piloted by test pilots Andrey Voropayev and Roman Taskaev. According to the after flight report, the objectives were met completely, the flight being in normal mode. The Minister of Industry and Trade of the Russian Federation Denis



the Irkutsk Aviation Plant, would join the flight tests.

Also in April, the MC-21-300 test aircraft, fitted with a passenger cabin made non-stop flight from Irkutsk to Ulyanovsk Vostochny airport, where the aircraft was given a paint scheme according to new production technologies, after which it flew to Ramenskoye airport (Zhukovsky, Moscow region) to continue flight tests. This aircraft was piloted by a crew of *Hero of Russia*, honoured test pilot Roman Taskaev and 1st class test pilot Vasily Sevastyanov. As Roman Taskayev later stated, “The flight was normal and without complaint”.

Various Ulyanovsk enterprises are major participants in the MC-21 programme : Aviastar-SP Plant produces the fuselage panels, empennage and many other units for MC-21-300 aircraft while the AeroComposit-Ulyanovsk Company builds the wing made of composite materials. 

Rosoboronexport contracts BT-3F AFVs for Indonesia



BMP-3F

JSC Rosoboronexport (part of the Rostec State Corporation) and the Indonesian Ministry of Defence have signed a contract for supply of BMP-3F infantry fighting vehicles and BT-3F amphibious armoured personnel carriers (APCs) developed and produced by JSC Kurganmashzavod for Indonesia's Marine Corps. "The contract for BT-3Fs to Indonesia is the first ever Russian export deal for these new AFVs. The design has reflected the requests of the partners as well as their experience of using BMP-3Fs, which were delivered to them earlier. Indonesia is very meticulous in selection of equipment for its armed forces, and this contract is major endorsement of the highest quality of Russian weapons and their superiority over competitors," stated Rosoboronexport's Director General Alexander Mikheev.

Development of the amphibious armoured personnel carrier BT-3F was based on the BMP-3F and is designed for transportation of marines, coast guards and land forces, as well as for fire support of landed parties in various combat operations. The APC can transport 17 personnel, including the crew. The control compartment houses the driver, a member of the landing party and commander's assistant on the left and right sides accordingly, both being positioned for firing machine guns.

The APC is equipped with energy-absorbing folding seats, providing significant reduction in shock loads on spines and in the event of mine explosions or when driving over rough terrain, the seats being fitted with five-point seat belts. In addition, the vehicles are equipped with aggregate compressor air conditioning, vital for hot tropical climates. Mounted on top of the BT-3F is a two-axis stabilised remote-controlled combat module with 12.7 mm machine gun fitted. The combat module is equipped with tele-thermal imaging sight with a laser rangefinder, and equipped with a built-in diagnostic system and ammunition status indicator.



There is high level of commonality between the BT-3F armoured personnel carrier and the BMP-3/BMP-3F for reducing operational and personnel training costs, which also eases spare parts inventory and logistics.

"Indonesia is one of Rostec's key partners in South-East Asia, both in the areas of military and technical cooperation and civilian products, plus on transfer of technologies, jointly with enterprises of the state corporation. For instance, Rostec is exporting to Indonesia a wide spectrum of medical equipment. A subsidiary of the KAMAZ company has been established in the country to deal with the supplies of trucks to the local market, and there is huge potential for co-operative development. Rostec is not just offering the entire range of armament and civilian products of the state corporation, but it is ready to build industrial partnerships of the highest order," noted Sergey Chemezov, Rostec's head.

Military and technical cooperation between the erstwhile USSR and Indonesia goes back to 1958, with intensification of military-technical ties between Moscow and Djakarta taking place in the late 1990s and early 2000s. Since November 1992, the total volume of military products supplied to Indonesia has been some \$2.5 billion, with Indonesia receiving BTR-80A armoured personnel carriers, BMP-3F infantry fighting vehicles, Kalashnikov assault rifles of the '100' series, Sukhoi Su-30 fighters and 'Mi' type helicopters, apart from various other types of weapons and military equipment. 🦋

Beyond Zhuhai 2018



China's Mountain Eagles and Falcons

The almost frenetic pace of Chinese 'next gen' fighter developments continue to dominate the headlines, and thus Chinese 'next gen' lead in fighter trainers (LIFT) get second billing. This article, with extracts from China aviation analysts, reviews developments beyond the Sino-Pak K-8 Karakoram which is being supplanted by various new types, including the JL-9/FTC-2000 Mountain Eagle and the Hongdu L-15 Falcon.

The FTC-2000G is latest avatar of a well-established family that started off as the Guizhou JL-9 Mountain Eagle, unabashedly based on the venerable MiG-21 and its Chinese clone, the F-7. Development of the JL-9 began in 2001 as an advanced lead-in fighter trainer (LIFT) based on the earlier JJ-7/FT-7 design and later the JJ-9. Essentially, the JL-9 incorporates a new forward fuselage, the erstwhile nose intake replaced by a solid nose accommodating an X-band pulse-Doppler fire-control radar, with the engine intakes now relocated on the fuselage sides. The stepped tandem cockpit section is a new design, with a single-piece windshield giving improved forward and downward vision when compared with the original item. The aircraft has a double-delta wing without leading edge flaps, has a modern avionics suite and the cockpit includes a head up display (HUD) as also a multi-function display (MFD).



The prototype JL-9 made its first flight on 13 December 2003 with the test aircraft flight evaluated during 2004-2005. Following some fine-tuning, the modified JL-9 flew for the first time on 23 August

2006, featuring a new control augmentation system (CAS) for enhanced stability and an improved cockpit environment control system. Series production JL-9s were first delivered to the PLAAF in 2007 and



The JL-9 'Mountain Eagle'

operational deliveries began in 2011 with PLA Naval Aviation receiving their first JL-9Hs soon thereafter. An improved variant, known as the JL-9A, features new formation lighting strips on the forward fuselage and tail fin to enhance visibility in night training as also a new VHF omni-directional radio range (VLOC) navigation system. Entering production in 2004, this variant is still in production.

Another development of the JL-9 is the JL-9G, a dedicated naval version, for naval aviators to practice take-offs and landings on a simulated aircraft carrier deck, particularly for take-offs from the 'ski jump' ramp, followed by a conventional recovery. The JL-9G has been extensively modified, with strengthened landing gear and enlarged wings, as also a redesigned forward fuselage with diverterless supersonic intakes (DSI). Furthermore, the twin ventral stabilisers are replaced by a taller tail fin.

Based on the JL-9 is the FTC-2000 trainer, first unveiled as a demonstrator at the 2016 Zhuhai airshow when, quick off the mark, a contract was signed with the Sudanese Air Force for six FTC-2000S,

the initial batch already delivered in November 2017. The Nigerian Air Force has also expressed interest, probably eyeing the latest, further improved FTC-2000G, which employs the stronger airframe of the navalized JL-9G with the DSI intake and redesigned tail with improved aerodynamics and increased fuel capacity. The FTC-2000G is offered as "an affordable, versatile aircraft for different types of training as well as combat missions" and features up to seven

hardpoints for a maximum armament load of 3,000kg. Ironically, the FTC-2000G may well have spawned competition for the JF-17 Thunder amongst many operators of MiG-21 and F-7 fighters in Asia and Africa.

The Hongdu JL-10 (export L-15)

The latest LIFT to enter PLAAF and PLA Naval Aviation service is the Hongdu JL-10 Falcon, which actually began life with the export designation of L-15. This advanced



The Hongdu JL-10 Falcon



JL-10Hs of Chinese Naval Aviation

jet trainer (AJT), whose design approach is very familiar, was, not unsurprisingly, developed with technical assistance from the Yakovlev OKB, and has been developed by Nanchang-based Hongdu Aviation Industry Corporation, the chief designer being Zhang Hong. The JL-10 is designed for lead in fighter training of aircrew moving to the new generation of Chinese fighters including the J-10, J-11, J-15, J-16 and J-20.

Two different versions are being developed : the standard JL-10 a.k.a L-15A AJT, powered by two Ukrainian-origin AI-222-25 turbofans and a dedicated L-15B LIFT, powered by two AI-222-25Fs with afterburning to give it supersonic capability. The JL-10 has a more modern airframe, with prominent leading-edge root extensions (LEX) which gives a maximum angle of attack of 30°, a large vertical tail fin and a modern aerodynamic configuration. The cockpit is considerably more advanced than the JL-9's, having a fully digital glass environment with HUD, three colour MFDs, hands on throttle and stick (HOTAS) controls and three-axis quadruplex digital FBW. For weapons training, the JL-10 has four underwing and two wingtip pylons for a wide variety of stores plus an optional gun pod underneath the fuselage. The standard JL-10 is equipped with a small radar, while the L-15B can carry a small passive electronically scanned array (PESA) fire-control radar.

First flight of the L-15 AJT prototype was on 13 March 2006, this first example powered by two interim DV-2 turbofans but followed by an improved AJT prototype using two AI-222-25 turbofans which flew on 10 May 2008. The LIFT version,

with the afterburning AI-222K-25F, first flew on 26 October 2010. The JL-10 was unveiled before its first flight on 1 July 2013 and several prototypes have since been undergoing testing, based on images from mid-2016. China's Naval aviation received its first aircraft (the JL-10H) in March 2017. The series production JL-10 is to receive an indigenous turbofan without afterburning (actually an AI-222-25 copy), which was flown for the first time in May 2016.

The L-15B is powered by the WS-17 Minshan turbofan, having a maximum thrust of 4700kg with afterburning, which was developed by the Guizhou Aero Engine Research Institute. In fact, there are speculations that the JL-10 might well be used by naval aviation as a carrier-based trainer, possibly based on the L-15B airframe with the more powerful engines.

Export potential

Three different variants are currently being promoted in the export market : the standard L-15A, comparable to the JL-10 and the L-15Z, which is already in service with the Zambian Air Force; the L-15B, available with combat-capable avionics and the L-15C, which combines the L-15B's avionics with the airframe of the L-15A. The Ukraine, Pakistan and Uruguay are amongst the first potential operators but there are no second guesses as to which (Western) AJTs and LIFTs are being competed against !

Still, it would be a brave man indeed who could imagine that, in a perfect (unreal) world, the JL-10 could well have been a contender for the USAF's T-X programme itself! 🦋

PS



The L-15 is being vigorously promoted in the export market

Frisian Flag 2019



Fighter pilots from various countries trained in complex missions during the international exercise *Frisian Flag* in April 2019, some 50 aircraft operating from Leeuwarden airbase. During the exercise, air-to-air refueling was performed by tanker aircraft at Eindhoven airbase (NL), that flew in their own exercise (EART2019).

The Royal Netherlands Air Force participated with F-16s from Volkel and Leeuwarden, while the Polish Air Force brought their new F-16Cs. The US Air Force sent F-16C aircraft from the 148 Fighter Wing of the Minnesota Air National Guard, based at Duluth (MN) airbase, these F-16s being in special 'Have Glass' paint of dark grey colour.

The German Air Force participated with Eurofighters and the French Air Force contributed a number of Mirage 2000Ds from Nancy.

Special participants were the Swiss Air Force with F/A-18 Hornets, after some decades of absence. A Cobham DA-20 was deployed from the UK to disrupt communication of the fighter aircraft, which made their operations much more difficult. In addition, a number of air defence systems



contributed to making the scenario as realistic as possible. The new ground-based Multi Mission Radar (MMR) was also employed, to add to the complexity.

Current missions increasingly take place in a coalition context, which makes training in an international context necessary. Because the Leeuwarden airbase is close to large

exercise areas in the North Sea, the exercise is based at the Frisian location. Conducting the Exercise, Lieutenant Colonel Ronald van der Jagt was aware that Frisian Flag has an impact on the environment, yet he hoped for understanding. "One of the points of attention was to minimise unnecessary inconvenience. Fixed departure and landing



times were used as much as possible, so people in the neighborhood were quite aware of when the flight movements take place.

Frisian Flag takes place not only over Dutch airspace, but also those of neighbouring Germany and Denmark, which requires close cooperation between

airspace control authorities of the 3 countries. Combat management is with the Dutch and German Control and Reporting Centre (CRC), and an Airborne



Early Warning and Control (AWACS) reconnaissance aircraft from Geilenkirchen also took part.

During first week of the exercise, all aircraft flew in north-south direction when simulated attacks were carried out north of the Netherlands. During the second week, the targets were in northern Germany, with the aircraft now flying west to the east.

Monday April 1, 2019, first day of the Exercise, was also media day at the Leeuwarden airbase. We interacted with various personalities and give some extracts :

✦ The experienced Lt Col Raphael of the French Air Force came to Leeuwarden with 85 personnel and 4 aircraft to carry out *Composite Air Operation* (CAMAQ). In the role of Mission Commander, he prepared and executed the complete

Frisian Flag mission during the first week.

✦ For the young USAF Lt Smidt, with just 100 flying hours on the F-16, this was his first exercise abroad, taking part in a virtual air war, engaged in aerial combat with as many as 50 fighters.

✦ The Swiss Lt Col Studer was at 'Frisian Flag' for the first time. Given the upcoming selection process for new fighter aircraft of the Swiss Air Force, *Frisian Flag* was the lone foreign exercise they will participate this year, and not going to the NATO *TigerMeet* at Mont-de-Marsan, the Tactical Leadership programme in the Spanish Albacete and the *Arctic Challenge* exercise in Sweden. With 16 pilots and 4 aircraft, the Swiss only participated for a brief time in the exercise and for operational reasons,

the Swiss aircraft and pilots returned to Switzerland in the second week.

✦ Frisian Flag Exercise Director, Lieutenant Colonel Ronald van der Jagt confirmed that the number of personnel at the airbase had doubled during these 2 weeks. Planning for *Frisian Flag* 2020 has already started following end of this exercise. Given the arrival of first Dutch F-35s around October/November 2019 and continuing reduction of F-16s at Leeuwarden, a decision will also be taken as to whether the FrisianFlag 2020 can be planned in its current manner. ✦

All photos and text : Joris van Boven and Alex van Noye ; interview with Swiss Commander by Kees van der Mark

Participating Aircraft Types, Air Forces and Bases

F-16AM of RNLAf of 322 Squadron from Leeuwarden
F-16AM of RNLAf of 312 and 313 Squadrons from Volkel
F-16C of USAF of 148 FW from Duluth
F-16C of Polish Air Force from Poznan (photo below)

Eurofighter of Luftwaffe of GAF of TLG31B from Noervenich
F-18 of Swiss Air Force of Staffel 11 from Meiringen
Mirage 2000D of Armée de l'Air of 3rd Wing from Nancy



The Supporting EART



The European Air Transport Command (EATC) at Eindhoven air base were the organisers for this year's air-air refueling competition, which took place during the *Frisian Flag* exercise at Leeuwarden airbase during first two weeks of April 2019. This supporting tanker exercise *European Air Refuelling Training* (EART) was conducted from Eindhoven.

In addition to the Dutch Air Force's McDonnell Douglas KDC-10, a German

Airbus A310 MRTT, an RAF Airbus A330 Voyager, a French Boeing C-135F and an USAF Boeing KC-135 participated this year, however the latter aircraft was only present at Eindhoven for a day, the remaining missions being flown from RAF Mildenhall in the United Kingdom.

EART's Exercise Director Colonel A Massucci gave an overview of the aerial tankers in Europe. Presently, European countries continue to rely heavily on the

USAF's capacity which became obvious during the *Unified Protector* operations over Libya in 2011. Since then, steps have been taken with, among other things, the joint purchase of A330 MRTT tankers, the first of which is expected at Eindhoven in early 2020. Ultimately, eight such aircraft will be purchased, some of which to be located at Eindhoven with others at Germany's Cologne-Bonn.

The French Air Force is also replacing its obsolescent C-135Fs, dating from the '60s, with

2019



the Airbus A330 *Phoenix*, the first aircraft delivered at Istres airbase last October.

In addition, Airbus A400M tactical transport aircraft have been put into service by the German, French, British and Spanish air forces. This aircraft type can also be used for aerial refuelling and the German Air Force has recently completed flight trials with the A400M.

Major Fred *Frolic* of the Royal Netherlands Air Force talked about

structure of the EART exercise and about the objectives. “Not only was refuelling of fighters part of the exercise, but also the operational deployment of both tankers and fighters in limited air space. At different heights (with a vertical separation of about 150 meters (500 feet), the tankers flew close to each other (with a horizontal separation of 1850 metres) in so-called ‘tracks’, where the fighters had to close up with the tankers : flying closely in such

small airspace was also one of the objectives of this exercise”.

A note on Dutch KDC-10 aircraft, which are to be retired from service end of 2019. The second such Dutch aircraft has recently been upgraded and will continue to fly for a few years longer but too will be replaced by the A330. 🦋

Photos and text by Joris van Boven and Alex van Noye

Iniochos



Exercising Greek Air Power !

During the first two weeks of April 2019, the Hellenic Air Force base at Andravida, home to the 117 Combat Wing and its F-4E Phantoms, staged the annual medium-scale 'Iniochos' exercise, hosted by the Service. Under auspices of the Air Tactics Centre (ATC), some 80 fighters participated in the Exercise everyday, exposing the participants to an intensive battle rhythm.

How it all began

Given the high (readiness) level of the Hellenic Air Force (HAF) personnel owing to the everlasting tensions with neighbouring country Turkey, for years the HAF has been looking for a way to verify ability to employ their weapon systems in a high-density environment. *Iniochos* is an annual medium scale exercise flown from the facilities of



Italian AF Tornado

the Air Tactics Centre at Andravida Air Base, located in northwest Peloponnese. It was first conducted in the late 1980s, as a small scale tactical level exercise tailored to the contemporary necessity for training in combined air operations in accordance with the *Hellenic Air Force Doctrine*.

Lt Col Gkioles, Director of Operations of *Iniochos* for some years, elaborated how the exercise has evolved to its current form: “In 2013 the project started with a small group of people. The then Chief of Staff, General Tournas, tasked the Fighter Weapons School to create this type of exercise from scratch and deliver it within six months. Nobody believed it was feasible but General Tournas put his full faith in the then Majors Karpouzis and myself. We worked 18 hours a day with no vacation. We made it happen with help of the squadrons – and at minimal cost. We were dog tired by the end of the exercise but the smiles on the faces of the participating pilots were one’s best reward! A month later I happened to read the book *Sierra Hotel* which is the story of how *Red Flag* at Nellis Air Force Base came about and the similarities were astonishing!”.

The success of the exercise led to the decision on establishing this as an annual event including international participants adopting the single base concept, meaning that all participants would operate from the same base as much as possible to maximise all benefits like (de-)briefing together – as also social activities.

Demanding missions

While the participants are exposed to non-stop flying by day and night, the flow of information affects every aspect of the mission thus creating a realistic and immerse environment where the air crews’ tactical flexibility in decision making is challenged at high levels. To ensure the quality, tactical



USAF F-16



Mirage 2000D of the Hellenic Air Force at Andravida

relevance and valid results, the Fighter Weapons School (FWS) has the oversight of all tactical aspects of the exercise. The aforementioned characteristics create a unique demanding training environment that can only be provided by *Iniochos*. The area used by participating units included the entire Athens FIR (Flight Information Region) up to its most southeastern area near the island of Kastelorizo which lies very close to Turkey. One might call this provocative, another a show of force.

The traditional roles of *Blue Air* and *Red Air* were alternated between (mainly) HAF participants, Lt Col Gkioles explained why: “The HAF is an Air Defense-focused Air Force, which is in full alignment with our doctrine and geostrategic position (at the edge of Europe and NATO). *Red Air* operations are mostly tasked with DCA (Defensive Counter Air) missions hence our guys get a lot of benefits by these missions.” *Iniochos* is known by its participants for its variety of demanding missions, in conjunction with the simultaneously held Hellenic Navy (*Astrapi*) and Army (*Polifimos*) exercises, including Air operations versus Integrated Air Defence Systems (IADS), Anti Surface Warfare and Strike Coordination and Reconnaissance (SCAR).

The Lightnings !

Being the biggest exercise for the HAF during the year, all its combat squadrons were involved during the exercise. The United Arab Emirates also returned to *Iniochos* for the third consecutive year, the UAE AF & DF bringing six advanced



Israeli F-16 C

Mirage 2000-9s of 71 Squadron based at Al-Dhafra Air Base. The Israeli Air Force, who have been participants from the very first exercise, announced their presence at an early stage but were only present during first week of the exercise. This year their 117 Squadron flying F-16Cs and 109 Squadron F-16Ds brought six jets each from Ramat David Air Base. They flew directly to Andravida with the support of KC-707 tankers. The United States Air Forces Europe (USAFE), joined this year with a small detachment of just 6 F-16s from the Spangdahlem-based 480 Fighter Squadron. Returning after last year’s debut was the Italian Air Force with six Tornados from 6° *Stormo*, based at Ghedi Air Base.

Undoubtedly stars of the show this year were the F-35A Lightning IIs of the Italian Air Force from its 13° *Gruppo* (squadron) bringing all their currently delivered six Lightnings to Greece, this being the

first non F-35 programme-country to receive these jets. “The experience has been amazing because we had the opportunity to exploit all capabilities of our weapon systems, performing both air-to-air and air-to-ground missions, SEAD (Suppression of Enemy Air Defenses) and DEAD (Destruction of Enemy Air Defenses) missions,” Detachment Commander (DETCO) Lt Col Lodato commented after *Iniochos*. As expected, the F-35s operated with the Lunenburg lenses installed on the aircraft ensuring that the actual Cross Radar Section (CRS) could not be picked up by those who might be interested in knowing !

Pillar of stability

Greece geographically straddles this strategic part of Europe. “The Balkan countries, the Middle East, Northern Africa and the Eastern Mediterranean Sea are areas of great strategic importance and known for its broad scale of security challenges,” Greek minister of Defense Evangelos Apostolakis said during the *Iniochos* press conference. “Greece plays a key role in the promotion of international defence cooperation and initiatives. Exercise *Iniochos* enables realistic international operational air training in a joint environment and contributes to strengthening stability and effectively tackling common security challenges at international level. Thus, the interaction and synergy achieved, in addition to the obvious operational benefits in the area of defence, also contribute to the strengthening of the bonds of cooperation and friendship among the participating states.”

The Greek Government would like to take the lead role in organizing international exercises while the ATC plans to make



Focus of attention: F-35 A Lightning II of the Italian AF



Greek F-4E Phantom

Iniochos the most important medium scale air-exercise for Europe and the Middle East. To reach this objective, a fully simulated combat environment is being provided to all participants, together with the opportunity of using different kinds of target ranges for perfect realistic training conditions.

According to US Ambassador Geoffrey Pyatt, Greece is well underway in reaching this goal: “It’s very, very impressive to see how *Iniochos* has grown. It’s a fantastic example of the unique role that Greece is able to play because of its geography, the unique set of participants that Greece pulls together for this exercise, the unique opportunities to fly over sea, high mountains, over a very large airspace, and to develop the capacity to work together and so to build security. It reflects the ambition of Greece as a builder of bridges, as a pillar of regional stability.”

And the Future

Overall, the exercise was a big success once again and a great opportunity to verify the capabilities of the organising home team. For the HAF it was interesting to get a “glimpse” of the F-35A and its capabilities, an aircraft which might well be the successor of (part of) its current F-16 fleet. According to Lt Col Gkiolos, the exercise is still evolving based on lessons learned from the past: “Participants tend to request extra flights (more than what they initially request in the Main Planning Conference) once they arrive and realise the available training opportunities, so we added more flying slots for side missions and increased the flying window. There is



Greek F-16 D

also an increased interest on SEAD/DEAD vs IADS missions, so we multiplied the scenarios involving SBAD (Surface Based Air Defense) like the Patriot, Hawk and Skyguard. Although all missions can be flown without Air-to-Air Refueling (AAR), because the exercise areas are predominantly close to the air base, participants still want to train thus. So this year we had AAR in five days (one was cancelled due to weather) supplied by Israel with KC-707s and USAFE KC-135Rs flying out of Mildenhall.”

Looking at the future there are a few aspects Lt Col Gkiolos would like to add to the exercise: “We would like to add more diversity in participating assets. For example CSAR Helos from other countries, Remotely Piloted Aircraft MALE (Medium

Altitude Long Endurance), Naval air assets or even an aircraft carrier itself which could make for an even better scenario, especially with the ASUW (Anti Surface Warfare) missions that take place in the Southern and Eastern Aegean Sea.”

But at the end it is the men and women who do the job. “Don’t focus on the machines, it is the people that participate that make the exercise a great experience and the underlying objective for all exercises is to boost morale across the ranks. This has been achieved, the effect is profound!” Lt Col Gkiolos concluded after this year’s *Iniochos*. 🦋

Photos and text: Patrick Smitshoek, Stephan van Geem and Remco Stalenhoef

Sound of freedom over the Peloponnese



Iniochos 2019

The Israeli Air Force participated with six F-16D's, all part of the 109FS at Ramat David AB

The *Iniochos 2019* Exercise was conducted at Andravida AB in the north west of Greece from 1 to 12 April 2019. Marked as the largest exercise in the Mediterranean area, *Iniochos 2019* attracted several foreign countries to join the *Elliniko Polemiki Aeroporia* (Hellenic Air Force) in an exercise which was organised by the Air Tactics Centre at Andravida. This year's edition witnessed the participation of

air forces from Israel, United States, Italy and the United Arab Emirates. Apart from these countries, there were nations such as Canada, France, Germany, Jordan and Kazakhstan who registered their presence as observers to the *Iniochos 2019*.

The *Iniochos exercise* was held for the first time in the late 1980s as a small scale tactical exercise. The focus was to provide realistic training for defence

personnel in planning and execution of Combined Air Operations (CAMA) in a realistic environment to test and evaluate operational plans and tactics. Through the years, this concept became a success and the Hellenic Air Force made the decision to make this an annual event.

Exercise Iniochos 2019 was divided into four phases: Phase 1 (Exercise Preparation 4-15 March), Phase 2 (Force Deployment 26-28 March), Phase 3 (Execution Phase 1-12 April) and Phase 4 which was Force Redeployment (on 12 April). All the missions of *Iniochos 2019* were supervised by FWS, right from planning to debrief. Some of the missions included Air Operations versus Integrated Air Defence Systems; Reconnaissance missions; Combat Search and Rescue missions; Time Sensitive Target Missions; Dynamic Targeting / Strike Coordination and Reconnaissance / Close Air Support; High Value Airborne Asset / Protect – Attack; Slow Mover Protection; Offensive Counter Air / Airfield Attack; Air interdiction on special targets (bridges, power stations, vehicles) and Anti-Surface Warfare.



A Mirage 2000EG coming in for landing: two single seat and two twin seat Mirages came from 332 Mira at Tanagra



For the first time at Iniochos, the F-35 participated, six aircraft, coming from 32 Stormo at Amendola AB

A large flying force was tasked to operate alongside maritime and land forces which provided a full scale threat with the variety of hittable targets. During the exercise, operations were carried out by using majority of the Athena FIR. The prime objectives of the 2019 exercise were to develop interoperability and standardisation between HAF units and allied nations air forces, to promote cooperation between the forces in planning the tactics, practice of several techniques and procedures during air-to-land and air-to-sea operations, the use of combination of classic and modern assets in a modern combat zone, prepare aircrews for the future theatre of war.

The *Accurate Shot/Event Assessment* was also an important part of the exercise which was achieved with the use of on-board and off-board tracking data, sensors and specialised debriefing software. All these devices were used to reconstruct the missions, under the experience of Fighter Weapons School instructors who supervised the debriefing process.

Iniochos 2019 had participation from 77 fighter aircraft at Andravida and for the first time, witnessed the participation of 3rd, 4th and 5th generation fighter aircraft. Rather exceptional was the fact that aircraft from the two fighter squadrons at Araxos Air



IDF F-16s on the flight line

Base flew missions from their own airfield as a part for the exercise. More than 1000 sorties were flown by the participants in nine operational days. During the operational days, two missions usually took place, one in the morning and the second in the afternoon, but there were few evening missions as well. Participants in the morning missions flew mostly above the Aegean Sea, while the afternoon participants flew above

the mountain areas. The exercise included two air refuelling aircraft, one KC-135 from the USAF and one KC-707 from the Israeli Air Force, these tankers only used by Greek Air Force F-16s.

The Israeli Air Force F-16s only participated during the first week of *Iniochos* and left Andravida on 5 April with the support of one C-130 and Boeing-707. The participating F-16s consisted of 13



Greek F-16D Block 52 from 340 Mira



Tornado IDS from 154 Gruppo (6 Stormo)



The Hellenic Air Force is one of the last air forces still flying the F-4E



aircraft (six F-16Ds and seven F-16Cs), and two carried some kind of kill marking on the nose. Later on, Israeli crew members explained that the markings highlighted the shooting down of a Unmanned Aerial Vehicle (UAV) which was flying in Israeli air space. Other IDF aircraft that were seen at Andravida were a Beech 200 and a single Gulfstream G550.

Given the high level of HAF personnel and the capability to involve a variety of weapon systems within one of the largest exercise areas in Europe, the *Iniochos* exercise intends to become one of the most competitive exercise in Europe and in the Mediterranean region. 🦅

Text and photos: Vincent Martens
Author would like to thank the HAF HQ and the Air Tactics Centre Comm Col. Zolotas

Visiting the Ghana Air Force today

The Ghana Armed Forces have a small but smart Air Force, the key to their success being training, as Patrick Dirksen and Frank Mink found during a recent visit to Ghana.



Chief of Air Staff Air Vice Marshal Maxwell Mantserbi-Tei Nagai

As Air Vice Marshal Maxwell Mantserbi-Tei Nagai, current Chief of the Air Staff of the Ghana Air Force (GAF) said, “our primary role is support of the army and the navy. Next to that we assist with governmental issues, like disaster management. We also support the police and Ghana Gas as well. But our main role is support of the army with troop transport, airborne forces, paratropping, fighter ground attack and close air support with helicopters. We also carry out aerial photography, air transport of the yield from gold mines in middle of the country and transport of personnel and logistics of the Electoral Commission during elections”.

Accra

Accra is the main airbase of the GAF, where two of the recently acquired C.295s are flying with the Communication squadron, having replaced the venerable Fokker F.27s. These aircraft have been put through the test

in Mali, where Ghanaian Forces played a major role in the United Nations mission MINUSMA. However, a terrorist attack at

Gao in 2016, damaging a C.295, put an end to that deployment, but the damaged aircraft is operational again.



Mi-171 flying the Ghanaian flag (via GAF)



K-8 advanced trainer and strike aircraft (via GAF)

Ghana has participated in dozens of UN and ECOWAS missions since the 'sixties, in which helicopters played a big role. A recent example was in neighbouring Cote d'Ivoire during the genocide, where A.109 helicopters were used as gunships and Bell 412s for troop transport. These have now been replaced by Z-9 and Mi-17/171 helicopters. All helicopters are operated by No.3 Squadron and are based at Accra AFB. The main roles of the four Z-9s are patrols over the gas pipeline and powerline, coastal fishery protection and ambulance flights.

Also flying from Accra AFB are the Chinese-origin K-8s of No. 4 Squadron which replaced the L-39 and MB.339. "The home base of the squadron is supposed to be in Tamale, but at the time that they arrived, Tamale was not positioned to receive them maybe they will move there now, we are thinking about it, if the leadership academy is pulled through." says Nagai. "The role of this aircraft is strike and reconnaissance, mostly on the border. The aircraft can be armed for ground attack and for such training we have a live firing range at Bundase, close to Accra. We coordinate with the army and carry out air power combat fire training together." K-8 pilots are selected after the fixed wing training and sent to China for K-8 conversion.

Takoradi

Takoradi AFB was taken over from the RAF in 1961 and since then the Flying Training School (FTS) has been based here. First aircraft were Chipmunks donated by the RAF, later on Beavers, Otters and Caribous were employed. The FTS currently still operates the venerable



Two of the female Da.42 pilots (via GAF)

Ce.172s, although these haven't flown for years. Initial flying training is now done on the Diamond Da.42, which is operated by No.1 Squadron. After selection process in Accra, student pilots get an initial 10

hours of flying experience on the Da.42 before they are sent to Bristow Academy for helicopter pilots or Flight Safety Academy for fixed wing pilots, both in the USA. After this the students that transit to fixed



A group of K-8 pilots (via GAF)

wing squadrons, come back to Takoradi AFB for follow up training on the Da.42, while helicopter pilots go directly to the squadrons. No.1 Squadron operates three DA.42 aircraft, of which only one fulfils the training role while the other two are dedicated for surveillance tasks.

A DA.42 simulator has also been procured from Diamond to facilitate instrument flying and in-flight failure training. The main task however of No.1 Squadron is surveillance, the ISR capability of the Ghana Air Force assured by the two surveillance DA.42s, which are which equipped with the SAFIRE sensor suite. These aircraft were modified in the UK by DO Systems Ltd, which also supplied a dedicated DA.42 crewman trainer simulator. Their main roles are maritime surveillance, reconnaissance and internal security operations in support of police forces.

The future

Asked about future plans, Nagai talked about plans to establish an air force base at centre of the country, around Atebubu. “Plan is to establish a helicopter squadron there, so from there we can reach the North and also the South. Furthermore there are plans to have a joint FOB with the navy somewhere in the west, because of oil find. All these are still on the drawing board, and we are currently technically working towards there. But the final approval of course needs to come from the government.” Nagai continues: “So there are plans to expand. The air force is already much bigger than when I joined in 1980. But as both the economy and the population grows, there will be new requirements.”

Regarding the addition of new aircraft to the fleet, the Super Tucano is high on the wish list of Nagai. “In 2013 this came

recommended the government to have it. It would be used both as a strike aircraft and a trainer, because it could do both. So far this didn’t get through, but we had a long cooperation with the manufacturers in Brazil, and the negotiations are not totally closed. Because we still need it, and while we are also looking for alternatives, the Super Tucano remains the key in our new acquisitions.” The intention is to get four aircraft and one simulator. However there are no plans to get additional helicopters over the coming three to five years and an option for a fourth C.295 will not be exercised for now.

Focus has been and will be for the coming years on personnel, both on training level and comfort. “We try to increase the housing facilities for air force personnel, because that’s a very serious command challenge. And we try to train people, for which we’ve run set courses on our own. In the past we depended on the programme for the whole armed forces, and there was a very big backlog. So we had to find money, locally, within the air force for training and to improve the working environment for our troops. We believe that if the soldier is happy, well trained and has a place to put his head, he will come to work leaving the home baggage at home, do his work, and we get a good product.” And based on both reputation and results, this should work out well indeed!

The authors would like to thank Air Vice Marshal Maxwell Mantserbi-Tei Nagai for the warm welcome and the time he took for the interview, and also Squadron Leader Francisca Aholo without whom this article would not have been possible. 🦋



Chinese built Z-9 at Takoradi AFB

The Diamonds also contribute to the international organisation *Oceans Beyond Piracy*. Together with Ivory Coast, Togo, Benin and Nigeria, Ghana is responsible for Zone E and Zone F in the Gulf of Guinea. There is also a Z-9 detachment at Takoradi, operating under No.1 Squadron.

Tamale AFB

Smallest of the three airbases is Tamale AFB, which was built in 1966 with help of the former Soviet Union. One of the Casa 295s is based here, flying with No.2 Squadron, although at the time of writing this was undergoing an initial heavy maintenance with Airbus in Spain after being in service for six years. Also used for training is a F.27 which aircraft had the honour of making the last operational flight of the type in 2013, then delivered to Tamale for ground training.

up. Chief of the Air Staff at the time assessed the threat level and we looked at capabilities of the Super Tucano, and



File photo of GAF C.295

Space is so startling !

Astronomers capture first images of a Black Hole

An international collaboration has presented paradigm-shifting observations of the gargantuan black hole at the heart of distant galaxy *Messier 87*. The Event Horizon Telescope (EHT) – a planet-scale array of eight ground-based radio telescopes forged through international collaboration – was designed to capture images of a black hole. In April 2019, in a coordinated press conferences across the globe, EHT researchers revealed that they had succeeded in unveiling the first direct visual evidence of a supermassive black hole, and its shadow. This breakthrough was announced in a series of six papers published in a special issue of *The Astrophysical Journal Letters*. The image reveals the black hole at the centre of Messier 87, a massive galaxy in the nearby Virgo galaxy cluster. This black hole resides 55 million light-years from Earth and has a mass 6.5 billion times that of the Sun.

Black holes are extraordinary cosmic objects with enormous masses but extremely compact sizes. The presence of these objects affects their environment in extreme ways, warping spacetime and super-heating any surrounding material.

The EHT links telescopes around the globe to form an Earth-sized virtual telescope with unprecedented sensitivity and resolution. The EHT is the result of years of international collaboration, and offers scientists a new way to study the most extreme objects in the Universe predicted by Einstein's general relativity during centennial year of the historic experiment that first confirmed the theory.

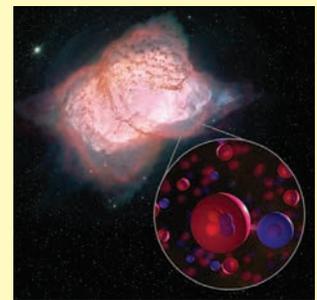
Multiple calibration and imaging methods have revealed a ring-like structure with a dark central region – the black hole's shadow – that persisted over multiple independent EHT observations. Creating the EHT was a formidable challenge which required upgrading and connecting a worldwide network of eight pre-existing telescopes deployed at a variety of challenging high-altitude sites. These locations included volcanoes in Hawai'i and Mexico, mountains in Arizona and

the Spanish Sierra Nevada, the Chilean Atacama Desert, and Antarctica. The EHT observations used a technique called very-long-baseline interferometry (VLBI) which synchronises telescope facilities around the world and exploits the rotation of our planet to form one huge, Earth-size telescope observing at a wavelength of 1.3 mm. VLBI allows the EHT to achieve an angular resolution of 20 micro-arcseconds – enough to read a newspaper in New York from a sidewalk café in Paris. 🐦

The Universe's first type of molecule is found at last

The first type of molecule that ever formed in the universe has been detected in space for the first time, after decades of searching. Scientists discovered its signature in our own galaxy using the world's largest airborne observatory, NASA's Stratospheric Observatory for Infrared Astronomy, or SOFIA, as the aircraft flew high above the Earth's surface and pointed its sensitive instruments out into the cosmos.

When the universe was still very young, only a few kinds of atoms existed. Scientists believe that around 100,000 years after the "big bang", helium and hydrogen combined to make a molecule called helium hydride for the first time. Helium hydride should be present in some parts of the modern universe, but it has never been detected in space — until now. SOFIA found modern helium hydride in a planetary nebula, a remnant of what was once a Sun-like star. Located 3,000 light-years away near the constellation Cygnus, this planetary nebula, called NGC 7027, has conditions that allow this mystery molecule to form. The discovery serves as proof that helium hydride can, in fact, exist in space. This confirms a key part of our basic understanding of the chemistry of the early universe and how it evolved over billions of years into the complex chemistry of today. The results have been published in a recent issue of *Nature*.





Air Vice Marshal Cecil Parker recollects...



The Learning Curve

The Tiger Moth

Every profession has a desired learning curve. The curve itself is a notional graph that plots the progress of knowledge, skills and competencies on one axis against opportunity, time and costs on the other. When knowledge and skills are applied over a period of time, experience is gained which, along with demonstrated performance, should determine levels of employment. In the flying profession, the learning curve is sought to be maintained by periodic training courses, dual checks, simulators, examining boards, categorisation/ratings and exercises. Every military aviator has a pilot's log book that records details of each sortie flown. It is a de facto record of experience and thus,

also serves as a written version of a particular learning curve. To recheck some facts for a recent article, I unearthed my old log book, which, of course, has had no entry for the past 33 years ever since I left the air force. I very soon lost myself in reliving some of the highlights of my own learning curve in the IAF.

My very first flight as a teenaged flight cadet, was an 'air experience' sortie in the rear cockpit of the fabric-covered, piston-engined biplane, the Tiger Moth in 1951. My last recorded flight was, as a 53-year old AVM (AOC J&K) on a familiarisation flight in the front cockpit of the twin-engined Jaguar T.2 in 1986. Between these two entries were the records

of 20 other types covering piston/jet, single/multi-engined, fixed/rotary wing aircraft amounting to 4000 flying hours. I recalled my bail-out from a blazing Tempest in 1952, transition from pistons to jets (Vampires and Toofanis) and to the learning experience of actually using these platforms to fire rockets, guns and drop bombs plus air-to-air gunnery. An unexpected posting to a communication squadron enabled me to gain experience on twin-engined aircraft, being Devons and Dakotas. Some years later, while undergoing a training course in the USA, this experience was most useful in flying the T-39 twin-jet aircraft. As a QFI, I relived my great personal delight in sending my first pupil solo on the HT-2, in 1955.



Hawker Hunter Mk. F.56A



TS-11 Iskra

Teaching is a great learning experience and certainly sharpens the learning curve.

I spent ten consecutive years on the Hunter, first as a flight Commander, next as the CO/CI in raising the IAF's first OTU in Jamnagar (1966-69) and then back to No.20 Squadron as the CO (1969-72). This was an eventful period some of the highlights of which include the safe landing of a Hunter with three outboard tanks one of which was a live hang-up napalm bomb. Others were, ferrying of a Hunter from the UK to India and being privileged to take up the very first Indian lady to fly in an IAF jet, a lady doctor in 1970. The high point was undoubtedly all the counter air strike sorties in the 1971 Indo-Pak war in which the demonstrated performance of my squadron was superb.

As a station commander (1975-77) I had the job satisfaction of inducting 50 Polish jet Iskras into our air force and then as the AOC of a MiG airbase, had the learning opportunity of converting onto

and flying various marks of this jet fighter in 1977-79. While attending a course in the UK in 1980, I was again fortunate to fly familiarisation sorties on the Hawk and the Harrier. As Commandant of our Air Force Academy, we coped with the non-availability of a basic trainer aircraft by carrying out the IAF's very first all-jet basic pilot training on the Kiran for five courses. My post air force professions had their own learning curves which, thanks to my experience in yesterdays air force, were much easier to master. Finally, let me assure you dear reader that creative retirement also has its own learning curve !

The OTU : A Legacy

On 1 October 1966 the IAF established its first Operational Training Unit (OTU) at Jamnagar with 24 Hunter aircraft (four trainers and 20 fighters) drawn from the six Hunter Mk.56 equipped squadrons, as was also the ground equipment and most of its human resources. The OTU was given

a dual role: 'training' for which it came under HQ WAC at Palam and 'operations' for which it came under an ad hoc HQ WI (Western India) in Poona. On the same date I reported on posting and promotion to wing commander rank to raise the new unit as its first Commanding Officer & Chief Instructor. HQ WAC asked me to draft its Training Directive which I did; it was approved in toto.

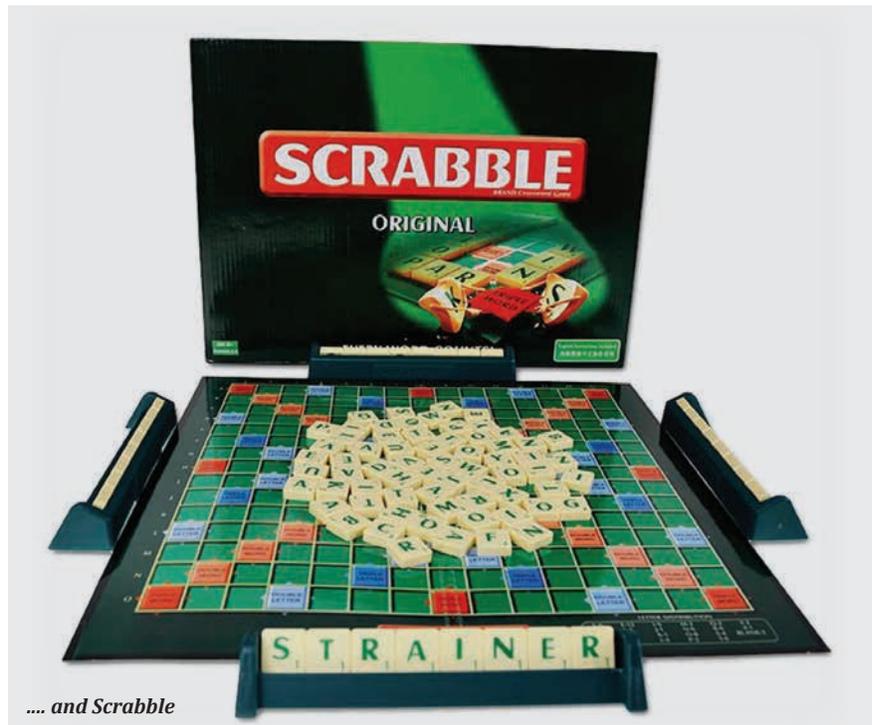
It took a few weeks to obtain the allotted resources, create the syllabus, get organised and commence ground and flying training. I had some experienced QFIs, a few staff pilots, 16 pupils and technical personnel most of whom had some experience with the aircraft; extensive flying commenced. In 1967 tension rapidly built up in the Kutch area and ground forces were moved to the borders. HQ WI immediately stopped all our flying training, we mounted an ORP (Operational Readiness Platform), were assigned targets and prepared for offensive air operations along with No.10

Scramble....



Squadron's Maruts which were co-located. All non-essential flying was curtailed to conserve flying hours. Our ORP was in tented accommodation close to two open blast pens and controlled by our local SU (Signals Unit) by landline. All eligible pilots readily volunteered for ORP duties in the hope of a scramble and the surety of a dawn/dusk patrol flight. Ground training for the pupil pilots continued but, when the prime activity of an air base (i.e. flying) ceases, in the unnatural silence that prevails, 'unemployed' pilots get in everyone's way and time hangs heavy.

It was during this waiting period that the Flt Cdr/CFI brought in a scrabble set and introduced this word-building game into the crew room. It proved very popular and soon loud arguments on word spellings, meanings and usage rent the air in the flight office and the ORP. Personal dictionaries were produced in support of or attack on words both within and outside our normal vocabularies. It must be a rare experience for a flight fund to acquire a dictionary but eventually one was purchased and accepted as sole authority to settle disputes! After a few days, tension reduced, normal flying recommenced and in 1968 the OTU went on to win the HQ WAC ISWM Arjuna trophy. Meanwhile, the new passion for scrabble transferred to our homes and families. Many a pleasant Sunday/holiday morning was spent in a scrabble session followed by beer and lunch in various homes, including the CO's as his wife became an enthusiastic participant as well.



.... and Scrabble

The 53 year old OTU, having been equipped with the Hunter, followed by the MiG-21, now operates the Hawk trainer, is renamed as the HOFTU (Hawk Operational Flying Training Unit), based at Kalaikunda and has spawned a clone in Bidar. In 2012 the (then) CO very kindly sent me a framed photograph of a MiG-21 being flown by 'The Young Ones', was deeply appreciative of the first OTU diary (1966-69) but a little puzzled by the report of 'scrabble sessions between scrambles from

the ORP' in 1967. I explained the meaning and the context and he had a good laugh.

My wife and I continue to play the game twice a day and I estimate we have had several thousand such 'vocabulistic' encounters. However, having been married for 63 years (to the same lady) I have learned that, in the interest of domestic peace and harmony, no record of the results should be maintained nor referred to!

For us, the game of scrabble is certainly one happy legacy of the OTU. 🦋

25 Years Back

From Vayu Aerospace Review Issue III/1994

More F-16s for Pakistan

The US proposes to supply Pakistan with thirty eight F-16s, three P-3C Orions and some electronic warfare equipment in return for a “verifiable capping” of its nuclear programme. However, Pakistan’s Prime Minister, the former Army Chief as well as the present one have already publicly declared Pakistan’s resolve to continue with its nuclear buildup. The US administration seems determined to restore supply of military equipment to Pakistan and is finding means of circumventing the Pressler Amendment, and this “one time waiver” could be a thin end of the wedge.

More MiG-29s for IAF

The MoD has declined to comment on reports emanating from Moscow that India had finalised a deal for acquiring 30 more MiG-29 aircraft, but reliable sources in New Delhi have confirmed that negotiations were on for the purchases of this frontline fighter. While no direct link should be made to the likely transfer of 38 F-16s by the USA to Pakistan, the sources maintained that such development would definitely have added a certain urgency to India’s plans to boost its air defence system in which the MiG-29 plays a key role.

IN Sea Harrier upgrade plans

The Indian Navy and British Aerospace are negotiating an upgrade for the former’s Sea Harrier FRS 51s, with the package to include a derivative of GEC-Macroni Blue Vixen multi-mode radar. The Indian Navy has 22 Sea Harriers FRS Mk.51s serving with INAS 300 (*White Tigers*), last of these being delivered in 1992. The IN has expressed a long-term interest in upgrading the aircraft.

US asks India not to deploy ‘Prithvi’

The Clinton administration has urged India to consider the “dangerous consequences” of deploying its indigenously-developed medium-range surface-to-surface *Prithvi* missile. The US ambassador-designate to India said that though *Prithvi* is a short-range missile, “I am not aware that it has been configured for a nuclear warhead but, again, I think a detailed analysis of the qualities of *Prithvi* is something which you should look at in executive (secret) session”.

Successful launch of ASLV-D4

On 5 May, 1994, the fourth Augmented Satellite Launch Vehicle (ASLV-D4) was successfully launched at the Sriharikota Launch Range (SHAR), not far from Madras in South India. The payload

of the launch vehicle was a SROSS-C2 satellite weighing 113 kg, which carried two payloads, namely the Gamma-Ray Burst experiment developed at the Bangalore-based ISRO satellite centre for detecting celestial Gamma-Ray bursts and the retarding potential analyser designed by the National Physical Laboratory, to investigate the characteristics of the equatorial and low altitudes ionosphere and thermosphere.

Upgrade of IAF MiG-21bis

It has been officially announced that upgradation of the IAF’s MiG-21bis fleet will be responsibility of the MiG-MAPO Bureau of Russia, thus setting to rest much speculation about the possibility of Israeli or US companies being given the task. The Minister of State for Defence Mr Mallikarjun has informed that a letter of intent has been given to the Russians for upgrading the 100-odd aircraft and “negotiations stand completed”. Chief designer of the MiG Design Bureau, Rostislav Belyakov said that an agreement on the joint venture had already been initialed during the visit of a Russian aerospace industry delegation to New Delhi, the agreement signed by the MiG Design Bureau and Hindustan Aeronautics Limited (HAL).

Jet Airways inducts Boeing 737-400s

An advanced Boeing 737-400 of Jet Airways was inducted into its fleet on 4 April, 1994. Jet Airways launched its operations on 5 May 1993 and is the only private airline to offer the new generation Boeing 737-400 on domestic sectors linking 12 destinations with 28 flights daily. An agreement with Malaysia Airlines also establishes close cooperation between the two airlines for training of pilots, engineers, ground personnel, technical, simulator and flying training at the facility in Kuala Lumpur.

Indian Army to acquire attack helicopters

The Indian Army has firmed plans to acquire some 15 attack helicopters to meet its immediate needs. Bids from two US, one French and an Italian manufacturer have been received for the latest generation attack copters which will cost between Rs 15 and Rs 20 crore apiece. The American Apache and Super Cobra, the Italian Mangusta and French Panther are short-listed.

IAF evaluates Sukhoi Su-30

Confirming reports doing the rounds in New Delhi is a dispatch from Moscow dated 16 June 1994 that an Indian Air Force team is presently evaluating the new generation Sukhoi Su-30 air defence fighter in Russia and has offered India 20 Su-30s in ‘flyaway’ condition on credit, with licence-manufacture of a follow-on batch of 60 Su-30s by HAL at their Nasik facilities. An IAF-delegation, led by Air Vice Marshal S Krishnaswamy, ACAS (Plans), is currently visiting the Sukhoi plant at Irkutsk which produces the Su-30s and IAF test pilots are flight evaluating the new fighter and its systems. ✈

Tale Spin

Indian aviation history enshrined – on postage stamps

Much feedback has been received on the *India Post* first day cover which marked Aero India 2019 and appeared in the last *Talespin*. Readers have flooded us with fascinating images of Indian Indian aviation history on postage stamps over the past 70 years. Hard to choose from but here are *Afterburner's* choice, with some attributes :



Douglas DC-4 Skymaster heralding India's Independence, with over a dozen airlines then flying various types till nationalisation in 1953



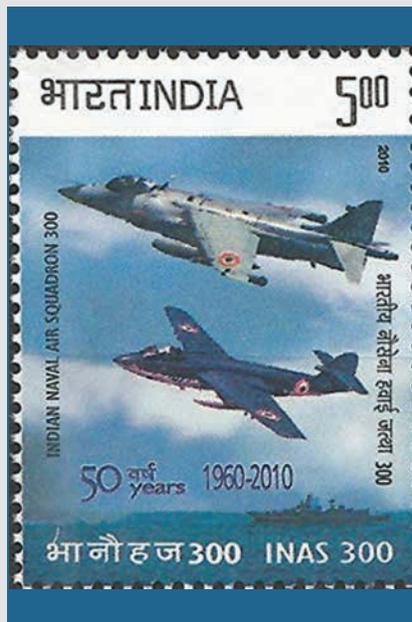
On the IAF's Golden Jubilee, its first aircraft (Wapiti IIA) was seen alongside trisonic MiG-25



Air India International was the first Asian carrier to operate the Lockheed Constellation, vying to become one of the world's "best airlines"



Alfred Cooke's Hunter in air combat with Sabre over Kalaikunda in 1965, the most classic of that war !



Golden Jubilee of the Indian Navy's famed 'White Tigers', INAS 300, flying Sea Hawks and then Sea Harriers (now phased out).



Marking Indian Civil Aviation's Centenary in 2012 (although the world's first airmail was from Naini to Allahabad and took place in February 1911) see actual photo below:



Aviation in the Nizam's Dominion



Fascinating stamps amongst the many at a recent exhibition highlighted the allegiance of the erstwhile Nizam of Hyderabad to Britain.

What is however forgotten is the Nizam's desperate attempts to declare independence in 1948, even planning for mercenary-piloted ex-RAF Halifax bombers to target Bombay before the 'police action' put a quick end to all that !

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