VAYU

Aerospace & Defence Review

III/2018

Gaganshakti 2018

Military Diplomacy

Re-energising Air Power

DefExpo 2018

The Chinese Way

IAF's new RFI

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Cover : 'Made in India' : HAL-built aircraft flypast over the beach during DefExpo 2018. (Photo : MoD).

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Printed at Aegean Offset Printers

Protecting India

In a significant defence reform, a new integrated institutional mechanism called the Defence Planning Committee has been set up under chairmanship of the national security adviser. It is tasked with preparing a national military and security strategy, assessing external security risks and defining security priorities. It will have on board the principal secretary to the prime minister, chairman chiefs of staff committee, service chiefs, defence secretary, foreign secretary and secretary (expenditure) in the finance ministry. The composition of the committee reflects its goal of bringing both military and civilian components of defence planning on one platform. This is absolutely vital for a modern defence strategy that is nimble and adaptable to changing security realities.

At present defence planning in India is very disjointed, with lopsided emphasis on acquisitions. There is little coordination between ministries, while the bureaucracy and the military are often not on the same page. This leads to situations as witnessed recently where the military submitted to the parliamentary standing committee on defence that this year's defence budget barely made room for modernisation. There's a yawning gap between the expectations of the armed forces and the diplomatic priorities and financial capacity of government. The new committee is expected to bridge these various needs, and refine recommendations for defence procurement by taking a long-term view of security.

Functionally, the committee will be aided by sub-committees on policy and strategy, plans and capability development, defence diplomacy and defence manufacturing ecosystem – so that defence planning isn't confined to silos. At a time when India's security environment is fast changing with an assertive China increasingly flexing its muscle in India's geo-strategic domain, integration ought to be the buzzword within the defence establishment. This is the only way procurement can be streamlined and decisions implemented in a timely fashion.

From *The Times of India*

Fresh tenders for fighters

The Defence Ministry's disclosure about its plans to invite a foreign manufacturer to make 110 fighter jets in India has expectedly set the world's major military-industrial complexes agog with expectations. Nearly three years after the Modi government scrapped the tender for 126 fighters and then opted to buy 36 from the French, the wheel has come around in a full circle. The government had defended its retail-level purchase of just two fighter squadrons by hinting at another purchase plan up its sleeve that would bridge the gap between the requirement (42 squadrons) and the inventory (31 squadrons). It now appears that the government has formalised its often-aired intention of asking a foreign company to set up a combat jet manufacturing plant in India.

This is an opportunity pregnant with several possibilities. If the plan succeeds, India will be able to lift itself in the technology adaptation ladder by several notches. The combat jet plant could become a strategic asset if the planes are exported to neighbouring countries. But as the UPA I discovered after ineffectually grappling with the 126 fighter jet tender for the bulk of its term, defence technologies are not readily available on tap. There may hardly be an example of a foreign defence behemoth transferring sensitive technology. They prefer to export ready-made jets or, at best, assemble them in the recipient country.

India's procurement culture is marked by a lack of transparency and often national security becomes the standard argument to avoid accountability for professional neglect. No heads are likely to roll for having kept the IAF fleet depleted for over a decade. The malaise extends to the other two services as well — outgoing service chiefs at times have drawn attention to the danger of India falling behind the equipment curve. Apart from failing to efficiently manage its arms procurement decisions, the absence of the Planning Commission means the government is unable to take into account national and societal needs while planning to induct expensive advanced weapons systems. This absence of a national planning system may prove costly for the country's national security in the long run.

From *The Tribune*

Army needs a fine balance

It is not surprising to find India among the world's top five military spenders, given that the country has been grappling for some time with the urgent requirement of modernising its armed forces to cope with a challenging security environment. The Stockholm International Peace Research Institute (SIPRI) has placed India behind only the US, China, Saudi Arabia and Russia in terms of defence spending. India's military expenditure last year was about $63.9 billion, far less than the spending of the US ($610 billion) and China (an estimated $228 billion) but more than the spending by countries widely seen as global military powers, such as the UK ($47.2 billion) and France ($57.8 billion).

India faces a shortage of combat aircraft. It also needs new warships, aircraft carriers, submarines, artillery and a host of equipment for the army. However, military hardware is not bought off the shelf. It is built and supplied over several years, and payments too are made over an extended period. Therefore, as India inducts more new equipment, the outlay for capital expenditure should increase over the coming years. This will also require sustained growth of the GDP so that adequate funds can be set aside for big ticket defence deals. In fact, the defence budget to GDP ratio for 2018-19 is 1.49%, the second lowest since 1950, while most experts believe it should be around the 3% mark.

Reports on defence spending such as the one by SIPRI do not always present the complete picture. For instance, a chunk of India's defence budget goes towards the salaries of around 1.4 million serving personnel and pensions for some two million veterans. In 2017, 67% of the defence budget went towards these heads and only 33% was spent on new acquisitions of hardware. There is a need for a healthier ratio here, which can be achieved by increasing the outlay for capital expenditure. It may be imperative for the government to hike the allocation for capital expenditure if it wishes to go ahead with the speedy acquisition of new platforms such as Predator drones from the US. This is all the more necessary to keep the military prepared for all eventualities, especially challenges from China and Pakistan.

From *The Hindustan Times*

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COMMENTARY

Indian Air Force seeks commitment

Global aerospace manufacturers with huge stakes in India's proposed procurement of hundreds of fighter aircraft, are struck by the level of detail the Indian Air Force (IAF) has sought in a Request for Information (RFI) issued in early April 2018.The 72-page RFI, apart from specifying the IAF's requirement in minute detail, seeks a clear commitment from vendors of their willingness to supply sensitive technologies, documentation, training facilities and performance guarantees.The level of detail in the current RFI contrasts starkly with the sketchy, one-page RFI issued in 2004 in the ultimately aborted contest to supply the IAF with 126 medium multi-role combat aircraft (MMRCA).

In October 2016, the IAF issued an even shorter, one-paragraph RFI, soliciting interest in supplying the IAF with 100-200 single-engine fighters. "The latest RFI seeks to avoid the mistakes of previous procurements, especially the MMRCA tender. In those, vendors were not pinned down to clear commitments about transferring technology. This time, the commitments demanded to ensure that non-serious vendors would be eliminated at the RFI stage itself." The RFP is a formal tender that is issued to vendors whose response to the RFI meets the military's key requirements. It will be issued after detailed scrutiny of vendor responses to the RFI, which must be submitted by 6 July. IAF sources hope the RFP would be issued by this year-end, but admit that the defence ministry's track record makes this an optimistic time frame. In the MMRCA procurement, the RFI was issued in 2004; and the RFP eventually in 2007.

The October 2016 RFI, which specified "single-engine fighters", effectively reduced the contest to two aerospace vendors, Lockheed Martin and Saab, since they were the only companies with high-performance, single engine aircraft: the F-16 Block 70 and Gripen E respectively. However, the current RFI opens the doors to four more vendors with twin-engine fighters on offer. These include Boeing (F/A-18E/F Super Hornet), Russian Aircraft Corporation (MiG-35), Eurofighter GmbH (Typhoon) and Dassault, which is already executing a contract for 36 Rafale fighters, signed in June 2016. A key gainer is Boeing, which is already well placed in the navy's acquisition of 57 carrier-borne multi-role fighters. So too is Dassault, with the IAF already having ordered 36 of its Rafale fighters.

Eurofighter GmbH is another possible gainer, with the Typhoon fighter back in the fray. Along with the Rafale, the Typhoon was the only other aircraft to clear the MMRCA flight trails. However, Airbus, which owns a 46 per cent stake in Eurofighter (BAE Systems owns 33 per cent and Leonardo owns the remaining 21 per cent) stated only that it would examine the RFI. Surprisingly, Lockheed Martin, which now faces enlarged competition, is the most upbeat of the vendors. Saab, a Swedish aerospace company, which similarly finds a two-horse field now expanded to 5-6, has reserved comment until it analyses the RFI. "We believe Gripen is the best choice for India and that Gripen will satisfy the Indian needs in the best possible way", according to a statement from Saab.

From *Business Standard*

Innocents at the DefExpo

It was a surprisingly pleasant Saturday morning. I can still remember every dent and scratch on the car in front of me. Despite being recently-widened, East Coast Road was crawling with traffic heading towards Tiruvidenthai for the 10th edition of Defexpo 2018. Reaching the venue after two hours on the road, I didn't waste a minute. I met head on with a tank fitted with the upgraded Schilka weapon system which boasts to be self-propelled; a low air defence weapon system capable of firing multiple rounds under all weather conditions. Also in the vicinity were artillery guns one generally only see in news casts and films.

The real star was the Arjun battle tank with its big guns and machine guns — children thronged around it to take pictures. It was surreal to witness people take selfies beside machines like this: all sophisticated military hardware capable of a single purpose — destruction.What's artillery without intelligence? The outdoor display had various fixed radar systems and a tour inside the LLTR (Low Level Transportable Radar System) which was soon closed due to the crowd.

People also had a chance to get up-close with missiles such as Akash, an air missile; Varunastra, a heavy torpedo; Nirbhay, a sub-sonic cruise missile system.

The best was saved for the last. The Dhruv advanced light helicopter was cordoned off, but people tried to squeeze their cameras into the area. Fitted with sophisticated vision systems and missiles, this was the crowd-winner. "I had a different perception of the Armed Forces until today. It was exciting to learn how the tax-payers money is being spent," said MJ Krithikaa, a visitor.

The PAS suddenly announced that people shift their gaze towards the sky. There was a roar of cheers as the audience watched paratroopers descend. The crowd shifted towards the sea for the air show. Moving through, I heard three consecutive explosions with three pillars of water shooting up into the sky. By the time I got to a vantage point, I had missed the Tejas jets soar by. It was only later that I realised people had to cross through the ECR, effectively blocking the entire stretch for a good one hour. A crowd this size was only expected, because this was a rare chance to witness such aircraft fly close to civilian air space. I just wish the traffic had been better planned.

Hopes still high, I finally managed to perch on high ground and set my camera up to get real close to the flying mavericks. The coordinated fly-by by the Sarang air display team was an impressive spectacle. I eavesdropped on the awestruck children beside me: "Wouldn't it be awesome if they showered chocolates from the sky? I wish they took us for a ride."

The crowd had begun leaving as the sea and air displays wrapped up, with the National Flag hoisted from a chopper, but then the land show picked up with a cloud of dust. For a moment, ECR looked like the dust storm scene from Mad Max. "The event was a good experience. It was worth the hassle to get here; a well spent half-day," said ManojMadhavan, a visitor.

All the halls were completely packed by the time we got back from the air show. The security had to stop entry into the halls until it was cleared. Exhausted and drenched in sweat, I decided to turn back and hit the road before getting caught in traffic again.When I finally set my hands on a cold beverage, only one phrase stuck in my mind: *Si vispacempara bellum*, meaning, 'If you want peace, prepare for war'.

Prathap Ravishankar in the *Hindu*

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"Weapons Procurement Process is In Tatters"

India's weapons-buying is frequently crippled by "multiple and diffused structures with no single point accountability, multiple decision-heads, duplication of processes, delayed comments, delayed execution, no real-time monitoring, no project-based approach and a tendency to fault-find rather than to facilitate," assesses a very candid Defence Ministry report. As a result of these flaws, the government's flagship 'Make in India' initiative for the defence sector, launched in 2014, "continues to languish at the altar of procedural delays and has failed to demonstrate its true potential."

The 27-point internal report prepared late in 2017 by Minister of State for Defence Subhash Bhamre is a stinging indictment of the way the Defence Ministry functions. Of 144 projects in the last three financial years, "only 8-10% fructified within the stipulated time period." Significantly, a chart identifies how each step of the nine-stage process of ordering weaponry sees enormous delays.

From the stage of Request for Proposal (RFP), when the government formally reaches out to OEMs to submit their proposal to the deal-closing clearance given by the Competent Financial Authority, the delays are a whopping 2.6 times to 15.4 times the deadline set.

The problems actually begin at the level of the headquarters of the individual armed forces, when the demand for new purchases is first raised. Pointing at a "lack of synergy between the three services", the report says that the Army, Air Force, Navy and Coast Guard do not work as a system, which "puts greater strain on the limited defence budget and as a result, we are unable to meet the critical capability requirements."

What is more, different departments of the ministry "appear to be working in independent silos" driven by their interpretation of policy and procedures. Thereafter, once a weapons purchase enters the 'Request for Proposal' (RFP) stage, the average time taken to clear files is 120 weeks or six times more than rules laid down by the MoD in 2016. "The fastest RFP clearance was accorded in 17 weeks while the slowest took a monumental 422 weeks (over eight years)," the report noted.

The Tejas LCA

The report points out that the Armed Forces, as eventual users of the weapon systems, "continue to view the Acquisition Wing (of the Defence Ministry) as an obstacle rather than a facilitator". So there needs to be a "tectonic change in mindset of the ministry officials and the need of the hour is assigning responsibility and accountability." At the level of Trials and Evaluation conducted by the Armed forces, "the average time taken is 89 weeks, which is three times more than authorised." The armed forces are a part of the problem here, as they list "ambiguous trial directives, leaving scope for varied interpretation."

Dr Bhamre observes in his report that the Technical Oversight Committee (TOC) stage needs to be done away with altogether. "I am not sure whether any TOC has brought up any relevant issue, and is assessed to be yet another delay in the procurement procedure. "The Cost Negotiation Committee (CNC) stage sees delays about 10 times more than that allowed because of the inability of the Defence Ministry to benchmark costs with global standards especially where an item is being procured for the first time or involved Transfer of Technology."

Shockingly, even if a weapons system actually makes its way through this bureaucratic quagmire, an acquisition can be "shot down" when the file reaches the Finance Ministry or the Cabinet Committee of Security since "currently, the MoF or CCS is not aware" of the defence ministry's plans and needs. The report also flags the "raining of numerous queries, a few of them even of a basic nature."

In other words, the Finance Ministry does not seem to have any idea of what to do with a complex agreement once it is presented by the Defence Ministry for financial clearance so that a contract can be signed. Given the fairly hopeless

Saab's Gripen D on takeoff

bureaucratic jumble within the government, the report lists a series of remedies to de-clutter the process, revolving around "accountability" and "ownership", to ensure the purchase of weapons can realistically be expected. But ridding the government of this debilitating red-tape will not be easy.

Very recently, 17 years after the Air Force stated a requirement for 126 new gen fighters, the Defence Ministry stalled the process to build more than 100 of these jets in India under 'Make in India'. The two main firms competing for this requirement were America's Lockheed Martin, which offered its F-16 Block 70IN fighter, and Sweden's SAAB, which was competing with its Gripen E/F multi-role combat aircraft.

Now, the government wants the Indian Air Force to "broaden the scope" of its RFI to also include multi-engine fighters, a decision taken soon after the controversy over the Rafale fighter deal where the government was accused by the opposition of not being transparent in its handling of the contract with the French government.

For the Indian Air Force, which is seeing its squadron strength fall drastically because older jets need to be retired, there is a strange sense of *deja-vu* about this all. In 2001, the IAF had projected its requirement under the Medium Range Combat Aircraft (MRCA) deal for single-engine jet fighters. The scope of the deal changed dramatically when the government said that they wanted to include twin-engine fighters in the IAF's fighter evaluation. Since twin-engine jets are heavier and more capable, "MRCA" warped into "MMRCA," or Medium Multirole Combat Aircraft, a programme which was ultimately scrapped altogether in 2015, after an incredible 15-year process. Finally, in 2015, realising that the Indian Air Force was desperate, the government agreed, controversially, to directly buy 36 Rafale fighters from France in an off-the-shelf purchase worth more than Rs. 58,000 crores.

But there still remained a some semblance of hope because in October 2016, the government had also began a new process for single-engine fighters, which would be acquired in significantly larger numbers, made in India and bought at considerably lower per-unit costs.

With the decision to confuse this programme (with a new RFI issued in April 2018) and given the ministry's own track record, it seems clear that the Indian Air Force will not be inducting any new type of fighter for several years to come other than the indigenous Tejas LCA, which is smaller and arguably less capable than variants of the F-16 or Gripen that the Air Force is really looking to acquire.

Vishnu Som, as assessed by NDTV.
Photos: Angad Singh

Lockheed Martin F-16 with afterburner

OPINION

Chasing a Chimera ?

Dr Manoj Joshi on the IAF's latest RFI for fighters

Not representative ! Image of a futuristic (tenth-generation?) fighter with which the IAF could well be equipped with at turn of the century !

So now, two decades after the Indian Air Force (IAF) projected a requirement for 126 medium-role combat aircraft (MRCA), we are back to the starting point. That journey had ended in 2012 when the government, after a laboured process, selected the Dassault Rafale and began negotiations for its procurement—only to have the succeeding Narendra Modi administration scrap the deal and decide in 2015 to purchase only 36 Rafales off the shelf.

On 6 April 2018, the IAF issued a request for information (RFI) for the purchase of 110 fighters. Three-fourth of these will be single-seaters and the balance twin-seat aircraft. Eighteen or so of the aircraft would be bought off the shelf. The rest would be 'Made in India' through a partnership between the manufacturer and a strategic partner. The fighters would thus add six squadrons to the IAF and the order could be worth between $9 billion and 15 billion.

It is no secret that the IAF is in dire straits, both because of its declining fighter aircraft numbers and the government's refusal to raise the defence budget. The numbers are telling. The IAF has 31 combat squadrons today as against a desired 42. It will lose nine in the next five years when the remaining 7 MiG-21 and 2 MiG-27 squadrons retire. And presuming it gets the two Rafale, two LCA and one more Su-30MKI squadrons, it still will be at an uncomfortable 27 by 2022. If it repeats the fiasco of the first MMRCA deal, taking more than a decade to select an aircraft, it could well end up in a disaster where it is down to just 15 squadrons in 2032, when its remaining six Jaguar, three MiG-29 and as many Mirage 2000 squadrons also retire.

The budgetary part is vital because the IAF, at the insistence of the government, wants the bulk of the aircraft to be 'Made in India'. Setting up an assembly line for just 80 or so fighters will actually require the exchequer to pay double or even triple the sum that would be needed if one simply imported the aircraft off the shelf. When India purchased the Su-30MKI from Russia directly, its average cost was Rs 270.28 crore, but some years later when its manufacture from raw material was begun by the Hindustan Aeronautics Ltd it cost Rs 417.85 crore.

But the Air Force certainly is to blame as well. In crafting an RFI that mixes single- and twin-engine aircraft, it makes selection that much more difficult. Actually, the IAF knows what it wants and has tacitly been saying so loudly for decades: a lighter fighter, cheap to operate, one that would be the work-horse of its fighter fleet. After the forced rejigging of the Rafale purchase in 2015, the IAF had issued another RFI for buying and building 100-200 single engine fighters in 2016. This had in effect become a competition between Lockheed Martin's F-16 and Saab's Gripen. By

PERFORMANCE

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Revenue	681	805	1102	1450	32% ⇧
Profit Before Tax	53	111	177	327	85% ⇧
Return on Average Capital Employed (ROCE) (%)	10.6%	23.2%	29.8%	44.5%	15% ⇧

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scrapping its 2016 aim, the IAF has muddied the competition again. Instead of narrowing down the choice, the Air Force has broadened it to the point of obtuseness.

The problem is that by the time RFIs and RFPs (request for proposals) are sent, lobbies enter the picture and muddy issues. That is what happened the last time around, and that is what is happening now. With the inclusion of twin-engine fighters, the competition is back to the startlines. In other words, it is a repeat of the old MMRCA competition. Thus, the Rafale can re-enter it and conceivably win again. Because in a competition against the single-engine fighters, the heavier twin-engine fighter will end up being superior in range, endurance and capability. If budgetary issues are taken into account, as they most certainly should, it is 40 per cent or more expensive to run a twin-engine machine. Incidentally, an analysis of the accidents in the IAF has shown that twin-engine aircraft like Jaguars have had more losses than the single-engine Mirage.

Given the detailed questions relating to the ToT (transfer of technology) component in the RFI, perhaps this time around, the key element in the decision-making matrix will not be the fighter's performance alone, but the willingness of the partner to transfer technology. According to the RFI, the transferred technology would have to be state-of-the-art and boost India's indigenous design and development, production and maintenance capabilities as well. Also, the transfer should also aid the country's indigenous programmes.

Actually we have been doing 'Made in India' kind of license production of fighters since the mid-1960s, beginning with the MiG-21. Subsequently, the MiG units gave way to the Su-30MKI production line in the 1990s. Yet, we learnt little in the design and development of fighter aircraft.

The Sukhoi Su-30MKI is now allegedly manufactured from "raw material". But this is deceptive. For example, the raw material that goes into the fighter such as titanium and steel must be sourced from Russia, along with nuts, bolts and rivets. Likewise, while some of the Al-31FP engine is made with Indian-made components, key high-end composites and special alloys—some 47 per cent by value of the engine—are imported.

Countries could well be willing to offer some design and development technology but those that are being phased out by them. But they will certainly not offer their crown jewels, say, technology related to next-gen engines. This is one area where the West retains its edge and even the Russians are not quite there. The Chinese have spent an arm and a leg and are only slowly moving towards developing a viable fighter engine, but not one that can be compared to which power the western fighters. In any case, why would anyone offer cutting-edge technology for a deal involving 110 aircraft and at $15 billion ?

Watch out for drone swarms guided by artificial intelligence !

If India thinks the acquisition will help it leapfrog its way to acquiring world-class fighter aircraft design and development capability, it is chasing a chimera. Such capabilities, as the Chinese story suggests, take place over decades and are directed by those in authority. They involve not simply ToT, but espionage and, as the Americans now charge, forced technology transfer.

An advanced capability to design and manufacture aircraft involves thousands of engineers and technicians and takes decades to build. So, it requires a systematic build-up of design, development and manufacturing capacities, accompanied by a symbiotic effort to develop engineering and technical institutes to support the effort. Most importantly, it needs sustained higher strategic direction, much in the way that the Space Commission has provided in building up the capabilities of the Indian Space Research Organisation. The members of the Space Commission include Nripendra Misra, principal secretary to the PM, and National Security Advisor Ajit Doval, besides the Cabinet, Finance and Foreign secretaries.

This latest RFI suggests that the IAF wants a heavy fighter, capable of everything: air defence, deep strike, reconnaissance, maritime strike, electronic warfare, buddy-refuelling capability and so on. The RFI is loaded with all sorts of possible requirements. One asking whether the fighter on offer will "allow crew members to relieve themselves and take provisions in flight". Now, existing fighters do have provision for urine collection, but for defecation, things are more complicated! The Russian Su-34 would seem to be the only one to fit this bill since it even has a small toilet and kitchen behind the tandem cockpit crew cabin. Then, the RFI wants an aircraft that "can fly in excess of 10 hours with air-to-air refuelling". Now ten hours of flying in a fighter is well beyond human endurance. US Navy pilots, for example, are not expected to be in the air more than 6 hours at a time.

In all this, everyone seems to have forgotten that there was another important programme the IAF was looking for. That was for a fifth-generation fighter to be built jointly with the Russians—a deal that also incorporated sharing a great deal of design and development know-how. But that seems to have receded into the background, *(see news item)*.

The threats we confront by 2025 will most certainly include fifth-generation fighters like the Chinese J-20 and possibly the J-31, the latter possibly even be exported to Pakistan. Speed and manoeuvrability may matter less than sensors and weapons, and the manner in which they are fused. Beyond this is the possibility that threats will mutate to include autonomous unmanned aerial combat vehicles and drone swarms guided by artificial intelligence. In the meantime, are we trying to play catch-up in a game where the rules have changed beyond comprehension?

Defence planning:
Old wine in new bottle?

In what has been declared, by some media, as a 'major step' towards reforming the process of higher defence planning, the government has created a new mechanism; designated the Defence Planning Committee (DPC) under the chairmanship of the National Security Advisor (NSA). This permanent committee has been tasked to undertake a strategic defence review, prepare a draft national security strategy, and formulate an international defence engagement strategy. Taken at face value, this step deserves a cautious welcome by the Services as well as the strategic community, even if only as a long overdue token of the government's concern for national security.

The past 14 years, that include a decade of stasis during the UPA regime, and four years of NDA (that saw four Raksha Mantris), have also witnessed a steady deterioration in India's security environment. While China's spectacular economic and military rise is helping it reshape the fundamentals of global power, our immediate concerns relate to the rapid modernisation and integration of different arms of the Chinese military into a cohesive 'joint' entity. Heightened military activity on our land borders, incursions into the Indian Ocean and the brandishing of tactical nuclear weapons by Pakistani generals, speak of an unfolding Sino-Pak strategy.

The 'first charge' on a nation's exchequer is universally acknowledged to be national security. But in India, defence expenditure, having been relegated to the 'non-plan' category, budgetary allocations are whimsical, and pay no heed to factors like threat assessment, force-planning, self-reliance or alignment of 'ends, ways and means'. This is largely because of the defence-planning process has remained an arbitrary, sporadic and neglected activity in India. Recent revelations about India's stalled military modernisation and shortfalls in war-reserves provide worrisome proof of this.

Post-independence history bears out the short shrift given to this vital process in the Indian system. A 'defence planning cell' was created as late as in 1962, in the aftermath of the India-China War, to be replaced by a Committee for Defence Planning in 1977, under the Cabinet Secretary. It was only in the Rajiv Gandhi-Arun Singh era that a properly constituted, inter-Service Defence Planning Staff (DPS) was set up. Headed by a 3-star Director-General, the DPS was charged with the preparation of force-level and hardware perspective plans, in consultation with the Service HQ. However, lacking support from the military, as well as MoD, the DPS failed to gain any credibility and was wound up in 2001.

The near-disaster of May 1999 saw the Kargil Review Committee (KRC) bluntly highlighting the fact that India's system of defence planning and management had remained utterly stagnant "despite the 1962 debacle, the 1965 stalemate and the 1971 victory, the growing nuclear threat, end of the cold-war, continued proxy war in Kashmir…" Reacting swiftly to the KRC's criticism, the NDA government of the day constituted under Deputy PM, LK Advani, a Group of Ministers (GoM) whose report declared its intent of *"bringing about improvements in the organisation, structures and process through integration of civil and military components of MoD and by ensuring 'jointness' among the armed forces"* (emphasis added). The defence planning process, according to this Report, had remained deeply flawed due to the absence of a national security doctrine and inter-service prioritisation.

The two-fold panacea offered by the GoM was: integration of the Service HQs with MoD and creation of a Chief of Defence Staff (CDS). One of the vital tasks of the CDS would be to bring "effectiveness to the planning/budgeting process" through intra-Service and inter-Service prioritisation and the preparation of a Joint Services Plan. The government's surrender to bureaucratic pressure and abandonment of the GoM's substantive recommendations is now history, and does not bear repetition.

It merits recall that in the past two decades, actions of UPA as well as NDA governments in the arena of national security reform have been disappointing. Both have convened groups, committees and task-forces to examine issues relating to higher defence management, defence-research and defence-production. Submitted for bureaucratic scrutiny, rather than political decision-making, the findings and recommendations of these bodies, have generally disappeared in dusty MoD cupboards.

Notwithstanding past omissions, there is need to curb scepticism in the case of the newly constituted DPC. Possibly, there is just enough time for it to tackle its weighty task and generate some deliverables before the next general election is upon us. However, the constitution of this committee, at this juncture, and its composition, does leave an unanswered question in the air.

The exclusion of issues like civil-military integration, 'jointness' and CDS, from the Committee's charter, means that they are obviously not on the NDA agenda – which is a pity – but does it also imply that the NSA has, now, replaced the Defence Secretary as de-facto Chief of Defence Staff ?

Admiral Arun Prakash (Retd)

Establishment of Defence Planning Committee

The government of India has issued notification for the establishment of a Defence Planning Committee (DPC) under the present National Security Advisor, Ajit Doval. Mandate of the committee is to be monitored by four sub-committees which include Policy and Strategy, Planning and Capability Development, Defence Diplomacy and Defence Manufacturing, the latter focusing on 'Make in India'. The DPC will include Chiefs of the Army, Navy and Air Force, the Defence Secretary, Foreign Secretary, Expenditure Secretary and Chief of the Integrated Defence Staff (IDS) to the Chairman Chiefs of Staff Committee (CISC) as members. Possible inclusion of the Principal Secretary to the Prime Minister has also been indicated.

It is expected that the Committee "will expedite and smoothen defence acquisition by removing bottlenecks which have made the process protracted over the years." The DPC will define priorities and decide between the competing proposals of the Services with the adequate inputs from supporting Ministries and will address the need for the continuity of understanding, the necessity for relevant ministries to be on the same page and a review system for the NSS. A vital task of the DPC will be to refine recommendations for defence procurement, taking a long term view of the acquisition as they relate to current and future scenarios. "The committee will function through various sub-committees responsible for providing inputs for senior functionaries and assessing unconventional and emerging threats, apart from developing workable defence concepts related to evolving geopolitical situations."

IAF issues new RFI for fighters

On 6 April 2018, the Indian Air Force formally issued a 'Request for Information' concerning procurement of 110 aircraft of which 75% would be single-seaters and the balance twin-seaters, "but having full operational capability." The aircraft would be truly multirole, including for air superiority, air defence, air to surface operations, reconnaissance, maritime, EW missions, capable of buddy refuelling. In the given narrative, OEMs are required to respond by 6 July 2018, following which will be issued a formal request for proposal to those shortlisted, the acquisition process to be carried out under the provisions of DPP 2016.

The 73-page document details technical parameters and operational characteristics, giving a typical mission profile including that in the strike role with 2 PGMs + Designator Pod + 2 BVRs + 2 A4Ms + External fuel. The airborne multi-mode radar should be AESA, and there are a slew of EW systems + SP jammers included. Importantly, there is a section on transfer of technology for indigenous manufacture of the aircraft in India, being state-of-the-art "to ensure rapid build-up of indigenous design and development, production and maintenance capabilities of the aircraft, its sub-systems and support equipment."

As there are no restrictions on size or weight or number of engines in the RFI, observers believe that there could well be an increase in number of OEMs responding, perhaps beyond the original six that took part in the MMRCA tender issued in 2007 which resulted in selection of the Dassault Rafale.
(*See several commentaries on the subject in this Issue*).

India's participation in FGFA uncertain

According to reliable reports, India's plans to participate in joint development of the Russian Fifth Generation Fighter Aircraft (variously known as the PAK-FA or T.50 and now officially the Su-57, as depicted in the painting above) have been finally abandoned. The two countries had agreed in 2007 that HAL would partner the Sukhoi Design Bureau in further developing and then manufacturing this stealth fighter for the Indian Air Force, and team of HAL engineers were seconded to Sukhoi in this context. The Government of India had also paid an initial $300 million for certain documentation but uncertainties continued, not the least because of the scope of design & development as also the IAF's reduced requirement (halved to some 140 aircraft) and some short falls in performance but most importantly, uncertainty in numbers required by the Russian Air Force itself.

An Experts Committee headed by Air Marshal (retired) S Varthaman opined in 2017 that the FGFA programme would be complementary, and not competitive to the Advanced Medium Combat Aircraft (AMCA) which is to be India's fifth generation fighter developed by ADA at Bangalore. It is understood that financial limitations may have finally swung the case in favour of the AMCA, as also the Indian Government's support of building indigenous capabilities. According to reports, Indian NSA Ajit Doval, who attended the recent meeting in Moscow along with Defence Secretary Sanjay Mitra conveyed this decision to their counterparts; however, that India might possibly join the project later or procure the finally developed fighter after it has entered service with the Russian Air Force.

MULTI-ROLE COMBAT-PROVEN BUILT FOR THE FUTURE

As the most advanced and lowest-cost fighter per flight hour, the F/A-18 Super Hornet will deliver next-gen superiority and survivability to India. By assembling, testing and certifying this aircraft at a state-of-the-art Factory of the Future in India, Boeing will help grow the country's aerospace ecosystem. And with a plan for growth, the F/A-18 Super Hornet will continue to outpace threats—and make India stronger.

BOEING

Tripartite agreement between HAL-Boeing-Mahindra

The US Aerospace giant company Boeing have signed a tripartite agreement with state-owned Hindustan Aeronautics Ltd. (HAL) and private company Mahindra Defence Systems (MDS) for the manufacture of F/A-18 Super Hornet multirole combat aircraft in India (painting above). Announcing this at the recently held DefExpo 2018 in Chennai, Pratyush Kumar, Boeing India President, said: "Our partnership with HAL and Mahindra will enable us to optimise the full potential of India's public and private sector to deliver next-generation F/A-18 fighter capabilities. Together we can deliver an affordable, combat-proven fighter platform for India, while adding growth momentum to the Indian aerospace ecosystem with manufacturing, skill-development, innovation and engineering and job creation," he added. Boeing will reportedly be responding not only to the IAF's recently issued RFI for 110 aircraft for the IAF but has earlier received the Indian Navy's RFI for 57 carrier-borne fighters.

Boeing's objective is not only to build the F/A-18 Super Hornet in an entirely new and state-of-the-art production facility in India but one which can be utilised for other futuristic programmes including the Indian Advanced Medium Combat Aircraft.

T Suvarna Raju, HAL Chairman and MD, said: "The partnership with Boeing and Mahindra Defence Systems will create an opportunity to develop capabilities of the aerospace industry and strengthen indigenous platforms in India."

India-Sweden defence and security links

During Indian Prime Minister Narendra Modi's visit to Sweden from 16 April, a number of defence and security cooperation matters were reportedly discussed, with a strategic innovation partnership plan announced. PM Modi had several meetings with his Swedish counterpart Stefan Lofven, the media reporting a "win-win" outcome, it being noted that defence and security cooperation remained a "key pillar" in the bilateral ties. The Indian PM has invited top Swedish firms to invest in India which is "a very strategic market". Although, there was no official word on Sweden's interest in offering the Gripen multirole fighter to meet the Indian Air Force's requirement, this matter was reportedly part of the discussions.

IAF's Exercise *GaganShakti* 2018

For two weeks in April 2018 (8-22), the Indian Air Force carried out its largest exercise extant, the aim of *GaganShakti* 2018 being "deployment and employment of IAF assets in a short and intense battle scenarios." Conducted in two phases, to test the efficacy of various Commands, Phase-I involving Western, South Western and Southern Air Commands, with affiliated Army and Navy components while Phase-II meant relocating bulk of the forces to the East and Northeast, within a short span of 48 hours.

According to official debriefing, of the 11, 000 sorties during the pan-India exercise, around 9000 were of fighters including Sukhoi Su-30MKIs, Mirage 2000s, Jaguars, MiG-21s, MiG-29s, Tejas and Hawk advanced jet trainers (in a combat support role). Air Chief Marshal BS Dhanoa metaphorically stated that the IAF was "Shaking the Heavens and splitting the Earth" with the extremely rapid operational tempo maintained during the Exercise. There were also reports that Su-30MKIs from airbases in Southern India, carried out long range simulated attacks, also with BrahMos supersonic cruise missiles on targets in the Malacca Straits, 9 Degree Channel and other sensitive places in the seas around the Indian peninsula. *(See article in this issue).*

Chinese/Pakistanis monitor IAF exercises

It is learnt that the PLAAF closely monitored various aspects of the Indian Air Force (IAF)'s Exercise *GaganShakti 2018* which took place in April 2018 particularly the second phase when IAF assets were swung from the western to eastern theatre in less than 48 hours. On 16-17 April, it is learnt that IAF fighters including Su-30MKIs carried out firing of air-to-ground ordnance against practice targets at high altitudes areas, while the IAF's considerable air transport fleet, including Boeing C-17s, Ilyushin Il-76s, C-130J Super Hercules and Antonov An-32s, flew numerous sorties with logistic-support equipment for fighter squadrons being re-deployed to eastern airbases as also mobile radars and air defence missile units. It is learnt that the Pakistan Air Force too closely monitored the Exercise during the first phase, also using their airborne early warning aircraft for the purpose.

IAF Chief flags PLAAF activities

Air Chief Marshal Birender Singh Dhanoa, CAS IAF has made pointed reference to increasing Chinese combat aircraft activities in the Tibetan Autonomous Region, the PLAAF now considerably ramping up its aerial prowess in the plateau north of Arunachal Pradesh and Sikkim. The Indian Chief said that "The deployment of Sukhoi Su-27 and J-10 fighters for continuous operations during the winter months affords them a credible all round capability. Many years ago, they used to only occupy the air fields in summers."

Upgradation of Chinese air defences along the 3,500 km long Line of Actual Control (LAC) with India has been recorded in several past issues of the *Vayu*, including I/2018 which reported on Chengdu J-20 stealth fighters also exercising in Tibet. Chinese state run media have released photographs of J-10s and J-11s flying over Tibet, the PLA's website further clarifying that the fighters belonged to an Aviation Brigade under the PLA Western Theatre Command: "With India importing new jets, China will continue strengthening fighter jets in Western Theatre Command."

India seeks US 'exemption' for buying Russian S-400

In an extraordinary example of realpolitik, the Indian government is reportedly in discussion with US authorities "for an exemption to allow it to procure the S-400 advanced air defence missile system from Russia". This is because a waiver is now needed from the "Countering America's Adversaries Through Sanctions ACT (CAATSA), for the procurement of this weapon system worth $5.5 billion (Rs 39,000 crore)." Some years earlier, India and Russia finalised an inter-governmental agreement on the S-400 Triumf air defence systems, in October 2016 and are currently in advance negotiations for at least five systems. The discussions have been stalled because of price issues and related matters. The S-400 matter could set India and the US on a "collision course" as at stake is India's half century-long major defence relationship with Russia/ Soviet Union, which fact has been acknowledged by US Defence Department officials who opined that "forcing India to abruptly cut off Russian supplies would create unacceptable risks to India's self-defence."Other recipients of the S-400 are China and Turkey, the latter having earlier reacted strongly to US pressures.

India to participate in SCO military exercises

In a first, as recently announced by Defence Minister Nirmala Sitharaman, India is to participate in a multi-nation military exercise to be conducted in Russia during September 2018. Addressing the Defence Ministers' meeting of the Shanghai Cooperation Organisation (SCO) in Beijing on 24 April, she stated, "We are guided in our relations with China (as per) consensus reached between our leaders that at the time of global uncertainty,

India-China relations could be a factor of stability and that we must not allow our differences to become disputes." Although India along with China, Pakistan, Russia and several other countries are a part of the SCO bloc of largely Asian countries, this will be first ever exercise which will have the militaries of India and Pakistan taking part in anti-terrorist exercises. This exercise *Peace Mission 2018* is scheduled to begin in end August at Russia's Ural Mountains and slated to conclude in the first week of September.

IAF to upgrade 90 Mi-17 helicopters

So as to enhance their self-defence capabilities, the Indian Air Force is upgrading some 90 earlier variant Mi-17 helicopters with Electronic Warfare (EW) systems. Of these medium-lift helicopters, 56 Mi-17 and 34 Mi-17 1V, will be upgraded by No.3 Base Repair Depot at Chandigarh in collaboration with Bharat Electronics Limited (BEL). The new EW suite is equipped with radar warning receiver (RWR), a missile approach warning system (MAWS) and counter measure dispensing system (CMDS). It is expected that the upgradation task will be completed within 48 months including training an initial batch of pilots, flight engineers and flight gunners to operate the new systems.

Dassault reaffirms commitments to 'Make in India'

During their four-day visit to Delhi, Banaglore, Mumbai and Hyderabad in April 2018, major French companies, as part of GIFAS, the French aerospace industries association, reaffirmed their plans for 'Making in India' of key aerospace products.

Interestingly, M. Eric Trappier, who is Chairman of GIFAS and Chairman/CEO of Dassault Aviation also chaired meetings of the Dassault Aviation Executive Committee in New Delhi, stressing the importance of India in the Company's vision and his own dedication to successfully implement his company's commitments to 'Make in India'. This is the first time that such a Board meeting took place away from the company's headquarters in Saint Cloud, France and was "to reinforce the existing links and to finalise the roadmap for the establishment of concrete methods and processes to ensure the efficiency and competitiveness of Dassault Aviation in setting up its facilities at Nagpur." The joint venture *Dassault Reliance Aerospace Limited* was established in April 2015 and foundation stone of the manufacturing facility in Mihan at Nagpur laid in end-October 2017.

IAF Chief affirms faith in Tejas

Responding to a question Air Chief Marshal Birender Singh Dhanoa, CAS Indian Air Force said that the Tejas LCA, which also took part in *GaganShakti 2018*, is "the aircraft of the future" as compared with the Sino-Pakistani JF-17 Thunder. He alluded to an article in one of the aviation journals (hinted as the *Vayu)* where the author says JF-17 is not as technologically advanced as Tejas. So, he said, "JF-17 is the aircraft of today because they have fielded more squadrons than us, and Tejas is the aircraft of the future. It has much better systems." Although, however, some of the Tejas LCAs initially reported snags during *GaganShakti 2018*, these were quickly sorted out and continued operating operations from their desert locations. The Air Chief later attributed this to the fact that the Tejas had been relocated from their Bangalore base with temperate climatic conditions to the hot and dusty environment.

Tejas LCA in BVR missile test

Operating from the Naval Air Station INS Hansa (Goa), an LCA carried out test firing of a Derby air-to-air beyond visual (BVR) range missile on 27 April as part of the process to attain final operational clearance (FOC). Piloted by Wing Commander Siddharth Singh, the firing was preceded by an exhaustive study of the missile separation characteristics and plume envelope.

Exercise *Samvedna 2018*

A five-day multi-national exercise *Samvedna 2018* was conducted by the Indian Air Force 12-16 March 2018 "with the aim of sharing procedures and capabilities of air forces to improve disaster response." Besides India, the air forces of Sri Lanka, Bangladesh, Nepal and the UAE took part in the multilateral Humanitarian Assistance and Disaster Relief (HADR) exercise which showcased disaster preparedness of Indian Air Force's Rapid Action Medical Team (RAMT) and its flying capabilities at the Air Force station at Shangumugam Beach, Thiruvanathapuram, Kerala. A mass casualty demonstration by the RAMT involved evacuation by An-32 aircraft was also carried out. The Indian Air Force's RAMT is equipped with modern 25 bedded transportable tent based Medical Shelters which include ICU, Operation Theatre, X-Ray and Laboratory, and capable of handling 100 Outpatients per day.

Defence agreements between India and Russia

A slew of agreements between India and Russia were reportedly signed at the DefExpo 2018, which included on helicopters, naval systems and combat vehicles. According to MoD sources, some 48 items covering major platforms were identified for "making in India" with Russian collaboration. The mega Indian private company Larsen & Toubro signed deals for naval programmes and for Future Ready Combat Vehicles (FRCV) as also co-production of rockets in India. Ananth Technologies signed an agreement for opto-electronic sighting and navigation systems for Su-30MKI aircraft. Ananth also signed another to set up technical and logistics support in India for T-90S and T-72 MBTs in service with the Army. Russia's JSC AGAT signed agreements for after-sale support and modernisation of the Fregat radar, installed on Indian naval ships.

Shipborne variant of Kamov Ka-226T proposed

Russian Helicopters are reportedly proposing a shipborne variant of its Kamov Ka-226T helicopter to the Indian Navy. The Ka-226T was subject of an agreement signed in October 2016 wherein, HAL took a 50.5% majority stake in the joint venture with Russian Helicopters having 49.5%. The first 60 Ka-226Ts will be imported as 'flyaway' for the Indian Army/Air Force with 140 thereafter to be built under licence by HAL.

Issues concerning compatibility of the Ka-226T on board Indian naval ships has been addressed by Russian Helicopters who believe they can modify the type for meeting the Indian Navy's requirement for 111 naval utility helicopters (NUH). According to Russian Helicopters, "A delegation from the Indian MoD is to visit Kamov Design Bureau in order to participate in demonstration of the Kamov rotorcraft and familiarise themselves with the ship-based version."

Army Commanders deliberate on security dynamics

The biannual Army Commanders' Conference took place at New Delhi from 16 April 2018, chaired by General Bipin Rawat, Chief of the Army Staff, when senior Indian Army commanders deliberated on specific issues. These included management of extant security dynamics, mitigation of future security threats and enhancement of the combat edge over potential adversaries. Other issues like infrastructure development for capacity enhancement along the Northern borders, review of strategic railway lines, optimisation of limited budgets to ensure making up of critical deficiency in

ammunition, issues related to Border Road Organisation projects, ECHS, as also other matters relevant to operations, administration and welfare of troops were reportedly discussed in some detail.

According to analysts, the Indian Army is working on a proposal to utilise its budget in the judicious way to meet its critical requirements. The plan is reportedly to spend less on certain types of ammunition, such as particular missile and spares for vintage vehicles, and instead exploit that money on buying new equipment and procurement of making up the ammunition level for "10 days of intense war". The Army believes these measures will not only save the some thousand crores, but also help substantially meet its requirement of ammunition for the next three years.

First M777 howitzers by September

According to BAE Systems, a first batch of five M777 ultralight howitzers are likely to be delivered to the Indian Army by September 2018 while the remaining 140 guns ordered would be delivered in batches from June 2019. The induction rate from June next year is expected to be five guns per month till the complete consignment is received by mid-2021. Made of titanium, each gun weighs 4, 000 kg. allowing its lift by CH-47 Chinook helicopters in mountainous terrain and thereby enhancing mobility at high altitude.

Rafael Spike ATGMs for Indian Army

The Ministry of Defence has reportedly been deliberating on the procurement of Israeli-origin Spike anti-tank guided missiles, made by Rafael. According to MoD sources, the Minister of Defence was to chair a meeting of the Defence Procurement Committee in late April 2018, for clearing the Army's proposal for 5000 Spikes to meet the urgent requirement of infantry battalions as also 500 launchers and 20 simulators. At the same time, some numbers of indigenous Nag anti-tank missiles and Nag missile carrier (Namica) would be initially ordered to supplement the current, earlier generation Konkurs and Milan 2T ATGMs.

Bulletproof jackets ordered

The MoD has contracted with an indigenous defence manufacturer SMPP Pvt Ltd for procurement of 186,000 bulletproof jackets for the Indian Army at a cost of Rs 639 crore. "The contracted BPJs have contemporary and state-of-the-art specifications with added protection levels and coverage area. These ergonomically designed BPJs have modular parts, thereby providing immense protection and flexibility to soldiers operating in different operational situations ranging from long-distance patrolling to high-risk room intervention scenarios." SMPP will begin the supply of the BPJs within the next few months and complete the entire order within a period of three years.

Export of BrahMos and Akash to "friendly nations"

According to reliable reports, the Government of India is in discussion with some "friendly nations" for sale of BrahMos supersonic cruise missiles and Akash air defence missiles, as also other military hardware and systems. Defence Minister Nirmala Sitharaman has stated that, "The interest in Indian missiles is definitely growing and we are addressing it. India wants to sell them to the friendly nations." Although she did not name any specific country, India is known to have offered the BrahMos missile to Vietnam. There are also requests for the BrahMos missiles from seven other countries in the Asia-Pacific, Latin America and the Middle East regions.

Defence Minister urges defence PSUs "to be more dynamic"

Defence Minister Nirmala Sitharaman has underlined the need for revitalising defence PSUs and ordnance factories for meeting the requirements of India's defence forces. "The management of these organisations need to be ahead of the curve and show dynamism as they possess immense and valuable assets that could offer manufacturers huge production opportunities," she said. The government is also encouraging private investment in defence production, including liberalisation of foreign direct investment and also proposes to bring out an industry-friendly Defence Production Policy 2018 to promote domestic production by public sector, the private sector and MSMEs. She said that the Defence Ministry was encouraged by the quantum of outsourced components in defence manufacturing which had risen to 29% in FY 2016-17.

Mahindra Defence and ShinMaywa MoU on US-2

Mahindra Defence has signed an MoU with ShinMaywa Industries Ltd of Japan to set up MRO services/manufacturing and assembling of structural parts and components for the US-2

amphibian aircraft. As Yasuo Kawanishi, Director, ShinMaywa Industries Limited stated, "This is a versatile aircraft ideally suited for Indian conditions. The US-2 with its unmatched capability is considered to be extremely useful for strengthening the safety and security of SLOCs, long range fleet support and island/off shore assets (both overseas and coastal) support functions. These missions when combined in a single multimodal platform such as the US-2 can earn for India the precious goodwill of nations of the Indian Ocean region commensurate with its identity as a responsible rising power. Japan Maritime Defence Force have extensively used this aircraft for many years now."

Bharat Electronics forecasts 12-15% annual growth

Although Bharat Electronics (BEL) received reduced orders in 2017-18, still the state-owned PSU expects large sales in the coming three years, which include Akash surface-to-air missiles, EW Samyukta , Commander Thermal Imagers and quick reaction surface-to-air missiles (QR SAM). BEL is also venturing into the manufacture of ammunition, and setting up two factories in Andhra Pradesh for the purpose. MV Gowtama, Chairman/MD expects a 12-15% annual growth over the next three years.

48 private sector defence projects approved

The Home Ministry has reportedly given security clearances to 48 private sector companies investing in the defence sector, which clearance follows 'stream lining' of the security clearance mechanism from May 2015. The government expects the domestic private share in defence budget to go up by 20% in four years from the present 5% after liberalising the FDI regime and 'Make in India' initiative. According to a senior official, the MHA has cleared around 1,200 applications annually over the last few years to promote 'Make in India'. The ministry also cleared foreign investments from the US, UK, Israel, Belgium, China and Japan.

MoD delegation visits Russian defence production facilities

Apurva Chandra, Director General Acquisition, MoD has recently visited facilities of Russia's Ulyanovsk-based Aviastar-SP, constituting a part of the United Aircraft Corporation's Transport Aviation Division. He was given detailed presentations on the Ilyushin-Il76MD-90A and Il-78MK-90A aircraft. "The Indian Air Force and Navy have between them considerable numbers of Il-76s, Il-78s, and Il-38s… Russia is ready to upgrade both the aircraft already in service and supply new equipment meeting long-term requirements of Indian partners," noted UAC's Vice President for Transport Aviation and CEO of Ilyushin Aleksey Rogozin.

The Indian delegation also visited the National Centre of Helicopter Building in Moscow witnessing flight demonstration of the Ka-226T helicopter, and thereafter were at Baltic Shipbuilding Plant 'Yantar' in the city of Kaliningrad. As Rosoboronexport's Director General Alexander Mikheev stated, "We are happy to receive such a representative delegation of the Indian Ministry of Defence and to demonstrate to our partners unique capabilities of the Russian shipbuilding enterprises and promising Russian-Indian projects in the military and technical area in general."

Formation of Tata Aerospace & Defence

Tata Sons are in the process of consolidating their various businesses across Aerospace and Defence sectors under a single entity known as Tata Aerospace & Defence (Tata A&D) "to leverage their full range of expertise, experience, and capabilities from across the Group related to Land Mobility Solutions, Aerospace, Weapon Systems, Sensors and Command, Control, Communication, Computers and Intelligence (C4I)." Tata A&D will also be deeply invested in the development of indigenous platforms specifically for the Indian Defence Forces, "which is central to Tata A&D's long-term strategy".

Thales opens new office in Bengaluru

Thales established their new office in Bengaluru on 18 April 2018, inaugurated by Emmanuel de Roquefeuil, VP & Country Director for Thales in India. As Emmanuel de Roquefeuil stated, "The new office marks an important milestone in our commitment to India. Supporting our growth plans for local team and business, it opens up a new space for commitment and excellence. As we move forward, we will continue to work closely with our customers and partners, helping them to master every decisive moment along the way."

BEL and L&T sign MoU

Bharat Electronics Limited (BEL) and Larsen & Toubro have signed an MoU "to share their expertise in design, development, engineering and manufacturing to develop and produce products and systems to meet the requirement of the defence services as well as for export markets." Seen in the picture are M V Gowtama, CMD, BEL and J D Patil, Director and Senior Executive Vice President (L&T Defence) at signing of the MoU.

BEL wins AIMA 'Outstanding PSU of the Year' award

Bharat Electronics Limited (BEL) have been given the All India Management Association (AIMA) Managing India Award for being the 'Outstanding PSU of the Year'. M V Gowtama, CMD, BEL, received the award from Col Rajyavardhan Singh Rathore, Minister of State for Youth Affairs & Sports and Information & Broadcasting, at the awards ceremony held at New Delhi on 18 April 2018 *(see photograph above).*

Boeing and TAL Manufacturing announce new contract

TAL Manufacturing Solutions have announced a contract for manufacturing the Advanced Composite Floor Beam (ACFB) for Boeing's 787-9 and 787-10 Dreamliners. Boeing had awarded the first contract to TAL for the floor beams in October 2011 and TAL recently delivered the 13,000th floor beam to 787 fuselage suppliers. TAL has a dedicated manufacturing facility for Boeing at Nagpur from where it manufactures and delivers the ACFBs.

HAL in tripartite MoU with Motorsich JSC and Ivchenko Progress SE

HAL has signed an MoU with Motorsich JSC and Ivchenko Progress SE, Ukraine for engine design, development, testing and manufacturing of critical components. "HAL is engaged in design and development of medium thrust and shaft engines and this MoU will facilitate further testing of these indigenous engines," said T. Suvarna Raju, HAL Chairman. Motorsich JSE and Ivchenko Progress are manufacturers of Aero Engines for various platforms, situated in Ukraine. Motorsich supplies PV-117MT engines for the Mi-7 helicopter and AL-20D engines for An-32 tactical transport aircraft *(see photograph).*

Goa Shipyard Limited and MTU to manufacture engines in India

Goa Shipyard Limited and MTU of Germany are to cooperate in production of MTU Series 8000 engines in India. Under the agreement, the companies will manufacture the 16-cylinder and 20-cylinder MTU Series 8000 engines at GSL's new facility in Goa. The agreement includes transfer of MTU technology related to local manufacture of engine components, engine assembly, testing, painting and major overhauls. MTU Series 8000 engines are the largest and most powerful MTU diesel engines with a power output of up to 10 MW, fitted onboard Offshore Patrol Vessels (OPV) built or currently under construction in India. This includes eleven Coast Guard OPVs by GSL (six completed and five under construction), five Naval OPVs under construction at Reliance Defence Engineering and seven Coast Guard OPVs by L&T.

Mahindra Defence and Aeronautics of Israel in partnership

Mahindra Defence and Aeronautics of Israel have signed an MoU for naval shipborne UAVs, as launched and recovered from warships. Aeronautics manufacture the Orbiter series of UAVs, the Aeronautics Orbiter 4 being an advanced multi-mission platform with an ability to carry and operate two different payloads simultaneously. Mahindra Defence and Aeronautics will supply the maritime version of Orbiter 4 for the Indian Navy, the UAV carrying advanced sensor payloads and capable of launch and recovery from small warships.

Kalyani Rafael Advanced Systems (KRAS) expansion plans

Kalyani Rafael Advanced Systems (KRAS), a joint venture between Kalyani Strategic Systems Ltd. and Rafael Advanced Defence Systems Ltd. of Israel plan to expand their product profile. The JV will be involved in missile systems with New Generation Precision Guided Munitions (NGPGM), as also various air defence systems for the MRSAM, LLQRM and QRSAM programmes. The expansion will also include the Drone Dome system (radar and laser beam system for detecting, jamming and destroying drones) and the naval remote control weapon station systems programme, to be manufactured at Hyderabad.

Kalyani Group and BAE Systems in strategic partnership

Kalyani Group and BAE Systems are to develop air defence guns for the Indian Defence Forces. As Rajinder Singh Bhatia, President and CEO (Defence and Aerospace) of Bharat Forge Ltd stated, "The Kalyani Group are now expanding their profile in the defence segment to include air defence guns and ammunition in order to provide solutions to Indian security forces for terminal air defence. The Group and BAE Systems have agreed to partner for transfer of technology for air defence guns and ammunition. This will be the perfect example of *Make in India* solutions."

MKU and Thales to develop optronic devices

MKU Limited and Thales have signed two MoUs for development and production of optronic devices and F90 close quarter battle (CQB) rifles at MKU's facilities in Kanpur. Neeraj Gupta, MD of MKU stated, "This partnership will not only focus on meeting the requirements of our forces in India, but will also look at exporting the products to other parts of the world." Light, balanced and accurate, the F90CQB (Close Quarter Battle) developed with MKU "will be well suited for Indian conditions and requirements."

Adani Group collaborates with Punj Lloyd and Rave Gears

The Adani Group is to collaborate with Punj Lloyd and Rave Gears (USA) for the design, manufacture and assembly of high precision gears and transmission systems for rotary platforms, currently under production by HAL, and for future programmes including the Naval Utility Helicopter (NUH) and Naval Multi Role Helicopter (NMRH). This entity in India will also export to global OEMs, both in the military and civil aerospace domain. As Ashish Rajvanshi, Head of Adani Defence & Aerospace stated, "The collaboration is another step in Adani Group's vision of creating a vibrant defence manufacturing ecosystem by bringing world-class capabilities to the country. It will help establish new production lines in India, generate employment and build sustainable skills."

Godrej Aerospace's "Centre of Excellence"

Godrej Aerospace, a unit of Godrej & Boyce Mfg. Co. Ltd. have recently inaugurated their Centre of Excellence (CoE) in Mumbai, following the expansion in partnership with Rolls-Royce which had recently awarded contracts worth US$ 30 million over next five years to manufacture unison rings, complex fabrication and external brackets commodities. As Kishore Jayaraman, President, India and South Asia, Rolls-Royce, stated, "The expansion of partnership with Godrej & Boyce for manufacturing of aero engine components showcases our commitment to developing an aerospace ecosystem in the country. We are constantly developing and rationalising strategic partnerships across our supply chain. With the expansion of this partnership with Godrej & Boyce, our focus will be to meet our customers' strategic requirements in quality, cost and delivery."

Nucon and Alkan in JV

Nucon and Alkan of France have formalised a Joint Venture for manufacture and supply of 'Weapon Carriage Systems' for the Indian Air Force, DRDO, Hindustan Aeronautics Limited as well as various equipment for their military aircraft facilitating carriage of any type of bombs, missiles, pods, tanks.

MoU between GIFAS and SIDM

The Society of Indian Defence Manufacturers (SIDM) and the *Groupement des Industries Françaises Aéronautiques et Spatiales* (GIFAS) have entered into an MoU to promote a sustainable framework for present and future partnerships and cooperative actions between the French aerospace industry and the Indian defence industry and "to expand trade, through industrial cooperation between France and India."

Tata Lockheed Martin Aerostructures new facility

Tata Lockheed Martin Aerostructures Limited (TLMAL), a joint venture between Tata Advanced Systems Limited (TASL) and Lockheed Martin, have inaugurated India's first-of-its-kind metal-to-metal bonding facility at Adibatla, Hyderabad. The new 4,700 square-metre metal-to-metal bonding facility will directly support indigenisation of C-130 manufacturing by transitioning the production of approximately 2,000 previously imported empennage parts to Tata Sikorsky Aerospace, Ltd. (TSAL), another Tata-Lockheed Martin joint venture located there.

Goa Shipyard Limited and Naval Group in cooperation

Goa Shipyard Limited and the Naval Group have signed a Letter of Intent to expand their collaboration in the field of design and production of all shore based simulators for *Scorpene* submarines and for other future advanced simulator requirements of the Indian Navy, "with significant indigenous content." The two companies had earlier signed Memorandums of Understanding (MoU) for submarine Combat Management System (CMS) simulators. The two entities had also collaborated earlier on future projects including advanced simulators for Integrated Platform Management System (IPMS) and Submarine Escape Training Tower (SETT). With this renewed collaboration with Naval Group, GSL will be able to offer complete suite of simulators, including 3D simulators for the different future platforms of the Indian Navy.

Exercise *Varuna 2018*

From 1 to 7 May, the Indian and French Navies participated in Naval Exercise *Varuna* 2018 in the vicinity of Reunion Island administered by France in the Indian Ocean. The seven-day exercise witnessed simulated scenarios, including air defence, asymmetric

warfare and embarkation of ships at sea. First phase of the exercise involved joint anti-submarine training off the Indian coast in Goa, with the participation of both a French nuclear submarine and the INS *Kalvari (Scorpene*-class submarine), while the second focused on amphibious operations off Chennai's coast, also involving the French landing helicopter dock LHD *Dixmude*.

The exercise included participation of two major vessels of the Indian Navy, the destroyer INS *Mumbai* and the *Talwar* -class frigate INS *Trikand*, and the maiden deployment at Reunion Island of IN's P-8I multimission maritime patrol aircraft, along with units of the French Navy deployed at Reunion Island, including the frigate *Nivôse*.

Deployment of Indian aircraft in Maldives

Continuing uncertainties regarding deployment of Indian Navy HAL-Dornier 228 maritime patrol aircraft and HAL Dhruv advanced light helicopter in the Maldives have exacerbated relationships between India and the Indian Ocean island republic. Tensions have remained with the Abdulla Yameen regime in the Maldives refusing to renew the letter of exchange (LoE) for deployment of a Dornier 228 in the archipelago and two Dhruv ALHs which India had gifted the Maldives. The latter were to operate from the Addu and Laamu atolls, the latter being one of the southern most and at entrance of the one-and-half degree channel, a major international shipping passage through the Maldives. Speculations are that the Chinese may have influenced the Maldivian decision.

L&T-built OPV commissioned by Indian Coast Guard

Larsen & Toubro-built Offshore Patrol Vessel ICGS *Vikram* has been commissioned into the Indian Coast Guard in presence of Raksha Rajya Mantri Dr. Subhash Bhamre, at L&T's Defence shipyard at Kattupalli, near Chennai. The vessel is the 'First of Class' of seven new generation Offshore Patrol Vessels (OPVs) contracted by the Ministry of Defence to L&T in March 2015. The ship was completed in just 25 months and is tasked to conduct coastal and offshore patrolling, policing maritime zones of India, control & surveillance, anti-smuggling & anti-piracy operations with limited wartime roles.

Regional Level Marine Search and Rescue Exercise 2018

The Regional Level Marine Search and Rescue Exercise 2018 was conducted off Port Blair in March 2018 to ascertain preparedness of the Indian Coast Guard along with stakeholders in responding to a major marine/aircraft accident in the Andaman Seas in line with the provisions of National Maritime Search and Rescue (NMSAR) manual. Highlight of the exercise was participation of the newly commissioned Coast Guard Ship *Sujay* along with 8 Coast Guard ships of the A&N Region; were deployed Indian Coast Guard Dornier 228s and Chetak helicopters alongside Indian Air Force MI-17s for SAR operations.

Expansion of Vistara

The joint venture between Tata Sons and Singapore Airline, Vistara which currently operates a score of Airbus A320s, in services around India, is on the cusp of ordering wide-bodied airliners as part of plans to expand to overseas routes. According to sources within the airline, the first international destinations could include Tehran as also some in Southeast Asia. Although decision on the type is yet to be announced, possible options are the Airbus A330neo, Airbus A350 and Boeing 787 Dreamliner.

Jet Airways to acquire 75 Boeing 737 MAX airliners

Jet Airways are to acquire 75 Boeing 737 MAX aircraft, a follow on to its first order for 75 MAX aircraft in 2015 as part of the strategy to modernise its fleet. In this context, GECAS has committed to lease twelve Boeing 737 MAX8s to Jet Airways with deliveries commencing from12 June 2018 and continuing till 2020. Six of these MAX aircraft will be from GECAS' skyline order while the other six are from sale and lease back transactions from Jet Airways' order book. These new technology aircraft are powered by CFM-LEAP-1B27 engines.

ATR 42 services to Pasighat

Maiden landing of an ATR 42 of Alliance Air at Pasighat ALG in Arunachal Pradesh took place on 23 April 2018, adding air connectivity to this remote town in India's north east. The flight from Guwahati took about two hours and as Pema Khandu, Chief Minister, Arunachal Pradesh stated, "Soon we would have the first civilian aircraft fly from Pasighat and I am optimistic the same would follow in various ALGs of the state, taking our state to the country's flight map."

15 AAI-managed airports to be privatised

According to reliable reports, about 15 'profitable' airports, presently managed by the Airport Authority of India including those at Chennai and Ahmedabad, could be put under private management in the first such privatisation initiative by the National Democratic Alliance (NDA) government. Earlier, the UPA government had privatised India's two biggest airports, at Mumbai and Delhi, besides the two southern airports at Bangalore and Hyderabad. Amongst the airports now under consideration for privatisation are Ahmedabad, Jaipur, Kolkata and Lucknow, the plans being prepared by NITI Aayog and the Department of Economic Affairs.

Lufthansa Technik contract with Jet Airways

Lufthansa Technik AG and Jet Airways have signed a Total Component Maintenance (TCM) contract for the airliner's fleet of 80 Boeing 737NGs, with single components repaired in a "closed-loop and flat rate-based process." In addition, the existing Total Component Support (TCS) contract for Jet Airways' widebody fleet has been extended by another seven years. The contract comprises an extensive component pooling-based support for ten Boeing 777 and eight Airbus A330 aircraft.

PSLV-C41 launches IRNSS-1I navigation satellite

On 12 April 2018, ISRO's Polar Satellite Launch Vehicle PSLV-C41 launched the 1425 kg IRNSS-1I Navigation Satellite from Sriharikota. After a flight lasting about 19 minutes, the vehicle achieved its Sub Geosynchronous Transfer Orbit with a perigee (nearest point to earth) of 281.5 km and an apogee (farthest point to earth) of 20,730 km inclined at an angle of 19.2 degree to the equator following which, the IRNSS-1I separated from PSLV.

'Chandrayaan-2' to cost Rs 800 crore

According to ISRO Chairman K Sivan, India's second lunar mission, 'Chandrayaan-2' scheduled for launch in October-November 2018, would cost Rs 200 crore for the launch and Rs 600 crore for the satellite itself. "This cost, is almost half of what it would cost if the same mission had to be launched from a foreign launching site," K Sivan stated. India's first lunar probe,

'Chandrayaan-1', launched on 22 October 2008, *(impression above)* had been lauded for costing a fraction of what other lunar missions had cost: $80 million as compared with Japan's 'SELENE' mission's $480 million as an example. The 'Chandrayaan-2' is an advanced version of its predecessor, will weigh 3,250 kg at the launch, with orbiter, lander and rover that are all indigenously developed. "The probe will descend the surface of the moon, from where they will collect samples of soil, water etc. to carry back home for detailed analysis and research," Sivan stated.

India and France in joint inter-planetary missions

The Indian and French government have signed an MoU to collaborate on inter-planetary missions, as part of their joint vision for space cooperation. "ISRO and CNES will work together on autonomous navigation of rovers on Moon, Mars and other planets, aero-braking technologies for planetary exploration and modelling of Mars and Venus atmosphere as also inflatable systems for the exploration of Venus," according to the Document. Dr K Sivan, Chairman ISRO added that "Based on ISRO's Announcement of Opportunity for the MOM-2 mission, we shortlisted some payloads. We will study the payloads and configure a spacecraft for the mission. Currently, there is no plan for collaboration with the CNES for the mission. However, we may consider joint cooperation with CNES for the MOM-2 mission."

India to buy 240 KAB-1500s from Rosoboronexport

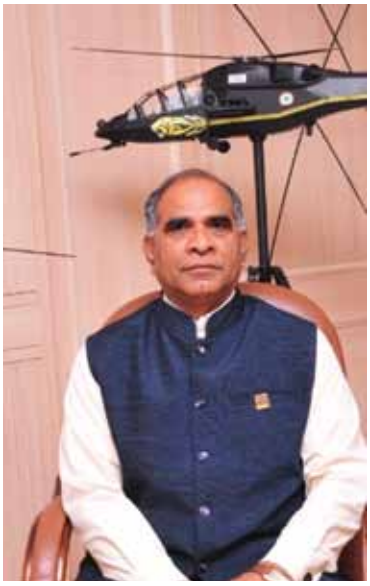
MoD has announced purchase of 240 precision-guided bombs at a cost of Rs 1,254 crore from Russia's Rosoboronexport; the smart KAB-1500 laser-guided bombs will be procured for Sukhoi-Su-30MKI fighters and will "address the deficiency of precision guided munitions in the IAF arsenal, besides enhancing the offensive capabilities of the IAF." The bomb's warhead weighs 1,100 kg and has folding fins that allow it to manoeuvre while being guided to the target.

Ashok Leyland MoU with Rosoboronexport

Ashok Leyland Defence Systems (ALDS) has signed an Memorandum of Understanding (MOU) for cooperation with Russia's Rosoboronexport (ROE). Ashok Leyland (AL) has been a supplier of Logistics and Special Role Vehicles to the Indian Army for the past 25 years. Congratulating ALDS, ELCOM and the Rosoboronexport team, Vinod K Dasari, Managing Director of Ashok Leyland stated, "Ashok Leyland is fully committed to making the Prime Minister's 'Make in India' in Defence sector, a resounding success. The signing of this MOU is a step in the direction as this new partnership will allow Ashok Leyland to provide tracked vehicle solutions to the Armed Forces."

HAL's record turnover in FY 2017-18

Hindustan Aeronautics Limited recorded a turnover of over Rs. 18,000 crores (provisional and unaudited) for the year ending 31 March 2018 (corresponding figure for the previous year was Rs. 17,605 crores). The Company expects continued 'Excellent MoU' rating for the FY 2017-18 for meeting relevant parameters related to its performance.



T. Suvarna Raju, Chairman & Managing Director of HAL

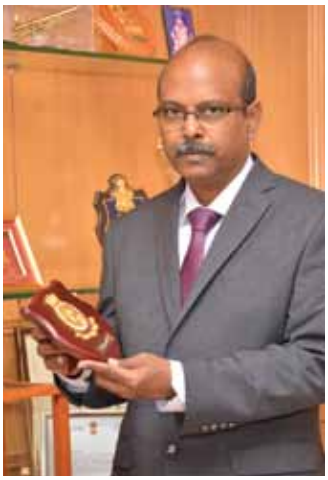
During FY 2017-18, the Company produced 40 new aircraft/helicopters and 105 new engines, and also carried out overhaul of 220 aircraft/helicopters and 550 engines. HAL received orders for 41 Advanced Light Helicopters and 8 Chetak helicopters from Indian Armed Forces during FY 2017-18. Amongst other major achievements, the Company received Initial Operational Clearance(IOC) certificate for its Light Combat Helicopter (LCH), Certificate of Airworthiness for its civil variant Dornier Do-228 from DGCA, acceptance of Mirage 2000 upgrade by Air HQ after its Final Operational Clearance, first successful run of Hindustan Turbo Shaft Engine -1200 and successful test firing of BrahMos missile from the Su-30 MKI.

T Suvarna Raju, Chairman & Managing Director of HAL stated that,"The Company strongly supports the Indian Armed Forces with its indigenous and licence manufactured products. The Company has also continued to emphasise on

self-reliance towards development of indigenous products, diversification into civil segment, enhancement of capacity, support development of defence manufacturing eco-system by developing domestic vendors (including MSMEs) and enhance outsourcing. These efforts will provide steady growth of the Company and opportunities to capitalise on the future requirements of the Indian Armed Forces."

BEL's landmark turnover

Bharat Electronics Limited (BEL) achieved a landmark turnover of more than Rs.10,000 Crores (Provisional & Unaudited) during FY 2017-18, sustaining double digit growth over the previous year's turnover of Rs.8,825 Crores. Some of the flagship projects executed during the year include Integrated Air Command & Control System (IACCS), weapon locating radar (WLR), hand held thermal imager (HHTI), Akash Weapon System (Army), naval fire control system, integrated communication system, 3-D Tactical Control Radar (TCR), electronic warfare systems, L-70 gun upgrade, electronic voting machines (EVM) and voter verifiable paper audit trail (VVPAT).



BEL's Chairman & Managing Director, Mr Gowtama MV, stated: "The focus on indigenisation for self-reliance has continued with more vigour, besides capacity building, expansion and enhanced outsourcing to SME sector. Also, BEL has been able to maintain good order acquisition this year. These efforts will complement BEL to sustain growth, capitalise future opportunities and consolidate market leadership in the defence business."

Russian Helicopters on helicopter maintenance in India

Russian Helicopters (part of the Rostec State Corporation) have held discussions on after-sales service of Russian helicopters. Currently, Mi-8/17 medium multi-mission helicopters, Mi-26 heavy helicopters, Mi-25 attack helicopters and the Ka-25/28/31 naval helicopters are in operation with the Indian Armed Forces, the total Russian helicopter fleet in India being some 400.

At DefExpo 2018, Russian Helicopters showcased models of the Ka-226T helicopter (which is expected to be manufactured in a Russian-Indian joint venture) and the latest offshore version of the Mi-171A2. In November 2017, Russian Helicopters had signed with Vectra Group of India, for delivery of a Mi-171A2 multi-mission helicopter and the agreement stipulates an option to purchase another helicopter of this type.

Ka-226T

"During negotiations, we plan to concentrate on after-sales service, repair and modernisation of equipment that has already been delivered to India. Moreover, we will discuss the implementation of a joint project, a Russian-Indian joint venture for assembling Ka-226T helicopters. A presentation of the Ka-226T naval helicopter which, as we believe, could be assembled under the joint venture, will be included," stated Andrey Boginsky, CEO, Russian Helicopters.

ShinMaywa seeking parts manufacture, MRO of US-2i in India

In a move to augment its network in India, Japan's ShinMaywa is considering the at manufacture of parts and sub-assemblies besides part -manufacture of the full flight simulator of its US-2i amphibious aircraft in India. The Indian Navy and the Indian Coast Guard are seeking 12-18 of these search and rescue aircraft (SAR) to expand their reach and capability. The Japanese have offered to not only 'Make in India' but setting up MRO and re-exports. However, "There is still no clarity about the number of aircraft that will be manufactured in India and what components will be identified for export."

Tribute to an iconic leader, soaring air warrior

Air Chief Marshal Idris Hasan Latif (1923-2018)

Air Chief Marshal Idris Hasan Latif, an exceptionally-gifted 'peoples' leader, towering air warrior, former Governor of Maharashtra, and Ambassador to France flew into eternity on 30 April 2018 at Hyderabad after a brief illness quietly and courageously borne. He would have been 95 on 9 June. India lost a great son, an elder statesman and a much-admired public figure of exalted stature.

Idris Latif clocked many 'firsts' in independent India: first Muslim as armed forces Chief; first retired armed forces Chief to be both Governor and Ambassador; and the first retired armed forces Chief to be asked (in great confidence by Prime Minister Rajiv Gandhi) if he would agree to be the Vice President of India, an offer he very politely declined, "as his insistence on a high standard of discipline, which had become so much a part of him, may well [prove] to be, in the Rajya Sabha, a cause of serious embarrassment for the government." This was the quintessential Idris Latif !

Rewinding to early years, soon after commissioning in 1941, he was under training in the UK for air operations to support D Day landings at Normandy. But the gravity of the situation on the Burma front took him there, and he completed his full combat tour on Hurricanes with No.3 Squadron. He flew some 22 aircraft types in his career, with the Spitfire—on which he had the maximum flying hours—being his all-time favourite.

Idris Latif commanded No.4 Squadron, Air Force Stations Begumpet, Hakimpet, Poona, Operations (J&K) and was Air Attaché, in Washington (1961-64) where he persuaded Head of Mission BK Nehru to fly a familiarisation sortie on the F-104 Starfighter that earned him the sobriquet "supersonic ambassador"! In staff and higher command assignments, Idris Latif kept unfailingly in touch with flying fighters, bombers, transport aircraft and helicopters of all varieties. I had the privilege to fly with him on most of his sorties on the Canberra with No.35 Squadron at Poona when he was Base Commander. These invariably meant live armament work, including heavy-weight bombs.

After tenures as ACAS (Plans), AOA, AOC-in-C Central Air Command and Maintenance Command and a short stint as the VCAS, Idris Latif took over as Chief of the Air Staff in 1978. "It was an epochal event", avers Air Marshal 'Rags' Raghavendran, "the morale of the personnel changed dramatically with Latif's professional, fair and caring approach." Key procurements across a wide capability spectrum like the Jaguar, MiG-23, MiG-25 (which trisonic aircraft he also flew) and the heavy-lift Mi-26 helicopter came to fruition during his tenure which also witnessed the initiation of cases for the Mirage 2000, An-32 and the Il-76. In recognition of his exemplary work and the respect he enjoyed in the Government he was appointed Governor, Maharashtra, and later India's Ambassador to France.

So, what was iconic about Chief Latif ? Not for him leadership through hard coercive authority. His working culture, unfailing pursuit of excellence, easy sense of humour, highest standards of professionalism and utmost caring for others, particularly subordinates were truly inspiring. There were many instances of his firmness, 'loyalty downwards' and moral strength to stand up for his juniors, whom he always encouraged to speak freely if they had suggestions to offer for improved operational preparedness.

Idris and his charming wife Bilkees Latif were unquestionably a couple extraordinaire, epitome of civility and culture with wide ranging interests. He embodied the richest values and core belief systems of a democratic and inclusive India founded on a rich and plural civilisation. Their home bespoke of highly refined and aesthetic ambience. Shrinivas S Sohoni, who was Secretary to Governor when the Latifs adorned the Raj Bhawan in Mumbai, saw them as "perfect for the role of Governor, Maharashtra and his spouse…few indeed would have held any different view of that remarkable and charming couple." Sharat Sabarwal, former High Commissioner of India to Pakistan, who was First Secretary when Chief Latif was Ambassador to France, echoes in a similar vein, "the Latifs were an exceptionally gracious couple and excellent representatives of the country with admirable warmth and a generous nature. He provided incomparable leadership for his team."

In conclusion what the Greek General and statesman Pericles said nearly 2,500 years ago, is so tellingly apt for the redoubtable Air Chief Marshal Idris Hasan Latif:

What you leave behind is not what is engraved in stone monuments

But what is woven into the lives of others you touch

Air Vice Marshal (retired) Kapil Kak

After his flight in the MiG-25 trisonic strategic reconnaissance aircraft of No. 102 Squadron at Bareilly

Gaganshakti 2018

"Shaking the Heavens and splitting the Earth"

Tejas LCAs were 'operationally deployed' for the first time

The IAF conducted its Exercise *Gaganshakti* from 8 to 22 April 2018 but planning for this had reportedly been set in motion almost nine months earlier. Described as the largest exercise in the past three decades, with its dimension range and lethality translated into 'shaking the heavens and splitting the earth', this was quite in contrast to the general public perception that the IAF is much in need of enhancement of its fighter squadron strength from the present 31 to 42 and more, along with drastic modernisation and substantial increase in its other assets.

"India has not witnessed anything on this scale since Exercise *Brass Tacks* in 1987", stated Air Chief Marshal Birender Singh Dhanoa, Chief of the Air Staff, and added that the western neighbour was apparently concerned by the sheer scale and complexity of *Gaganshakti 2018*. According to the Air Chief, the country's western neighbour had monitored the Exercise closely through their airborne warning and control systems.

Considering that this massive exercise was during peace time, in a real confrontation, vital assets and ammunition (missiles, bombs, etc) would have been used resulting in diminishing war reserves. The aim of the exercise was to surmount constraints of economy for conserving air power needed when the real challenges occured.

Su-30MKIs on long-range missions

As enunciated by the CAS, "The intention of the Exercise was to validate our operational capabilities and concepts in a realistic war-like scenario as well as check our ability to sustain high-tempo operations. It is not aimed at any country."

The exercise was conducted in two phases so that all Commands of the IAF got adequate opportunity to test the efficacy of their preparedness. Phase-I of the exercise involved activation of Western, South Western and Southern Air Commands, with the affiliated Army and Naval components. Phase-II of the exercise involved activation of Western, Central, Eastern and Southern Air Commands. Re-deployment for Phase-II involved relocating the forces so as to be effective at the new locations within a short span of 48 hours. This was made possible by round the clock operations of heavy lift transport aircraft like the C-17 and Il-76 as well as by employing a large number of tactical airlift aircraft, C-130s and An-32s. The IAF also used civil chartered flights and trains for mobilisation of its resources.

During the exercise, a spectrum of combat missions, encompassing various air situations, were conducted. Fighter aircraft were involved in *surge operations,* generating maximum number of sorties in a 24-hour cycle. These included long range missions with concentrated live and simulated weapon release at various air-to-ground ranges in India, creation

IAF Hercules airdropped Special Forces in critical sectors

of an air defence umbrella to facilitate operation of ground forces and Counter Surface Force Operations in support of the Army in various sectors. During both phases, Maritime Operations involving long range maritime strikes with Maritime Reconnaissance provided by Indian Navy aircraft also took place. The integration of Tejas LCAs and Akash SAMs in the operational matrix of the IAF was checked out. In addition, capabilities of upgraded Mirage 2000s and MiG-29s were tested in an operational environment. Various types of aerial weapons, including standoff and precision weapons, were employed to validate their use in air operations.

Combat Support Operations involved missions by force enablers like AWACS and mid-air refuellers, Special Operations including a Battalion Group paradrop, Special Operations by IAF's *Garud* Commandos, Combat Search and Rescue for effective extraction of downed aircrew behind enemy lines, rescue from the sea and operations from Advanced Landing Grounds. The transport aircraft undertook mass casualty evacuation missions both in Eastern and Western Sectors. Helicopter missions included Special Heliborne Operations, casualty evacuation, strike missions against 'enemy' formations and Inter-Valley troop transfers.

For joint operations, the IAF's joint command and control structures alongside the Indian Army and the Navy, involving Advance Headquarters of the IAF co-located with Army Commands, Tactical Air Centres, Maritime Air Operations Centre and Maritime Elements of the Air Force were activated. Army troops and combat vehicles were deployed in simulation Tactical Battle Areas in various sectors and some Army exercises were dovetailed with air operations for simulation of realistic battlefield environment. Warships were deployed, both in the Arabian Sea and the Bay of Bengal, for simulating anti-shipping strikes by IAF aircraft operating from bases on the east and west coast, as well as from the island territories.

"The Exercise emphatically demonstrated the IAF's proven command over operationalisation of its assets yielding airpower in defence of the century." The Su-30MKIs, with a combat radius of 1500 km without mid-air refueling operated from an eastern coastal airbase to strike a multiple targets in the western seaboard over distances beyond 2200 km before recovering to a southern base covering a total distance of about 4000 km in single non-stop missions.

The IAF was able to achieve 80% serviceability of aircraft while radars and surface-to-air guided weapons maintained a serviceability of 97%, which included some legacy systems that were over 40 years old. Focused effort enabled a dispatch of more than 95% for combat assets, 100% availability of combat support systems and almost 100% dispatch rates of combat enablers.

There were no reports of casualties in various missions in the air or on the ground. Amongst the few glitches was that of a Jaguar veering off the runway at Bhuj owing to unfavourable weather conditions and six of the eight Tejas LCAs developing some snags, but quickly fixed by HAL engineers.

During the Exercise, Defence Minister Nirmala Sitharaman visited Chabua airbase in Assam and Pasighat in Arunachal Pradesh and expressed satisfaction with the manner in which the Exercise was conducted.

What stood out was the demonstration by the IAF through deep sea missions that military bases alongside Indian maritime boundary are within its striking range of the IAF. Su-30MKI aircraft took off from bases in Southern India including Tanjavur and Sulur with Brahmos supersonic cruise missiles, having a range of 300 km and carried out simulated strikes in the Malacca straits, Nine Degree Channel and other sensitive areas.

An impressive aspect of the Exercise was the massive deployment of air and ground crew plus other personnel setting an unprecedented record of sorties flown by the fighter and transport aircraft. The IAF flew some 11000 sorties during the Exercise, 9000 by fighters including Su-30MKIs, Mirage 2000s, Jaguars, MiG-29s, MiG-21s, MiG-27s, Tejas and some Hawk advanced jet trainers.

Based on information released by PRO, IAF and MoD sources

'Garud' special forces deploying from Hercules

Brigadier Gurmeet Kanwal on

Fighting a two-front war

Several times in recent years, the chiefs of staff have publicly emphasised the need for the Indian armed forces to prepare to fight a two-front war. Given the ever-deepening nuclear warhead-ballistic missile-military hardware nexus between China and Pakistan, now supplemented by close economic cooperation, the probability of a two-front threat is constantly increasing.

The history of military collusion between China and Pakistan goes back over 50 years. During the 1965 India-Pakistan war, though Pakistani president General Ayub Khan had asked China for military aid, China limited its support to making some threatening military manoeuvres in Tibet. The aim was to keep Indian military reserves tied down so that additional divisions could not be moved from the eastern theatre to the western front.

Similarly in the 1971 India-Pakistan war, despite Henry Kissinger's entreaties to China to intervene, China chose to restrict its support once again to threatening noises. It is noteworthy that during the Kargil conflict in 1999, Chinese military advisers were reported to have been present in Skardu in Pakistan-Occupied Kashmir (POK).

Since the early 1990s, China has been using Pakistan as a proxy to embroil India in perpetual conflict. It provided nuclear warhead designs to Pakistan and reportedly some fissile material as well. China helped Pakistan to test its prototype warhead at its Lop Nur range and gave it M-9 and M-11 nuclear-capable short-range ballistic missiles (SRBMs).

China also facilitated the transfer of Nodong and Taepo Dong ballistic missiles from North Korea to Pakistan. American journalist Selig Harrison wrote in *The New York Times* that close to 10,000 Chinese engineers and personnel of the People's Liberation Army (PLA) have been engaged in road and hydel projects in Gilgit-Baltistan (GB) for over a decade.

It is believed that Pakistan has outsourced counter-terrorism operations in GB against extremists of the East Turkistan Islamic Movement (ETIM), active in China's restive Xinjiang, to the PLA. Also, Pakistan has handed over its Gwadar port on the Makran Coast to China. It is possible that as part of China's 'string of pearls' strategy, the port will be turned into a Chinese naval base.

It was in the light of these developments that former army chief General Deepak Kapoor had said during the Army Training Command doctrine seminar in December 2009 that the Indian Army must prepare for a two-front war. Several armed forces chiefs have repeated this formulation since and it has become the *sine qua non* for India's defence preparedness.

In fact, some former chiefs have spoken on the need to prepare for a two and a half-front war. The implication is that the army is already engaged in a 'half-front war' by way of counter-insurgency operations that drain resources in Jammu and Kashmir (J&K) and some of the north-eastern states. Also, during a future war with either China or Pakistan, given the unstable internal security environment, there will be a requirement to keep the internal lines of communication safe from interdiction and sabotage. The term 'half-front war' was coined by General Shankar Roychowdhury, former COAS.

Strategic Partnerships

The conventional wisdom in the policy community in New Delhi is that if there is a war between India and Pakistan, China may not come to Pakistan's aid militarily unless Chinese troops are directly under attack, for example in Gilgit-Baltistan. China will raise the issue in the UN Security Council, provide weapons and defence equipment as well as logistics support and probably demonstrate some military manoeuvres in Tibet to prevent India's dual-tasked divisions from being moved to the western sector, as it has done in the past.

However, if there is a war between India and China, Pakistan is unlikely to hold back. It is certain to take advantage of the situation in various ways. Pakistan will step up the infiltration of trained terrorists to play havoc with the lines of communication of the Indian armed forces and may, under certain circumstances, open another front against India. If Pakistan does launch offensive operations in support of China, these will probably begin in J&K, but may not necessarily remain limited to J&K.

Can India fight both China and Pakistan simultaneously? The armed forces will be stretched to the limit but, given adequate resources, they could fight a holding action successfully, though with large-scale casualties. However, with the present force levels and combat capabilities, they cannot fight and win. That implies that they cannot hope to terminate the conflict on India's terms and impose the nation's will upon the adversaries. As such, the political and military aims and objectives will have to be kept low.

Should India enter into a military alliance with friendly powers? Military alliances are passe as these are generally too restrictive and it is necessary for India to preserve its strategic autonomy. Ideally, India's key strategic partnerships should be of sufficient significance to ensure that India is never required to fight a two-front war. Though it was not a military alliance, the Treaty of Peace, Friendship and Cooperation, which India had signed with the erstwhile Soviet Union before the 1971 war, had ensured that China refrained from aiding Pakistan militarily during the war.

The Indo-US strategic partnership has been described as India's 'principal' strategic partnership. Its defence cooperation element must be taken to the next higher trajectory - joint threat assessment, joint contingency planning and the conduct of joint operations when the vital national interests of both countries are threatened simultaneously. This will ensure that a situation similar to 1971 obtains in future and India's military adversaries are deterred from ganging up against India.

Simultaneously, India should upgrade its present military strategy of dissuasion against China to deterrence, which will come from the capacity to take the war into the adversary's territory, the ability to cause unacceptable damage and the wherewithal to dominate the sea-lanes of the Indian Ocean.

The IAF Su-30MKI forms backbone of the force (photo: Angad Singh)

Dassault's Rafale will be a strategic asset (photo: Angad Singh)

Gurmeet Kanwal

(The writer is Distinguished Fellow, Institute for Defence Studies and Analyses, New Delhi)

Air Marshal M. Matheswaran on the new RFI

Victim of politics or serious intent?

Saab Gripen

The Indian Air Force issued a RFI (Request for Information) on 6 April 2018 to global OEMs of fighter aircraft, and in the process abandoning the RFI for single-engine fighters floated two years earlier. The current RFI of 73 pages is a detailed document, which has derived much from the earlier fully evaluated MMRCA project, scrapped in 2015. Much of all the information is already available with the IAF, thanks to the earlier evaluation. Nevertheless, the RFI signals an intent, and allows the OEMs to furnish certain technical and policy related information that would be very useful in formulating a very practical and viable RFP.

Lockheed Martin F-16

Effectively, the RFI signals a repeat of the MMRCA process for the same multi-role aircraft, technologies and production intent. The players are the same, similar processes and methodologies, and so, what is different now? Going by GOI's track record on major acquisitions, this would well be another 5-year cycle, which means if everything goes well and efficiently, the first aircraft may be with the IAF not before 8 years, that is not before 2026! Why couldn't the government fast-track the process through a sensible G to G agreement? Quite obviously, affordability is an issue but MMRCA has also become a victim of the politics of the day.

There are some significant differences that come into play in this repeat MMRCA process. In the previous evaluation, there were one or two aircraft that may have been considered as still under development, for example the Gripen-NG and the MiG-35. In the current scenario all competitors will have fully developed and matured platforms, particularly the Gripen E and the MiG-35. New upgraded avionics and sensors may be in operation. In the last evaluation, AESA radar, which was a critical requirement, was mostly part of subjective evaluation as except for the Americans, none had operationalised AESA radar. In the current scenario, all the contenders will field operational AESA radars. Technology requirements asked for in the current RFI

Boeing F/A-18 Super Hornet

are virtually a repeat of what was asked for in the earlier RFP, but it is now supported by DPP 2016 with better clarity in policies with respect to categorisation, TOT requirements, and indigenous content strategies. More importantly, while the previous RFP dealt with HAL as the sole production agency and technology partner, the RFI indicates the options for Indian private sector as the production agency. This could be a double-edged sword. Unless Indian private sector with strong foundation in manufacturing and technology innovation are involved, they could end up as glorified licence-production agents of foreign OEMs. We can see various OEMs and Indian private sectors adopting a hedging strategy by announcing MOUs for partnership. With the recent announcement of Boeing, the alignments are clear: Boeing with HAL and Mahindra, Lockheed Martin with Tata (TASL), Dassault with Reliance Defence, and Saab with Adani. Eurofighter and the Mikoyan have not announced anything yet but it is most likely that they would prefer HAL as their partner. In all these groupings, other than HAL there is really no private sector with any significant aerospace and fighter aircraft manufacturing experience. While Tatas and Mahindras have the manufacturing culture and foundation, the other two, Reliance and Adani are primarily trading and infrastructure companies. Given the complexity of fighter aircraft technologies, these private sectors will take decades to imbibe the hi-tech manufacturing and innovation culture, provided its apex leadership moves away from trading culture to technocrat culture. It is therefore, imperative that the government creates a strategic mechanism to closely monitor and steer the Indian private sector towards achieving strategic objectives of technology acquisition and development, much like the French DGA.

DPP 2016 has brought in major changes which will impact on how the evaluation is now reinterpreted. As opposed to the earlier simple set of 'mandatory SQRs', DPP 2016 permits SQR to be listed in three sets: Essential Parameters A (which will be tested fully in evaluation), Essential Parameters B (which need to be validated in a certain timeframe), and Enhanced Performance Parameters (where each OEM can highlight additional or extra technology strengths, which could give them additional evaluation credits). This could make the evaluation more comprehensive, as well as complex and tricky.

Why is it that India's major acquisitions are always delayed repeatedly causing

Eurofighter Typhoon

Russia's MiG-35

grievous damage to the country in terms of adverse impact on force structures, higher costs, opportunities lost, and missing the technology bus ? The IAF's AJT selection was completed first in 1985 but it took 20 years more to sign the contract. The air-to-air refuelling tanker proposal continues to go around in circles for more than 10 years. LUH for the Army and Air Force went through three repetitions over the last 12 years, and there are many more cases.

The problem lies in the absence of right coupling of defence industrial strategy and military modernisation. It becomes worse when political leaderships do not have the expertise or the time for defence issues, which allows the generalist bureaucratic system to play the decision making game. If defence ministers are not technocrats and lack the depth in understanding military operational and strategic issues, it compounds the problem.

The original MMRCA RFP was a path-breaking one and could have benefitted the country immensely if it had been followed in earnest. While forwarding the draft RFP for MOD approval (which took two more years), a most important issue was flagged – that the final decision on this selection should be in consonance with para 59 of DPP 2005. This said that in major high value acquisitions, considerations should come into play in terms of strategic, technological, political, and economic benefits that would accrue to India from the competing vendor's country, and such a decision would be made by the CCS, irrespective of whoever is the L1. The implication of this is that governments should get involved, and CCS should make the final decision as to who should be negotiated with. Quite obviously, this was too complex for officials involved, and was ignored with conveniently different interpretation. Para 59 is repeated verbatim as para 73 in DPP 2006, and a watered down version as para 105 in DPP 2016.

It is very evident that the government has already moved into 2019 election mode. If the RFP process and the trial evaluation are not completed before it, which looks very unlikely, the second round of MMRCA may go on much longer than anticipated.


Dassault will be delivering 36 Rafales to the IAF

Dr Manoj Joshi on

Transformation and Jointness : The Chinese Way*

Transformation and jointness are two concepts that need examination, the first obviously being a more expansive concept incorporating concepts, doctrines, equipment and organisation. Rightly understood, military transformation is less about emerging technologies, hardware and software, and far more about the mindset of military and civilian professionals dealing with defence.

The term 'jointness', means different things to different people; in the US Dictionary of Military and Associated Terms, 'joint' is as in any activity, operation or organisation in which elements of two military departments participate. In this analysis the term is used to mean the effective integration of the combat capabilities of the three services. In the United States, the evolution of this 'effective integration', as well as the mind set among military officers who facilitate it, has progressed unevenly since the passage of the Goldwater Nichols Act of 1986.

America now fights wars almost solely under joint commands. Most recently and vividly, this was seen in the integration of combat effects in Afghanistan and Iraq. In addition, there were operations in the so-called global war on terrorism. What these operations revealed that from the top to the tactical level, there was a great deal of interoperability. I recall an example of an article I read which said that a captain seeking a strike against a particular target could expect his needs to be met through an air force jet flying overhead, an Army ATACMS missile or a cruise missile fired by a Navy ship or submarine.

There also have been less pronounced but consistent successes toward jointness made in peacetime—the steady evolution in joint doctrine and exercises, for one example. But it is also the case that jointness has failed to evolve in other areas in which it was anticipated and intended by the framers of the Goldwater-Nichols Act. There are still only few standing joint forces ready for joint deployment and employment and, rather, forces are, by and large, still assembled only at the time of deployment. Further, there has been only glacial movement toward such joint force.

The Goldwater Nichols perspective was to leverage the capabilities of individual services to meet the requirements of the joint force. While the challenge now is to move towards a joint interdependency where, as the Chinese see it, 1+1+1+1 will be greater than 4, or in other words, service capabilities are magnified through integration.

Integrated Joint Operations (IJO)

Combined arms operations have been taking place since WW II where the services broadly tended to fight their battles separately. Of course the value of 'coordinated joint operations' was well understood and most of our military exercises have sought to practice these. The shift now is towards 'integrated joint operations'. In the former, services conduct operations towards the same operational goals but with limited interactions at the lower echelons. But IJO is what countries like the US, and now China, believe is vital for winning wars. IJO is all about highly integrated and networked operations and joint force groupings down to the tactical levels.

Fielding an integrated C4ISR architecture is the key to IJO. This is not a simple step as it requires effective integration of systems and training of operators, as well as commanders at the campaign and tactical levels.

The application of IT to weapons and equipment–what the Chinese call *informationisation*–requires a change in all aspects of the military : strategy, operations, tactics, organisation, equipment, force structure, training and exercises.

The US and China believe that IJO are a more advanced form of Joint Operations where modular organisations can provide the ideal force mix from existing organisational divisions which can be integrated through joint command and a communications systems architecture.

The Goldwater Nichols Defence Reorganisation Act of 1986 focused a great deal of attention on joint officer management policies so as to focus on the quality and capabilities of officers serving on joint staffs and joint military operations. There is however a debate as to the extent to which jointness can be spread. In an influential article in 2003, Don Snider argued that there was need for further legislation to create a new joint warfare profession, a new joint doctrine and education command and a new joint personnel command. While Michael A Coss argued that the US already had a joint profession and the processes to develop and manage the body of joint knowledge, in his view, the process of diffusion of jointness has to be done with the view that future conflicts required decentralised operations where interdependent joint capabilities and associated forces would hold the key to victory.

In essence, there has to be an understanding that service identities must remain strong because they are the core of the expertise, which is required in ever greater measure in the modern battlefield but their perspective needs to be joint to not only meet the new warfighting challenges but to magnify the capabilities.

What is happening in China

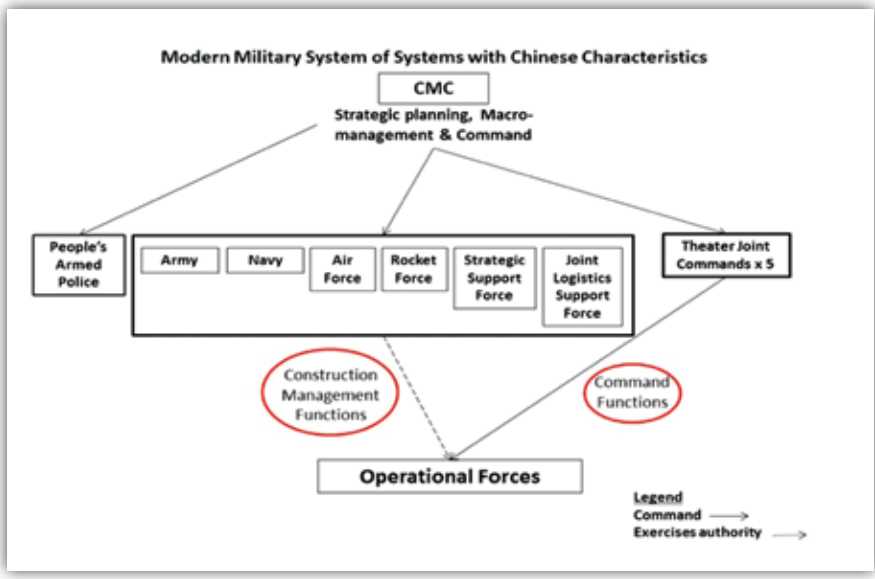
The first Gulf war triggered the interest of the PLA on the RMA based on precision strike and IJO capability, beginning as an experiment and to exercise individual components of jointness. Finally, after many stumbles, China is moving towards a military transformation based on the PLA analysis of IT-driven revolution in military affairs. This has arisen because of the awareness that the many traditional strategic and operational concepts and practices must be revised as potential threats and economic imperatives that China confronts have changed. An important aspect of this was contained in the China Military Strategy document of 2015 which declared that "China is a major maritime as well as a land country."

The other imperative has been the growth of technology : new missile, naval, air, as well as cyber and electronic warfare capabilities which demand integrated command and control. The reforms undertaken by Xi Jinping are aimed at accelerating the long-term military modernisation programmes that had been slowed down by inertia and widespread corruption.

This has involved new multi-service joint headquarter organisations at the national (strategic) level and the theatre (operational) level. The former is the new Central Military Commission which has folded the erstwhile General Departments into fifteen departments, institutions and commissions (three commissions on discipline inspection, politics and Law, S&T; five institutions on strategic planning, reform and organisational structure, international military cooperation, audit, agency for office administration; seven departments including general office, joint staff, political work, logistics support, equipment development, national defence mobilisation and training and administration).

This new 'flatter' command structure of the CMC provides greater political oversight over PLA affairs. These new headquarters will seek to build an Integrated Joint Operations (IJO) system and enhance the PLA's ability, in the words of Xi Jinping, "to fight and win" an 'informationised' war.

The Theatre Commands which will, through the Joint Operations Command Centre, be directly commanded by Xi Jinping, are now responsible for the planning of joint operations in a particular zone, and have the responsibility for the joint training of the forces, keeping in mind the potential joint missions they could be entrusted with.



New Flat Command Structure from PLA System of Systems Operations : Enabling Joint Operations (as per analyst Kevin McCauley)

PLAAF J-11 fighters on 'Quick Reaction Alert' at a Tibetan air base. There are reports that the Chinese have recently carried out air exercises over the Tibetan Plateau 'in order to confront any threat from India" (see separate news item)

Each of the four service HQ—the new Army HQ, that of the Air Force, Navy and the PLA Rocket Force—will supervise their force development and training.

The reforms which have actually led to a *reduction* of the PLA strength by 300,000, also stresses the enhancement of the professional military education, joint training, of NCOs and so on. The current reforms are aimed at operationalising a joint operations doctrine through a joint command system. This involves enhancement of joint officer development and improving joint training, doctrines, tactics, logistics and standardisation and working out procedures in establishing joint command procedures to support the weapon and equipment modernisation. This cycle is expected to continue till 2020.

The three-stage phase actually involves a long and complex process that would go on till the middle of the 21st century. The PLA's joint operations research and experimentation has revealed weakness in its military training institutes, joint proficiency of its officer cadre, joint training, doctrine and tactics and logistics, and command structures, all of which are being addressed in the current reform.

According to analyst Kevin McCauley, what the PLA is seeking to do is to successfully implement, what he says, is a *system of systems operational capability* which would synergise the combat effectiveness of the various component systems : weapons, equipment, units beyond their individual capabilities. In other words, this system of system operational capabilities based on information systems is viewed as the key enabler for IJOs.

The PLA is developing a theoretical basis for a new joint operations doctrine : integrated joint operations which is aimed at enhancing its capabilities to execute contingency operations in potential crises. Developing this capability is slowly but surely moving the PLA away from the Army-dominated system.

In essence, the development of such 'system of systems' operations and IJO are vital for the PLA's transformation. System of system operations are essentially system war fighting capability based on information systems. Success here requires the development of an integrated C4ISR system linking the services in a joint operations command system down to the tactical level, realistic training, battle labs and simulation centres for experimentation and innovation in joint operations and tactics, better military academic institutions,

The KJ-200 AEW&C aircraft incorporates an AESA radar system, mounted on a top fuselage beam. The aircraft is based on the Y-8 transport aircraft, itself based on the An-12 but with Pratt & Whitney Canada PW150B turboprops

The Chinese SH-5 amphibious maritime patrol aircraft has been developed by the Harbin Aircraft Manufacturing Corporation (HAMC) for maritime warfare, SAR and transportation of key stores to ships at sea

optimisation of the force structure and the creation of new type of operational forces.

The PLA has been experimenting since 2009 with 'Jointness' in the erstwhile Jinan Military region which covers the north eastern part of the country and includes the Shandong peninsula. They have validated various ideas and concepts for implanting the IJO system. An important element of this is to train a new generation of joint operations commanders and staff officers and evolve mechanisms to select, train and appoint joint operation commanders. Simultaneously, the PLA educational systems and universities need to adapt their curriculum and student composition to prepare officers for the joint assignments.

By 2020, one will get a clearer idea of whether the PLA moves have been successful and the one indicator of this is the proportion of non-Army senior officers who get the new billets in the Theatre commands. Already the Southern Theatre Command has a naval commander, Vice Admiral Yuan Yubai and we may soon see an Air Force officer heading the Eastern Theatre which is oriented towards Taiwan and Japan.

The shift of the PLA from being a continental army to an integrated joint force capable of operations within and without China's borders could take at least a generation. The senior military leadership understands the challenges, even though there is some unease among the younger officers as they confront a career which could be quite different from the one they envisaged.

Indian perspectives

In India the three services have their distinct cultures which go back a long time and all of them have tended to fight their fight separately. Not for nothing did the Army term its campaign in Kargil as *Operation Vijay* and the Air Force this as *Operation Safed Sagar*. But as the Karachi operations revealed in 1971, the battle space could get crowded with overlapping operations. Subsequently, this challenge has only grown and the Army and the Air Force, for example, learnt to coordinate their air and ground attacks so that there was no overlap.

Various exercises have also revealed that both services saw jointness as a means to an effective end. Where the US developed an entire doctrine, the *Air Land Doctrine* to take on the Soviets in Europe, in India the coordination came sans any doctrine since there was no institutional or legislative imperative to change. We have, of course, seen a joint doctrine emerge in 2016, but this appears to be severely flawed.

Not that there have been no efforts : various commissions have including the Arun Singh Committee which was set up in the specific context of the financial crisis of 1990-91. The idea of the Committee which was called the 'Committee on Defence Expenditure', was to propose ways of managing India's security challenges within the budgets available. In line with this, Arun Singh proposed major changes, including the appointment of a Chief of Defence Staff and the move towards joint theatre

Indian Navy MiG-29Ks on board the INS Vikramaditya during exercises at sea

Indian Naval landing craft disgorging troops and armoured fighting vehicles during amphibious exercises in the Andamans

commands. However, this report never saw light of the day, leave alone move towards any kind of implementation.

The Group of Ministers proposals for reform in 2001 was led by the top-most ministers of the Union Cabinet, indeed, they were all members of the CCS. However, they were assisted by specialist task forces and the one on military issues was headed by Arun Singh. This, too, proposed the creation of a CDS as a starting point of a process of creating joint war fighting capabilities.

The Naresh Chandra Committee was an expert committee which also recommended a CDS-like appointment : a Permanent Chairman of the Chiefs of Staff Committee: He would be selected from the three chiefs and have chief of staff from another service; He would coordinate and prioritise the 15 year LTIPP, the 5-year Plan and the Annual acquisition plan of the three Services; He would administer the tri-service institutions; He would command the A&N Command, Special Operations forces and those forces for out-of-area contingencies (expeditionary forces); He would have administrative control over the SFC, and be an invitee to the NSC and CCS meetings; He would plan joint service exercises to lay the foundations for operational, logistics and command control of future operational contingencies.

Such exercises would serve as proving ground for the Integrated or Theatre Command concept, and he would also push the integration of common functions now performed by individual services such as logistics, training and administrative areas. He would be responsible for the preparation of the annual Defence Operations Status Report and the idea of joint logistics. Further, among the tasks of the CDS would be to begin experimentation for implementing the Theatre Command idea.

Experience of the A&N Command

The Andaman & Nicobar Command has certainly offered an opportunity to experiment, especially on issues like joint logistics, joint campaign formations, joint tactical formations, refining joint command and coordination procedures and fielding an integrated command system. Yet, the first such exercise took place only recently ! The ANC has suffered neglect, again because of turf wars, lack of resources and general bureaucratic apathy and the fact that it does not have an "owner". However, there now seems to be a shift underway.

Implementation of an advanced integrated joint operations doctrine is the key to our ability to employ modern weapons and equipment, form and employ expeditionary forces at the campaign and tactical level to generate increased combat effectiveness to fight and win wars in South Asia and the IOR.

The deployment of integrated command, control, communications, computer, intelligence and surveillance and reconnaissance C4ISR will be foundation of the integrated joint operations capability (IJO).

Challenges towards creating an Integrated Joint Operations capability are of course manifest and require :

- Integrating operational theories of the different services.
- Standardising the joint operations orders and procedures which will also take into account the level of independence of the component services
- The establishment of a joint command structure with clearly defined authority.
- Creating an integrated C4ISR architecture going down to the tactical level.

Above all, there is the need to integrate *knowledge* by having trained personnel at all levels of joint command and operations with extensive knowledge of the operations and capabilities of all services at all times.

Extracted from lecture given at the College of Air Warfare (CAW)

Lt Gen Kamal Davar articulates on the need for

Military Diplomacy

A Vital Tool for Furthering National Interests

A nation's strength to thwart diverse threats to its interests and adequately address the varied transformational geo-political challenges in today's highly troubled world rests primarily on its Comprehensive National Power (CNP). The various parameters which contribute to CNP should be robust, sustainable and ever improving. Some of the constituents of CNP are a nation's economic power, military capabilities, industrial and technological prowess, infrastructural architecture, its population and the resultant demographic dividends, educational and medical reach, societal harmony within and, more importantly, the respect its diplomacy enjoys in the comity of nations. The CNP gets enhanced from a judicious amalgam of hard and soft power leading to augmentation in its smart power. Diplomacy to further a nation's goals is, unquestionably, a critical dynamic and, if supplemented with defence/military diplomacy, will prove vastly beneficial for a nation.

The world's leading power, the United States, like many other Western nations, since decades has effectively employed military diplomacy to further its interests all around the globe. Its theatre commands are staffed and chartered to pursue US objectives all across the world. The US has consciously implemented what one of its renowned and popular presidents, John F Kennedy, once wisely expressed, "Diplomacy and defence are not substitutes for one another, either alone would fail." As currently the sole superpower in the world, however, with an assertive China making frantic efforts to catch up, the US rightly believes that, even in a democratic dispensation, a nation's effective power is synonymous with the power of its military – to be pragmatically employed both in its hard and soft connotations.

But is India, a regional power currently and aspiring to be a global power, conscious of the fact that it underplays and under-utilises the beneficial impact of its military in various hues and roles? In keeping with its rising status, is India according the necessary impetus to another eminently useful ingredient of its CNP, namely, military diplomacy within the overall gambit of overall diplomacy? The answer would be, woefully, in the negative ! India appears to be, inexplicably, ambivalent about the utilisation of military diplomacy in the furtherance of its interests. That absence of a strategic culture in India and thus it not being strongly inter-woven in the Indian way of life, perhaps, is the answer to India not giving adequate priority to its military. Military diplomacy is not an exclusive instrument, but supplements a nation's foreign and security policies objectives…

Military Diplomacy: An Overview

There is no official definition or standard interpretation of military or defence diplomacy. Both the words, military and defence, though being different, are customarily interchangeable in their usage. On the face of it, the term (Military Diplomacy) appears to be an oxymoron! As the military normally achieves the nation's objectives with hard power by employment of force, on the other hand, diplomacy endeavours to accomplish the nation's goals by soft power, be it dialogue, persuasion, cooperation, treaties and alliances, aid which may include both economic and military and other humanitarian assistance. Somewhere, coercion is also an aspect

Fly the flag!

of diplomacy – thus the term 'gunboat diplomacy' since many decades being a part of the overall diplomatic lexicon when a threat or recourse to hard power is sought to be conveyed. Nevertheless, pragmatism dictates that a nation must not compartmentalise its diplomatic or military endeavours in achieving its strategic objectives. As the famed Prussian strategist Karl von Clausewitz had astutely opined, military force was "a true political instrument, a continuation of political intercourse, carried on with other means."

Overall, military diplomacy is the non-violent and peaceful utilisation of varied and wide-ranging military resources in establishing positive and cooperative relations with other foreign nations, both bilateral and multi-lateral. This form of diplomacy covers activities like defence cooperation across a wide spectrum, mutual security pacts, training and exercises to enhance inter-operability, visit by ships and aircraft to each other's bases, bilateral meetings, staff dialogue, intelligence sharing, high level engagements between senior military hierarchies, anti-piracy missions, communications assistance, humanitarian and disaster-relief operations, sharing of logistical support and various other mutual confidence-building measures. The positioning of Defence and Military Attachés (DAs/MAs) in each other's country is also a significant aspect of military diplomacy. In this form of interplay among nations, conflict waging yields place to conflict prevention attributable to the successful exercise of diplomacy, including military diplomacy, even among recalcitrant nations.

Goals of Military Diplomacy

One of the ills that has plagued India's higher defence management and its overall security preparedness, is the civil-military disconnect…To put it in simple and clear-cut terms, military/defence diplomacy aims to achieve both national security and a nation's foreign policy objectives. The renowned author, Dr Marc Faber in his best seller, 'Gloom, Boom and Doom', has succinctly observed that, "India continues to be ambivalent about power. It has failed to develop a strategic agenda commensurate with its growing economic and military capabilities. Throughout history, India has failed to master the creation, deployment and uses of its military instruments in support of its national objectives." The London-based, widely-read *Economist*, in its March 2013 issue in its lead article on 'India as a Great Power' had pithily opined that, "The Indian Armed Forces have grown exponentially since independence, but no civilian leader has the faintest idea of how to use India's growing military clout !"

Military diplomacy endeavours to fill the gaps, as required, to make its parent nation responsive to the challenges and complexities of disruptive, rapidly-changing, strife-torn geo-political scenarios, albeit in concert with other instruments of the state. It must be appreciated by all stakeholders that military diplomacy is not an exclusive instrument, but supplements a nation's foreign and security policies objectives. In addition, it endeavours to acquire/develop, with technologically advanced nations, the wherewithal for state-of-the art weaponry, equipment and systems. In addition, knowledge of modern concepts and techniques of combating newer traditional and non-traditional threats, each other's Standard Operating Procedures to ensure inter-operability can be shared for mutual benefits. Cooperation in meeting disasters – both natural and man-made – countering terrorist challenges, pandemic threats, anti-piracy operations and synergy in various humanitarian activities between nations is also an important objective of military diplomacy.

Evolution of India's Military Diplomacy

India at its independence in 1947 was categorised as a 'third-world nation'. Owing to Prime Minister Jawaharlal Nehru's

IAF transport aircraft in aid to civil power

Indian Army troops on a UN peace keeping mission in the Lebanon

global vision and idealistic dreams of a peaceful world, diplomacy was given its due significance. However, military diplomacy in its true sense was overlooked. Former Chief of the Army Staff, General Ved Malik, in his book entitled 'India's Military Conflicts and Diplomacy', candidly expresses that "India started poorly in making use of military diplomacy as a national security and foreign policy tool." He further opines that, "There were several reasons for this, the foremost being a steep erosion of every aspect of India's military's capability; civil-military relations, leadership and morale. Nehruvian India was distrustful of the armed forces and kept them out of the Ministry of Defence and important decision making. The prevalent practice of 'bureaucratic control' instead of 'political control' in South Block ensured that policy-making was crafted by bureaucrats and strategy by diplomats. Both lacked military expertise or perspective."

In keeping with Nehru's world view, however, India, right from the beginning, did contribute a fair number of troops for various United Nations peace-keeping missions. When Prime Minister Nehru chaired the UN-sponsored Neutral Nations Repatriation Commission in Korea in 1953, India sent a large contingent and a field ambulance under Major General KS Thimayya (later to be the COAS); this step and the professional competence of the Indian Army contingent was widely acclaimed by the global community.

Even with an adversarial nation like Pakistan, India ought to give military diplomacy a chance. Since the inception of UN peace-keeping missions, India has been the largest contributor participating in over 45 peace-keeping assignments in Korea, Congo, Egypt, Haiti, Lebanon, Rwanda and recently in strife-torn South Sudan. Indian police forces including a women's contingent have also commenced participation in these UN missions. Currently, India is the third largest contributor to the UN in peace-keeping missions. But it is also a fact that bureaucratic and diplomatic powers in India have steadily ensured that Indian military diplomacy never attained its full potential.

Notwithstanding discouragement from the powers-that-be in India, the Indian Armed Forces has made some modest efforts in fostering military diplomacy. Since 1950, India's prestigious Defence Services Staff College in Wellington, Tamil Nadu and in later years, the National Defence College, New Delhi, have hosted (some on the basis of diplomatic reciprocity) officer students from advanced Western nations and later from the Afro-Asian bloc. This step has been a successful ingredient in fostering India's military diplomacy contributing to improvement of India's image in the world. More importantly, some of the officer-students who have attended training courses in India, have risen to high positions in their nations, some becoming heads-of-state.

Globally, the Indian Armed Forces enjoy a sterling professional reputation. Thus many friendly foreign nations, especially from the 'Third World' nations such as Botswana, Nigeria, Angola, Malaysia, Egypt, Nepal, Bhutan, Iraq (where the author has also served) and Afghanistan, among others, have eagerly sought Indian military assistance in training personnel of their armed forces. This is another significant extension of military diplomacy contributing to national objectives and image-building.

Current Status of Military Diplomacy

India's military diplomacy is, overall, still to touch the desired levels in its endeavours and impact. However, since the last decade or so, a few qualitative changes for the better have certainly taken place. Currently, 120 officers from the three services belonging to 73 nations from across the globe, are represented in their embassies/high commissions in New Delhi. Meanwhile India has over 70 officers, posted as Defence/Military/Air Force/Naval attachés in 44 nations with their numbers increasing as India spreads its diplomatic footprint across the world. As India shuns its traditional reluctance to get militarily closer to some nations, especially countries like the US and Israel, military diplomacy will surely play its part.

With the US, the world's sole super-power, India's diplomatic relations including in military cooperation is on the upswing. The fillip to Indo-US military relations came about with the formulation of the Kickleighter proposals in 1991-1992. The conduct of army and naval exercises such as *Malabar* has become a regular

feature leading to unprecedented military cooperation between the two nations. In June 2005, India and the US signed a new agreement for strengthening their relationship over the next ten years. This was again renewed for another ten years in 2015.

The US is now the third largest weapons exporter to India and many earlier military troublesome issues pertaining to Transfer of Technology, intellectual property rights and inspections are being resolved, thanks to military diplomacy at work. The three services of both the nations are regularly now exercising with each other including in the globe's latest theatre of the 'great game', namely the Indo-Pacific region. Defence trade is gradually assuming a significant area of India-US strategic convergence and India could well become a recipient of high-grade US military capabilities.

The much heralded 'Make in India' initiative can do extremely well with US military cooperation. The Quadrilateral Initiative comprising the US, India, Japan and Australia for ensuring maritime stability and freedom of navigation for all in the Indian and Pacific Oceans – to counter a belligerent China – will be a natural outcome of India's far-reaching military diplomacy goals. Incorporating the ASEAN countries in this framework will be highly beneficial for India and all other nations who wish to thwart China's continually rising ambitions in these maritime commons.

For decades, Russia (formerly the Soviet Union), has had deeply fraternal relations, including in the military, with India and even today, India's military arsenal is over 65 to 70 per cent of Russian origin. As India must continue to sustain this time-tested military relationship with Russia, some changes in the geo-political contours of the South Asian region and India's deepening ties with the US, are causing these age-old relations to drift. India will have to manage the Indo-Russia association astutely and in the area of military trade, avoid putting all its 'eggs in one basket.' Russia too can further assist in India's indigenous production programmes.

With Israel, India's military relations emerging from a never-ever-seen-before bonhomie, are unquestionably on the ascendant. Thus India must prudently whip up its military diplomacy to the maximum to ensure attainment of mutually beneficial objectives. Israel's expertise in certain military high-technology areas can be fruitfully tapped along with their participation in India's lagging 'Make in India' programmes.

India's pioneering 'Look East' policy initiated by Prime Minister Narsimha Rao in the mid-nineties and now ambitiously captioned by Prime Minister Modi as 'Act East' cannot be a success without giving it a military dimension. It is a matter of satisfaction that since 1995, the Indian Navy has been vigorously reaching out to all the Indian Ocean littoral nations. The Indian Navy has been conducting multi-national cooperation exercises codenamed *Milan* in its outreach to nations in the Bay of Bengal. In February 2016, the International Fleet Review, conducted by the Indian Navy at Vishakapatnam that was attended by 99 warships from 50 nations was a spectacular showcasing of India's military diplomacy at work *(see lead image)*.

Although India seeks harmonious relations with the other global power in the making – China– the latter's propensity for assertive and aggressive behaviour along the ill-defined Line of Actual Control between the two nations, its irrational and belligerent stance in the Indo-Pacific region and the launch of its China Pakistan Economic Corridor running through the disputed Gilgit-Baltistan and POK areas, are hardly conducive to improvement in India-China relations. However, it is pertinent to note that China accords tremendous significance to the role of military diplomacy in furthering their national objectives. President Xi Jinping himself has frequently spoken about the importance of military diplomacy in today's world. The Chinese have strived to ensure synergy between its People's Liberation Army and the all powerful Chinese Politburo. China has its military attachés in 109 countries and has established strategic and military linkages with nations such as Pakistan, North Korea, Bangladesh, Sri Lanka, Tanzania, Seychelles and the Maldives among others. The Chinese Navy frequently makes goodwill visits to many countries in the world to showcase its reach and display its emerging naval technologies and prowess.

Roadmap: Military Diplomacy

One of the ills that has plagued India's higher defence management and its overall security preparedness, is the civil-military disconnect. Inexplicably, since independence, the Indian military has been kept out even in strategising in macro-level matters of national security. This malaise needs to be speedily addressed by the government. As India, deservingly, seeks its rightful place at the global high table, it has to ensure that all the constituents of CNP are coordinated adequately and synergistically addressed by the various organs of the government. The Ministry of External Affairs (MEA), Ministry of Defence (MOD), National Security Council and where applicable, the Ministry of Home affairs have to jointly conceive and implement the security roadmap. India's diplomacy will get energised and rise to greater heights if appropriately supported by military diplomacy.

Within the armed forces, the Integrated Defence Staff has been making some efforts to rejuvenate the nation's military diplomacy. The Defence Intelligence Agency (DIA) is the appropriate institution to provide the much required fillip to the nation's efforts towards military diplomacy. The DIA, on behalf of the MOD and the three services, can foster defence diplomacy, in close cooperation with the MEA to achieve the nation's diplomatic goals. The Government of India may wish to flag that many nations in the world are ruled by military/quasi-military governments and a large number of heads of state have a military background. All these foreign luminaries generally respond favourably to the uniformed community and that is the strength of military diplomacy. In nations like Nepal for instance, why cannot India have a retired senior Army officer, a Gurkhali-speaking High Commissioner from the Indian Army's Gorkha regiments? The late Lt Gen SK Sinha's tenure in Nepal, as India's Envoy, is still fondly recalled by many Nepalese. Similarly, in nations ruled by the military, some retired and suitable senior officers of the Indian Armed Forces will be able to represent the nation better. Even with an adversarial nation like Pakistan, India ought to give military diplomacy a chance!

As India stands at a defining moment of its history, the Indian government has to shed some of its antiquated practices in governance and priorities. The world looks up to India to show the way in many fields of human endeavour. India, as it banks on enlightened diplomacy to attain national objectives, the optimum utilisation of military diplomacy by the nation will surely add to India's image in the comity of nations and, more importantly, the fulfillment of national aspirations.

Admiral Arun Prakash rues

India's missed maritime opportunities

The Yulin Naval and Underground Base is shaping up to be the most strategically important military base in the South China Sea. (photo: Google Earth/ the diplomat.com)

Seven decades ago, Indian historian-diplomat, KM Panikkar presciently observed, "That China intends to embark on a policy of large scale naval expansion is clear enough... with her bases extending as far south as Hainan, China will be in an advantageous position..."

No one paid attention to Panikkar, because, just weeks before independence, India was busy with the 1947 Asian Relations Conference, where Nehru articulated his grand vision of India's role in emerging Asia – an idealistic dream, in which a 'non-violent' India would be an exemplar by eschewing the use of force. China's realist founders, on the other hand, had set two basic objectives for the newborn Communist nation; that China would attain 'great power' status via the nuclear-weapon route; and that it would brook no rival for leadership of Asia. The quarter century that elapsed between Deng Xiaoping' splea to his countrymen to "hide your capabilities, bide your time and never take the lead" 'Chairman-forever' Xi Jinping's authoritative declaration of his "dream of national rejuvenation", has seen China's economic heft and coercive military power take a quantum jump.

Panikkar's prophesy came true in 2000, when China started construction of its southern-most naval base at Yulin, on Hainan Island. Built at colossal cost, Yulin's tunnel-complexes house China's submarine nuclear-deterrent, while its piers will accommodate aircraft-carrier strike-groups. This is a maritime hub created for the PLA Navy (PLAN) to exercise sea-control and power-projection,

across the Pacific and Indian Oceans, whose waters carry China's vital trade and energy sea-lanes. President Hu Jintao's 'Malacca dilemma' encapsulated anxiety about China's vulnerability to possible interdiction of its sea borne trade by the Indian Navy. China consequently, decided to become a major player in the Indian Ocean Region (IOR). Deftly playing its economic and diplomatic cards, China has established a chain of maritime footholds in Myanmar, Sri Lanka and Pakistan,and acquired its first overseas military base in Djibouti last year.

The tiny, but strategically located archipelagic Republic of Maldives has traditionally maintained warm and friendly links with India. However, alert diplomats should have picked up early signs of Maldives slipping out India's ambit; the appearance of radical Islam via Pakistan and Saudi Arabia, the warming of relations with China and the decline in India's stock. President Yameen's actions, albeit unconstitutional and arbitrary, still remain an 'internal affair' of the Maldives and China's thinly-veiled threats enable him to defy India.

New Delhi has, very sensibly, resisted the urge to invoke an 'Indian Monroe Doctrine' and attempt regime-change in Male through military action; its forbearance is bound to be rewarded. Alarmist reports about possible PLAN's 'gunboat diplomacy' need to be viewed against the geographic reality that a Chinese warship would take 8-10 days to cover the 3500 miles from Yulin to Male. The flip side of this reality is that Indian troops were in Male within 16 hours to save that nation from a coup in 1988, and it took the IN just 24 hours to come to the aid of tsunami-hit Maldivians in 2004. The Maldivian participation in the IN exercise 'Milan' is always a token one, and too much need not be read into their absence this year.

Against this backdrop, India's recent agreement with Oman, providing access for 'military use and logistical support' in the new Port of Duqm, has raised hopes that India is, belatedly, strengthening its maritime posture in the Indian Ocean Region (IOR). There have been other significant developments too, such as President Kovind's visit to Djibouti and its impending recognition by India; the conclusion of an Indo-Seychelles agreement for creation of air and naval facilities on Assumption Island and the agreement with UAE for joint naval exercises. Whether they herald a renewed impetus to India's maritime outreach or perhaps the actualisation of PM Modi's 2015 'Sagar' vision, depends on whether they are random actions, or part of a coherent Indian maritime grand-strategy.

China has been releasing Defence White Papers every two years, and its 10th White Paper, issued in 2015, enunciated; that "It is necessary for China to develop a modern maritime military force, commensurate with its ... maritime rights and interests; and to protect the security of strategic sea lanes". Accordingly, Beijing has built a powerful navy that will soon overtake the US Navy in numbers, lagging only in capability. New Delhi, on the other hand, has shown no tangible signs of strategic-thinking or long-term security planning, as evident from a total absence of defence white papers or security doctrines to-date. The navy did spell out, in 2004-05, its own vision of India's maritime interests and challenges through a Maritime Doctrine and a Maritime Strategy. But, in the absence of higher strategic guidance in the form of a national-level document, they are of limited utility.

Thus, while lack of political resolve and diplomatic lassitude have been contributory factors, it is the absence of an over-arching vision which conceptualises the IOR in a 50-75 year perspective, that have led to the neglect of maritime issues critical to India's vital interests. Examples: the Chah Bahar port project should have been completed long ago,notwithstanding US sanctions; the offer of Agalega Islands, from Mauritius, should have been taken up years ago;the Maldives imbroglio, should have been pre-empted and, must of all, our disregard of distant Mozambique and Madagascar, remains a huge maritime 'missed opportunity'. The IOR strategic agenda may be soon taken out of India's hands, as the Chairmanship of two important bodies, the Indian Ocean Rim Association (IORA) and the Indian Ocean Naval Symposium (IONS) devolves on UAE and Iran respectively.

There is no doubt that, today, Mr Modi strides the world stage like a colossus, gaining entry for India into select international clubs and striking strategic deals in national interest. However, at home, the fixation of our political leadership with unending electioneering and political survival has resulted in egregious neglect in many spheres, including national security. If India's political leadership is to spare mental space for national security issues of existential import, there needs to be a semblance of harmony in the political domain. This will not happen as long as India's deep internal divisions and instabilities continue to be exploited and its polity remains so bitterly divided that Parliament is rendered dysfunctional.

Let us remember that 'great power' status is not pre-ordained for India. If we do not get our political and economic acts together, India could well remain a large, over-populated and chaotic third-world nation–even if with the world's 3rd largest GDP.

India's vital interests in the IOR cannot be over-emphasised

Thunder amidst the Temples

The DefExpo 2018 at Kancheepuram

This time around, the biennial DefExpo Land, Naval & Internal Homeland Security Systems Exhibition was held in the land of a thousand temples in southern India, specifically at Arulmigu Nithyakalyana Perumal Temple, Thiruvidanthai, Thiruporur Taluk, Kancheepuram, on the Coromandel coast of southern India. According to the Defence Ministry, over 670 firms, including 154 foreign OEMs, participated in this exhibition, whose dates and location had officially only been announced a little over two months before the event. This naturally resulted in frenzied organisational activity, which true to the Indian tradition of being "JIT", was pulled off with surprising results, and the obvious shortcomings accepted with patience. Hindustan Aeronautics Limited who took on the mantle of organising this DefExpo, did a Herculean job !

However, unlike during past DefExpos, there was no inaugural ceremony but instead on Day One, Defence Minister Nirmala Sitharaman held an expectedly well-attended

Press Conference, alongside RRM Subhas Bhamre. They were flanked on the stage by all senior defence ministry bureaucrats, including DRDO's Dr S Christopher,

Defence Secretary Sanjay Mittra and Dr Ajay Kumar, Secretary Defence Production. In her characteristic and cryptic style, the Minister fielded questions in English, Hindi – and frequently in Tamil, which was perhaps understandable considering the locale. Upon being questioned on the choice of the venue as Kanchipuram in Chennai, Nirmala Sitharaman stated that this was "a conscious decision. Of the two defence corridors in India recently announced, one is in southern India, being a swath between Chennai and Coimbatore and also in Western UP. Historically too, this was from where the ancient ships of the Cholas set sail to Southeast Asia."

Pre-empting some criticism, Mrs Nirmala Sitharaman defended the total count of participants at DefExpo which must take into account the numerous entities of DRDO and left it at that. The two distinct features of this year's edition were the "clear accent" on Indian defence companies vis-à-vis foreign participants, who were dutifully showcasing their products at DefExpo. As many 'Made in India' products were receiving support for export, the Minister hoped that India would soon be emerging as a major defence-manufacturing hub. Select DPSUs, including HAL, BEL, and those under the aegis of the DRDO, who are engaged in independent R&D, have the potential of acquiring "so many patents." The Defence Minister also articulated how much she felt "extreme pride" in showcasing these.

Taking questions from the audience, patiently managed by the DPR Ms Rajshekhar, Nirmala Sitharaman walked the diplomatic thin ice in context of indigenous production versus import of foreign weapon systems. "When I am promoting Indian exports and Indian manufacturing, I am also telling the forces to procure from them. They do too. But I would want to draw a thin line –and I am conscious that it is a thin line – between the government's enthusiasm on making sure the production capabilities are such that they can meet with international standards and be export-worthy; and the other side of the line where the Army or the Navy or the Air Force make their decision on what they want, what combination of equipment they want and in that combination, if an Indian-produced item fits in."

"I can only go that far and not further, just as they can go that far and not any further without compromising each others' interest–and my interest is not different from theirs, because after all the MoD has to take care of the forces as much as the defence production aspect," she admitted.

As expected, there were several questions on the recent RFI issued for procurement of 110 fighters for the Indian Air Force but these were smartly deflected by the Defence Minister to her Defence Secretary, who continually evaded a clear cut response, simply repeating that "this was too early." *(Considering that the IAF have been struggling for near two decades to identify options to augment their fast depleting combat strength, this is as much an understatement as it gets ! Ed)*

Now, Day Two of DefExpo 2018 saw the official inauguration by Prime Minister Narendra Modi, who arrived at the show amidst thundering applause. There was a posse of ministers from the Ministry of Defence, the Tamil Nadu legislature as well as the three Chiefs from the Army, Navy and Air Force, all of whom joined the thousands present in the make-shift hall when the invocation *Neeraarum Kadaludutha* (Tamil State anthem) was played: which had some eyebrows raised.

The Prime Minister electronically launched iDEX (Innovation for Defence Excellence), the entire event being telecast live to missions in several foreign countries, including Australia, Russia, Germany, Italy, Nigeria Bhutan, Nepal and other places.

The PM thereafter addressed the mammoth crowd in his characteristic oratorical style and bluntly criticised the previous UPA government's "laziness, incompetence or perhaps some hidden motives" for delays in defence procurement. Mr Modi re-iterated that "the present government had initiated a new process to procure 110 fighter aircraft. We do not want to spend ten years in discussions without any tangible outcome…but, we do not want to take short cuts."

In another dig at the UPA, the PM said the "policy paralysis" that had set in the defence sector was a thing of the past and "it shall not happen again." Addressing concerns of the industry, Modi emphasised: "Our goal is not merely to tinker but to transform. We want to move fast, but with no shortcuts... I am aware we need to do a lot more, we are committed to do so", even as he promised extensive consultation with all stakeholders—both Indian and foreign companies. The PM concluded that "Dreams must be transformed into thoughts, and thoughts into actions."

Invitees then trooped out to the nearby 'Demonstration Area' on the nearby beach to witness flypasts by HAL-built aircraft even as tanks and guns churned up the sand and warships sailed offshore with some aplomb.

Demonstrating defence prowess on the beach!

Defence Minister Nirmala Sitharaman with Vice Admiral Karambir Singh, FOC-in-C Eastern Naval Command

Dissimilar formation of HAL-built aircraft types, led by Dornier 228 and flanked by HTT-40 turboprop trainer and Hawk-i advanced jet trainer (see cover).

Curtain raiser: quadrat of HAL Dhruv ALHs of the Sarang formation display team

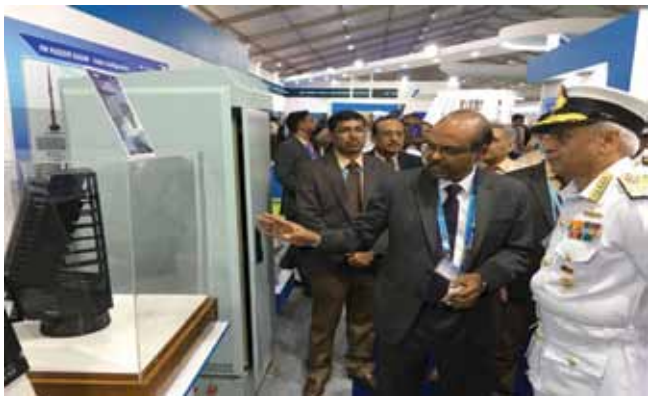
DRDO-developed Arjun MBT Mk II MBT and other AFVs at the demonstration area

Indian Navy Mk. 42C Seaking hovers along the coast line, even as Indian Army field howitzer is prepared for firing

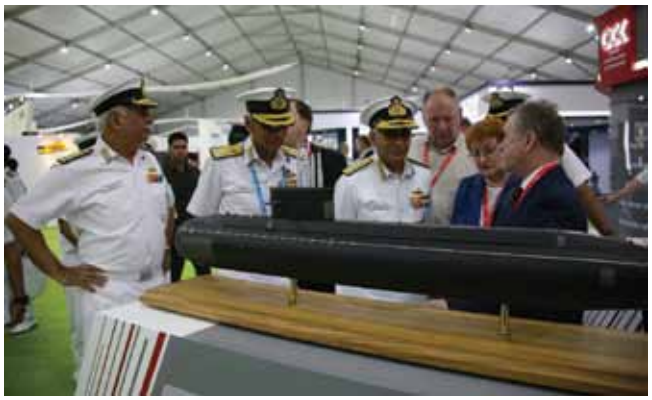
The Indian Navy sailed several warships along the Coromandel coast as IN helicopters disgorged marine commandos on the beach

Into the Halls, where the airconditioning was divine !

Hall 3 housed a large number of exhibitors from Europe and the United States



Seen in Hall 2 is Admiral Sunil Lanba, CNS, launching the 3D Air Surveillance Radar at the Bharat Heavy Electronics Limited (BEL) stand, along with M V Gowtama, CMD BEL



Chief of the Naval Staff Admiral Sunil Lanba and CEO Rubin Igor Vilnit next to a model of Amur-class submarine 1650 being offered to India in the Project 75I competition

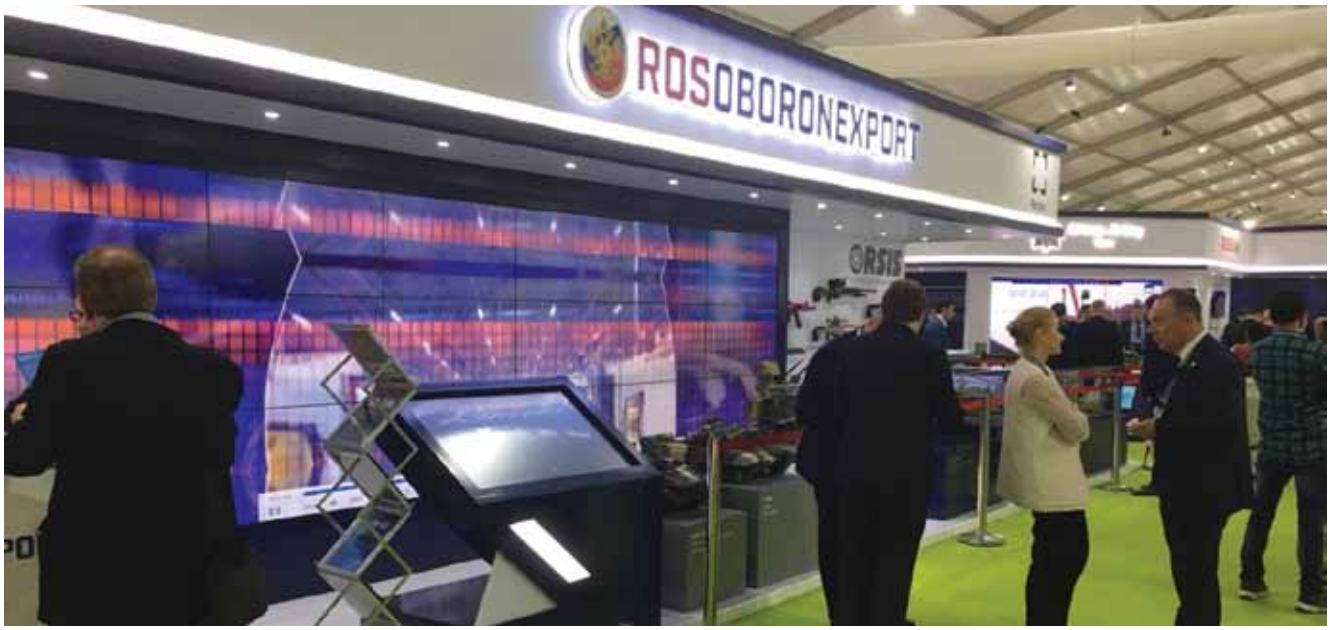
Signing a tripartite MoU: HAL Chairman T Suvarnaraju and Director Venkatesh along with executives of Motorsich JSC and Ivchenko Progress SE, of the Ukraine

The Lakshya pilotless target aircraft (PTA) at the ADE section of the large DRDO display area in Hall 2

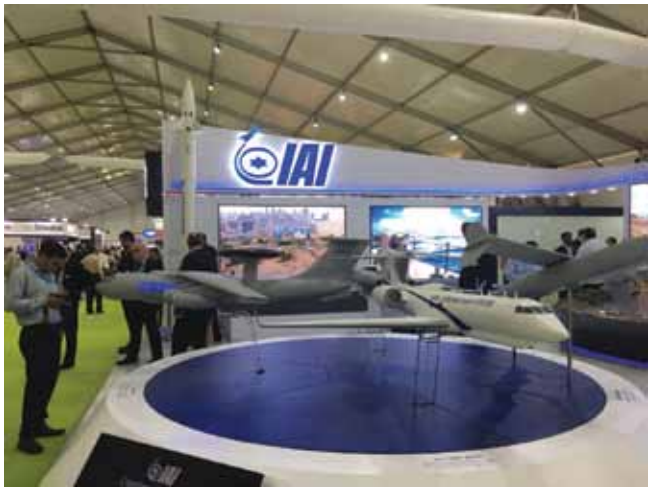
The M777 155mm Lightweight Towed Artillery System was at entrance of the BAE Systems' display in Hall 1

Several foreign defence delegations were invited to DefExpo 2018 and were given briefings on Indian-developed and manufactured systems

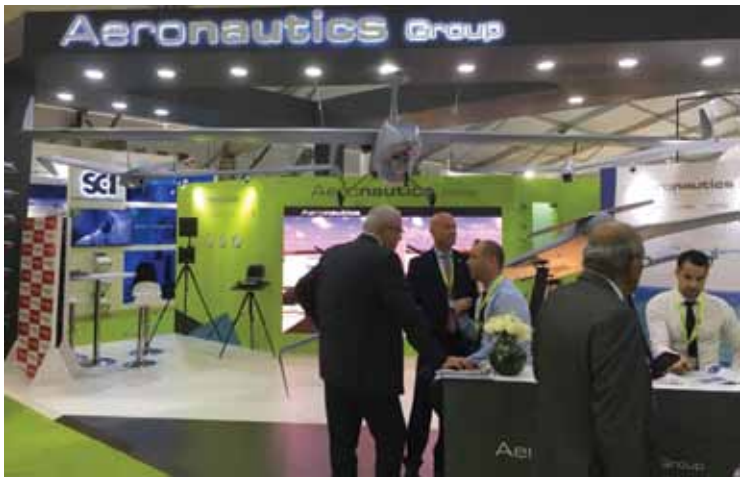
Seen with the Advanced Precision Kill Weapon System (APKWS) laser guided rocket are Alan Garwood, Tom Fillingham, John Gay and Nik Khanna of BAE Systems



The thematic scope of the large Rosoboronexport stand included armoured vehicles, missiles and artillery systems, small arms, air defence systems, naval equipment, military clothing, communication means, engines, environmental control assets, optoelectronic devices, space and satellite technologies, telecommunication systems, information systems, explosives, maintenance and servicing of defence products



IAI focussed on Indian-specific requirements including remotely piloted aerial systems, special mission aircraft, equipped with the Phalcon AWACS, state-of-the-art radars, air defence systems and military robotics solutions

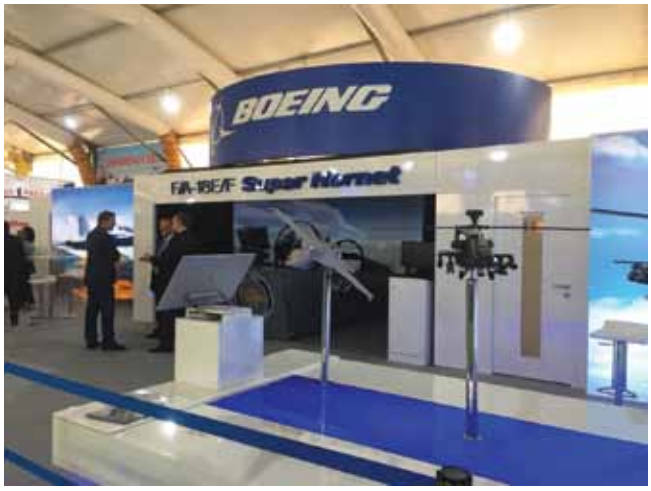


Aeronautics Group presented its wide range of UAS platforms, which included the Dominator XR , the Aerostar, and state-of-the-art unmanned mini UASs: the Orbiter family

Nammo's MD for India Karanjit Singh explaining features of the M-72 lightweight shoulder-launched weapon system

The Lockheed Martin display in Hall 3 concentrated on its F-16 fighter, contender for the IAF's new fighter requirement

Gary Hopper, VP Strategic Development of General Atomics at DefExpo 2018



The large Boeing stand showcased various aircraft and systems including models of the AH-64 Apache attack helicopter and CH-47 Chinook heavy lift helicopter

Model of Safran's maritime surveillance version of its Patroller UAV displayed at their stand

Inaugurating the Saab display at DefExpo 2018 were Klas Molin, Sweden's Ambassador to India, General John Stjernfalk and Captain Karl Henriksson along with senior Saab executives. The products and systems displayed by Saab included the Gripen E, RBS 70 NG VSHORAD; the BAMSE SRSAM; RBS15 Mk3 surface-to-surface missile; Carl Gustaf M4 and AT4, Electronic Warfare portfolio with IDAS; SOTAC & MCS camouflage systems; TAURUS long-range precision attack missiles; GlobalEye Airborne Early Warning & Control (AEW&C) systems; Giraffe 1X Ground Based Air Defence radars; super stealth A26 submarines; Visby corvettes and AUV62-MR mine countermeasures

Next gen version of the BrahMos supersonic cruise missile was on display in Hall 2 alongside the air-launched version, depicted on the underside of an IAF Su-30 MKI

The large HAL stand in Hall 2 included models of the Kanpur-built Dornier 228 LTA and Nasik-built Sukhoi Su-30MKI

Dr AK Ghosh, Project Director of the Advanced Medium Combat Aircraft (AMCA) project which development has reportedly been accelerated at ADA

Model of the proposed Indian AWACS to be developed by CABS on an Airbus A330 platform

The Adani Group had their stand adjoining that of Saab, with a large-scale model of their proposed production facilities

On outdoor display was an Arjun main battle tank (MBT) developed by the Defence Research and Development Organisation (DRDO). Featuring a 120mm main rifled gun with indigenously developed armour-piercing fin-stabilised discarding-sabot ammunition, the Arjun is powered by a MTU multi-fuel diesel engine rated at 1,400 hp. Subsequently, delays and other problems in its development from the 1990s to the 2000s, resulted in the order for T-90S tanks from Russia. In March 2010, the Arjun was pitted against the T-90 in comparative trials and performed well. The Army placed an order for an additional 124 Arjun Mk.I tanks on 17 May 2010 and 124 Arjun Mk.II tanks on 9 August 2010

Alok Shriram Vice Chairman DCM Shriram Industries Ltd (DSIL) with the prototype of ZEBU armoured vehicle. DSIL's foray into defence manufacturing was marked by the launch of its Light Bullet Proof Vehicle ZEBU for use by Indian Defence and Para Military forces, and on public display for the first time at DefExpo 2018.
As stated, "DSIL's mission is to design and manufacture a world-class armoured bullet-proof vehicle which meets all requirements and various service conditions that our armed personnel face and function in, including various types of terrain and climactic conditions. We believe the ZEBU's debut at DefExpo 2018 is the first major step towards achieving our goal."

VAYU at the Show

As at all DefExpos (and Aero India Shows), *Vayu* was the official media partner and apart from the 'Show Special Issue' reported on, published and distributed show dailies over the first three days of the exposition.

Vayu's Stand in Hall 6 was thronged by large numbers of visitors even as their team were widely distributing the journal and dailies throughout DefExpo 2018.

Briefings from the Defexpo
Boeing's focus on India

IAF's C-17 Globemaster III strategic airlifter

"Providing services and support capabilities in keeping with modernisation needs of the Indian Armed Forces" is Boeing's primary focus in India and the company is working with the Indian Air Force and Indian Navy to provide training and support of Boeing platforms such as the P-8I, C-17 and Boeing Business Jets.

In 2017, Boeing announced the establishment of Boeing Defence India (BDI), a local operating entity to drive the company's future growth objectives in India "by being responsive to customer needs and growing indigenous engineers, sourcing, manufacturing and lifecycle management capabilities."

BDI is the local services delivery vehicle of Boeing Global Services, the new dedicated services business established in June 2017 and which integrates service capabilities of its commercial, defence and space sectors into a single business to provide aerospace services to customers worldwide, regardless of platform manufacturer.

Global Services has four capability focus areas to make platforms more productive and reduces operating costs, which include supply chain; engineering, modifications and maintenance; digital aviation and analytics; and training and professional services.

Boeing has been working with the Indian Navy and Indian Air Force on mission requirements of the P-8I maritime reconnaissance and anti-submarine aircraft and the C-17 Globemaster III strategic airlifter. Boeing is also working to ensure that crews are trained and ready to operate the soon-to-be-delivered AH-64 Apache and the CH-47 Chinook.

As Pratyush Kumar, President, Boeing India said, "Boeing remains focused on executing on commitments to customers on schedule and cost. The Indian Navy and Indian Air Force can be assured of achieving exceptional operational capability and readiness of their P-8I and C-17 fleet."

The P-8 and C-17 have demonstrated an excellent record in supporting the missions

Indian Navy's P-8I maritime reconnaissance and anti-submarine aircraft

File photo of the AH-64D Apache helicopter

they have been deployed for and the forces have expressed satisfaction about their operational readiness. Both aircraft were at the forefront of rescue and humanitarian aid efforts following natural disasters that affected Bihar, Jammu and Kashmir and Odisha states. The C-17 was deployed to evacuate people and deliver relief supplies. The P-8I has been used extensively in maritime reconnaissance missions by the Indian Navy, including performing aerial reconnaissance and gathering data for planning relief efforts during *Cyclone Hudhud.*

P-8I: enhancing IN's Long Range Maritime Reconnaissance and Anti-Submarine capability

In June last year, Boeing received a three-year contract to support the Indian Navy's P-8I long range maritime surveillance and anti-submarine aircraft fleet "to achieve enhanced operational capability and readiness." The contract came as India's P-8I fleet surpassed 11,000 flight hours last year, a milestone for which the squadron operating the aircraft received a citation from Admiral Sunil Lanba, Chief of Naval Staff for the Indian Navy.

Since its induction in the Indian Navy, Boeing has been supporting the P-8I fleet to ensure high rates of mission readiness. The Indian Navy has successfully used the P-8I on a number of occasions for SAR missions during *Cyclone Ockhi*, maritime patrol missions during the recent Maldives crises and multi-nation exercises such as *Malabar*. "The support contract continues the service Boeing provides under the programme's current initial production contract. This contract will substantially bolster Boeing's performance-based support to the Indian Navy and should maintain or increase the operational capability of the eight aircraft fleet."

In addition to initial P-8I training for Indian Navy pilots, mission system operators and maintenance technicians, Boeing and the Indian Navy are also in discussions for a training solution to support P-8I crews. Dedicated support will be provided to maintain the simulators and courseware, ensuring maximum availability. "The indigenous, ground-based training system for the P-8I will allow Indian Navy crews to increase proficiency in a shorter time, without using finite fatigue life or putting the aircraft at risk during a training scenario."

The CH-47F Chinook: soon in Indian colours

"Boeing has a proven performance record of providing training solutions for naval customers that enable them to maximise operational capabilities. The overarching goal for the P-8I Training Solution is to allow crews to achieve real-world proficiency without consuming valuable airframe life or impacting aircraft mission availability," stated Howard Berry director, Global Sales and Marketing, International Government Services for Global Services.

The Indian Navy operates eight P-8I long-range maritime reconnaissance and anti-submarine warfare aircraft at INS *Rajali*. Boeing is also contracted to deliver four additional P-8I aircraft to the Indian Navy with deliveries to commence in 2020.

C-17 Globemaster III for strategic airlift missions

In 2017, the Indian Air Force's No.81 Squadron with the C-17 Globemaster III fleet achieved over 12,000 flight hours since induction in 2013. As a vital part of the Indian Air Force strategic airlift capability, Boeing and Air Force teams work together to ensure the military transport aircraft is always ready to successfully conduct relief and humanitarian missions domestically and internationally.

The Indian Air Force presently operates ten C-17 strategic airlifters that Boeing delivered in 2013 and 2014. Boeing works with the Indian Air Force to provide training, sustainment services and modernisation of its C-17s through the C-17 Globemaster III Integrated Sustainment Programme (GISP) contract. "This has resulted in unprecedented levels of mission capable rates that enable the IAF to use the aircraft for the missions they want."

The C-17 have been used for humanitarian missions during *Cyclone Hudhud* and flood operations in Bihar and Jammu and Kashmir when the C-17s airlifted people from the affected areas and ensured the delivery of vital aid and assistance.

The high mission readiness rates are a result of Boeing's C-17 GISP, *virtual fleet* arrangement, which ensures mission readiness by providing all C-17 customers access to an extensive support network for worldwide parts availability and economies of scale. "This makes the C-17 more affordable to own and operate. The C-17 GISP is a system-level partnership, where the customer pays for readiness, rather than specific parts or services."

Initial qualification training of Indian Air Force C-17 crews was conducted by the US Air Force at Joint Base Charleston in South Carolina. In addition, 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 in July 2017. The Centre has maintained a serviceability state of 100 percent.

The Swedish Challenge

The Swedish company Saab had various systems on display at DefExpo 2018 and Vayu's Sayan Majumdar spent much time imbibing information on the RBS 70NG, which is designed to meet the VSHORAD challenge. His report:

The Saab RBS 70NG VSHORAD (Very Short Range Air Defence) System, comprising surveillance radar and firing units, is on offer to the Indian Army to fill a crucial gap in their Ground Based Air Defence (GBAD). "The RBS 70NG system's automatic tracking capabilities and ability to detect multiple targets, both day and night, meets and exceeds the requirements of the Indian Armed Forces for a VSHORAD system." The RBS 70 in its various evolving versions is operational with the Swedish armed forces and has also been exported to 18 countries worldwide.

The RBS 70 missile can be operated independently in stand-alone mode or can be configured with several firing units (up to nine) linked with truck-mounted Saab Microwave Systems Giraffe surveillance radar to form an anti-aircraft battery protecting an area of 175 square kilometres. The target data, including range, bearing and velocity is transmitted to each designated missile firing post. The RBS 70 system entered service in 1978 with the 2 km-ranged Mk.1 missile providing altitude coverage of more than 5 km. Current production model is the fourth-generation all-target BOLIDE (in RBS 70NG) missile (a further development of the Mk 2) with increased speed with manoeuvrability ensured by the new sustainer rocket motor. The system, entering the digital era, also included non-cooled laser diodes (No Freon), BORC Thermal Imager, Digital Identification Friend & Foe (IFF) Interrogator, Target Data Receiver, PC-based Weapon Simulator and external power supply.

The RBS 70NG comprises the 'beam rider' BOLIDE missile in the launch container, a tripod firing stand and an optical sight, operable by one, and portable by three soldiers. The system can be vehicle-mounted by rapid moving units and remotely controlled. The missile is equipped with a solid propellant booster motor developed by Bofors and a solid propellant sustainer motor by BAE Systems Land Systems (Royal Ordnance) and Imperial Metal Industries. When the operator fires the missile, the booster motor is ignited inside the launch tube and the missile is accelerated out of the tube. The control surfaces and the four fins open into position as the missile leaves the tube. The sustainer motor ignites after the missile has travelled a safe distance from the launch position, subsequently jettisoning the booster.

Saab's RBS 70NG on launch

Presently, FLIR Systems close loop cooled Clip-On Night Device (COND) operating in the 8-micron to 12-micron infrared band (with a 12x 8-degrees field of view) ensures day and night capability to be replaced by BORC, based on Quantum Well Infrared Photodetector (QWIP) thermal imaging technology. A hostile target can be located visually by the missile operator or detected by the Giraffe surveillance radar. When the target is acquired, the operator tracks the target in tandem Raytheon Cossor IFF880 Identification Friend or Foe (IFF) system. If a friendly target is detected, a warning light in the sight is illuminated halting the firing sequence. However, in case of a hostile intrusion, the operator (this *Vayu* observer was fortunate to operate in simulation multiple times) aims the missile towards the target, fires and tracks the target, aiming a laser guidance beam continuously at the target until the moment of impact. The RBS 70NG sight enhances the capability of the BOLIDE missile by reducing the tracking noise through the implementation of an auto-tracker function. Lowered noise will result in even higher maneuverability and higher kill-probability than in the present RBS 70 system against small targets at maximum range.

Rosoboronexport : good prospects

Kamov 226T

According to the Russian Federal Service for Military and Technical Cooperation's order, JSC Rosoboronexport had been appointed organiser for the joint Russian display at DefExpo India 2018. "Rosoboronexport has been a long-standing exhibitor at DefExpo India. Over the years, it has become the largest Asian venue showcasing weapons and military equipment for the land and naval forces. We consider our participation in the exhibition as a major contribution to the development of military-technical cooperation between Russia and India and an important area of the company's marketing activities," stated Sergei Goreslavsky, Deputy Director General of Rosoboronexport.

He added, "Today, Russia and India have good prospects for stepping up mutually beneficial cooperation in the supply of arms and military equipment for the land and naval forces, localising their production in India and upgrading previously supplied military products. We are also carrying out some hundred joint R&D projects. Much of this was the result of our active work at exhibitions in India. The distinctive feature for DefExpo India 2018 for Rosoboronexport was to promote, inter alia, Russian security systems, equipment for counter-terror forces."

"Rosoboronexport is the only state-owned arms trade company in the Russian Federation authorised to export the full range of military and dual-purpose products, technologies and services." It is a subsidiary of the Rostec Corporation. Founded on 4 November 2000, Rosoboronexport is presently one of the leading arms exporters in the international market. Its share in Russia's military exports exceed 85 percent. Rosoboronexport cooperates with more than 700 enterprises and organisations in the Russian defence industrial complex and maintains military technical cooperation with more than 70 countries around the world.

Rostec State Corporation is a Russian corporation that was established in 2007 to facilitate the development, production and export of high-tech industrial products designed for civilian and military applications. The Corporation comprises over 700 organisations that are currently part of 11 holding companies operating in the military-industrial complex and three holding companies working in civilian industry, as well as 80 directly managed organisations. Rostec's portfolio includes well-known brands such as AVTOVAZ, KAMAZ, Kalashnikov Concern, Russian Helicopters, VSMPO AVISMA, Uralvagonzavod, etc. Rostec companies are located in 60 constituent entities of the Russian Federation and supply products to more than 70 countries. In 2016, the consolidated revenue of Rostec amounted to one trillion, 266 billion rubles, while the consolidated net income and EBITDA amounted to 88 and 268 billion rubles respectively. Rostec's key objectives include the introduction of a new techno-economic paradigm and the digitalisation of the Russian economy.

S-400 surface-to-air missile battery system

BAE Systems at Kancheepuram

"Focus on partnerships with Indian companies" is what BAE Systems promoted at DefExpo. Occupying pride of place was the M777 Ultra Lightweight Howitzer, on display for the first time since the Governments of India and the United States approved the FMS of 145 of these weapon systems for the Indian Army in November 2016. In fulfilment of that, the first two weapon systems arrived in India ahead of schedule in May 2017. "Encouraged by Prime Minister Modi's call to 'Make in India', BAE Systems has awarded the development of an Indian Assembly, Integration and Test facility for the M777 to Mahindra and Mahindra. In addition, the finalisation of this procurement has paved the way for BAE Systems to make an investment of over $200 million with Indian defence suppliers."

As Nik Khanna, Managing Director (India), BAE Systems stated, "In addition to showcasing the range of our capabilities and technologies, the Show offered us a focused platform to engage with our customers, users in the military, partners, suppliers and the industry at large, providing both direction and momentum in our plans to 'Make in India'. To underline BAE Systems' capabilities for the naval forces, on display was the Mk45Mod 4, the lightest, most compact, 5-inch fully automatic naval gun in the world and is the most widely deployed to the US Navy and other allied navies. Also on display was a wide array of munitions including versatile 57mm and 40mm programmable 3P Ammo, BONUS 155mm sensor-fused ammunition, 105mm and 155mm artillery, and 120mm tank ammunition, CT40 cannon, 39 Calibre gun, among others besides the BvS10, an armoured articulated vehicle that is designed to provide total operational support".

Debut of L&T MBDA Missile Systems Ltd

"DefExpo 2018 was particularly exciting to MBDA as it was the first time L&T MBDA Missile Systems Ltd, the Joint Venture we formed with Larsen and Toubro in 2017, was displayed. We see L&T MBDA Missile Systems Ltd as a key channel for delivering the next generation of complex weapons capabilities to the Indian Armed Forces and developing the capabilities of India's defence industry in the complex weapons sector. L&T MBDA Missile Systems Ltd showcased a number of products, including ATGM5 and Exocet MM40 B3," according to the spokesman.

"One of the finest examples of this is ATGM5 which will be designed and manufactured in India to meet India's specific operational requirements. ATGM5 will draw on the next generation technologies of the MMP battlefield anti-tank weapon that recently entered service in France. ATGM5 will be designed and manufactured in India to meet the specific operational requirements of the Indian Armed Forces. It will be a true Indian Designed, Developed and Manufactured (IDDM) product, involving the transfer of next generation key technologies to India, boosting the domestic defence industry sector," stated company officials.

Exocet MM40 Block 3 is the latest version of the well-known Exocet missile family, and includes replacement of the missile's traditional rocket motor with a turbojet to extend the range of the system out to 200 km while the missile's "already excellent navigation system has seen further enhancements."

In conversation with Emmanuel de Roquefeuil, VP & Country Director, Thales in India

With new initiatives and policy decisions on several fronts, the Indian defence sector is moving towards an era of self-reliance. Many of the projects under the ambitious 'Make in India' flagship programme of the government has helped in translating the "good beginnings" as concrete realities on the ground.

"Being the third-largest armed forces in the world, strengthening and modernising the defence capabilities is arguably one of the key priorities for India. Prime Minister Narendra Modi's initiatives to push Indian defence sector as one of the fastest developing industry on the global platform has caught attention of policy makers all across the world. It has not only helped in developing a camaraderie with nations who have special strengths in defence but has also cemented India as an important strategic and defence partner with them. Ever since Thales began operations in India in 1953, the company has actively contributed to the modernisation of the defence, aerospace and ground transportation markets in the country. Over 600 employees are working with Thales and its joint ventures in India."

Supporting Indian Armed Forces

From optronics to software defined radio, from full command and control networks to missiles and vehicles, Thales is a leader in offering a broad palette of solutions to help India's armed forces gain and maintain operational superiority. Backed by such high-technology solutions, Thales has cemented its position as a trusted partner to all the three branches of the Indian Armed Forces: Navy, Air Force and Army.

One of the key milestones for Thales has been selection of the Rafale MMRCA by the Indian Air Force as it provides a number of state-of-the-art equipment and systems aboard the omnirole combat aircraft. The Indian Air Force has also relied on Thales for enhancing the technical-operational capabilities of its Mirage 2000 fleet. In July 2011, Thales and Dassault Aviation signed a contract for the upgrade of this fleet. "The teams from Thales and Dassault Aviation have been supporting Hindustan Aeronautics Limited in upgrading the Mirage 2000 fleet as per the contract."

For the Indian Navy, Thales offers a wide range of systems and solutions that includes- electronic warfare systems, long-range surveillance radar, anti-submarine warfare sonar systems and mine-hunting solutions while for the Indian Army, these include optronics like Hand Held Thermal Imagers (HHTI) and Catherine thermal imagers on T90 tanks and air defence radars, among others.

Contributing to 'Make in India'

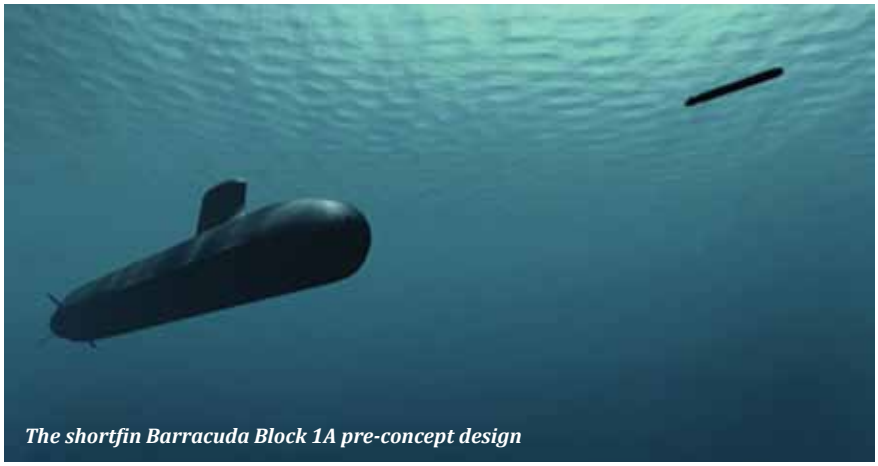
Encouraged by the Government of India's policies on indigenisation, the Indian defence sector has seen an infusion of energy. With important initiatives like 'Make in India', 'Skill India' and 'Digital India', Thales believes the country is taking the right strides towards emerging into a very capable defence manufacturing hub on par with international standards.

"Thales's strategy of developing its industrial footprint in India is in line with the Indian government's policy of 'Make in India'. Over the last five decades, Thales has been working closely with Hindustan Aeronautics Limited in all technological areas that can be used for military aircrafts. The JVs with Bharat Electronics Limited and Samtel along with L&T Technology Services in the fields of civilian and select ground-based military radars, military avionics and airborne sensor systems, and avionics software respectively further reinforce the company's commitment towards India."

Innovation is in Thales's DNA. In partnership with leaders in academia and industry, the company is seeking to deliver ground breaking research and transformative technology that drives growth in India. Nearly 20% of the annual sales is dedicated to research & development. On 10 March 2018, Thales and the Indian Institute of Technology Madras (IIT Madras) signed an MoU to create a jointly supervised PhD fellowship programme in coordination with *Centre Nationnal de la Recherche Scientifique* (CNRS). It has similar partnerships with IIT Bombay, IIT Delhi and Indian Institute of Science Bangalore.

StarStreak

Naval Group at DefExpo 2018



The shortfin Barracuda Block 1A pre-concept design

The Naval Group have showcased the state-of-art innovations created for modern navies demonstrating its capabilities in modern ship and submarine building along with high tech solutions for systems and competence as leading naval integrator.

"The Naval Group was launched in 2008 in India as 'a live example of our dedication within the country'. This long-term partnership has only matured through long term, sustainable industrial cooperation and technology transfers. Naval Group's activities are synced with the 'Make in India' policy of the Indian Government. The P75 programme is an illustration of the successful indigenisation process where the first submarine of the class INS *Kalvari* was commissioned during end of last year. On 31 January 2018, the third made-in-India Scorpene-class submarine, the *Karanj*, was launched in Mumbai, highlighting the empowerment of the Indian Navy toward complete self-reliance."

As Alain Guillou, Executive Vice President stated, "Naval Group is pleased to present its latest innovations at DefEpo 2018. Our know-how is the result of our large investment in Research & Development (10% of annual revenues). Our sea-proven technologies benefit from the vast feedback from different navies including that of the French Navy and offers superior and adapted technologies to our customers. Our trained and talented Indian teams at the subsidiary are motivated to serve for the Indian business as well as being integrated in the international projects of the group."

MKU : Poised for the future

MKU State-of-the-Art facility at Malwa, UP

MKU exhibited latest solutions for Indian Army, Navy, Coast Guard and other services for upcoming requirements. The company is equipped to deliver solutions for up-coming RFIs in electro-optics, arms, ammunition, rifles and protection, having worked continuously in adding a wide range of force multiplier solutions that will not only enhance the night fighting capabilities and lethality but also provide a wider shield of protection for soldiers and platforms.

"Looking at the opportunities of more than INR 12,000 crore in the defence and homeland security domain, MKU remains positive towards the Indian market. MKU has signed an MoU with the UP Government for an investment of INR 1,000 crore in the newly announced Uttar Pradesh Defence Corridor by Prime Minister Modi in February, 2018. Located in the heart of the corridor, MKU is looking at several opportunities from MoD and MHA based on expected RFIs."

In addition to the protection solutions for body and platforms, MKU also launched its newly developed IDDM range of electro optic systems at DefExpo 2018, which include various Thermal Imaging Devices, Night Vision Devices, Laser Range Finder and Day EO Devices.

'Make-in-India' raised much interest amongst international defence manufacturers. Leading foreign OEMs are in the process of forming alliances with MKU to offer vast array of products which include electro-optics, rifles and remote controlled weapon systems, to name a few.

Keeping in mind the special requirements of the Indian Forces for upcoming vehicle programmes, MKU also showcased blast protection solutions along with special materials to defend land systems from RPGs. Also on display were the MoST (*Modular Schutz Technik*) range of light weight armour for airborne platforms.

Periscope on new Russian SSBNs

More deterrence and deadlier !

SSBN Tula (photo: Zvyozdochka)

SSBN Yury Dolgoruky (photo: Oleg Kuleshov)

The Russian MoD have announced that trials of its newest improved *Borei*-class (*Borei-A*) SSBN will start in 2018. The boat was launched at the Sevmash shipyard in Severodvinsk on 17 November 2017 named *Knyaz Vladimir (Prince Vladimir*, for Vladimir the Great). The Russian MoD has ordered a total of eight *Borei*-class vessels with three already in service (*Borei*-class) and the remainder (improved *Borei-A* class) under various stages of construction. The Russian Navy has indicated that the signature of the *Borei-A* ships is "considerably reduced."

Russian defence officials have also reported that R&D for another upgraded variant of the class, *Borei-B* has commenced. Russian Navy Commander-in-Chief Vladimir Korolyov stated that the timeframe for building *Borei-B* submarines would become clear after the conceptual design of these underwater cruisers was completed. "We are beginning to work actively on this project from 2018 and I believe that this will happen very soon and we will specify the dates following the results of the first stage, that is, the work on the outline design," the Naval Chief said.

Meanwhile, the Russian MoD is proceeding with a refit and modernisation programme of previous generation SSBNs that are already in service. In late 2017, the Zvyozdochka ship repair yard in Severodvinsk completed the refit and modernisation of the *Delta-IV* class SSBN *Tula*. The maintenance work for the submarine's life extension started in 2015 and took two years including trials. Two sister ships, *Verkhoturye* and *Ekaterinburg,* have undergone the same renovation already, while a fourth SSBN of the class, *Bryansk*, has arrived at Zvyozdochka for life extension work to commence this year.

VAYU Interview with

Shekhar Mital, CMD, Goa Shipyard Ltd.

VAYU : GSL has recorded exceptional financial results for the last financial year. Can you elaborate on that?

Backed by timely delivery of quality products, GSL has been recorded phenomenal growth year-on-year since last four years. Four years ago, company was facing a really hard time but now that phase is over and GSL has recorded PBT of Rs 305 crore (unaudited) for FY 2017-18, a jump of five times. Similarly for VoP, we have recorded ever highest VoP of GSL at Rs 1370 crore (unaudited) for FY 2017-18, which is a three times increase in the last four years. This becomes particularly more impressive when growth of 30% achieved in the last 4 years is compared with other shipyards operating under similar ecosystems. These excellent financial results are a direct manifestation of new benchmarks established on reduced 'build periods', thereby reducing overheads significantly.

VAYU : What are the key elements responsible for the exponential growth of GSL in the last few years?

The excellent performance in exports is driven by dependable and quality products with international acclaim. Because of our high quality products, we have been able to make significant inroads into global market with export of diverse vessels to Indian Ocean Region (IOR) countries. We have delivered 2 OPVs to Sri Lanka, 11 FIBs and 2 FPVs to Mauritius, and a Damage Control Simulator to Myanmar. The second and last vessel of the Sri Lankan OPV project was delivered on 22 March 2018, 25 days ahead of schedule. These OPVs are the biggest warships to be exported from India and largest in the Sri Lankan Fleet. Based on export performance, the Shipyard was given RM's award for 'Best performing in export amongst all DPSUs'.

VAYU: How has GSL managed to deliver all projects ahead of contractual delivery schedule?

If you take a scan of India's shipbuilding industry, except for GSL you will hardly find any shipbuilding project which is not struggling with time and cost overruns. In such a scenario, GSL has stood out to deliver 24 ships/projects in the last four years, all ahead of contractual delivery schedule. These platforms amount to a 32000 gross tonnage, highest amongst Indian shipyards. Another major highlight of our achievement has been the reduction in 'Build Period' of OPVs from 67 months to OPVs delivered prior 2014 to 36 months for the recently completed six Coast Guard OPV project. This has substantially helped in controlling the construction schedule, besides keeping the cost under control.

These outstanding outcomes are the result of hard work, toil and strategic alignment across various departments of the company. The slew of measures undertaken for this turnaround include strategic realignment of priorities, strict cost control measures, stringent monitoring mechanisms, seamless coordination amongst various stake holders, accountability of personnel, on the spot decisions, fast tracked approvals and effective supply chain management. This, of course comes only with sound understanding of technical and financial issues required in running shipyard efficiently.

VAYU: GSL has also been spearheading the 'Make In India' mission with lot of initiatives. Can you shed some light on the same?

One of the major 'Make in India' initiatives of GSL is major import substitute project for manufacturing of 12 MCMVs for which the construction should commence by 2019. The infrastructure for the MCMV project is in final stages and post completion, GSL would have the only facility in South Asia to construct high end MCMVs with advanced FRP hull. Another major import substitute project is construction of two Advanced Missile Frigates 1135.6 under collaboration with Russia. GSL has also collaborated with Griffon Hover works Limited (GHL), UK, towards inflicting indigenous production of hovercraft in India. GSL has already developed expertise and erected requisite infrastructure for the indigenous construction of hovercraft at GSL and presently pursuing vigorously with potential customers.

Ship design is one of the thrust areas of GSL, where 100% self-reliance has been achieved, which otherwise would require considerable FE expenditure towards bought out designs from foreign shipyards/ designers. We design and build one of the best patrol vessels in the world in terms of quality, fuel efficiency, ergonomic design and optimum cost. We also have designs of few future vessels such as ASW Shallow Water Crafts, Corvettes, Mini frigates, Training Ships, Interceptor crafts, etc. in our inventory. We are first Indian shipyard to have an in-house R&D unit recognised by the Department of Scientific and Industrial Research (DSIR), Government of India in 2014.

Another major initiative was adoption of 'Purchase Preference Policy' in favour of indigenous equipment manufacturers in 2014. I am happy to state that the Central Government has recently promulgated a similar purchase preference policy. Further, we have identified various equipment and systems, which were imported till date, for replacement with locally produced products. Various products such as gearbox, heli grid, steering and stabiliser, water proof doors, steel plates etc. are being sourced locally for new projects. Increased indigenous content onboard ships constructed at GSL have been and will be the focus areas of GSL in the times to come. Having touched 70% indigenous content on GSL OPVs, I am hopeful that day is not far when we will have 100% indigenous content.

"True Partnership paves the way for IAI in India"

Vayu in discussion with Eli Alfassi of IAI

"Over the past three decades, India and Israel have established strong and friendly relations that span technology, space, agriculture and tourism. But defence cooperation has dominated from the start, boosting cooperation between the two countries to new heights. As Israel's leading aerospace and defence conglomerate, Israel Aerospace Industries (IAI) has led many joint programmes evolving with India, providing aerial refueling capabilities, unmanned aerial systems (UAS), airborne early warning aircraft, various radars and many other defence systems and capabilities. Today, systems and products developed and produced by IAI are operational with the air, land and naval services of India, along with other government agencies. From the beginning, IAI was open and ready to cooperate with Indian companies and organisations and have leveraged this partnership to expand and win new business."

One of the leading programmes that IAI is currently pursuing is the Medium Range Surface-Air Missile system (MRSAM). Launched in 2006 to become the principal air defence system for the Indian and Israel navies, MRSAM was gradually adopted by other customers and is now established as a world leading three-service air defence systems.

Over the 12-year development, MRSAM sets an example for a successful joint programme. Initially the joint development phase was led by IAI, while the production, integration, delivery and testing was managed by the Indian partners – the Defence Research and Development Organisation (DRDO) and Bharat Electronics Limited (BEL).

Today, MRSAM represents much more than the naval air defence system it was. The system has evolved into a long range, wide area air defence capability adopted by the Indian Air Force for the defense of fixed sites and relocatable, extended air defense capability to be operated by the Indian Army. All three Indian services, as well as Israeli and other operators, operate systems

based on a common core that was developed under cooperation between the DRDO and IAI; each configuration was designed, adapted and tuned to best meet the specific service requirements and utilise the resources and capabilities already invested in the system. "This is an unprecedented undertaking, where such indigenous, cutting-edge technology is harnessed to provide for the needs of multiple Indian and Israeli users." IAI Executive VP Marketing, Eli Alfassi stated.

According to Alfassi, the MRSAM project is also an excellent example of joint development and production that fully endorses the strategic 'Make In India' vision. "Since the beginning, the programme embraced a true cooperation and partnership and has implemented the spirit of 'Make In India' vision, even before this policy came into effect," Alfassi said. Through the past decade, the programme has expanded to take new challenges, gradually increasing the Indian workshare as the Indian partners assume a growing responsibility for development and production.

A major milestone in the programme was assigning Bharat Electronics Limited (BEL) as the prime contractor and lead integrator for the upcoming naval programmes. In this role, BEL is also responsible for the highly complex acceptance tests at sea, clearing the MRSAM systems on each and every vessel that receives the system. Another major partner, Bharat Dynamics Limited (BDL) is the integrator for the interceptor missiles that equip the MRSAM systems.

"Aligned with the evolving Indian policies, as part of the offset obligations, we have been buying Indian subsystems and services worth nearly $800 millions from 80 Indian suppliers. We intend to increase our work here, adding more Indian suppliers in the future," Eli Alfassi noted. IAI, Dynamatics Technologies Limited and Sun Group are working to establish a JV for UAVs, seeking opportunities in this field. Another planned JV with Mahindra addresses the field of defence electronics, radars and communications, and a third, with Bharat Forge Limited (BFL), will seek opportunities in smart munitions - programmes involving missiles, guided projectiles and loitering munitions.

Brahmos JV: building strong partnerships

Even as India is evolving as a great power, economically as well as militarily, it has gained immense expertise in designing and developing state-of-the-art defence systems. This accomplishment has made it entre into an elite club of powerful nations at the global stage having the capability to build their own military platforms and systems.

An excellent example of India's growing military might is the Brahmos supersonic cruise missile system which, with its multi-role capability, universality and utmost lethality, has carved a distinct place for itself with Indian Armed Forces. The weapon is the only universal supersonic cruise missile system in the world with the capability of neutralising land or sea based targets.

"Today, when speed is considered as one of the major determinants in the outcome of military conflicts, Brahmos, capable of flying at a top speed of around Mach 3, becomes extremely lethal in striking an enemy target in no time. The supersonic speed of the missile also makes it difficult for interception by the enemy's air defence system," said the spokesman.

"Induction of the missile in the Indian Armed Forces has rendered the armed forces an unmatched potentiality. The weapon has become mainstay of the Indian Army's artillery firepower. Similarly, for many of the Navy's frontline surface ships, Brahmos has been deployed as a prime strike weapon. In its sub-sea launch configuration, the supersonic cruise missile is set to increase the Navy's underwater weapons delivery capability manifold by being armed in the future submarines."

On 22 November 2017, a new dimension was added by Brahmos, when an Indian Air Force's Sukhoi-30MKI, after being modified to carry the 2.5 tonne missile integrated with half a tonne launcher, was test-fired against a sea-based target in the Bay of Bengal. With this maiden launch, Brahmos has augmented the IAF's strike capability and completed the tactical cruise missile triad.

"The supersonic cruise missile is a unique example of the partnership between India and Russia in critical areas of research and development. The speed, precision and power of Brahmos has proved to the world that a Joint Venture of advanced technology can lead to a high performance product in shortest possible time with far-reaching capabilities."

On 22 March 2018, Brahmos missile test-fired the weapon system fitted with an indigenously developed Seeker at Pokhran test range in Rajasthan. This feat has enthused a fresh impetus in the ambitious 'Make in India' programme of the Government of India.

The 300-km range missile, initially conceived and developed as an anti-ship cruise missile (ASCM) system, has evolved over the years and added many more variants, from sea-to-land, sea-to-sea, land-to-land, land-to-sea, sub-sea-to-land, sub-sea-to-sea and air-to-land configurations. The missile can be fired either from static, mobile platforms (land and sea) or fighter aircraft, in solo or salvo mode. "This multiplicity makes the weapon all the more versatile in taking on the enemy anywhere, anytime," the spokesman enthused.

It is the untiring efforts and competent leadership of the entire team of BrahMos, including the consortium of more than 200+ Indian industries and multiple Russian industries, R&D labs and academic institutions of both the countries, which have made significant contribution in design, development and production leading to the induction of Brahmos in the Indian Armed Forces. More than 20,000 specialists, engineers and technicians in public and private industries are currently associated in realising various systems and sub-systems of the weapon complex.

"The Brahmos Joint Venture has set the brightest example for the defence industry to build strong partnerships and work jointly towards realising the larger goal of producing sophisticated and highly advanced military systems. It has become a national model for the country to become self-reliant in defence technology."

MTU: "Continued commitment towards India"

Vayu talked with Praveen Mohan, Director & CEO, MTU India (Rolls-Royce Power Systems). His views:

"With decades of experience, our MTU brand high-speed engines and propulsion systems (part of Rolls-Royce Power Systems business) is the right partner for customers who place the highest demands upon their propulsion systems. Known for cutting-edge innovation and technological leadership, we continue to focus on the advancement of our core competencies: fuel injection, turbo charging, exhaust after treatment and electronics. Our engines have varied applications across commercial ships and naval vessels, construction and industrial vehicles, agricultural machinery, mining, rail and military vehicles as well as for the oil and gas industry. Our full range of service solutions help maximise uptime and performance. MTU India, head quartered in Pune, is involved in sales and servicing of MTU engines. Our MTU engines propel and power many Indian Coast Guard and Indian Navy vessels. Our own service teams are present at several locations along with the Indian Coast line and together with our Service Partner - Yeoman Marine Private Limited, we are geared up to support our customer's varied needs. Our Propulsion System Integration (PSI) capability will further help in offering complete drive-line integrated system solutions to naval customers across the world. MTU engines also powers 118 Indian Army Arjun Main Battle Tanks enabling swift movement from one location to another through

high manoeuvrability, high power density and maximum acceleration.

Through our partnership with Garden Reach Shipbuilders and Engineers, we assemble MTU Series 4000 engines for naval vessels at the Diesel Engine Plant in Ranchi. More recently, we formed a JV with Force Motors to manufacture Series 1600 engines at a dedicated state-of-the-art manufacturing facility at Chakan near Pune. We look forward to continued commitment towards India and work more closely with our stakeholders."

BEL's Drone Guard shown at DefExpo

Cotemporary times find drones as familiar flying objects and as with any other technology, drones are used and misused. They could be threats to military establishments and strategic civilian locations. Drones are easily launched by adversaries for spying and causing damage to these establishments. Countering such drones is essential for security agencies. BEL has developed an indigenous 'Drone Guard' solution to support these agencies.

"BEL's Drone Guard System (DGS) has been configured to detect, track and neutralise the intruding drones. The system utilises RF spectrum to detect the drone and EO-IR sensor to track the drone continuously. The neutraliser is initiated to scan and identify the target's communication frequencies and generate RF jamming signal to neutralise the target and is capable of bringing down the drone by hampering its communication link as well as blinding its GPS source. The system can be operated in semi-automatic/manual mode through user friendly GUIs. This portable and agile system can also be configured to be vehicle mounted as per the user's requirement."

Re-energising India's Air Power

Maj Gen Ashok Mehta, who took part in the recent roundtable conference organised by the *Delhi Forum for Strategic Studies* and *Vayu Aerospace & Defence Review* at New Delhi, encapsulates the IAF's current crisis

The story can now be told about how the IAF, confronting an operational crisis after a protracted delay of many years, got the MoD to issue an RFI for 114 single-engine fighter aircraft in 2016 to start a new process of establishing an additional fighter assembly line in addition to production of the existing LCA. But the MoD and IAF are adept in self-attrition. The new RFI, made public on 6 April seems to be a repeat of the follies committed in the procurement rigmarole of the MMRCA in 2007. The process

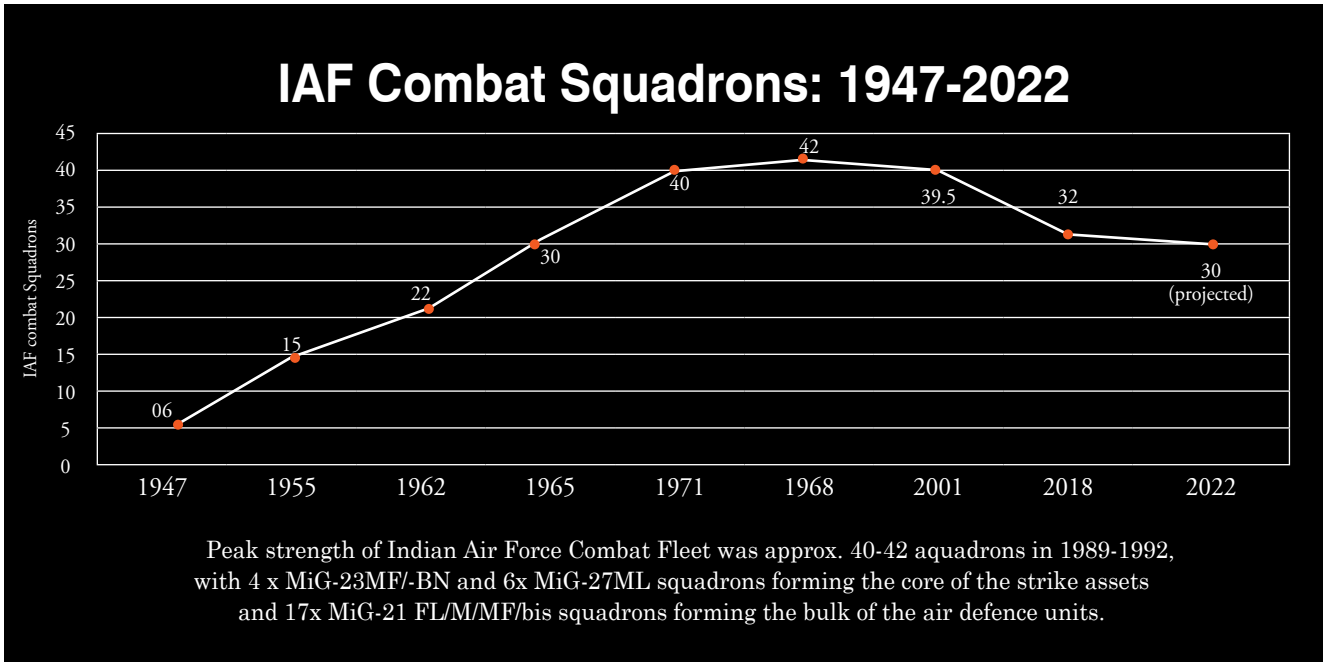
Moderating the Conference was Admiral Arun Prakash, former Chief of the Naval Staff and Lt Gen Kamal Davar, President DFSS and first Director-General Defence Intelligence Agency

and competitors are the same, though Defence Secretary Sanjay Mitra, at the DefExpo 2018 was evasive, telling the media"that these were early days."Earlier in Parliament, Defence Minister Nirmala Sitharaman said that the IAF will have 32 squadrons by 2020. Remember this government had inherited 34 squadrons in 2014. The new process may well end up like it did in 2015, unable to conclude the contract and instead outright purchase 36 Rafale aircraft forfeiting additional numbers and transfer of technology. The IAF crisis is so serious that it requires the 'Modi solution' of 2015 and not the conventional defence procurement route given the acute deficiencies in India's air power and looming threats.

Just a week before the RFI of 6 April, a Delhi-based think tank *Delhi Forum For Strategic Studies* along with *Vayu Aerospace & Defence Review* assembled a group of former senior Air Force, Navy and Army officers (including two former IAF Chiefs, a former Navy Chief, senior defence bureaucrats and ex-Chairman HAL, plus other strategic thinkers) to agonise on the IAF's dwindling combat fighter strength which would plummet from the present 31 squadrons to 24 combat squadrons by 2032 – unless urgent strategic decisions are taken by the highest executive. Following the day-long brainstorming it was decided that former IAF Chiefs would seek a meeting with Prime Minister Modi apprising him of the growing crisis and requesting he immediately order an IAF capability review against a two front collusive threat and simultaneously order a government-to-government 'Make in India' contract with the Company for its chosen single engine fighter (the Saab Gripen was repeatedly hinted at)and establishing a new production line integral with transfer of technology but avoiding the tedious MMRCA tendering process which it has already gone through. This route was tentatively explored in October 2016 along with Lockheed Martin's F-16 but the project mysteriously vanished. The *DFSS/ Vayu* conclusions were thereafter circulated and hopefully have been given due consideration.

Then on 6 April, the IAF issued an elaborate RFI (73 pages) for single/twin engined fighters against the one page RFI for 100 to 200 single engine fighters circulated in October 2016. The latter effort faded away without progress, the new process now seeks 110 aircraft with responses expected by early-July, and RFP to be issued by end-2018. Wishful thinking? The RFP for the MMRCA took three years after issue of the RFI. In the event and after strenuous evaluation, the French Rafale was declared as the lowest bidder (L1) in 2012. But after inconclusive negotiations, the new Prime Minister Modi chose to go directly for purchase of 36 Rafales and the original MMRCA tender was thereafter cancelled without clarification on

Air Marshal Ajit Bhavnani, former Vice Chief of the Air Staff, making his presentation



Peak strength of Indian Air Force Combat Fleet was approx. 40-42 aquadrons in 1989-1992, with 4 x MiG-23MF/-BN and 6x MiG-27ML squadrons forming the core of the strike assets and 17x MiG-21 FL/M/MF/bis squadrons forming the bulk of the air defence units.

LCA Programme

- Project launched in October 1983
- Conceived to fulfill the need for an affordable multi-role fighter to replace large numbers of the MiG-21/23/27s
- First flight on 4 January 2001
- Obtained LOC-I in January 2011, LOC-II on 20 December 2013.
  FOC still awaited
- IAF has agreed to initially induct two squadrons of LCA Mk.I and GoI has cleard production of 83 LCA Mk.IAs. Earliest production deliveries of these will be from 2024-25.
- LCA Mk.II development at preliminary stage, not expected to go into service before 2032.

Air Chief Marshal S Krishnaswamy, former CAS, making an emphatic point

the balance 90 aircraft as per the original total requirement for 126.

History of the Crisis

For near two decades, the IAF has lived dangerously by not getting close to solving the problem of maintaining sufficiency in combat aircraft squadron strength – today's 31 squadrons against the authorised 42 combat squadrons. In 1983, looking ahead, the Light Combat Aircraft (LCA) programme had been launched to replace the aging MiG fleet and have an indigenous single engine light fighter. In 2002, when the LCA appeared going nowhere, an acceptance of necessity (AON) was secured from government for 126 MMRCAs.

The LCA programmes remains well behind schedule – only nine aircraft have been inducted into the very first operational squadron by end – March 2018, even as HAL attempts to increase its production capacity to some 12 LCAs per year. For the IAF, the LCA Mk.I is like the proverbial bird in hand being better than two in the bush but the improved Mk.IA is some time away as whose development still needs to be funded.

The Rafale for which excruciatingly difficult negotiations had been going on for two years without any closure for 126 aircraft – 18 in fly-away condition and the remaining 108 to be license-built in India – was foreclosed when, on 10 April 2015, like a bolt from the blue, Prime Minister Modi, invoking national security imperatives, announced that 36 Rafales would be bought in flyaway condition. How the government would make up for the residual 90 aircraft was not indicated and even three years later, there was no clarity until the convoluted RFI of 6 April 2018. The IAF is already 10 squadrons short of the authorised 42 squadrons, and given the government's operational directive to be prepared for "a two-front war," it is in the words of the present Chief of Air Staff, Air Chief Marshal BS Dhanoa:"like playing a T20 match with seven players". Today, Pakistan has 20 combat squadrons and China, more than 80, which are increasing steadily.

Air Marshal P Barbora, former VCAS along with Air Chief Marshal SP Tyagi, former CAS, and other participants including Vinod Mishra, ex-Secretary Defence Finance and former Chairman HAL, Dr. R.K. Tyagi

The question is: why was the steady decline in combat squadrons not arrested earlier to avert the crisis which has long been confronting the IAF? In 1989-92 when the Indian armed forces were at their peak in outreach and capability, *Time* magazine had put India's formidable military machine on its cover, symbolised by the picture of the aircraft carrier, *Vikrant*. That was the first and last time India's military might had made it to the cover in a leading international magazine with the IAF inventory then standing at 42 combat squadrons.

And so the ignomious descent began… between 2001-2005, numbers had slipped to 39.5 squadrons, in 2012 to 37 squadrons and in 2018 to its lowest ever of 31 squadrons. By 2022, even with addition of some two new squadrons of Rafales and LCAs, another 7-8 squadrons of MiG-21s and MiG-27s will have been phased

JF-17 Programme

- Project launched in 1995 as a collaboration between CAC and PAC, powered by Russian RD-93 engines.
- First flight in August 2003
- Block I (50 aircraft) equips three squadrons, followed by Block 2 (50 aircraft) now with another three squadrons, all operational.
- Block II JF-17s, have improved avionics, BVR missile and mid-air refuelling capability.
- Block III (100-200 aircraft) could be powered by a western-origin engine and new generation weapon system. [Export orders have been received form three countries, with another eight as potential].

Air Marshal Nirdosh Tyagi, former Deputy Chief of the Air Staff, at the Conference

The Factor

MMRCA

- Requirement conceived in 2001 with the object of filling gaps between the LCA under development and the 'heavy' Su-30MKI
- RFI initially issued to four vendors: Dassault, Saab, RAC-MiG and Lockheed Martin. Eurofighter consortium and Boeing later entered the competition. RFP issued to all 6 companies in August 2006.
- Six aircraft types evaluated: Saab Gripen, Dassault Rafale, Eurofighter, Typhoon, Boeing F/A-18 Super Hornet, Lockheed Martin F-16 Super Viper and RAC-MiG-35.
- Initially 18 aircraft was to be 'fly-away' remaining 108 to be built under licence by HAL.
- Contract was to include economic offsets and transfer of technology, equivalent to 50% of contract value.
- First deliveries were to commence 36 months after contract
- MMRCA programme was officially terminated in mid-2015 and 36 Rafales ordered as 'fly-aways' with deliveries between 2019-2022.

out. By 2032, if additional replacements are not ordered or made alongside the LCA, the fighting strength will plummet to 24 squadrons against an estimated 25 squadrons of PAF and 100 squadrons of the PLAAF. The only other active production line will be Su-30 MKIs which is the long range mainstay of the IAF and will peak at around 272 aircraft numbers in two years. The legacy aircraft types such as the Jaguar, MiG-29 and Mirage 2000 will also begin to retire by 2032.Chief of the Air Staff, Air Chief Marshal BS Dhanoa has said that the IAF will reach its authorised strength of 42/44 Squadrons only by 2032. How this will happen from the present strength of the IAF, only he may know. Someone must have a magic wand !

Major General Ashok Mehta (right) emphasising his viewpoint to Admiral Arun Prakash

Numbers and affordability

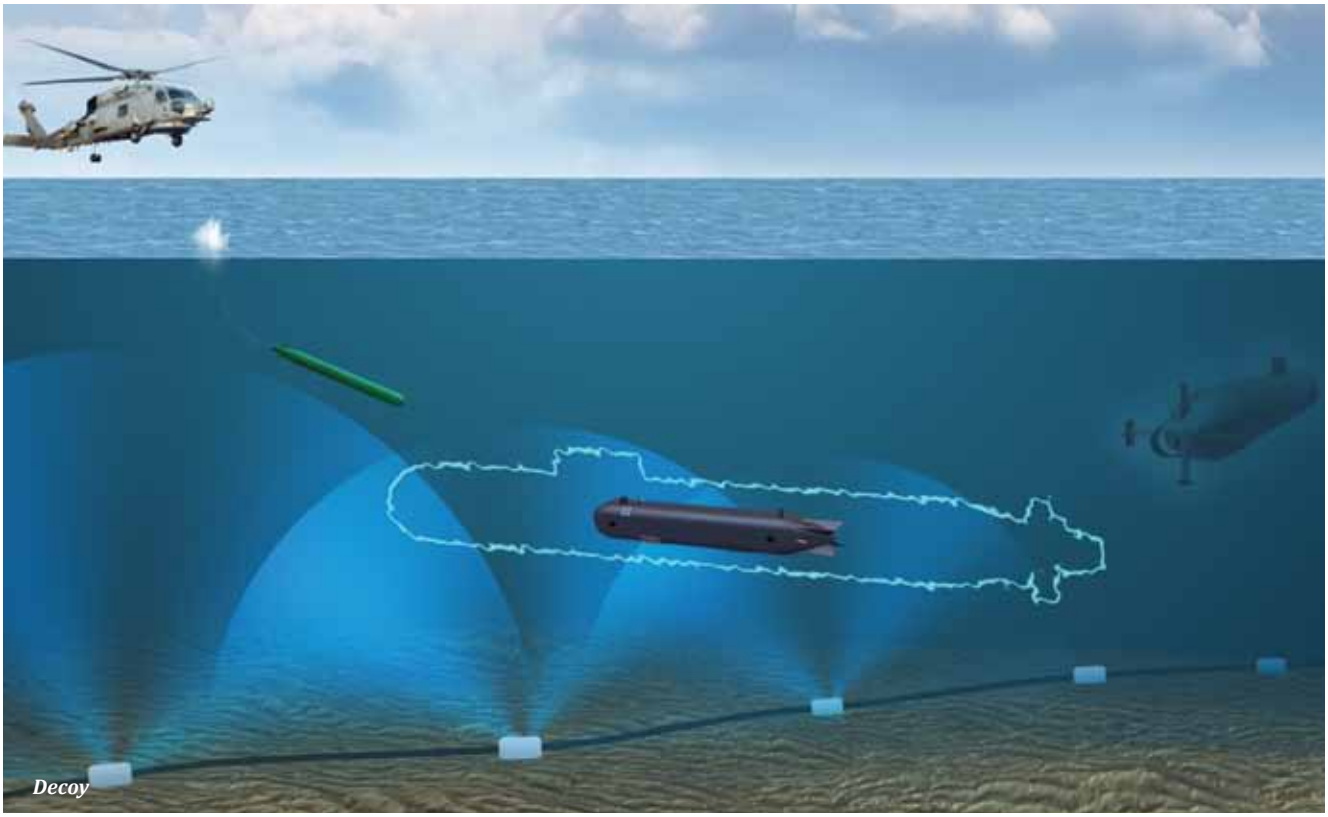
For making up numbers, cost, affordability and reliability have clearly to be factored. The predominant view among the IAF seniors at the *DFSS/Vayu* brainstorming last month was to select the most "cost-effective" fighter to 'Make in India' and if possible draw interim aircraft from that country's inventory to fast-track the process. At least three years will be lost in protracted decision making and the cost of each aircraft will exponentially increase every year. The new Defence Procurement Procedure permits proceeding with a single vendor situation, precisely what Modi unilaterally did in ordering 36 instead of 126 Rafales. Technically the order for 36 aircraft was a new contract. The Swedish Gripen, like the Rafale, has experienced turbulence of the MMRCA process but being relatively new, has considerable new development life ahead, the IAF factoring a life span of 50 to 60 years for its new acquisitions.

Let's now take a macro look at Pakistan, whose air force is increasingly being equipped with the indigenously-built, Chinese-origin JF-17 Thunders, of which 150 are already in operational service. Contrast that with our handful of Tejas LCAs. The Chinese PLAAF on the other hand, have some 86 combat squadrons, with first of the fifth-generation J-20s being fielded, also in Tibet, where there are four major air bases with sufficiently long runways and infrastructure to mount sustained air operations.

The IAF is facing an operational crisis, partly of its own making with lack of focus resulting in depletion of aircraft and squadron strength since the 1990s, when the geo-politics of the region is fragile and unfavourable to India. The IAF has to convince the government that its case for 42 combat squadrons is sacrosanct. The Cabinet Committee for Security must at least understand the imperatives of deterrence.

The way out of this crisis is not by reinventing the wheel: revisiting the MMRCA process, which however innovative, will only exacerbate the situation.

Submarines and autonomous UUVs


Decoy

Working in tandem and the way forward

We live in the creative phase of unmanned vehicles. It was not so long ago that the robot R2-D2 could exist only in the fantastic world of *Star Wars.* Today, we use similar robots in everyday life. Not trying to compete with *Star Wars* scope, let us consider the problem of interaction between submarines and underwater robotic vehicles.

A torpedo with acoustic homing can be considered the first autonomous unmanned underwater vehicle. No less an interesting example was the Granit missile deployed for the first time in the submarine of *Oscar*-class. These missiles had not only an advanced homing system but could interact with each other during the flight, exchanging data and coordinating their actions. This behaviour can be considered one of the first examples of interaction among unmanned vehicles in the group, which is called swarming today.

Of course, endurance of torpedoes and missiles is measured in minutes, payload is limited by the explosive charge. In contrast, modern unmanned underwater vehicles (UUVs) can operate autonomously for scores of hours, move with high accuracy along complicated trajectories, carry various types of payload and act according to sophisticated algorithms. At the same time, as compared to 'classic' submarines, UUVs remain small and inexpensive.

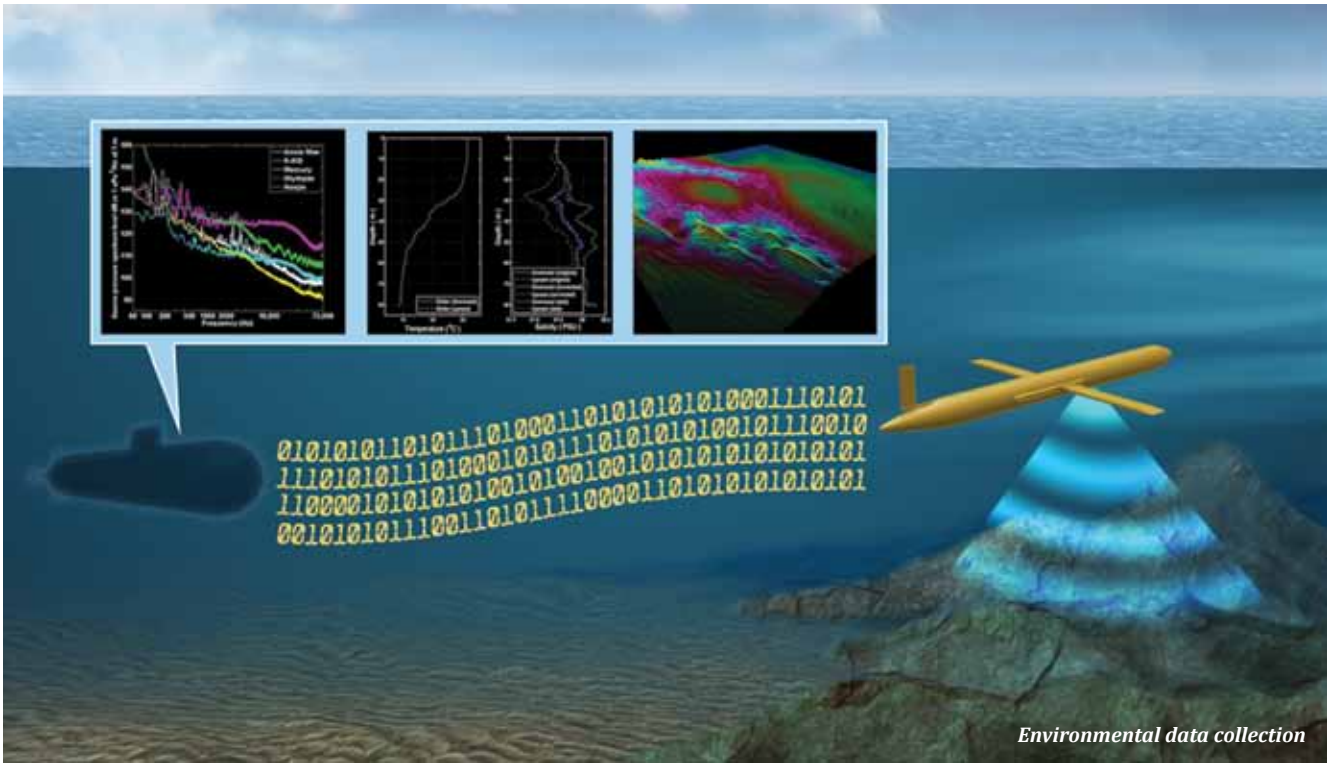
Submarine Hunters

From the underwater warfare point of view, the most attractive mission for the unmanned underwater vehicles is to search for and trail enemy submarines. Robots, unlike classic submarines, can also use unstealthy methods for enemy's search (for example, active sonar pings). Destruction of such a vehicle due to its small size and manoeuvrability is not only difficult but also too expensive.

However, this is not a low hanging fruit. Creation of these vehicles is full of difficulties – provision of necessary energy reserve and speed, accommodation of large antennas and processing of signals received from them, transmission of data on the detected targets, development of submarine tracking algorithms and others.

These problems can be solved in different ways. One should choose the right places for submarine hunting, use vehicles in swarms, include the vehicles in network systems of detection and data transmission. Another option is to create rather large vehicles of dozens of tonnes displacement that have a lot of energy and sophisticated detection means. Such vehicles are already being developed and tested.

Unmanned aerial vehicles UAVs can be used for above-water surveillance. As early as World War II, submarines that carried reconnaissance aircraft were developed, and German submariners used submarine-launched gyroplanes and kites for target search. However, all these aircraft were surface-launched and they



Environmental data collection

had to be recovered after the mission. Nowadays, already there is experience in launching expendable unmanned vehicles from underwater through a classic torpedo tube. Using these vehicles, submarines are capable of conducting reconnaissance beyond the horizon and even over land and availability of channel for covert reception of data from released drones considerably expands intelligence capabilities of the submarine.

Target Decoys

Enhancement of acoustic systems enables simulation of an acoustic signature of submarine with accuracy sufficient to deceive aircraft and ship sonars and in future stationary systems as well. Today, the range of offered decoy vehicles is large – from compact single-shot Mk.39 of 10 kg weight to huge vehicle MASTT with displacement over 60 tonnes.

The submarine is capable of launching only small decoys of limited endurance. However, large decoys can be delivered by other ways and move on their own to the areas where they will interact with submarines.

At the end of last year, the Rubin Design Bureau presented a concept design of the Surrogat robotic complex to be used for naval exercises. This large submarine imitator equipped with a lithium-ion battery can operate up to 15-16 hours. And during that period of time it will simulate manoeuvring of enemy submarines including manoeuvres at high speed.

Appearance and evolution of acoustic decoys has led to the development and complication of torpedo homing systems because today they should differentiate between actual and false targets. Battle of the robots – torpedo and decoy– is already taking place under water!

Communication and Navigation

Communication systems for submarines must be robust and high-speed, but first of all they must be discreet to preserve submarine's overall stealth. Use of satellite communication systems has increased considerably the security of radio channel itself, however has not solved the problem totally. To use the satellite communication system, the boat should come to the periscope depth and raise creates masts. This discloses and puts in a disadvantaged tactical position. Similar problems arise when it is necessary to use GPS.

One of the solutions allowing the submarine to maintain a two-way communication and receive data from space navigation systems 'keeping speed and depth' is a radio communication system with buoy antennas, for example, Calisto and RTOF (recoverable tethered optical fibre) systems. These systems give greater freedom to act but the submarine still remains tethered to the surface although with a looser leash.

A number of problems can be solved when the UUV is used as a gateway between the underwater and air environment. The ability of such communication vehicles to manoeuvre on their own practically lifts all the constraints of the submarine.

Moreover, the vehicle can be pre-programmed to transmit the information only after a certain period of time or after moving to the specified area. In the same way, the R2-D2 robot delivered the message on the *Death Star* plans to the *Rebels*. During this process, the vehicle is able to receive and transmit data to the submarine with the help of high-frequency underwater acoustic or even laser channel, i.e. it is unnecessary to launch and recover UUV.

Assessment of Environmental Parameters

As the theatre of submarine operations passes to coastal and shallow zones, mapping of bottom terrain becomes more and more important. Information on terrain is necessary not only for safe manoeuvring near the bottom but may also give tactical advantages allowing the submarine to appear in a place where it was not expected.

Ship and aircraft sonar systems are constantly being improved, and this factor requires more meticulous account for hydrological parameters. Firstly, to facilitate functioning of own detection sensors they will already have preset information on the underwater environment and, secondly, to evade detection by enemy sensors. New requirements appear as well. Thus, for laser communication the water transparency should be known. Such information can be collected with onboard sensors but it takes a lot of time that may not be available under certain circumstances. Instead of this, UUVs can evaluate hydrology comparatively fast and safely. Such vehicles are being developed by Indian universities.

Launch of these vehicles from submarines has also been implemented: they can be launched from lock-in/lock-out chamber installed on the submarine hatch. Launch of these UUVs from missile containers is also being developed.

Mine Detection

Today, many types of mine countermeasures unmanned vehicles have been developed and are being manufactured – from light man-portable of less than 40 kg to rather large ones with weight up to one tonne. Indian companies also offer such vehicles. There are even larger vehicles, for example, UUV RMMV with weight about 6 tonnes, which is used within the AN/WLD-1 system on board the ships like US Navy LCS. Single-shot underwater vehicles are used for mine sweeping.

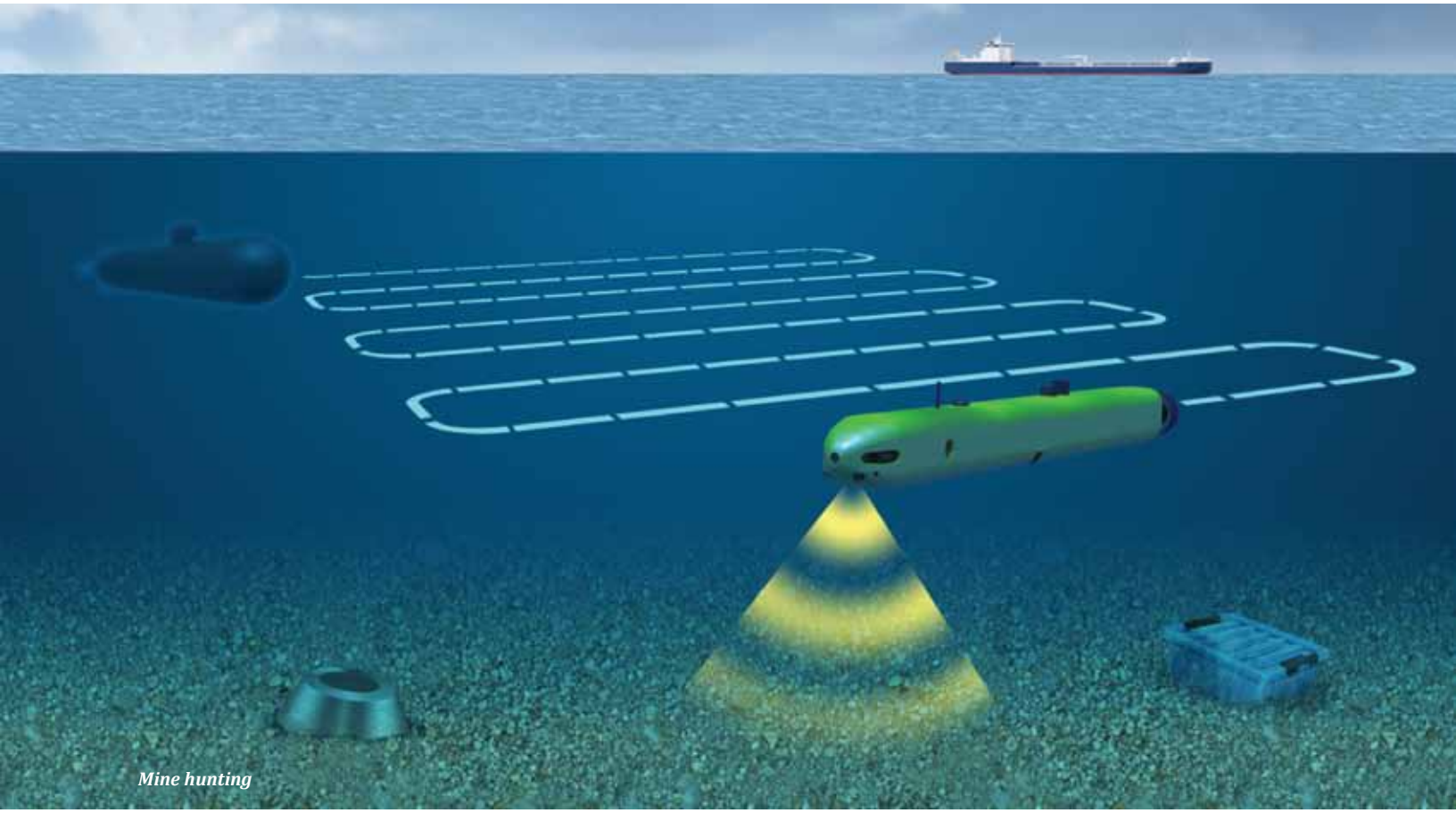
However, all these vehicles are intended for employment from surface ships. Hence, they can be used only in own coastal waters or in the areas controlled by one's own navy.

Near the enemy's littoral, in hostile conditions, covert intelligence is required. And covertness can be ensured only when a vehicle is delivered by a submarine. Moreover, it is the submarine that more often comes to the area of future operations for ISR purposes and therefore it needs reliable and up-to-date information on the mine threat. It is faster and safer to gather the information using UUV than to survey the area with submarine onboard sensors. In addition, autonomy of UUV allows the submarine to solve other tasks while the vehicles survey the area in order to detect mines.

However, even an UUV launch from the submarine is a serious challenge and UUV recovery is manifoldly difficult. Though the difficulties are not insurmountable; Swedish submarines operate the UUV AUV-62MR. Since 2007, the US Navy submarines have been using the AN/BLQ-11 system earlier known as LMRS (Long-term Mine Reconnaissance System).

The Rubin Design Bureau has also developed technology for employing autonomous UUVs and remotely operated vehicles from underwater moving objects. Of course, this method requires not only UUV with suitable capabilities but adaptation of the submarine itself and relevant training of the crew. Experience shows that the development of mine countermeasure complex comprising UUV and submarine makes high demands on both time and budget and even after all efforts it may not meet customer's requirements. However, covert mine reconnaissance has so many advantages that leading navies continue activities in this direction.

Igor Vilnit
CEO of Rubin Design Bureau



Mine hunting

Arrow ATBM: Lethal Evolution

Israel faces the grim prospect of potential Tactical Ballistic Missile (TBM) strikes with Nuclear, Biological or Chemical (NBC) warheads not only from its adversary nations but also from 'sub-states' (read terrorist groups). To tackle such threats, the Israeli Defence Force (IDF) deploys combination of Ballistic Missile Defences (BMD) systems with IAI/Boeing Arrow 2 Anti-Tactical Ballistic Missiles (ATBM) developed by MLM Division of Israel Aerospace Industries (IAI) presently forming the centre piece of Israel's layered system of strategic missile defence called *Homa*. The first battery at Palmachim airbase, near Tel Aviv became operational in 2000 followed by one at Ein Shemer airbase to the south of Haifa in 2002. They are deployed in such a manner that coverage of the systems overlaps vital military, commercial installations and concentrated civilian population. The system practically forming National Missile Defence (NMD) in Israeli context, is stand alone yet integrated with national command & control, and has the capability to provide early warning for itself and of dealing with multiple threats. In Israel, Arrow 2 Block 4 and Arrow 3 function as the upper-tier of the multi-tier combined air defence/ATBM network. The middle tier comprises of United States-origin and Israeli Patriot PAC-2/PAC-3 and United States Navy (USN) ship-borne AEGIS systems in addition to the IDF David's Sling Weapon System (DSWS) providing the mid-tier and lower tiers, defending against tactical missiles, long range rockets, cruise missiles and attack aircraft. The low-level is protected by Rafael's Iron Dome countering short-range rockets (C-RAM) and 155 mm artillery shells.

The refined and leaner (1,300-kg) Arrow 2, was first tested in 1995 being derived from the *Chetz* (Arrow) 1, a project initiated by the United States Strategic Defence Initiative (SDI) to be developed by IAI. The Arrow 2 is meant to intercept tactical ballistic missiles just as they begin re-entering atmosphere after reaching the highest point in their flight trajectory.

In February 2003, IAI signed an agreement with Boeing to establish the production infrastructure to manufacture components of the Arrow missile in the United States with Boeing responsible for the production and co-ordination of approximately 50% of the missile components in United States while IAI undertook integration and final assembly of the missile in Israel. Under the Arrow System Improvement Programme (ASIP), being carried out jointly by Israel and United States Ballistic Missile Defence Organisation (BMDO), a real (as against simulated) Scud-B Short-Range Ballistic Missile (SRBM) was successfully intercepted and destroyed at an altitude of 40-km at Point Mugu naval test range in California in July 2004. In December 2005, an Arrow 2 Block 3 missile successfully intercepted a target at an unspecified but reported record low altitude. In February 2007, the system

successfully intercepted and destroyed a Rafael Black Sparrow target missile, simulating a ballistic missile, at high altitude.

An Arrow battery is typically equipped with four or eight launch trailers, each with six launch tubes and ready-to-fire missiles, a truck-mounted Hazelnut Tree Launch Control Centre (LCC), a truck-mounted communications centre, a trailer mounted Elisra Citron Tree Fire Control Centre (FCC) and the units of a mobile Green Pine early warning radar system. There are microwave and radio data and voice communications (Link-16) between the LCC and the radar command & control centre with the launch system deployable up to 300 km from the site selected for the radar command & control centre offering unparalleled protection and flexibility to the Arrow Weapon System (AWS).

The two-stage Arrow 2 ATBM is equipped with solid propellant booster and sustainer rocket motors. The Arrow 2 is launched vertically, separately or in salvos, giving 360-degrees coverage to each battery. The Green Pine L-band, phased array, dual-mode (detection and fire control) radar determines the intercept point and thereby up-linking very accurate data to the Arrow 2 guiding the intercepting missile to within 4 m of the target. The missile uses an initial burn to carry out a vertical hot launch from the container and a secondary burn to sustain the missile›s trajectory towards the target at a maximum speed of Mach 9, or 2.5 km per second. Thrust Vector Control (TVC) is used in the boost and sustained phases of flight. At the ignition of the second stage sustainer motor, the first stage assembly separates. The Kill Vehicle (KV) section of the missile, containing the warhead, fusing and the terminal Electro-Optical (EO) seeker is equipped with four aerodynamically controlled moving fins to give low altitude interception capability. The dual mode missile seeker has a passive infrared seeker (Raytheon-developed indium antimonite focal plane array) for the acquisition and tracking of TBM and an active radar seeker used to home on air breathing targets at low altitudes. After the Arrow 2 is brought to the best engagement point on the TBM, its EO sensor acquires the target to allow very near pass and then activates the Rafael Advanced Defense System developed high explosive directed blast fragmentation warhead which is capable of destroying the target within a 50 m radius or sufficiently deflecting it beyond the confines of defended territory. The current Arrow 2 Block 4 version with improved target identification and discrimination capability remains an extremely lethal interceptor.

The ELTA Electronics subsidiary of IAI developed the EL/M-2080 Green Pine Early Warning & Fire Control (EW & FC) radar for the Arrow system. The Green Pine radar has a proven track record demonstrated in over twenty successful ballistic missile intercepts. The radar includes the trailer mounted antenna array, the power generator, a cooling system and a control centre. Developed from the ELTA Music phased array radar, Green Pine is an dual mode, electronically scanned, solid state, phased-array radar operating at L-band in the range 500 MHz to 1,000 MHz, weighs 60 tonnes and comprises of 2,000 transmit-receive modules. Green Pine is said to be capable of tracking ballistic missiles from a range of up to 500 km and is able to track targets up to speeds over 3 km/s while intercept of the attacking missile may occur 90 km away at an altitude of 10 to 50km. The long range of Green Pine radar system ensures that a second shot can be taken at the incoming ballistic missile if the first shot fails to secure the "kill". The ballistic missiles are again intercepted at a much higher altitude (exo-atmospheric or endo-atmospheric) to prevent them from disintegrating as they approach lower altitude, thus faking multiple targets on radar screens. Israel also receives data from the United States Defence Space Programme (DSP) early warning satellites and Boeing RC-135S Cobra Ball intelligence aircraft capable of picking up rapid movement or a rocket launch flash.

Interestingly, India had placed an order and received its first Green Pine EW & FC radar in 2001 and has since been integrated with the country's indigenous missile defence

system as the Swordfish radar system. The Super Green Pine also operated by India, has a tracking range of 800 to 900 km.

Tadiran Electronics Limited Golden Citron Tree Battle Management/Fire Control Centre (BM/FCC) capable of conducting multiple, simultaneous (up to 14) interceptions and includes ten battle stations. Launches are controlled by Hazelnut Tree launcher control centre. Citron Tree, which is trailer mounted, downloads the radar data along with data from other sources and uses powerful signal processing tools to manage the threat interceptions along with man-in-the-loop intervention capability at every stage.

Meanwhile, the United States and Israel have developed the upper-tier component (including an exo-atmospheric interceptor) to the Israeli Missile Defence architecture, commonly known as Arrow 3, based on an architecture definition study conducted in 2006-2007, determining the need for the upper-tier component to be integrated into Israel›s Ballistic Missile Defence system in addition to the Arrow 2 Block 4 ATBM, which was declared operational on 18 January 2017. The KV of two-stage Arrow 3 is propelled by rocket motor and equipped with flexible nozzles to offer exceptionally large divert capability, while the gimballed seeker obtains substantial hemispheric coverage to facilitate exo-atmospheric interception. By measuring the seeker's line of sight relative to the vehicle's motion, the KV would employ 'proportional navigation' deflecting the KV to divert its course and align exactly at target's fight path, hence achieving an accurate Hit-to-Kill (HTK) even at very high closing speeds and over long distances. The Arrow 3 in addition is reported to be a formidable Anti-Satellite (ASAT) weapon.

Sayan Majumdar

Arrow 3 flight tested

On 20 February 2018, the Missile Defence Agency and the Israel Missile Defence Organisation completed a flight test of the Arrow 3 weapons system that is designed to defend against ballistic missiles outside of the atmosphere. The test was conducted at a site in central Israel and was led by Israel Aerospace Industries, in collaboration with the Israeli Air Force. The Missile Defence Agency, as system co-developer, supported the test. Arrow 3 interceptors were delivered to the Israeli air force in January 2017 for operational use.

Nammo

Nammo Shoulder–Launched Munitions

"Proven, Powerful and Effective"

Recent conflicts often have soldiers in small units (squad or platoon) detached from larger forces and functioning autonomously. Self-sufficient, isolated units require the correct mix of armaments to ensure mission success while maintaining mobility and survivability. Units could be fighting in a city one day and mountainous terrain the next. Most of these skirmishes are conducted at less than 100 metres distance, typically representative of an urban fight requiring engagements against light and heavy masonry walls, earthen fortifications and technical vehicles, or at extended range, beyond several hundred metres, rendering conventional firearms and grenades only marginally effective. The size and weight of existing weapon systems to handle these scenarios are prohibitive for dismounted operations, and logistics required to deliver indirect fire are time prohibitive for a squad engaged in a firefight.

Amidst unpredictable conflict scenarios, the Nammo shoulder-launched munitions provide man portable, lethal and accurate firepower. Nammo very well understands these requirements and provides the most advanced, lightest-weight Shoulder Launched Munitions (SLMs) in the world. The M141 Bunker Defeat Munition (BDM) and the M72 Family of weapons are capable of destroying enemy fortifications, annihilating light armour and de-grading the enemy's will to fight. Nammo's shoulder-launched munitions deliver devastatingly lethal capability in lightweight, compact and easy to use systems.

Arduous battlefield requirements place an enormous burden on small unit leaders and the troops. Nammo SLMs are extremely effective in minimising those demands. The M72 and BDM give every squad complementary capabilities, a potent combination to scale the lethal and devastating effects of the situation in real time, thereby ensuring "mission success." Nammo SLMs provide soldiers the ability to quickly defend themselves, their units and civilians. Soldiers no longer have to waste precious time during a heavy enemy attack in waiting for or relying upon external help. These SLMs give them the necessary firepower to address enemy combatants immediately–and decisively.

Nammo System characteristics

Economic challenges place armed forces around the world under increased budgetary pressure along with the onerous obligation of making the right decision when choosing equipment for their forces. Key factors are vital to the decision for US and other force leaders to procure and deploy the Nammo SLMs which include being:

Combat Proven: These munitions are unmatched in safety reliability, and ruggedness in unforgiving real battlefield environs. Moreover, they are capable of distinguished combat use in different environments; MOUT, mountainous, desert, etc., and also prove to be combat multipliers for all operations; offensive, defensive and retrograde. Their merit is also

proven in air jumps, air drop, underwater delivery and by helicopter sling load.

Exceptional Design: For soldiers carrying increasingly heavier loads into combat, the Nammo munition systems come as lightweight and compact weapons and hence significantly reduce physical burden. Their best feature is that they are easy to use and train, which increases combat effectiveness and readiness.

Lethality: Nammo munitions comprise multipurpose warheads offering flexibility, overmatch and easy target defeat features that are accurate, repeatable firepower at extended ranges without elaborate or expensive sighting systems and system reliability to perform on target, every time without exception is guaranteed.

SLM historical impact

Shoulder-launched munitions or SLMs entered the battlefield during World War II and remain extremely effective even today. Armed Forces throughout history have a primary goal of completing missions successfully, while minimising combat casualties. The Nammo engineering and product development team understands this mission and specifically designs shoulder launched munitions to give war fighters the power and lethality to efficiently and effectively destroy armoured personnel carriers, hastily created bunkers, fortified structures, and other hardened targets.

Nammo SLM designs draw extensively from experience in current conflicts. The Nammo product development team works closely with operators to understand requirements and gaps in their current capabilities to continuously improve system designs and manufacture SLMs that effectively engage and destroy targets. The design and engineering teams' aptitude to remain in tune with the changing needs of soldiers is vital to providing them the decisive edge in any combat situation. Nammo's ability to listen to the soldier and design a solution that gives them an advantage has solidified the company as a key player in the industry.

System and warhead variants

The company offers a wide range of systems in the 66mm and 83mm families. The 66mm M72 LAW family of weapons offers both anti-armour and anti-structure capability. The 83mm systems include the reusable launcher ShoMulder-launched Multipurpose Assault Weapon (SMAW), and a disposable solution derived from the SMAW for the US Army, the M141 Bunker Defeat Munition. Both 83mm systems offer a variety of warheads that can be used as the situation dictates, providing military leaders with the flexibility to choose a system that best fits the mission.

The M72 LAW

The playing field will be tilted to the advantage of the soldier carrying the Nammo M72 lightweight assault weapon (LAW). The M72 LAW has been a battlefield staple since the Vietnam War. The US Army Type Classified modern M72 LAW is a single use, effective, easy to use and highly portable. The lightweight and lethal nature of the weapon enables soldiers to carry multiple M72s at one time, which allows light infantry, early entry, airborne and Special Forces to be prepared for multiple engagements without the need for resupply. Nammo has several variants of the system providing soldiers with the capability to destroy structures and vehicles or penetrate light armour.

BDM

The US Army Type Classified M141 Bunker Defeat Munition is a single shot, shoulder launched munition with a unique high explosive dual purpose (HEDP) round. Lightweight and rugged, the BDM is airdrop-certified and single soldier transportable. The HEDP rocket has a devastating impact on enemy targets, including breaching concrete structures,

The Nammo portfolio

light armoured vehicles, fortified caves and urban construction.

Fuze function (immediate or delayed) is determined automatically during target impact and no gunner action is required. The HEDP rocket detonates immediately upon impact of hard targets while the built-in fuze delay allows for deeper penetration before detonation when hitting soft targets. The BDM launcher includes a mounting bracket for quick attachment and removal of sights such as the AN/PAQ-4 or AN/PEQ-2 laser aiming lights, ACOG or red dot sights, or the Nammo/Crimson Trace quick detach range adjustable visible and IR laser pointers.

SMAW

The United States Marine Corps standard SMAW offers a variety of ammunition choices in a reusable launcher. In addition to being extremely accurate, the SMAW is light yet powerful enough to stop a tank. The war fighter can easily demolish bunkers, breach fortifications and defeat armoured vehicles using the SMAW. The SMAW family of ammunition manufactured by Nammo is well-suited for Military Operations on Urban Terrain (MOUT) scenarios enabling the war fighter to defeat enemy fortifications and other targets with overmatching firepower. The ability to select from one of three different projectiles allows troops to use the best round for the mission.

Realistic training solutions

Sustaining the advantage over adversaries is critical to a soldier's survival in combat. Nammo's realistic and cost effective family of sub-calibre training weapons develops and maintains the skills necessary to be an accurate and confident SLM Gunner. Nammo's specially designed rocket trainer authentically simulates tactical round firing effects including back blast, noise, and signature. Essentially, forces can increase proficiency among their soldiers while reducing overall training costs, since all Nammo systems utilise the same low cost 21mm rocket ammunition. This is the final part of the proven US military training regimen classroom with inert weapons, virtual with video simulation of scenarios, and ultimately live fire marksmanship with 21mm rounds and tactical round target defeat demonstration. The M72, M141 BDM and SMAW sub calibre training system is an ideal solution, allowing soldiers to achieve and maintain superior gunner skills. This 21mm rocket system is unmatched by any other SLM trainer in the world for rapid low cost gunner marksmanship skill building and maintenance.

The 21mm Sub Calibre Rocket Trainer is an outstanding/realistic marksmanship training weapon and its low cost along with unmatched training success rates make it extremely potent. It replicates back blast, noise, over pressure of tactical round and interestingly, one 21mm sub calibre training rocket is used in all Nammo marksmanship training weapons.

Decades of combat proven performance distinguishes the Nammo lightweight, lethal and accurate shoulder launched munitions from all others available to military Forces today. Nammo weapons increase user survivability by providing organic fire power to the squad and platoon when and where it is needed. War fighters recount thousands of instances in which they credit the decisive capability of Nammo SLMs during combat operations.

In effect, Nammo M72, M141 BDM and the SMAW ammunition are combat proven as vital equipment for soldiers in operations. Lethal, accurate and easy to use, the US-Qualified Nammo shoulder launched munitions are versatile fire power for the small unit leader. The Nammo SLM Development Team is close to introducing several new variants of M72 to the market. The company is in the final stages of development and will soon truly satisfy the long standing fire-from-enclosure (FFE) requirement.

With briefing from Nammo

M141 BDM SYSTEM CHARACTERISTICS		M72A9ASM SYSTEM CHARACTERISTICS		M72A7 LAW SYSTEM CHARACTERISTICS	
WEIGHT	7.26kg	WEIGHT	4.3kg	WEIGHT	3.6kg
CARRY LENGTH	813mm	CARRY LENGTH	787mm	CARRY LENGTH	787mm
CALIBER	83mm	CALIBER	66mm	CALIBER	66mm
MINIMUM RANGE	15mm	MUZZLE VELOCITY	150m/s	MUZZLE VELOCITY	200m/s
EFFECTIVE RANGE	500mm	MINIMUM RANGE	15m	MINIMUM RANGE	15m
EXT RANGE SUPPRESIVE FIRE	1000mm	EFFECTIVE RANGE	200m	EFFECTIVE RANGE	350m
NSN	1340-01-443-5477	NSN	1340-01-538-4308	NSN	1340-01-519-8759
DODIC	HA08	DODIC	HA48	DODIC	HA29

Nammo Warheads

The ever changing battlefield landscape requires that Nammo continuously develop new warheads to meet customer requirements. The versatility of Nammo's weapon systems and ammunition allows the war fighter to rapidly adjust to a wide array of ground threats. These variants are currently in production at Nammo for the USA and many customers worldwide:

M72 Warheads

M72A9 ASM, Anti-Structure Munition features anti-structure/ fragmenting case (Aluminised HE) that is essential for light structures (single brick), door opening, and checkpoint security.

M72A5 / M72A7 Anti-Armour Munition (AA) includes M72A5, 300mm RHA Penetration; M72A7, 150mm RHA Penetration and multi-purpose shape charge effects versus all manners of vehicles and buildings.

SMAW Warheads

High Explosive Dual Purpose (HEDP) boasts of "Fire and forget" target-sensing fuze self that discriminates between hard or soft targets and is highly effective against bunkers, light armour, as well as heavy brick and concrete walls.

Novel Explosive (NE) is similar round to the HEDP, with twice the weight of enhanced blast explosive and is a self-discriminating warhead for hard or soft target defeat. High Explosive Anti-Armour (HEAA) attains full penetration of heavy armour from nearly any oblique angle. Common Practice Round (CPR) is an inert warhead full caliber training round.

BDM Warheads

High Explosive Dual Purpose (HEDP)have the same high performance enhanced blast warhead as in the SMAW. Their "Fire and forget" target-sensing fuze self-discriminates between hard or soft targets, and these are highly effective against bunkers, light armour, as well as brick and concrete walls.

The Arrow in Apache's Quiver

In anticipation of the impending deal, the United States Defence Security Cooperation Agency (DSCA) notified Congress on 22 December, 2010 of a possible Foreign Military Sale (FMS) to the Government of India of various engines, equipment, weapons, training, parts and logistical support for a possible Direct Commercial Sale of 22 AH-64D Block III Apache helicopters, which was the only contender ultimately short listed. The complete package is worth approximately $1.4 billion. The notification was made in advance so that, in the event that the AH-64D proposal was selected, the United States might move as quickly as possible to implement the sale. "The proposed sale is projected to contribute to the foreign policy and national security of the United States by helping to strengthen the US-India strategic relationship and to improve the security of an important partner (India) which continues to be an important force for political stability, peace and economic progress in South Asia", stated the release. The attack helicopters later referred to as AH-64E Guardian are set to enter Indian Air Force (IAF) service 2019 onwards.

"To decimate hostile armoured formations and enemy bunker and fortifications," the package includes 812 Lockheed Martin AGM-114L-3 Longbow Hellfire Anti-Tank Guided Weapon (ATGW) plus 542 AGM-114R-3 Hellfire II ATGWs. The Hellfire name comes from its original role as a helicopter-launched fire and forget weapon. The AGM-114L-3, or Longbow Hellfire, is a fire and forget weapon equipped with a Millimetre Wave (MMW) radar seeker coupled with inertial guidance, enabling Lock on after Launch (LOAL) capability; very effective against hostile multiple rolling armour. The MMW radar also rectifies the inherent limitations of Semi-Active Laser Homing (SALH) guidance system by providing capability in adverse weather and battlefield obscurants such as dust, smoke and fog being able to mask the position of the target or to prevent the designating laser from producing a detectable reflection. Besides autonomous homing on targets designated by the Longbow Fire Control system, the missile can also use advanced modes, currently being upgraded to the system, which provide home-in on active jammers that try to degrade or disable the missile. The missile will also receive advanced countermeasures to defeat and cancel jammers. The AGM-114L-3 Longbow Hellfire weighs 49-kg, including the 9-kg tandem shaped charge High Explosive Anti-Tank (HEAT) warhead, and has a range of 12-km against armoured formations and fortified installations. In the close support anti-armour role, the helicopter carries 16 AGM-114L-3 Longbow Hellfire ATGW on four four-rail launchers plus 4 Stinger Block I-92H Air-to-Air Missiles (AAM) for self-protection.

For effective fire control and optimum utilisation of AGM-114L-3 Longbow Hellfire, the AH-64D 'Longbow Apache' is equipped with the Northrop Grumman AN/APG-78 millimetre-wave Fire Control Radar (FCR) capable of performing under poor-visibility conditions, less sensitive to ground clutter, while the short wavelength allows a very narrow beam width, which is resistant to Electronic Counter Measures (ECM). AN/APG-78 additionally, incorporates an integrated AN/APR-48A Radar Frequency Interferometer for passive location and identification of radar-emitting threats. The Longbow Apache can execute an attack in 30-seconds while remaining behind natural terrain if necessary with the radar dome atop the rotor blades unmasked for a single radar scan and then remasked, enabling the processors determine the location, speed and direction of travel of a maximum of 256 targets.

Complementing the AGM-114L-3 Longbow Hellfire will be the multi-purpose 8-km range AGM-114R or 'Romeo' that uses a Semi-Active Laser Homing (SALH) guidance system and an integrated blast fragmentation sleeve (IBFS) warhead likely built around tandem shaped charge HEAT to engage targets that previously needed multiple Hellfire variants. Hellfire II locks on before or after launch and can engage multiple targets simultaneously. The missile uses trajectory shaping to enable optimal performance in degraded weather along with automatic target reacquisition after loss of track in low clouds. The digital autopilot can be reprogrammed in flight, to home in on new targets in when employed in a LOAL mode. Equipped with electro-optical

US Army's AH-64D Longbow Apache, the type soon in 'Indian' colours

countermeasures hardening, the missile is capable of operating with pulsed radar frequency or A-Code laser codes for those aircraft equipped with dual code capability. AGM-114R weighs 50-kg and travels at a speed of Mach 1.3. Laser guidance can be provided either from the launcher, such as the nose-mounted opto-electronics of the AH-64 Apache attack helicopter, other airborne target designators or from ground based observers, the latter two options allowing the launcher to break line of sight with the target and seek cover.

Lockheed Martin has developed the 'Arrowhead' targeting and night vision system for the Apache, using second-generation long-wave Infra Red (IR) sensors with improved range and resolution, and has a targeting Forward Looking Infra Red (FLIR) with three fields of view, a dual field-of-view FLIR, a Charged Coupled Device (CCD) TV camera, electronic zoom, target tracker and auto-boresight.

Sayan Majumdar

Irkut's aircraft and advanced pilot training

Yak-130 combat trainer in flight

Irkut Corporation have expanded the deliveries of one of its bestsellers, the Yak-130 supersonic combat trainer aircraft, across the world. In December 2017, the first six aircraft of this type were inducted into the Myanmar Air Force. With this, the number of countries operating the Yak-130 now is five, which includes Russia, Myanmar, Algeria, Belarus and Bangladesh.

According to the Russian MoD, the Russian Air Force currently operates more than 80 Yak-130s which are slowly replacing their outdated L-39 jets. Irkut has continued to deliver a long-term contract of Yak-130s to the aviation training centres of the Russian Air Force. "In terms of its flight and performance characteristics at subsonic speeds, Yak-130 is closer to the latest ultra-manoeuverable fighters of the Russian Air Force such as the Su-30SM and Su-35."

The Yak-130 is equipped with a wide range of weapons weighing up to 3000 kg, that includes R-73E short-range missiles, precision air bombs with the KAB-500Kr guidance system and a wide variety of unguided aircraft weapons, enabling the aircraft to take on various targets at the same time.

Irkut is also working on increasing the combat performance of the aircraft. At the MAKS-2017 airshow, the Yak-130 was demonstrated with a modernised structure that enables the installation of a laser range finder. It is equipped with 'Talisman-NT' which is designed to significantly improve survival rate of the Yak-130 while carrying out strike missions. It should be noted that a number of Yak-130s operators also use this aircraft for combat missions. For example, Andrei Ravkov, the Belorussian Minister of Defence, stated that the Belarussian Air Force uses the trainer as a "light attack aircraft."

While developing this aircraft, the designers relied on the great experience of 'Yakovlev DB' (part of the Irkut Corporation) in development of light training aircraft. Since 1935, more than 22,000 training piston aircraft (UT-2, Yak-11, Yak-18, Yak-52) have been produced in Russia and abroad. The new 'Yak', like its predecessors, is focused on fulfilling the requirements of wide range of customers, both public and private.

The Yak-152, which is currently in flight testing mode, has higher capabilities than most of the existing competitors. With maximum takeoff weight of 1490 kg, the aircraft is fitted with a diesel engine of 500 hp which operates on aviation kerosene. The Yak-152 is designed for over 10,000 flight hours and is a rugged design.

A unique feature of the Yak-152 is the SKS-94M2-152 ultra-light catapult system, which is a newly installed technology for emergency escape. The escape system is triggered when the handle of the bailout is pulled, the pilot shoots the container with a parachute stacked in it, allowing for the breaking of the cockpit glass and opens the parachute within 0.2 seconds.

Yak-152 trainer in flight

PLAAF operationalises J-10C variant

The Chinese PLAAF have recently operationalised the J-10C fourth-generation multi-role fighter, timed with the 90th anniversary ceremony at Zhurihe military base in Inner Mongolia Autonomous Region. The J-10C reportedly has advanced avionics and new generation weaponry for both land and maritime attack roles. Shen Jinke, a spokesperson for the PLAAF,stated that, "The fighter will enrich the air force's offensive and defensive system and improve its capability to fulfil duties and missions."

RTAF Gripen in MS20 upgrade

The Royal Thai Air Force has been gradually improving capabilities of its Gripen C/Ds since the first six aircraft were ordered as air superiority fighters in 2008. Saab has offered its MS20 upgrade for the RTAF Gripens which includes MBDA's Meteor beyond visual range missile. Thailand is also seeking simulators for its fighter fleet, including those for their upgraded F-16s. Meanwhile, Airbus Helicopter are in discussion with the Thai Navy to upgrade its five H145M helicopters with the HForce weapon system.

Su-35s for Indonesia

Indonesia and Russia have signed a contract for 11 Sukhoi Su-35 (*Flanker-E*) fighters, some four years after the type was selected to replace Northrop F-5E and F-5F Tiger II fighters, reportedly valued at $1.14 billion. The procurement will include an unspecified weapons package and technology transfer to enable Indonesia to establish a maintenance, repair and overhaul capability for these aircraft. Russia will deliver the first two aircraft by October 2018 to No.14 Squadron based at Iswahyudi Air Base in East Java.

Egyptian Rafales

Egypt's intention to acquire another 12 Rafales from Dassault seems to have been delayed over issues on the supply of components for the Scalp cruise missiles Egypt wants to acquire. Egypt has wanted its Rafales to be armed with Mica air-to-air missiles, Scalp cruise missiles and AASM Hammer guided missiles, but there are issues with some US-components in the systems. Meanwhile, half of the 24 Rafales Egypt ordered in February 2015 have been delivered with more expected this year.

Upgrades for Israeli F-35s

Lockheed Martin is to deliver specific upgrades for the Israeli Air Force F-35A *Adir* fleet, being part of a wider Block 3F+ software package, with work to continue until December 2021. A DoD notification said: "This modification provides for the procurement of Israel-unique weapons certification, modification kits and electronic warfare analysis in support of the F-35 Lightning II Israel System Design and Development (SDD) to provide 3F+ fleet capability for the government of Israel under the Foreign Military Sales programme."

Japan's next-gen fighter

The Japanese Government is reportedly reconsidering its earlier plans to develop an indigenous next-generation fighter and are instead examining proposals for further development of an existing Western fighter. Japan's Defence Ministry has issued a request for information (RFI) seeking proposals for the new aircraft, which will be known as the F-3 in service. Japan is expecting to receive proposals for designs based on existing aircraft of British or American origin, the project being estimated at $40 billion. Even as the Japan Air Self-Defence Force (JASDF) is receiving 42 F-35As to replace the ageing Phantoms, it needs additional fighters from around 2030 to supplant its F-2 fighters. Earlier, Mitsubishi Heavy Industries (MHI) flew its X-2 stealth technology demonstrator under the advanced technology demonstrator experimental (ATD-X) programme which has been under test at Gifu, home of the JASDF's Air Development and Test Wing.

In related news, the Japan Air Self Defence Force is reportedly considering procurement of another 20-25 F-35As to its planned procurement. The JASDF's 3rd Air Wing is the initial unit to operate the F-35A at Misawa Airbase.

MS20 upgrade for Czech Air Force Gripens

The Czech Air Force has completed the MS20 capability upgrade of its fleet of Gripen fighters, enhancing combat and communication capabilities. The MS20 upgrade improves

the Gripen's ability to engage ground targets by incorporating unguided and laser-guided bombs into the weapons load with air-to-air capability enhanced by introduction of new radar modes. Another key element is integration of the targeting electro-optical pod Litening III, which will be used not only for guiding missiles and bombs, but also in aerial reconnaissance and combat. The upgrade also implements the Alliance datalink, Link 16, as well as cryptomodules for covert communication.

More Typhoons for Saudi Arabia

Saudi Arabia is close to ordering a follow-on batch of 48 Eurofighter Typhoons, with a memorandum of intent (MoI) signed on 9 March. Saudi Arabia had in 2007 ordered 72 Typhoons for some $41 billion. The first 24 aircraft were built by BAE Systems at its Warton production facility, after which it was planned that the remaining 48 be assembled in Saudi Arabia by the Alsalam Aircraft Company. In the event, all 72 aircraft were built in the UK, but there is no related decision on the next batch.

Su-57 FGFA developments

Russia had reportedly deployed two examples of its Su-57 fifth-generation fighters to Hmeymim Air Base in Syria's Latakia province. The two stealth fighters were escorted by a Su-30SM but departed three days later and it is unclear whether the deployment was related to on-going tests and evaluation of the aircraft. Earlier, Russia's Deputy Defence Minister Yuri Borisov announced that the Su-57 had completed its first stage of flight acceptance tests, being flown by contractor test pilots and that the defence ministry

was close to signing a contract for a pre-production batch of 12 Su-57s. Nine flying prototypes are currently undergoing tests and the first two pre-production aircraft could enter VKS service next year, according to Borisov.

China's Su-35S fully operational

According to authoritative reports, the Su-35S multi-role fighter is now "fully operational" with the People's Liberation Army Air Force (PLAAF). China had ordered 24 Su-35S fighters in November 2015 at a cost of around $2bn, deliveries to the PLAAF beginning December 2016. The first four examples in the initial batch flew from their factory airfield at Komsomolsk-on-Amur to a PLAAF training base at Cangzhou, 112 miles (180 km) south of Beijing, carrying on to Suixi, home of the 6th Brigade, which is assigned to the strategically important Southern Theatre Command. Five more Su-35s were delivered in March 2017 and another five followed in December.

More Yak-130s for Myanmar

Myanmar is to receive six more Yak-130 advanced jet trainer/light attack aircraft in addition to those in the initial contract for an undisclosed number of the type in June 2015. The first three were delivered in February 2017 and another three were inducted into service in December. Russian sources have confirmed that the contract for a second batch of six aircraft was signed in December.

First A330MRTT for Singapore

Singapore's first Airbus A330-243MRTT, of six ordered in March 2014, will lead the ceremonial flypast over Singapore on 1 September 2018. According to Major General Mervyn Tan, Chief of the Air Force, "Training will be commencing soon for the first batch of aircrew and maintenance crew, and its operationalisation is expected to be achieved in the following few years."

Canada to rejoin NATO AWACS force

The Government of Canada has announced its rejoining of the multinational NATO Airborne Early Warning and Control Force flying E-3A Sentry Airborne Warning and Control System (AWACS) aircraft. The size of the force was reduced to 14 operational aircraft following Canada's announcement in 2011 of its planned withdrawal from the force because of budgetary concerns. However, the RCAF has maintained a cadre of AWACS-qualified personnel since it stopped flying with the NATO force in 2014 by integrating them with US Air Force crews.

Dutch Apaches raised to AH-64E standard

The US State Department has approved Foreign Military Sale to the Netherlands of items and services to support the upgrade/remanufacture of its AH-64D Block II Apache attack helicopter to AH-64E configuration. The estimated cost of the work is $1.191bn, including that for four engines, targeting and other systems. The deal, revealed on 20 February by the US Defence Security Cooperation Agency, still awaits approval from Congress. Twenty-eight AH-64D Block IIs are involved in the standard revision, also known as Apache Guardian and will include bringing the 51 remaining engines to T700-GE-701D standard (42 engines to be installed, plus nine as spares).

US Defence Budget for FY 2019

The US President has recently presented the Congress with a proposed Fiscal Year (FY) 2019 budget request, which includes major investment in emerging technologies even as the US military seeks to shift emphasis from 'counter-terrorism operations' to potential 'great-power competition.' The two-year budget agreement includes $700bn of defence funding in Fiscal Year (FY) 2018 and $716bn in FY 2019. Major aerospace programmes in the budget include procurement of 77 F-35As (48 for USAF and 29 for US Navy); 15 KC-46s, 24 F/A-18s; 60 AH-64Es (12 new built and 48 remanufactured); 6 VH-92s; 10 P-8As and 8 CH-53Ks.

The US Navy is set to receive $19 bn for aircraft programmes, an increase of 26%. The Navy has requested 120 new aircraft for 2018 and wants to buy 110 more F/A-18E/Fs over the next five years, while continuing efforts to extend the service of its Super Hornets, including the airframe life extension, conformal fuel tanks, new computers and advanced cockpit displays. R&D funds for the US Air Force amount to $30.4 bn, which will fund programmes including the B-21 bomber and the Next Generation Air Dominance (NGAD) 'family of systems.' Other efforts will help develop hypersonic strike weapons (both the Hypersonic Conventional Strike Capability and the Air-Launched Rapid Response Weapon), autonomous technology including swarming drones, cyber-integrated defences, electronic warfare, artificial intelligence and directed energy. The USAF will also continue efforts to field a high-energy laser with a fighter.

The increasing focus on 'near-peer' foes is reflected in the emphasis of modernised nuclear weapons, including purchase of precision-guided tail-kits for the B61-12 tactical nuclear bomb and development of the AGM-180/181 Long Range Standoff Weapon (LRSO, $0.6bn) that will arm the B-21 and B-52H. For the latter bomber, a long-awaited re-engining programme should be kick-started with the help of $399m of funding. The Stratofortress is set to outlive the B-1B and B-2A, according the Air Force's new 'bomber vector' proposal, which envisages incremental retirement of the Lancer and Spirit once the B-21 arrives in the mid-2020s. The Air Force had previously intended to operate the B-1 and B-52 until 2040, with the B-2 continuing till 2058. Surprisingly, the US aims to reduce planned purchases of the F-35 in the short-term, down from 341 to 329 aircraft in FY 2018-21.

French Defence budget increased

The French *Loi de Programmation Militaire* (LPM or Military Planning Act), covering the period 2019-2025 has been presented to the Council of Ministers for consideration and includes the proposal for a major increase in defence spending. Total expenditure over the period is scheduled to be €295bn, of which €198bn has been budgeted for during the present five-year government term between 2019 and 2023. The LPM provides for the delivery of 28 new-build Rafales to the *Armée de l'Air* (French Air Force) between 2022 and 2024, while 30 more of the type will be ordered in 2023 for delivery by 2030. Efforts to further improve the Rafale's capabilities will include developing the F4 standard, work on which is to be launched this year. A mid-life upgrade of the ASMPA missile will also be carried out. Additionally, the air force will benefit from the delivery of 55 refurbished and upgraded Mirage 2000Ds. Hand over of A330 MRTT aircraft will be accelerated, compared with previous planning, with 12 due to arrive by 2023 and a further three expected to be ordered, taking the total MRTT fleet to 15 by 2025.

The tactical transport fleet renewal will continue, with 11 A400Ms due to be accepted during the period, along with the final two C-130Js in 2019. All 14 existing C-130Hs will undergo modernisation, although a programme to replace them will be initiated by 2030. An avionics retrofit and modifications to the four E-3F AWACS aircraft will ensure full interoperability with NATO forces, even as the search for replacements will begin by 2035.

The LPM will also consider a *Systéme de Combat Aérien Futur* (SCAF, Future Air Combat System), which will be a co-operative programme , with development of certain elements begun during this time period. The SCAF will comprise interconnected platforms and armament, centred on a multi-role combat aircraft covering the entire spectrum of operations, targeted for service entry by 2040. As for UCAVs, joint studies with Germany, Spain and Italy will continue with a view to launching a European MALE (Medium-Altitude Long-Endurance) UAV programme next year and delivery of the first system in 2025. It is planned to have eight MALE UAV systems in operation by 2030. The first three Patroller tactical UAV systems will be handed over and it is intended to have up to five in the French Army inventory by 2030. In addition, 15 UAV systems will be ordered for the French Navy, with entry into service planned for 2028. Light tactical UAVs, with multi-sensor intelligence capabilities and a weapons option, will be acquired for the special forces in 2019. The French Navy's 18 Atlantique 2s will be upgraded even as a programme will begin to search for a replacement. Under the *Charge Universelle de Guerre Électronique* (CUGE) programme, three Dassault Falcon dedicated electronic warfare aircraft will be acquired to replace the two ageing C-160G Gabriele aircraft currently employed in the role.

First USAF T-Xs to be based at San Antonio

The US Air Force has announced that the forthcoming Advanced Pilot Trainer (T-X) will initially replace the T-38C Talon at Joint Base San Antonio-Randolph, Texas as the preferred location for the first T-X aircraft, which is scheduled to arrive in 2022. The T-X will thereafter replace the T-38 at other undergraduate pilot training bases, including Columbus Air Force Base, Mississippi; Laughlin AFB, Texas; Sheppard AFB, Texas and Vance AFB, Oklahoma. Final decisions on locations are dependent on the outcome of environmental analyses. Stationing the T-X at San Antonio-Randolph, which is the base for USAF instructor pilot training will facilitate T-X instructor pilots orientation before the transition to T-X training at other flying training locations. The USAF expects to award a contract for the new trainer aircraft later this year.

Canada shortlists future fighter contendors

Canada has released a list of eligible OEMs that will be invited to submit proposals under the competition to replace the Royal Canadian Air Force's (RCAF's)fighter fleet with 88 new aircraft. The statement from Canada's Public Works and Government Services has listed Dassault Aviation (Rafale), Lockheed Martin (F-35A), Boeing (F/A-18E/F), Saab (Gripen E/F) and the UK government/ Airbus Defence and Space (Typhoon). The competition invites eligible suppliers to submit proposals in spring 2018 which will be assessed on cost, technical requirements and economic benefits. A contract award is anticipated in 2021 or 2022, with the first aircraft to be delivered in 2025.

More Typhoons delivered to Oman

Another two Typhoons for the Royal Air Force of Oman (RAFO) have been delivered, which bring total RAFO deliveries now to ten, from an order for 12 aircraft, three twin-seaters and nine single-seaters. The Sultanate of Oman had announced its decision to purchase 12 Typhoons along with eight Hawk Mk166 trainers in December 2012.

Additional Rafales for Qatar

Qatar is to purchase 12 additional Rafale fighters, with a contract signed on 7 December 2017 at Doha in the presence of the President of the French Republic, Emmanuel Macron and Sheikh Tamim bin Hamad Al Thani. This follows the contract signed on 4 May 2015 between Qatar and Dassault Aviation for the acquisition of 24 Rafales. Once these two batches have been delivered, the Qatar Emiri Air Force will operate a total of 36 Rafale omni-role fighters.

All Black Hawks delivered to Jordan

Jordan has taken delivery of the last of 12 new UH-60M Black Hawks, deliveries of which began in March 2017. The Black Hawks from the final shipment were formally accepted by the Royal Jordanian Air Force (RJAF) during a ceremony at Zarqa/King Abdullah II Air Base in Jordan on 28 January. As part of the strategic partnership between the US and Jordan, US Congress appropriated $470m last year for the Jordanian Armed Forces and RJAF, which has financed training for pilots, crew chiefs and maintenance technicians, as well as providing spare parts, ground equipment weapons, ammunition and shelters for the Black Hawks.

More Ka-52s planned

The Russian defence ministry is to place orders for an additional 114 Ka-52 attack helicopters under the State Armaments Programme for 2018-2027. The announcement was made by Deputy Defence Minister Yuri Borisov, who said that the helicopters will receive new long-range missiles and an improved optical-sighting system. The first six new Ka-52s should be delivered before end of the year.

Additional Sea Hawks for Singapore

The Republic of Singapore Air Force (RSAF) took delivery of two S-70Bs in late January which join six others of the Republic of Singapore Navy (RSN) but operated by the RSAF's 123 Squadron at Sembawang Air Base. The latest pair retains the same sensor suite as the previous six (APS-143 surveillance radar, AAS-44 electro-optical/infrared (EO/IR) sensor and the L-3 HLRAS dipping sonar). However, they incorporate an improved Block 2 avionics configuration, which includes upgraded hardware and software systems, an automatic identification system, as well as a joystick controller in the cabin to enable the tactical co-ordination officer and sensor operator to control the EO/IR sensor.

Safran engines for Qatar NH90s

Qatar has selected Safran Helicopter Engines as engine supplier for its new 28 NH90 military helicopters, whose acquisition was announced on 14 March. These are RTM322 engines, to be assembled in Bordes (France) and delivered to Airbus Helicopters' facility in Marignane, where the NH90 tactical transport version (TTH) is assembled, and to the Leonardo Venice-Tessera facility in Northern Italy for integration with the naval (NFH) configuration. Safran Helicopter Engines now power 80% of the worldwide NH90 fleet.

51 UH-72A Lakotas for US Army

The United States Army has contracted Airbus Helicopters for a total of 51 UH-72A Lakotas, for which Safran Electronics & Defense, Avionics USA, LLC supplies critical avionics systems. The awards came in two contracts with the initial award for 35 UH-72A Lakotas and a contract modification to deliver an additional 16 shipsets. More than 423 Lakotas have been delivered with the Safran avionics package consisting of the autopilot system, the Attitude & Heading Reference System (AHRS) and a data acquisition unit since the programme began in 2005.

26 Leonardo helicopters for China

The Sino-US Intercontinental Helicopter Investment of China has signed contracts for additional 26 helicopters, including 7 AW119Kx single-engine, 15 AW109 Trekker light twins and 4 AW139 intermediate twins with deliveries expected to start this year through to 2019, the contracts valued in excess of $120 million. The orders follow a series of contracts, particularly for EMS helicopters, signed by Sino-US in recent years which include 25 AW119Kx single-engines and a mix of 30 AW139s and AW169s in 2016, followed by 10 AW109 Trekkers in 2017.

First 787-10 Dreamliner for Singapore Airlines

On 26 March 2018, Boeing and Singapore Airlines marked delivery of the world's first Boeing 787-10 in commercial service. Like the other 787 Dreamliners, the 787-10 is designed with strong, lightweight composites, the most advanced systems, and comfortable cabin features. The 787-10 features a longer fuselage which accommodates some 40 more passengers or a total of 330 seats in a standard two-class configuration. Singapore Airlines, through its subsidiary Scoot, already flies the 787-8 and 787-9 Dreamliners with Singapore Airlines having 68 additional Boeing widebody jets on order, including 48 more 787-10s, and 20 of the new 777-9s.

Qatar takes first A350-1000

Qatar Airways is Airbus A350-1000 launch customer and has accepted its initial aircraft in Toulouse, from where the aircraft flew to the airline's Doha hub then onto London Heathrow. This is the first of 37 A350-1000s for Qatar Airways whose configuration is 327 seats (46 business class, 281 economy) 44 more than its 283-seat A350-900s. The A350-1000 is Airbus' largest widebody twin jet airliner with 8,000 nautical miles (14,800 km) range. Powered by Rolls-Royce Trent XWB-97 engines generating 97,000lb (431kN) thrust, having a modified trailing edge and a six-wheel, main landing gear, Cathay Pacific Airways will be the second A350-1000 operator.

HAIG Y-12Es for Nepal

AVIC Harbin Aircraft Industry Group (HAIG) of China continue their successful exports of twin turboprop Y-12E aircraft, the latest customer being Nepal, which has recently accepted two more aircraft on 17 April 2018. These join two Y-12Es procured in 2014 and 2017, being used for commuter operations in difficult terrain. The Y-12 family of aircraft are presently operating in more than 30 countries including the United States and Russia.

Double A400M delivery

Airbus has recently delivered two A400M new generation airlifters to two different countries (Germany and France) in a single day. The company handed over the aircraft at Seville in Spain on 20 March to the European Organisation for Joint Armament Cooperation (OCCAR), who manage the A400M Programme.

Dassault Aviation launches Falcon 6X

Dassault Aviation have unveiled their Falcon 6X, "the most spacious, advanced and versatile twinjet in business aviation" on 28 February 2018. This new 5,500 nm-range aircraft will make its first flight in early 2021 with deliveries to begin in 2022. Pratt & Whitney Canada's Pure Power PW800 engines have been selected to power the Falcon 6X "that offers the largest, quietest and most comfortable cabin of any aircraft in its class and more cabin volume than any other Falcon ever designed". The Falcon 6X is equipped

with the industry's most advanced digital flight control and cockpit technologies, drawing on heritage from other recent Falcon models and fighter jet programmes.

Adjusted production rates for A380 and A400M

Airbus has recently confirmed "the formal adjustment of production rates" for its A380 and A400M programmes. The revised plan presented to the European Works Council involves the production of six A380s and eight A400Ms per year starting from 2020. Such adjustment of the A380 production rate follows a recent order which provides visibility on the programme for years ahead: "at a baseline of 6 deliveries per year, Airbus can produce the A380 in an industrial efficient way over the coming years," which baseline allows Airbus to pursue further sales campaigns which may well lead to higher production levels. On the A400M programme, production will be adjusted to eight units per year as of 2020, following production of fifteen A400M in 2018 and eleven units in 2019, this adjustment based on discussions with the A400M Launch Customer Nations.

Airbus A321LR in record-breaking flight

The Airbus A321LR variant has recently made a record-breaking flight from Mahé in the Seychelles islands to Toulouse, in France, covering a total distance of 4,750 nautical miles in 11 hours. This was in late March as part of the A321LR's 100-hour flight test and certification programme. To make flight conditions as realistic as possible while evaluating cabin systems, the A321LR carried 162 human heat-replicating dummy passengers in addition to its 16-member test crew. According to flight test engineer Jim Fawcett, the A321LR's flight characteristics and fuel consumption "were as expected throughout the lengthy trip."

Congo orders Chinese ARJ21s

The Government of Congo has ordered a COMAC ARJ21-700 in VIP configuration with delivery scheduled for 2023. The order is part of a contract that also includes two of the type for delivery this year to Air Congo. While Government of Congo interest in the ARJ21 dates back to 2014, this deal was revealed after a delegation recently visited China for a test flight on a Sichuan Airlines ARJ21 from Chengdu.

Lion Group orders LEAP-1A engines

Transportation Partners, the leasing arm of Lion Group, and CFM International have finalised an order for 380 LEAP-1A engines to power Airbus A320neo/A321neo aircraft. In addition to the LEAP-1A engines, Lion Group has also ordered 544 LEAP-1B engines to power its Boeing 737 MAX 8, MAX 9, and MAX 10 aircraft, of which 10 are currently in service with Lion Air. With a fleet of 924 LEAP engines at a total value of $13.4 billion in service or on order, Lion Group is the largest LEAP engine customer in the world.

MQ-9B Protector for the UK

General Atomics Aeronautical Systems has been awarded Foreign Military Sales contract by the US Air Force Life Cycle Management Centre for the United Kingdom MQ-9B Protector unmanned aircraft system programme, which provides for integration and component level testing for UK-specific enhancements to support the MQ-9B Protector programme. GA-ASI performed the first flight of the MQ-9B configuration less than two years ago, and the Remotely Piloted Aircraft (RPA) has continued to meet a series of key qualification milestones.

Other important MQ-9B milestones were achieved in 2017, including the first FAA-approved flight for a company-owned RPA through non-segregated airspace without a 'chase aircraft,' when the RPA flew from Yuma, Arizona to Gray Butte, California in August 2017. Upcoming aircraft qualification milestones include lightning protection tests, which are expected within the next 60 days. A weaponised variant of the system is being acquired by the Royal Air Force (RAF) under the UK's MQ-9B Protector programme. The MQ-9B Protector can fly in excess of 40 hours with airspeed up to 210 knots, reach altitudes of more than 40,000 feet, and carry 4750lbs (2159 kg) of external payload.

Flight Deck capability for MQ-25

General Atomics Aeronautical Systems have demonstrated aircraft carrier deck handling to include taxi capability and transition to the launch and recovery phases using a Predator® C Avenger® jet aircraft as a surrogate. As part of the proposed MQ-25 solution, GA-ASI has demonstrated that the new carrier-based unmanned tanker can integrate with the complexities of existing flight deck operations. Specifically, MQ-25 deck operations will use specially designed director wands that are the same size, shape, and weight as those used currently. Directors control aircraft taxi operations on deck, including lowering/raising the launch bar, spreading/folding the wings, and raising the arresting hook. GA-ASI employs unique gesture recognition algorithms in the wands that recognise standard Naval Air Training and Operating Procedures (NATOPS), flight deck director hand gestures and then translates and sends those commands to the MQ-25 air vehicle. MQ-25 receives the commands and converts them into the appropriate aircraft actions.

Thales RBE2 radar for Rafales

Thales has delivered the 200th RBE2 electronic scanning radar, its teams having applied solid technological expertise in development of this electronic scanning radar with active array technology to customise the radar to the tactical missions carried out by Rafale combat aircraft. The RBE2 features state-of-the-art digital technologies, offering pilots greater flexibility in reconnaissance missions. The RBE2 is Europe's first active electronically scanned array (AESA) radar. Technology development for the RBE2 radar commenced in the 1990s, and the first Rafale equipped with the system was delivered to the French defence procurement agency (DGA) in 2012. All Rafales now exported incorporate this active array technology.

Russian Helicopters tests VRT300 UAV

VR-Technologies design bureau, part of Russian Helicopters (part of Rostec State Corporation) have started bench tests of the main systems and assemblies of VRT300 unmanned helicopter, with flight tests scheduled by the end of 2018.To date, functional and technical configuration of civil unmanned helicopters has been agreed with a range of Russian companies and authorities, this configuration becoming the basis for development of a flight prototype with MTOW of 300 kg. This will be a flying test-bed for testing of UAVs systems and equipment, as well as for its interaction with payload elements and ground-based monitor and control equipment. VRT300 system is developed in two versions: *Arctic Supervision*, equipped with a side-view radar for ice reconnaissance and operation in Arctic conditions and *Optic* vision, with increased flight range to perform monitoring and remote sensing missions. With a large payload of 70 kilograms the aircraft can transport urgent cargo, such as food and medical supplies and be engaged in 'search-and-rescue operations' particularly for scientific Polar stations.

CAMM completes qualification trials

MBDA and Lockheed Martin have jointly completed qualification of MBDA's Common Anti-air Modular Missile (CAMM) from Lockheed Martin's Extensible Launching System (ExLS) 3-Cell Stand Alone Launcher following a series of trials. ExLS is a low-cost alternative for integrating new missiles and munitions into naval surface combatants leveraging Lockheed Martin's proven Mk 41 Vertical Launching System (VLS) design and electronics. MBDA's CAMM is a highly compact missile that enables multiple weapons to be fitted in limited spaces, considered as the most modern air defence missile of its class on the market When operated from ExLS or MK 41 VLSD, CAMM comes in a quad-pack arrangement which allows to store and fire 4 missiles from a single containers.

New contracts for IAI's Tac4G communication system

Israel Aerospace Industries (IAI) has recently received several new contracts for Tac4G, its tactical communication system. Concurrently, IAI has announced that several new capabilities have been added, including Tac4G's integration in tactical UAVs and additional platforms. The unique communication system has been developed by ELTA, IAI's Intelligence and reconnaissance Division.

100th IAI-Elta Multi-Mission Radar System acquisition

IAI-ELTA marked the 100th ELM-2084 Multi-Mission Radar (MMR) family acquisition at an event and exhibition held in ELTA facilities in Ashdod, Israel, with participation of senior MOD and military officials, military attaches, and current users worldwide. Initially developed for the Israeli Defence Forces and improved for the 'Iron Dome' interception system a decade ago, the MMR

family has evolved throughout the years to offer capabilities for air surveillance, air defence, C-RAM and Artillery Hostile Weapon Location and Friendly Fire Ranging. MMR is a main sensor of 'Iron Dome', 'David's Sling, and IAI's land-based 'Barak' weapon systems "that have changed the modern battlefild." The Barak is a land and naval short to long range point and area defence missile system and has been proven through more than 1500 operational intercepts in battle since 2011. This continues to be improved through lessons learned during past conflicts and updated technologies.

Carl-Gustaf ammunition for FMV

Saab has signed a framework agreement with the Swedish Defence Materiel Administration (FMV) to enable efficient procurement of ammunition for the Carl-Gustaf weapon system allowing FMV to purchase every kind of combat and training ammunition available, as determined by the needs of the Swedish Armed Forces. "With this framework agreement, which enables FMV to place orders for ammunition for a minimum of three years with a potential for extension to four years, the terms and conditions are set for any ammunition procurement, regardless of quantities."

Elbit Systems' Seagull USV in joint exercises

The Seagull which is Elbit Systems Unmanned Surface Vessel (USV) participated in a joint Anti-Submarine Warfare (ASW) exercise of the Israeli and the French navies, recently held in the Mediterranean. Under the Israeli Navy command, an ASW force that included two Israeli ASW vessels, a frigate and an ASW helicopter of the Marine National and the Seagull, performed ASW missions against an Israeli Navy submarine. The joint force then simultaneously operated manned and unmanned surface and airborne vessels, practicing advanced means and tactics for submarine detection and deterrence.

China's new aircraft carrier 001A

China's second (and first indigenous) aircraft carrier, which is still unnamed but referred to as 001A is likely to begin preliminary sea trials in summer 2018 even as there are plans to design and construct much larger nuclear-powered carriers.

China's first carrier, *Liaoning*, bought from the Ukrainians has been used for operational training and has a 14 degree ski ramp, and embarks 24 fighters, while 001A will embark 35 aircraft with a lower (12 degrees slope ramp). The two ships are dimensionally very similar, with the newer ship some 30 feet longer than the original. Both weigh about the same, or 55,000 to 60,000 tons. According to intelligence reports, the Chinese have a long-term plan for six carrier strike groups, with at least two of them to be nuclear-powered.

LM's LRASM tested

Lockheed Martin has flight-tested a production-configuration Long Range Anti-Ship Missile (LRASM) from a US Air Force B-1B bomber of the 337th Test Squadron over the Sea Range at Point Mugu, California, impacting the maritime target and meeting test objectives. "LRASM is designed to detect and destroy specific targets within groups of ships by employing advanced technologies that reduce dependence on intelligence, surveillance and reconnaissance platforms, network links and GPS navigation in electronic warfare environments. LRASM will play a significant role in ensuring military access to operate in open ocean/blue waters, owing to its enhanced ability to discriminate and conduct tactical engagements from extended ranges."

Leonardo's Falco exceed 15,000 flying hours

Leonardo's Falco family of Remotely-Piloted Air Vehicles (RPAS) have collectively logged more than 15,000 hours of operational flight. Since its maiden flight in 2003, more than 50 Falco family RPAS have gone into operation around the world with five customers. While some users choose to operate the surveillance and intelligence-gathering platform independently, others opt for Leonardo to own and operate its own Falco aircraft and provide surveillance data as an air service provider. This latter model is becoming increasingly popular, with a reference customer being the United Nations. Leonardo has flown Falco RPAS for thousands of hours over its first four years of support for the organisation's humanitarian MONUSCO mission.

Yakovlev Design Bureau set world records with the Yak-130

Fédération Aéronautique Internationale have registered a number of records set by the test pilots of Yakovlev Design Bureau flying the Yak-130 combat trainer. The batch of the record flights was performed at the airfield of Gromov Flight Research Institute from 17 to 26 October 2016. The flight crews included test pilots Oleg Kononenko, Oleg Mutovin, Andrey Voropaev and Vasily Sevastianov. Several Russian and world records were set for this class of land-based turbojet aircraft with take-off weights between 6,000 to 9,000 kg. As Roman Taskaev, Yakovlev Design Bureau's Deputy Director General for flight tests, noted: "Record flights have demonstrated both outstanding capabilities of Yak-130 aircraft and the professionalism of our test pilots."

Raytheon's Patriot for Romania

The US Army has awarded Raytheon a contract for production of Romania's Patriot Air and Missile Defence System. Raytheon's Patriot is a missile defence system consisting of radars, command-and-control technology and multiple types of interceptors, all working together to detect, identify and defeat tactical ballistic missiles, cruise missiles, drones, advanced aircraft and other threats.

Overhauling of Canadian Navy Phalanx Close-in Weapon Systems

Raytheon Canada Limited is overhauling and providing in-service support for the Phalanx Close-In Weapon Systems operated by the Royal Canadian Navy. Raytheon produces the Phalanx, a

rapid-fire, computer-controlled radar and 20mm gun system that automatically acquires, tracks and destroys enemy threats that have penetrated other ship defence systems, with more than 890 systems built for navies around the world. Under the $330 million contract by Public Services and Procurement Canada, RCL, working with Raytheon Intelligence, Information and Services, will "provide maintenance, fleet technical support, repair and overhaul services on the Phalanx mounts which will ensure the systems are ready to address current and emerging threats." Work under the contract, which was signed November 2017, will be conducted in Raytheon Canada Limited's Calgary facilities. RCL has supported a broad range of Canadian defence and technology programmes for nearly 25 years.

Lot 1 production of SDB IIs completed

Raytheon has completed Lot 1 production of the Small Diameter BombII, "a new weapon that will give fighter pilots the ability to destroy moving targets at any time and in all-weather conditions."

The US Air Force has also contracted with Raytheon to produce Lots 2 and 3. The SDB II bomb is a gliding precision weapon with a unique tri-mode seeker that uses millimeter wave radar, uncooled imaging infrared guidance and semi-active laser guidance to acquire targets. The weapon's two-way datalink allows it to receive in-flight target updates. Once fielded, SDB II will enable pilots to engage more targets at ranges greater than 40 miles using fewer aircraft. Raytheon is producing SDB II bombs at the company's fully-automated manufacturing facility in Tucson, Arizona, with the programme nearing completion of developmental testing.

Anti-air Warfare Defence Technology for Australian Navy

Raytheon has completed design, development and testing of its Cooperative Engagement Capability (CEC) system, which will be certified by the US Navy for the system's first international installation. Onboard the Royal Australian Navy's HMAS *Hobart*, CEC will expand the ship's battlespace awareness by sharing sensor data among a network of other Australian and allied CEC-equipped ships and aircraft. CEC is a real-time 'sensor-netting' system that brings together radar data into a single integrated air picture from geographically dispersed ships, aircraft and ground-based units. This integrated picture improves task force effectiveness by enabling longer range, cooperative, or layered engagements. The CEC benefits from advancements in commercial and specialised technologies, as well as from the experience and expertise the Raytheon team has gained through more than 30 years as the US Navy's CEC Design Agent.

The equipment - certified hardware and software - will be transfered to Australia for installation on HMAS *Hobart* (DDG-39), and NUSHIP *Brisbane* (DDG-41) followed by an extensive integration, test and evaluation period. Raytheon is to actively support CEC system integration and testing, including scheduled sea trials, similar to support provided for the US Navy fleet. Enhancing the capabilities of US forces, CEC is currently deployed on ships and land-based test sites, E-2C/D aircraft and US Marine Corps network systems.

Passing of a legend

Dassault Aviation pays tribute to Serge Dassault (1925-2018)

"Serge Dassault has devoted his life to aeronautics and the French industry. He has defended with passion and determination Dassault Aviation and its employees, with the sole ambition of long-term viability of the French wings", expressed Eric Trappier, the Chairman and CEO of Dassault Aviation.

Serge Dassault was born in Paris on 4 April 1925 and passed away on 28 May 2018. His adult life began dramatically when, in early 1944, he was imprisoned by the Gestapo along with his parents and brother at Montluc near Lyon, and then at Drancy, from where prisoners were sent to the death camps. The Nazis thought they could thus force his father Marcel Dassault to place his aircraft designer skills at service of the Third Reich. Marcel Dassault refused and was deported to Buchenwald in August 1944, from where he miraculously returned in May 1945. After this traumatic experience, Serge was always attentive to humane matters as also to national sovereignty.

After graduation from the *École Polytechnique* and the *École Nationale Supérieure de l'Aéronautique*, Serge Dassault joined the design office at *Générale Aéronautique Marcel Dassault* in 1951. He became manager of the flight test department in 1955 and, as such was involved with a large number of military aircraft (Super Mystère B2, Étendard, Mirage III and Mirage IV). Appointed as Head of Export, he led the negotiations that resulted in the sale of Mirage III aircraft to Switzerland and Australia. Serge Dassault also launched the Mystère 20 (now Falcon jet) sales campaign in the United States.

In 1963, he took over senior management of the company *Électronique Marcel Dassault*1, where he was appointed Chief Executive Officer on 10 October 1967 and held this position until 23 December 1986. Then, from 29 October 1986 to 4 April 2000, Serge Dassault was Chairman and CEO of *Avions Marcel Dassault - Breguet Aviation* (which became Dassault Aviation in 1990), eventually becoming its Honorary Chairman. Since 2 December 1987, Serge Dassault had also been Chairman and CEO of *Dassault Industries*, which became the *Groupe Industriel Marcel Dassault* on 1 January 2000.

Under his leadership, Dassault Aviation consistently developed and implemented policies aimed at adapting to new market realities and led the Company in rising to the challenges of the 21st century. Under his watch emerged innovative aircraft types to meet new customers' requirements, notably the modernised Super Étendard, the Mirage 2000-5, the Mirage 2000D and the new generation Rafale as concerned combat aircraft types while business jets encompassed the Falcon 2000, the Falcon 900EX, the Falcon 50EX, the Falcon900C and multi-mission Falcons of the Falcon family.

These programmes ensured continuity in the company's reputation for excellence and successfully met many challenges, be it exports of the Rafale fighter, the first European combat drone demonstrator nEUROn or the widening of our range of Falcon business jets with the introduction of the 7X, the 8X and now, the 6X.

Under his guidance, and with the help of Charles Edelstenne, Serge Dassault restructured and modernised the industry while maintaining the company's social ethos. Notably, Serge Dassault ensured that 'every employee benefited from the efforts made, distributing incentives and profit-sharing far in excess of what the law required.

In 1975, after serving as Treasurer of the trade union *Union Syndicale des Industries Aéronautiques et Spatiales* (USIAS), which subsequently became the *Groupement des Industries Françaises Aéronautiques et Spatiales* (GIFAS), Serge Dassault was appointed General Commissioner of the International Paris Air Show at Le Bourget, thereafter successfully coordinated organisation of no less than ten Paris Air Shows.

He presided over GIFAS from 1993 to 1997, and in addition, was president of the French Council of Defense Industries (CIDEF) between 1994 and 1996, vice-president of the European Association of Aerospace Industries (AECMA) from 1994 to 1997, Chief Armaments Engineer (reserve corps), a graduate of the *Centre de perfectionnement des affaires* business school and a former auditor of the public administrative establishment *Institut des Hautes Études de Défense Nationale* (IHEDN), Serge Dassault was also awarded the Aeronautics Medal and became a *grand officer* of the Legion of Honour.

Beyond his position as a CEO, the employees of Dassault Aviation salute his passion for aeronautics, his human vision of entrepreneurship and the relentless support he provided, as a majority stakeholder, to the Company's strategy. Such passion, human vision and management stability are the core strengths of Dassault Aviation and will remain so tomorrow.

Frisian Flag 2018

The Leeuwarden Air Base in the Netherlands (ICAO code EHLW), hosted the annual *Frisian Flag* 2018 exercise, was held from 9 to 20 April 2018. Over these two weeks, participants executed a mix of air-to-air, air-to-ground and air-war exercises. A realistic international cooperation was one of the major aims of this exercise since many international operations were conducted by multinational taskforces, with different aircraft types, following different tactics, doctrines and training-levels, with different command-chains and different air-refueling procedures and certifications.

Each day, two missions were flown with 40-50 aircraft and missions became increasingly complicated as the exercise progressed. All participating countries played the role as mission-commander for mission and all countries also brought in their tactics, doctrines and lessons learned from previous exercises and real-war experiences.

As there were two missions per day, preparations for the morning-missions started on the day before and ended with a mass-briefing early in the morning and similarly, afternoon missions were conducted. There were flown offensive and defensive air-to-air missions and offensive and defensive air-to-ground missions twice a day with some 40-50 aircraft airborne each mission. Since air-to-air refueling was the part of the exercise, the planners and mission-commanders kept a close eye on that and made sure it was done timely, though it was not really needed since target area was close to Leeuwarden Airbase.

The Dutch No.322 TACTESS (Tactical Training Evaluation and Standardisation) Squadron organises the *Frisian Flag* exercises (and its predecessors) and has so over the past 20 years. The main task of 322 TACTESS Squadron is to standardise Dutch operational F-16 tactics and doctrines. Some years back, it was 323 TACTESS Squadron that used to organise *Frisian Flag* exercises but later on, it was 322 TACTESS Squadron that took the baton to convert the future Dutch F-35 JSF aircraft, which is expected in the Netherlands sometime in 2019.

Frisian Flag lessons (compared with *Red Flag*)

Most of the foreign participants were very pleased by *Frisian Flag* exercise which they found relatively low-cost as compared to the *Red Flag* exercise in the US. Almost all the nations across the globe participated in *Frisian Flag* exercise with all national and international doctrines mixed into the 20 missions.

RED-AIR

In the 2018 edition of *Frisian Flag*, there were dedicated RED-AIR aircraft with civil A-4s based at Wittmund AB and Polish MiG-29s based at Leeuwarden AB. With this dedicated RED-AIR assets available in the exercise, BLUE-AIR pilots experienced virtually-real adversaries with non-standard tactics and aircraft.

Text and photos:
Joris van Boven and Alex van Noye

Old and Bold !

A Very American Airshow

Heritage flight at Luke AFB: the P-51D, F-35A, F-22A and A-10C

With airshows at NAF El Centro, MCAS Yuma and Luke AFB in March, the US Air Force, Navy and Marines heralded a summer of aviation fun. While the show at El Centro had to cope with clouds and even some rain, the shows at Yuma and Luke witnessed bright sunshine and blue skies. But all the three shows boasted of vigorous footfalls.

It should come as no surprise that the US Navy showed off their newest Hornets at El Centro, with no less than 16 VFA-106 Gladiators performing a tactical demo with the F/A-18F Super Hornet. Two new EA-18G Growlers of NAS Whidbey Island based VAQ-129 and two F/A-18E Hornets of VFA-97 from NAS Lemoore were present at the static display. And of course, the world famous Blue Angels closed the flying programmes with their six F/A-18C's, their first public display of 2018.

Old but still bold, F-5 formation break over Yuma

Honouring the past and promising the present, Heritage flight formation of the F-86 Sabre and F-22 Raptor over Yuma

Steve Hinton taxies in his Sabre after an excellent Heritage flight display

The main attraction at Yuma was the F-35B Lightning II, which opened the flying display. Seeing a jet hanging still in the air remains a strange and impressive sight! Next to this modern hardware, a formation of four venerable F-5Es in attractive 'aggressor' colours made their presence felt by making two passes in close formation. The F-5Es are part of Yuma based Marine Fighter Training Squadron 401 (VMFT-401). This squadron acts as the opposing force during simulated air combat. Away from the thundering noise of jets, a UH-1Y Venom and AH-1Z Viper flew a tactical demo, closely working together. And the older cousin of the Venom, a Yuma-based HH-1N Huey, showed its capabilities in Search and Rescue.

Luke is the home of dozens of F-16s and F-35s, so lots of those types could be seen both in the air and on the ground. For the Joint Airfield Assault Demo, Luke was temporarily transformed into an enemy airfield. In a display of jets, helicopters and transport aircraft, assisted by ground forces, this enemy airfield was quickly taken over by the US forces. Next was the famous *Tora! Tora! Tora!* display which included nine Japanese fighters recreating the attack on Pearl Harbour. A B-17 Flying Fortress heavy bomber managed a safe landing on the heavily damaged airfield while this was still under attack. Back to modern times, the F-22A Raptor and still-going-strong A-10C Thunderbolt II flew their demonstrations, with the USAF Heritage Flight closing this part of the show.

USAF Heritage Flight

During 50th anniversary of the United States Air Force celebrations at Nellis AFB in 1997, the first Heritage Flight was born. Now twenty years later, the

MC-130J during the Joint airfield Assault Demo at Luke AFB

Air Force Heritage Flight is firmly embedded in many airshow programmes. The Heritage Flight formation is formed with active USAF fighter aircraft and privately owned veteran aircraft such as the P-51D Mustang, P-38M Lightning and the F-86F Sabre. The Heritage Flight Association was formed in 2010 to support and coordinate all these heritage flights within the United States and worldwide.

For two years now, Steve Hinton has been flying the F-86F for these heritage flights who commented: "We display the past and present for veterans. Every time we want to put on a display which is memorable for them." At the MCAS Yuma airshow, Hinton flew his F-86F in formation with the F-22A Raptor from the Air Combat Command F-22 Raptor demo team. Prior to every show season, Hinton and the eight other selected heritage pilots fly and train together with the US Air Force pilots in a formal training environment at Davis-Monthan AFB. Here they set the boundaries and standards for the display. "I enjoy training, pulling Gs, lofting and zooming through the air with this 1952 jet. I am lucky to do this. But most important is honouring the past and the present" says Hinton.

The North American F-86F Sabre that Hinton flies is a former USAF serial 52-5012 and *Fuearza Aérea Argentina* (Argentinian Air Force) serial C-127. The aircraft is now civil registered as NX186AM. It is painted in the colours of 335th Fighter-Interceptor Squadron, part of the 4th Fighter-Interceptor Wing with serial 12834 coded FU-834. It is to represent the aircraft that was flown by Korean war ace Captain Clifford D. Jolley. It includes the nose art "Jollet Roger" and the 7 kills that Jolley scored during the Korean War. The aircraft is now owned and operated by the Planes of Fame Museum at Chino, California. Hinton is President of the *Planes of Fame* museum.

Text and images by Patrick Dirksen and Frank Mink, Tristar Aviation

A-10C Demonstration Team from 355FW performs a slow pass at Luke AFB

F-35B entering hover mode over Yuma

F-35B taxies in after demo over Yuma

MV-22B of VMX-1 demonstrates vertical landing at Yuma

Iniochos Exercise

Act with Awareness!

A 117 Sqn F-16C 'Barak' taxies for departure while a Greek F-16C already gets airborne to act as Red Air

Members of the air forces of Greece, the United States of America, the United Kingdom, Italy, the United Arab Emirates, Israel and Cyprus joined the annual *Iniochos* exercise at Andravida airbase in Greece, from 12 to 23 March 2018.

Increasing level of realism

Given the high (readiness) level of Hellenic Air Force (HAF) personnel owed to the everlasting tensions with neighbouring country Turkey for years, the HAF has been looking for a way to verify their ability to employ their weapon systems in a high-density environment. Established in the late 80s as a domestic small-scale air exercise, the setup of *Iniochos* was changed in late 2013, based on experiences that HAF pilots had gathered during exercises such as *Red Flag* in the USA and the Tactical Leadership Programme (TLP) in Europe. *Iniochos*

Home based 338 MDV supported the exercise with four aging F-4Es

USAF F-15E touches down at Andravida after a morning COMAO

was then transformed into a medium scale *INVITEX* (Invite Exercise), meaning that other interested foreign nations could participate by invitation. Another change was the adoption of the so-called single base concept meaning the execution of operations from one single air base. As Colonel Konstantin Zolotas, deputy commander of the Air Tactics Centre (ATC, locally known as *Kentro Aeroporikis Taktikis* or KEAT), explained, "By implementing these changes, it contributes to better synergy effects, a more realistic simulation of real combat operations and the opportunity of a better analysis of the results by debriefing together. It improves the learning curve significantly and therefore provides a higher efficiency for all participants involved."

The first-and main-goal during the initial editions of *Iniochos* was to create a realistic environment for proper training of Hellenic Air Force fighter squadrons. This level of realism has increased over time, particularly when foreign participants started to contribute with their own training and combat experiences. The training scenarios are now executed in a challenging and demanding high-threat environment for the participating nations, which was expanded with the inclusion of simultaneous Hellenic Navy and Army exercises like *Astrapi*.

Ambitions

ATC plans to make *Iniochos* the most important medium scale air-exercise for Europe and the Middle East. To reach this goal, a fully simulated combat environment is being provided to all participants, together with the opportunity of using different kinds of target ranges (over land and over sea) for perfectly realistic training conditions. According to US Ambassador Geoffrey Pyatt, Greece is well underway in reaching this goal, "*Iniochos* has become an important multinational exercise with broad participation from across Europe and the Eastern Mediterranean, which reflects the ambition of Greece as a builder of bridges, as a pillar of regional stability," he stated.

Israeli F-16C of 117 Sqn of Ramat David air base takes off spectacularly during an afternoon mission

A Greek F-16C of 347 Mira comes in to land after the morning COMAO

the Hellenic Air Force to invite them was, besides strengthening of bilateral relations, the desire to have a closer look at the AESA radar, having in mind the forthcoming introduction of the F-35A Lightning II in the Turkish Air Force. This year, however, the UAE AF brought six less advanced Mirage 2000-9s of 71 squadron based at Al-Dhafra Air Base.

Unlike previous years, the Israeli Air Force was only present during a small portion of the exercise in the second week, with four F-16Cs from 117 squadron which is based at Ramat David airbase. Last year, the fact that the Israeli and UAE Air Forces trained together during *Iniochos*, received much media attention and this might have influenced the decision of the Israeli leadership to lower their presence in 2018.

F-16D of 337 Mira taxies at Andravida with the Skorta mountains in the background

Iniochos 2018

In previous years, the exercise was scheduled during April, but the start of other activities at Andravida forced the planners to reschedule to an earlier date; as a result, the weather conditions were less than ideal as they would normally be in April, resulting in some cancelled missions due to adverse weather.

Besides all HAF combat squadrons, six foreign countries were present during *Iniochos 2018*. The United Arab Emirates returned to Iniochos for the second year in a row. Last year they brought their F-16E Desert Falcons equipped with the Northrop Grumman AN/APG-80 AESA radar. According to unconfirmed statements, one of the main reasons behind the decision of

Highlights of this year's exercise were Mirage 2000-9s of the UAE AF

Using conformal tanks to extend mission time, this Greek F-16C returns back to Andravida

It was noteworthy that during the media and VIP day on the second Tuesday of the exercise, the Israeli and UAE aircraft did not fly together: the UAE Mirages only participated in the morning mission and the Israeli's F-16Cs in the afternoon mission.

The Royal Air Force joined *Iniochos* for the very first time, with Typhoons from No.3 (R) Squadron from RAF Coningsby. "This is the first time that Typhoons have been deployed to Greece. This exercise offers us a great opportunity to prepare for future operations and strengthens our existing relationship with the Greek Armed Forces," stated Wing Commander Lewis Cunningham, Detachment commander of No.3(R) squadron.

Another first timer was the Cyprus National Guard Wing, which participated with an AW139 helicopter from 460 SAR squadron during the first week of the exercise. Their role was to rescue simulated downed pilots from the nearby Mediterranean Sea. Returning after last year's debut was the Italian Air Force with Tornados from 6° Stormo, based at Ghedi air base. The United States Air Forces Europe (USAFE) is a very frequent participant and this year it joined with no less that twelve F-15E Strike Eagles from RAF Lakenheath.

Axis of stability

Overall, the exercise was a big success again and a great opportunity to verify the capabilities of the organising home team. Greek Defence Minister Kammenos underlined the importance of *Iniochos* for the Greek Armed Forces: "Year by year, the *Iniochos* exercise becomes larger with more participants, more countries, more aircraft and it actually turns into one of the most significant exercises worldwide. Together we are building a great axis of stability, northwards, with the Balkan countries, Bulgaria and Romania, southwards with the countries of the Middle East, Israel, United Arab Emirates, Egypt, Jordan etc. I hope that very soon we will be able to announce the establishment of the greatest air force training centre in Peloponnese which will interest air forces of friendly and allied countries. That is our objective".

Not many official words from the participant came to the surface, but it is understood that all participants praised the realistic simulation of combat scenarios and the multitude of unexpected simulated threats that the Hellenic Air Force General Staff incorporated in to the exercise to keep the participants always on alert. Specially designed to simulate modern, complex and intensive air operations, day and night, in order to provide realistic training that resembles the early days of a conflict (simulating real warfare), the annual exercise *Iniochos* is the frame in which personnel and aircraft are tested to the limits of their capabilities. This year, the Egyptian Air Force sent observers during the exercise. Therefore, it is possible that in a future edition they may participate as well.

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

European Air Refuelling Training (EART) 2018

Dutch Air Force McDonnel Douglas KDC-10

When the European Air Transport Command was established in 2004, it could hardly be foreseen that such cooperation between countries would arise. Still, when it comes to air-to-air refueling, European countries have joined forces by training together during the annual EART. Owing to the changing conditions in the world, it is necessary to have a well-functioning and modern tanker fleet. The 'hotspots' in the world are increasingly diverse and further away compared with the recent past, making a strategic tanker fleet an important factor for mission success. During the EART, all aspects of refueling are trained for and lessons which have been learned during this exercise, have made politicians in Europe agree to join forces when it comes to air-to-air refueling with strategic tankers. With the help of the European Defence Agency, a study was started which finally led to the purchase of a joint European Airbus A330MRTT tanker fleet in the near future.

The Importance of EART

Lieutenant-Colonel Chris van Dijk is current commander of No. 334 Squadron, who executed the EART (European Air Refueling Training) in 2018, who informed that this years' EART exercise, which was held in parallel to the exercise *Frisian Flag* at Leeuwarden Air Base, was again scheduled at Eindhoven Air Base. The entire EART exercise was dedicated to tanker operations and international cooperation between NATO partners. Of the participating

French Air Force Rafale

tankers, the French and American KC-135 had already left for home base and only the Dutch KDC-10 and the German Airbus A310MRTT flew daily missions to support the exercise *Frisian Flag* and EART. Both tankers from France and the United States were withdrawn, because there was unrest in the Middle East and especially in Syria.

Goals and Achievements of EART

It is well known that the European units have a shortage of tankers and EART was created to optimally use the existing fleet of tankers. In exercises such as *Frisian Flag*, the emphasis is often on the fighter crews and not on that of the tankers but during EART, it was the other way around where the crew of the tankers were also extensively trained alongside the fighter crew. One of the main goals of the EART was to receive different 'receivers' and not just their own fighter types.

On Tanker Mission with the KDC-10 and A310 during EART2018

During exercise *Frisian Flag*, tankers were flown in two designated areas. Just above the coast of Texel, above the North Sea, was the Shell Track located and just off the coast of Denmark, was located the Esso Track. During the training, the crews were briefed daily on the operators that they would receive. Crews were also instructed on how they would operate and with how many tankers they would fly into the cell. During this EART, it was the second time that the tankers were connected to the Link 16 system on which movements could be analysed in detail later. With the remaining two tankers on 12 April, the Dutch KDC-10 refueled eight Dutch F-16s; the German A310 refueled four German Eurofighters and three French Rafales. All refueling missions were flown in the Shell track.

Future Tanker Fleet

In 2016, the Netherlands and Luxembourg were the first countries to sign the intention statement (Memoria of understanding, MOU) to purchase these aircraft. These countries later also signed for the purchase of two aircraft with an option for another six aircraft. In 2017, Germany and Norway also signed for this project. With these two partners on board, the number of aircraft to be purchased was already at seven. On 14 February 2018, Belgium also contracted for and the number of aircraft has increased to eight.

Text and photos: Joris van Boven and Alex van Noye

A German Eurofighter being refueled

Dramatic shot of the F-16s!

Air Vice Marshal Cecil Parker recollects...

Bonding with Bhopal

The black-and-white, grainy photograph, rubber-stamped 'Bhopal Studio' and ink-dated 16/6/1896 (yes, 122 years ago!) showed a stiffly posed family of a serious looking man, his wife seated with her sari-*pallu* almost covering her face and their two young daughters. One of the girls is my paternal grandmother (Dadi), born in Bhopal and who passed away in Bhillai in 1979. This ancient photograph, locked in her trunk but shown to me on more than one occasion, was the sole recollection she had of her family as both her parents died in an epidemic soon after it was taken. The sisters were taken over and educated by missionaries in the Central Provinces/ Madhya Pradesh. In the late 1920s both sisters, along with their families, settled in adjacent homes in the tiny village of Jyotipur (Chhatisgarh) on the road to Amarkantak, the source of the River Narmada whose waters reach Bhopal. This then is my tenuous, ancestral connection to Bhopal which, till very recently, I had never visited.

Last year, on his return from an assignment abroad, our son was posted by his company to Bhopal; my wife and I were happy to accept an invitation to visit in December 2017. Ever since my retirement from the air force 32 years ago, our travels have been primarily by air. The air connection from Hyderabad to Bhopal was however at an inconvenient departure time, hence we opted for a train journey after almost a decade. In the event we quite enjoyed the14-hour rail journey by the Rajdhani made more pleasant by the company of a very friendly and helpful young couple who shared our compartment and were most caring for their octogenarian travel companions.

On Christmas Day in Bhopal, we attended service at a small church looked after by a priest with the very unlikely name of (hold your breath) Padre James Bond. Unlike his famous and flamboyant namesake, our onomastic '*desi* 007' is a quiet, simple, serious padre who hails from Tirunelvi down south, fluent in Tamil, Hindi, English and who has served in Tamil Nadu, Chhatisgarh and Madhya Pradesh. In his current assignment he ministers to the spiritual needs of fewer than 20 families from a church that barely seats 75 people. When I gently teased and quizzed him about his famed name, he was neither 'shaken nor stirred' but happily posed for a photograph before returning to his pastoral duties.

We found the New Bhopal to be a very pleasant city with well-planned, wide tree-lined roads, open green spaces and lakes that dot the countryside. Its malls and restaurants were as good as any we have elsewhere with lighter road traffic and not a policeman in sight. We were able to meet up with another retired air veteran after a gap of a quarter century. On the evening before we returned, we had an unexpected visit from relatives in Rajasthan who just happened to be visiting Bhopal. Among them was the daughter of a cousin of mine, who, after marriage, had settled in Bhopal over two decades ago. She was pleasantly surprised to learn that, unwittingly, she continues our family bonding with Bhopal.

Farokh: Flier, Friend and Author

On 27 February, 2018, Wing Commander Farokh Jehangir Mehta, VrC (Retd), marked his 87th birthday. Last year, he published his memoirs titled "Biff the *'t'* out of Can't". His family, friends and admirers assembled at the Sailing Club in Secunderabad for a book-reading followed by a birthday lunch for him and his guests. As a tribute to our close personal and professional relationship Farokh gave me the privilege of writing the Foreword which, reproduced below, will give the reader an overview:

The title of this book says as much about the author as its contents. Farokh Jehangir Mehta, a first time author, chose to commence penning his memoirs at the ripe old age of eighty by narrating ninety-four evocative episodes in his life in three phases. The first phase (1931-1954) covers his early years, the second (1955-1979) his air force service, and the third (1980 onwards) his post-retirement period. This fascinating

The faithful Hunter of yore

collection of stories takes the reader from a privileged childhood in the erstwhile State of Hyderabad, through Independence and service as a fighter pilot in the Indian Air Force in peace and war, to his successful entrepreneurship and creative retirement. Farokh Mehta is a true-blue Hyderabadi, at home in both the Urdu language and Islamic culture. I have had the privilege of knowing the author as a friend and erstwhile air force colleague for nearly half a century. His style of writing mirrors his personality. His story will have great interest, not only for those who wore uniform, but also for a much larger readership on both sides of the Indo-Pak border.

The book-reading was done by members of *The Little Theatre Hyderabad*, which includes this writer. The selected pieces were thoroughly enjoyed and appreciated by the audience. Despite the difference in our ages (Farokh is nearly two years my senior) while I was his commanding officer, our personal friendship was never affected. In fact we have some surprisingly similar experiences in our lives too. Both of us flew the Hunter aircraft for many years and served as Flight Commanders in the same squadron (No. 20); both of us commanded Hunter squadrons (he No. 27, me No. 20); both of us ferried Hunter aircraft from UK to India; both of us earned gallantry awards in the 1971 Indo-Pak war; both of us had a near-death experience – he in the lowest possible ejection from a Hunter Mk.66D on 19 December 1970 and me a successful manual bail-out from a blazing Tempest IIA on 28 October 1952; both of us took premature retirement from the air force and, in our 80s, both of us published books that recorded our experiences as 'episodes' in his and as 'anecdotes' in mine. On the family side both of us are blessed with a son and a daughter; both daughters are married and settled abroad while both sons are in India. In retirement, seldom was a function held in either of our homes that did not include the other couple.

For those readers who would be interested in reading more about this aviator and author, do get in touch with Naozar (80088 25050) or Padma (92468 77555).

Cricket in the Forties

Some of us from my generation (which predates *Midnight's Children* by 15 years) are still around and are quite *au fait* with our national obsession i.e. cricket. My younger grandson, a natural all-round sportsman, once asked me, 'Dada, did you ever play cricket?' I assured him that indeed I had, but 70 years ago! Being a teenager, this time span of seven decades was almost beyond his comprehension, so I shared the story with him.

During World War II (1939-45) our boarding school in Bihar, along with its extensive playing fields, was taken over and converted into a major British military hospital. We were relocated to a city in UP for four years (1943-46). At Independence we returned to find a large number of new buildings on our erstwhile playing grounds leaving just one field for hockey, football and athletics in their seasons. Post demobilisation after the war, some British armed forces personnel chose to stay on in India. Among them was a couple; the lady was a qualified nurse who joined our school staff as the Matron. Her husband, an ex-Sergeant from what he termed as the 'PBI', (Poor Bloody Infantry'), was appointed as our Games and Sports Master.

India's national obsession

Sarge, as he was known to all of us was very popular (not only for his earthy language) but for a very likeable, friendly and helpful personality. Unknown to us however was the fact that he was an extremely keen and experienced cricketer. He set up 'nets' in this (for him) 'corner of a foreign field', acquired cricketing gear and taught us the rules of the game and skills required for batting, bowling, fielding and umpiring fairly. Under his guidance we improved our team work, leadership attributes and other character building qualities. If any of us ever hesitated at the crease over a perceived doubtful LBW decision, he strode down the pitch, pointed to our makeshift pavilion and proclaimed imperiously, 'Mr…we walk!'. (Our subsequent private mimicry of his accent/action generated many laughs for us, but we did learn the meaning of discipline – an attribute I needed in great measure in my air force years). Other games were not neglected but all of us seniors (1947-48) practiced hard to make it into our very first ever school cricket XI.

In our final year, we played our first inter-school cricket match watched by our faculty, their families, guests and (most popular of all) the senior girls from our girls school…of course 'Cheerleaders' were still in the distant future! We won that match narrowly and Sarge was the toast of the school. In my college there was no cricket and I switched over to tennis which I enjoyed playing till about three years ago. In the air force, cricket was confined to just a few centres which did not cover any of the fighter air bases where we young pilots spent our formative years. I do however recollect at least two air force cricketers who were called up for the national team.

Cricket as we knew it, has of course changed over the years, as much else has, in our lifetime. In 2004, in my early 70s, I was invited by my old school to be the Chief Guest at its Platinum Jubilee celebrations. I was given a tour of the school buildings by the Head Boy and was amazed at the transition of our school from less than 100 boarders in my time to one that accommodates 1850! Seeing no playing fields, I asked him about games. His response was, 'Yes Sir, cricket is very popular; we have TVs in all our Common Rooms and are allowed to watch outside class hours'. I instantly decided to say nothing about cricket in the 40s; am certain Sarge would have approved – as did my grandson!

25 Years Back

From Vayu Aerospace Review, Issue III/1993

Indian – Russian Air Chiefs meet

Bilateral talks between the Russian and Indian Air Force Air Chiefs in late April ended on a promising note with the Russian Air Chief expressing optimism that the supply of critical spares would be ensured despite the present political pre-occupations in Russia.

Keeping in view that the IAF's fleet of aircraft is essentially of erstwhile Soviet origin, the two sides also held wide ranging discussions on "application of air power common to both the air forces, on aspects of serviceability of the air fleet, type of snags emerging on common aircraft types and understanding the usage of common equipment." Another issue that came up for discussion was service cooperation involving exchange of information on serviceability, accident rates, operational strategy etc.

While elaborating on the need for upgrading the MiG-21 fleet which is otherwise facing a phase out by 1995, Air Chief Marshal NC Suri said that the effort was to update it in order to sustain an expected battlefield environment over the next 15 to 20 years.

AJT, LCA and HAL

Chief of Air Staff IAF, Scientific Advisor to the RM and Chairman HAL have made certain policy statements on the AJT of which, "the immediate procurement is mandatory and in the absolute interest of the IAF." Dr APJ Abdul Kalam, said that the HAL-manufactured Light Combat Aircraft (LCA), which are to replace the MiG-21s, would be developed by HAL by June 1996 to meet the demand of the country and abroad by the year 2002 or 2003.

RN Sharma, Chairman, HAL, said that the year 1992-93 had been a nightmare for the aviation industry because of the cuts in defence budgets and the drop in the demand for aircraft. He added, however, "I don't believe that the warplane business will go away".

MiG-29 engine problems

In what amounts to a shocking revelation of the poor record of the MiG-29's RD-33 engines, the Comptroller and Auditor General's report tabled in Parliament on 11 May 1993, reveals that 74 per cent of the engines had "failed prematurely". In its latest report for the year 1993 on the Navy and the Air Force the CAG said that 74 per cent of these advanced engines for the fighter aircraft bought at the cost of Rs 326 crore had failed prematurely within five years and been withdrawn till July 1992. According to the report, of the total of 188 engines available in the fleet, 139 engines had failed prematurely, with 62 engines being withdrawn even before completion of fifty percent of prescribed over-haul life, which was 300 flying hours.

40th Anniversary of the Indian Naval Air Arm

Highlighting the 40th Anniversary celebrations of Indian Naval Aviation were the 'CNS Divisions' at INS *Garuda* (Wellington Island, Cochin) on 12 May. As part of the smart parade by officers and sailors, was the flypast by naval aircraft, led by 3 Chetak helicopters, followed by 2 Ka-28s and 3 Sea Kings. The fixed-wing component comprised pairs of Islanders and Dornier 228s, three Sea Harrier V/STOL fighters and finally a lone Ilyushin Il-38 ASW/MR aircraft. The latest aircraft-type inducted is the HAL-built Dornier 228 which has replaced the venerable Breguet Alize MR/ASW aircraft and will supplant the PBM Islanders for various secondary tasks.

Royal Air Force is 75

The Royal Air Force marked the 75th Anniversary of its formation of 1 April 1993. The main event was to be a ceremonial parade and flypast by 149 aircraft at the RAF station Marham in Norfolk but a heavy down-pour resulted in cancellation of the flypast and the colour ceremonial was restricted to a brief ceremony inside a hangar. HM Queen Elizabeth II graced the occasion with her presence and was received by RAF Chief of the Air Staff.

Chinese M-11 missiles for Pakistan

China is supplying Pakistan with hardware for making surface-to-surface missiles. The technology transfer, if confirmed, could have serious consequences on US relations with both Beijing and Islamabad. Over the past-four months, satellite surveillance photos and other sources have convinced the US intelligence agencies that China has shipped to Pakistan component parts for making M-11 tactical surface-to-surface missiles, which have a range of about 300 miles and are believed capable of carrying nuclear weapons. China has repeatedly pledged to the USA that it would not export missile components or technology.

China N-build up in Tibet

China, which has seldom been subjected to critical international scrutiny on the nuclear issue, has concentrated on Tibet as a base for its nuclear build-up. From engaging in secret nuclear weapons manufacture to dumping radioactive waste there, successive Chinese governments have been responsible for the illness and death of several Tibetans near the 'Ninth Academy' (a top-secret nuclear city) and uranium mines in Tibet. These are the findings of 'Nuclear Tibet', the first comprehensive study of China's nuclear activities on the Tibetan Plateau, which was released world-wide on 19 April by the International Campaign for Tibet (CT), a Washington-based human rights organisation.

Tale Spin

That Sinking Feeling !

The world's oldest independent *Air Force* (as distinct from *Army* or *Navy* Aviation) is the Royal Air Force of the UK, which marked its Centenary on 1 April 2018. One certainly expected that the RAF would have gone to town with extraordinary paint schemes on some of its leading aircraft types. But, alas no ! The chosen logo (see image) has the RAF roundel seemingly disappearing out of the picture, provoking some British enthusiasts to lament the fact that this was not only inappropriate (reflecting the reducing numbers of aircraft in service ?) but actually, disappointing, considering the RAF's splendid history and legacy.

The Indian Air Force, which was born in 1933 as a tiny adjunct of the RAF in India, today has multiple times the number of combat aircraft in service than its 'parent' does. But no paint schemes have adorned its aircraft ever since it went overall 'grey' some decades back.

Share of things to come ?

Continuing their focus on India's Armed Forces, *Discovery Channel* have just launched a series on the Indian Air Force Academy, with premiere on 4 June 2018. The preview (to which *Vayu* was invited), showed some fantastic footage and the telecast will surely inspire viewers no less than enthusiasts raring to join the Service.

But hold on ! What are those aeroplanes on the poster ? The trained eye knows : so will future IAF fighters really be F-18s and F-35s ?

Sweden's national dish – or is it ?

Sweden could well be flavour of the future, with its superlative Gripen multirole fighter amongst those being evaluated by the IAF, when presumably Indian personnel would be seconded to this Scandinavian nation for conversion training. And certainly they would be offered Swedish fare, including the signature 'national dish', being meat balls. Imagine then Sweden's consternation when it was recently 'discovered' that this is actually based on a recipe that King Charles XII brought home from Turkey in the early 18th century. The Turks rejoiced even as the Swedes were dismayed.

But then, according to an Indian food czar, the samosa is actually from Turkey too.

Namaste ji

All sailors have their own code of conduct and honour. Recently, when a Chinese Navy task force entered the Gulf of Aden to carry out anti-piracy patrol, the Indian Navy tweeted a warm welcome to the 29th Anti-Piracy Escort Force of the PLA(N) in the Indian Ocean Region which read "Happy Hunting."
(But Pirates only please).

Afterburner

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