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BUSINESS DEVELOPMENT MANAGER
Premjit Singh

Published By

Vayu Aerospace Pvt. Ltd.
E-52, Sujan Singh Park,
New Delhi 110 003 India
Tel: +91 11 24617234
Fax: +91 11 24628615
e-mail: vayuaerospace@lycos.com
e-mail: vayu@vayuaerospace.in

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Red tape binds our arms

"It is easier for a tank to pass through the eye of a needle than it is for India's defence ministry to buy or manufacture a weapon". A number of analyses show that despite many aggressive statements of intent, the present government has been as unsuccessful as its predecessor in making a dent in the ministry's thicket of red tape and brown files.

The first problem is administrative. An internal ministry study reportedly describes a procurement process that is so slow that, in the past three years, less than 10% of proposed arms deals have met their timelines. Just the initial tendering stage takes an average six times longer than it should. The second problem is financial. An *Institute of Defence Studies and Analysis* report has shown the inevitable fallout of measures like one rank, one pension and a military bureaucracy overflowing with clerks. Payroll and pension costs have risen dramatically. By 2018-19 they will constitute 56% of defence expenditure, 12 percentage points higher than seven years ago. Inevitably, this has come at the cost of weapons. Expenditure on defence modernisation will fall from 26% to 18% over the time span. The third problem is flawed indigenisation. Every government has touted its intention to reduce India's dependence on arms imports. All have failed. There has been an unwillingness to drastically reform the state-owned defence firms which largely assemble imported kits or make substandard weapons.

At the heart of all this has been a tendency to impose ideological goals on the country's defence policy, which ultimately should be about security. Instead, defence has become a place to posture politically, a laboratory for economic nationalism and affected by short-sighted wooing of foreign governments. A carefully worked out plan for indigenisation that encourages the participation of the private sector and which recognises (that) India must learn to walk before it can run would be the realistic path for the government. India continues to remains the only major country lacking a regular national security doctrine. Unsurprisingly, major arms buys have become sudden, government to government deals driven by desperation rather than any real thought.

From *Hindustan Times*

Defence allocation on decline

So far as the allocation of funds for the defence forces is concerned, this year has been no different from the previous ones. Notwithstanding the urgency of matching the country's military profile with some of our belligerent neighbours, the government hasn't quite come up to the expectations. Whatever be the arguments in favour of the projections made by the Services/MOD, the general tendency on part of the government is to allocate only in the region of 55 to 65 per cent of the projections. The allocation of Rs 2,95,511 crore for the ensuing fiscal over the current year's Rs 2,74,114 crore is tantamount to a mere increase of Rs 21,397 crore, a moderate hike of just 7.81 per cent.

This includes the capital outlay of Rs 99,563 crore meant for procurement, modernisation etc. With a large number of platforms for the Air Force and the Navy and multiplicity of other weapon systems for all the three services pending procurement, an increase in capital outlay of the order of Rs 13,075 crore seems equally moderate.

Capital outlay is rarely fully utilised every time is one argument advanced for restricted allocations at the BE (Budget estimate) stage. It is not fully utilised for reasons of complex procurement procedures, long-drawn negotiations, political constraints and devious other such factors. The fact that it also includes the time-consuming process of land acquisition and construction works also adds to the delay factor.

Modernisation is an inescapable necessity to keep pace with the adversary's rising potential. Despite all efforts, it continues to lag. Old and vintage platforms and weapon systems have to be replaced regularly because of their rising maintenance cost. All this takes time. In the acquisition of weapon systems, particularly involving foreign vendors, the gap between acceptance of necessity and contract signing could well take many years. The purchase of Rafale aircraft initiated in the year 2010 is yet to fructify. Factors like these lead to surrendering of capital funds on an almost regular basis. For once, the Ministry of Defence was able to utilise the entire capital outlay for the year 2017-18 whereas it had "only" surrendered an amount of Rs 6,886 crore during the previous year.

This may, perhaps, be one of the reasons for the government to hold back allocations at the BE stage. That is how every Finance Minister ends up saying that the government remains committed to enhancing the military's operational capabilities by ensuring requisite budgetary support when needed.

In contrast, the revenue expenditure is invariably fully utilised. It is critical to maintenance activity and defence-preparedness. But this too continues to fall short, averaging over a decade to about 17 per cent or so. The defence allocation of 1.57 per cent of the GDP for the new fiscal is perhaps the lowest in recent years. The downward trend seems rather inconsistent with the prevalent security environment in the region. The seventh largest economy in the world growing around seven per cent has not been able to keep pace with the neighbours who continue to spend much larger amounts year after year.

The fact is that the armed forces have to continuously upgrade their wherewithal to match that of the adversary. Modernisation is nothing but acquiring the best to match what the adversary has and what is required to achieve the politico-military objective. It's a plain and simple question of competitive re-armament. India has no option but to develop capabilities that would dissuade adversaries from any undue venture.

However, when defence allocation is viewed in terms of percentage of CGE (Central Government Expenditure) and not of GDP, it presents an entirely different picture. This year's defence allocation of 12.10 per cent of CGE is almost the same as last year. In fact, it had remained by and large constant between 12 and 13 per cent during the entire decade. But when viewed as a percentage of GDP, it shows a declining trend year after year. However, conventionally, the defence expenditure is always reflected as a percentage of GDP the world over.

Air Marshal RS Bedi (retd) in *The Tribune*

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Step up diplomacy

The Maldives declining India's invitation to participate in the naval exercise 'Milan' need not automatically lead us to the inference that Male has decided to spurn the India connection as it's engaged in wooing China, or that the Maldives' decision is dictated solely by Beijing. The China factor may well have played a part, but going by this explanation alone will shrink the diplomatic space for New Delhi. India-Maldives ties have looked fragile for some years. It's precisely at such a time that diplomacy must be given fuller play while being ready to exercise other aspects of state power. The Maldives have officially said the reason for its Navy not participating in the Naval Exercise 'Milan' in the seas around the Andaman and Nicobar Islands area, is that the state of emergency declared in the nation of atolls requires the deployment of all its naval forces and their equipment in maintaining security.

This doesn't appear to be an unreasonable proposition no matter how reprehensible the proclamation of emergency which New Delhi has strongly urged Male to roll back so normal life can resume, including restoring the status of Parliament, the Opposition parties and the judiciary. At the same time, however, India should ascertain the causes behind Male deciding not to participate in the 'Milan' programme of the Indian Navy designed as part of its regional maritime outreach architecture. This year 16 navies were listed as prospective participants, including the Maldives. Hard-nosed diplomacy will be needed to understand what's going on behind the scenes.

The 'Milan' outreach effort was begun in 1995 with four nations participating. Since then more and more nations have been taking part. Among others, Australia, New Zealand, Vietnam, Thailand, Malaysia, Singapore, Sri Lanka and Oman are likely participants this time. This is a major positive for India. Apart from seminars, discussions and socialising, the exercise takes in joint operations out in the sea to underscore inter-operability. This is why it is held in the Andaman and Nicobar Islands, housing India's only tri-services command, the base for a blue water navy.

With the Chinese Navy also seeking to spread itself in the Indian Ocean region in recent years, the smaller countries do harbour a sense of anxiety and are happy to associate with a major regional naval force. If Male has ducked this time around on account of considerations that may give comfort to China, then India will need to possibly refurbish itself in the Indian Ocean region through upgraded diplomatic activity with various countries, as well as raising its naval and air capabilities. This will call for budgetary support and political will in pursuit of a well thought out strategic design which cannot but include steps to pre-empt Chinese naval activity in countries on our periphery.

From *The Asian Age*

Asia's fighter market in perspective

The Singapore Airshow is important to the world's fighter manufacturers for one very simple reason: Asia takes 24 percent of the world's combat aircraft exports by value. That makes it the second-largest export fighter market in the world, after the Middle East. Over the past 10 years, a total of 561 jets worth $39.1 billion in 2018 dollars were exported by the world's fighter manufacturers, excluding Russian and Chinese designs. Of these, 128 aircraft worth $9.2 billion went to Asian countries, including Australia.

The Asian fighter market is also growing at a strong pace; the region's fighter order backlog is considerably larger than the historical market. Almost 200 Lockheed Martin F-35s are on order for Australia, Japan and South Korea, with Singapore likely to join the F-35 club in the next 10 years. More Korea Aerospace Industries T-50/FA-50s are on the way for Thailand, with more likely for the Philippines. Regional demand for major upgrade packages, such as the South Korean, Singaporean and Taiwanese F-16 enhancement programmes, mean further work for Western fighter primes.

The drivers behind this market are clear and strong. Regional tensions, historical grievances, superpower rivalries, and ongoing territorial and resource access disputes all motivate Asian air services to bolster their air power capabilities. Only combat aircraft combine fast deployability, real-time surveillance and precision lethality into one cost-effective package. Meanwhile, the ability of Asian countries to pay for new jets has served as a market catalyst. Most of the region has enjoyed strong economic growth, particularly in South Korea and Singapore. Relatively high commodity prices have bolstered government resources in emerging Asian market countries, such as Indonesia or Thailand.

Only Malaysia stands out as an exception; while the country has the resources needed for a strong military, it has let its air power capabilities badly lag. A fighter competition could begin in 2020, but there have been false starts down this road before. Japan, South Korea, Australia and Singapore have represented the high end of the market, both in Asia and globally. Until 2015, only these countries, plus Israel and Saudi Arabia, have ever purchased an exported fighter with a unit price greater than $50 million.

Historically, that has meant operating a Boeing F-15 (or in Australia's case, an F-111, finally retired in December 2010). The arrival of the F-35 is transforming this high-end market, and while Boeing will get considerable upgrade work, it is unlikely that it'll sell additional current-generation fighters in the region. One notable characteristic of the region is that U.S. manufacturers dominate the Asian export fighter market to a much greater degree than anywhere else. While Dassault and Eurofighter have done well in the Middle East, they have yet to sell any of their current-generation fighters east of India. Saab has sold 12 Gripen C/Ds to Thailand, and Korea Aerospace Industries' T-50 now has a regional presence, but Russia and China play a marginal role in Asia's fighter market.

For the future, Korea Aerospace Industries is pressing ahead with the KF-X, a medium-weight, twin-engine fighter, designed in conjunction with Indonesia. Even though South Korea is considering expanding its 40-aircraft F-35 buy with an additional 20 fighters, the KF-X may go ahead, too; the country has a very large F-4/F-16 replacement requirement. Assuming that indigenous projects will continue to play a relatively marginal role in meeting regional fighter requirements, Asia will be a growth story for Western fighter primes for many years to come.

Richard Aboulafia, TEAL Group

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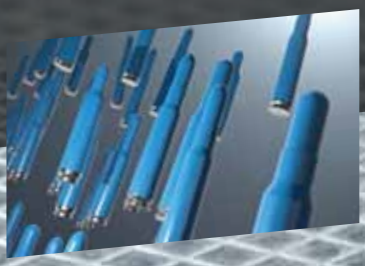

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VIEWPOINT

Admiral Arun Prakash feels we must

"Stop Tempting Fate"

A "security dilemma" in international relations represents a situation in which accretion of power – military and economic – by a state generates fear amongst its rivals, leading to tensions, a possible arms race and even the possibility of conflict.

India's acquisition of power is based on its nuclear arsenal, a modern but under-equipped military with 1.5 million personnel under arms and a defence expenditure of $60 billion. And yet, far from striking fear, India often fails to evoke respect in its Asian neighbourhood.

The *Economist* weekly, in a 2013 article titled "Can India Become a Great Power", seemed to put its finger on the reason: "India has the world's 4th largest military," it said, "and yet its political class shows little sign of knowing or caring how the country's military clout should be deployed." Warning India against "an unstable but dangerous Pakistan and a swaggering and intimidating China", it observed: "The absence of a strategic culture and the distrust between civilian-run ministries and the armed forces has undermined military effectiveness."

Such remarks are generally dismissed in New Delhi, as being rooted in Western biases against India. In this case, however, the British journal was only reiterating what Indian commentators had been saying for decades.

India's deteriorating neighbourhood situation requires us to reflect on "cause and effect" relationships. How, for example, has a smaller and weaker Pakistan sustained a war on India for three decades by infiltrating armed fighters across our border to wreak death and destruction with impunity? How does Pakistan keep the pot boiling in the Kashmir Valley, almost at will, without fear of repercussions?

In the case of China, despite our diplomats rejoicing over a series of bilateral agreements, protocols and confidence-building measures signed between 1993 and 2013, what emboldens China's People's Liberation Army to offer provocation and offence, at will, through repeated violations of the Line of Actual Control?

In the recent Doklam stand-off, what makes Chinese officials as well as the media indulge in boorish invective in an attempt to intimidate India? In international relations, as in the jungle, even the perception of weakness can provoke base and predatory instincts of unscrupulous rivals.

Has India, notwithstanding its nuclear arsenal, military muscle and economic and demographic strengths, conveyed an impression to its adversaries of a weak, diffident and irresolute nation? And has it, thereby, tempted them into bellicose adventurism and brinksmanship? If so, this is the fall-out of sustained political indifference that has eroded the credibility of our national security posture.

Of numerous areas of neglect, I cite just three. One, the top-ranking officer in India's higher defence organisation is the Chairman, Chiefs of Staff Committee, who is also a key functionary in the nuclear command chain. Currently, this is a part-time post, tenanted by one of the three Service Chiefs in rotation, with short, random tenures. Experience has proved this to be an absurd and ineffective model, which impacts on the credibility of our deterrent posture.

Successive governments have clung to this system, ignoring repeated recommendations that either this post be made permanent or be replaced by a Chief of Defence Staff.

Two, the US manages its forces worldwide through six joint military commands, while China reorganised its forces in 2014 into five geographic commands, each with integrated army, navy and air force components.

The Indian military, however, remains in a World War II time-warp, and is organised into 19 unwieldy commands, of which only two are joint and 17 single service, with no two HQs in the same location.

Again, India's failure to implement reforms and integrate the three services means that our soldiers will be denied the synergy and combat effectiveness that jointness has brought to every modern military.

A recent report of the Comptroller and Auditor General pinpointing material shortages of imported hardware and ordnance highlights the multiple challenges that our military faces.

The last issue that detracts from the credibility of India's security edifice is the civil-military dissonance and bureaucratic functioning of South Block that has stalled military modernisation.

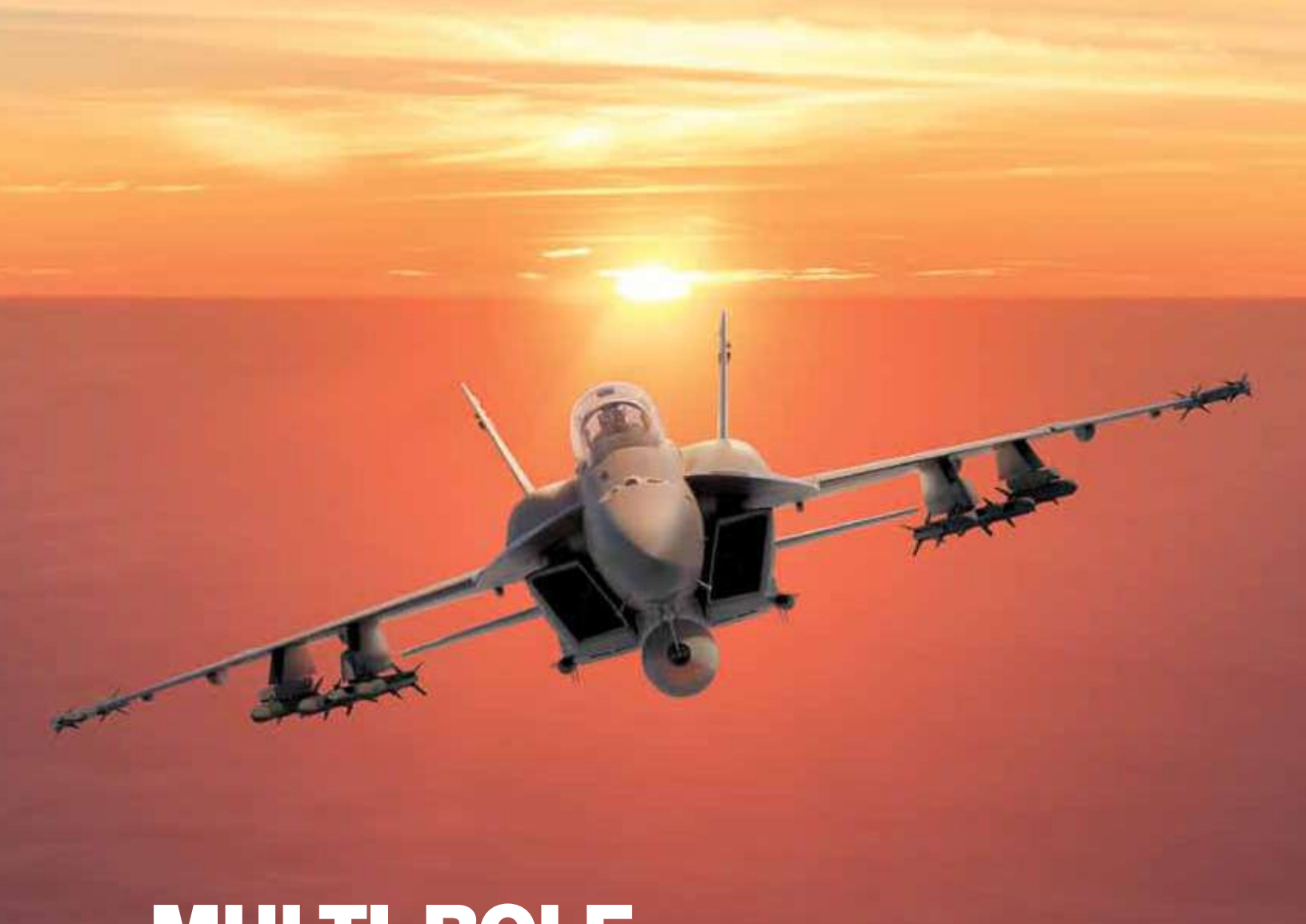
The roots of this discord lie in the fact that the 100 per cent civilian Ministry of Defence (MoD) and the Service HQs work in separate compartments and no government has mustered the will to buck the bureaucracy and integrate them. Each of these shortcomings is a self-goal by the Indian state.

In 2001, a Group of Ministers of the then National Democratic Alliance government had recommended a comprehensive revamp of the national security structure. A decade later, the United Progressive Alliance government received a similar set of recommendations from a committee convened by the cabinet.

The first was implemented superficially and the second vanished without trace in the bureaucratic maw. While Parliament has rarely lifted a finger in the cause of national security, China's military and the Pakistani deep state keenly observe the Indian scene and are taking full advantage of our egregious neglect.

The onus for the nation's security rests squarely on the Prime Minister, who must ensure that responsibility for defence is assigned to a full-time Raksha Mantri (RM) and not the MoD bureaucracy, as is the default practice.

By lifting the current embargo on meeting his service chiefs, the Prime Minister can set the tone for better civil-military relations and avail of first-hand, authentic military advice and consultation. Such are the demands of party politics and election campaigning that even the best of RMs have been overwhelmed by their political obligations. A credible national security organisation demands a RM, unburdened by demands of electoral politics.



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OPINION

A dose of realism

The Rafale at Aero India 2017

There is something about the procurement of military equipment from western commercial sources that generates public interest far greater than its financial or strategic content. The entire spectacle of open tendering, nail-biting selection, followed by endless negotiations - all played out in the public domain – does little justice to the very serious business of dealing with a weapon system for the battlefield which, in reality, should remain strictly confidential, if not totally secret. In rare cases of contracts approaching fruition, chances are that at some politically opportune time, these would also become the subject of political controversy with scarcely any concern about the adverse impact this will have on national security, the operational capability of the armed forces or, indeed, on their morale.

The latest to join this league is the truncated MMRCA purchase of 36 Rafale aircraft from Dassault Aviation against the Indian Air Force's requirement of 126 aircraft, a process that was initiated in 2007 as a commercial bid, but remained deadlocked till a new government took charge, scrapped it, and took a decision to go by the government-to-government route. Political opponents have now fired a salvo, alleging that the final contracted unit cost per aircraft was far greater than the one that had been negotiated by the previous government and that due procedures laid down had been violated. This, in turn, has generated a freewheeling public debate much of it based on limited technical knowledge and perception rather than on hard facts.

As someone who has spent nearly a decade in Air HQ in the planning and procurement branch in various capacities, including its head as deputy chief of air staff, was part of the ministry of defence team that negotiated the Anglo-French Jaguar contract in the late 1970s (which, at the time, had more than its share of speculative media debate and corruption criticisms), observed at close range how the United Kingdom and the French military aerospace industries function and been a part of numerous MoD negotiating teams thereafter, one feels morally bound to inject some realism in this self-defeating debate. This is because whatever may be the political or moral compulsions driving it, at the very least it undermines the confidence that the IAF rank and file will have in its own military leadership and adversely affect morale. That is why the IAF chief has been constrained to take the unusual step of publicly stressing that it was a government-to-government contract, and that it was a better deal with lower cost implications than the earlier MMRCA contract negotiations.

Even in commercial contracts that relate to modern combat aircraft and associated weapons and systems, national governments and strategic security interests of both seller and buyer countries are invariably involved. National governments of aerospace suppliers hence keep a benign check on their own industries – to promote their international sales footprint – as also on their industrial practices to prevent diplomatic embarrassment. All suppliers also require that their costs are treated as 'commercially confident' information for the buyer only. In the event of such contracts being backed through a government-to-government understanding, these commitments take on a more formal role.

Unlike many stand-alone products, it is too simplistic a notion to calculate costs per aircraft, because without ground and test equipment, weapons, spares support, repair facilities and a host of other essentials, the aircraft has no utility as an operational weapon system. Any cost comparisons to

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be meaningful must hence be based on the total system cost on a like-to-like basis. If a realistic analysis were to be attempted comparing the earlier MMRCA proposal and the truncated renegotiated one, this would need a detailed cost-benefit analysis by a body of specialists, who, in the end, would still be left guessing about many subjective issues that have significant value in the operational domain but are not readily quantifiable in financial terms.

In this context, two examples merit mention, although there would be many more. According to Nitin A Gokhale's book, *Securing India the Modi Way: Pathankot, Surgical Strikes and More*, Dassault Aviation is now contractually committed to provide performance-based logistic support for five years to two squadrons against the earlier proposal to support only one squadron. Further, it is committed to ensuring that a minimum of 75 per cent of the IAF fleet will always be available for operations. These contractual commitments are a major advantage and, to one's knowledge, have never been undertaken by any earlier supplier to the IAF, including the Hindustan Aeronautics Limited. For those looking for juicy headlines, these may be mundane issues, but for a combat force these have tremendous operational and support value and cannot be quantified in monetary terms. To reduce this debate to higher unit costs being paid without weighing in the operational returns not only exposes our hollow understanding of operational imperatives but is also an unfortunate political red herring that needs a swift burial.

This brings us to the issue of due procedures not being followed. The Bofors scandal has resulted in a defence procurement eco-system within the South Block where procrastination has become the norm. Few in the decision-making chain would venture to take decisions for fear of falling prey to allegations of wrongdoing. The bureaucratic shield for this is hence the defence procurement procedure, first issued in 2002 and now in its ninth edition. Rather than using this as a procedural guide, it is being treated as a policy cast in stone. In the complex world of defence trade, lack of flexibility on the part of those negotiating purchases is a sure recipe for stalling any acquisition proposal as there are innumerable variables. This explains why our armed forces are hopelessly behind in executing modernisation plans.

Two fundamental errors were made by MoD while issuing the initial tender. First, the bidder was expected to take ownership for the 108 aircraft to be produced by HAL, a demand that is patently impractical. Second, competitive commercial bids were evaluated on the basis of production man-hours as indicated by bidders in their respective production environments without applying any multiplication factor in case of HAL manufacture (a factor that was even applied to earlier licence programmes like the Jaguar). In the event this was determined by HAL as 2.7 times and would have upset calculations that had led to the initial choice of the lowest bidder.

Instead of recognising these lapses and making amends in a transparent way through policy intervention, the MoD let procedure prevail over operational imperative. To quote from Gokhale's book, "Parrikar told Modi it would be legally untenable to go through with the MMRCA contract since the process had been completely vitiated thanks to Antony's indecisiveness and a crucial oversight in the original terms of the contract."

The one exception to the Bofors syndrome thus far has been that at least it did not hamper government-to-government procurement contracts. This would explain how, since 1987, the armed forces have managed to retain some semblance of preparedness. It would now appear that even this last avenue for modernisation is being targeted by an attack on this government-to-government Rafale programme.

We have a constitutional authority, the comptroller and auditor general of India, to look into the integrity of defence purchases. Having been at the receiving end of its audit of the Jaguar procurement decades ago, this writer can vouch for its thoroughness and professionalism. People's representatives would be fully justified in asking for a CAG audit if there are genuine doubts. But by raising this on the electoral battlefield, we have ended up compromising the cause of the real one. Indian democracy should be made of sterner stuff.

Air Marshal (R) Brijesh D. Jayal

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"Defence Budget Grossly Inadequate"

Given the continuously increasing threats and challenges to national security, particularly the possibility of a two-front war, the funds earmarked by the Finance Minister for defence expenditure for Financial Year (FY) 2018-19 are grossly inadequate. The defence budget proposed in the budget speech on 1 February 2018 for the next financial year will neither enable the armed forces to achieve the required levels of defence preparedness, nor permit them to undertake the military modernisation that is necessary to acquire the desired combat capabilities.

According to a statement issued by the Ministry of Defence (MoD), a sum of Rs 2,95,511.41 crore (excluding pensions) has been earmarked as budgetary estimates (BE) for FY 2018-19. This is 7.81 per cent more than the BE for FY 2017-18 (Rs 2,74,114.12 crore) and 5.91 per cent more than the revised estimates (RE) for the year (Rs 2,79,003.85 crore). Leave aside modernisation, the nominal increase is unlikely to contribute even towards making up the shortages in ammunition and equipment as it is barely sufficient to allow for the annual rate of inflation.

Other budgetary parameters too show a downward trend. The allocation of Rs 2,95,511.41 crore for FY 2018-19 is 1.57 per cent of India's projected GDP for the year. It is projected to be approximately 1.60 per cent of the GDP for FY 2017-18 and was 1.65 per cent in FY 2016-17. At its peak, during the 1980s, the defence budget was 3.5 per cent of the GDP; since then there has been a steady decline.

No matter which yardstick India's defence expenditure is measured by, it is among the lowest in the world. As a ratio of the Total Central Government Expenditure (TGE), the share of defence is 12.10 per cent for FY 2018-19. In Pakistan, it is 25-30 per cent of the TGE. While India has 1.25 soldiers per 1,000 people, China has 2.23 and Pakistan 4.25.

The ratio of capital to revenue expenditure is also far from the ideal of 50:50 (Capital expenditure is that which is incurred on new acquisitions for modernisation and the replacement of obsolete weapons and equipment plus land and buildings. The revenue budget is for expenditure on salaries, ammunition, transportation, clothing and maintenance, et al.)

Of the defence budget of Rs 2,95,511.41 crore for FY 2018-19, Rs 99,563.86 crore (33.7 per cent) is for capital and Rs 1,95,947.55 crore (67.3 per cent) is for revenue expenditure. Manpower costs take away a large chunk of the defence budget. As the army is manpower intensive (1.2 million personnel), its capital to revenue expenditure ratio is as low as 17:83.

The net effect of consistently low capital budgets is that obsolescent vintage weapons and equipment in service are degrading combat efficiency and no modernisation is taking place, particularly in the army. The worst impact is the inability to acquire precision guided munitions and to modernise the command and control and

intelligence, surveillance and reconnaissance systems of the armed forces, even as the three wings of the People's Liberation Army of China are modernising at a brisk pace.

The pension bill for the ensuing financial year (Rs 1,08,853.30 crore) is projected to rise by 26.60 per cent over FY 2017-18 (Rs 85,740 crore, BE). This is more than the capital expenditure planned for the year! Surely, urgent steps need to be taken to adopt innovative measures to reduce the costs of manpower in the armed forces even if the number of personnel in uniform cannot be drastically reduced immediately due to manpower-intensive deployments on the LoC with Pakistan and the LAC with China as well as for counter-insurgency operations in J&K and many of the north-eastern states.

On the positive side, in his budget speech, the Finance Minister announced the completion of the Rohtang Pass tunnel that will provide an all-weather route to Ladakh, expressed the government's satisfaction on the progress of work on the Zojila Pass (J&K) tunnel and declared the government's intention to construct a tunnel under the Sela Pass (Arunachal Pradesh). He also said that the government will establish two military-industrial corridors to give a boost to indigenisation. The Defence Minister later said that the first of these is likely to come up in the Tamil Nadu-Karnataka area *(the second in western UP).*

Finally, China and Pakistan, India's military adversaries, spend 2.5-3.0 per cent and 3.5 per cent, respectively, of their GDP on defence. Parliament's Standing Committee on Defence has repeatedly emphasised that defence expenditure should be progressively raised to 3.0 per cent of the GDP.

India's quest for "defence on the cheap" can only lead to another debacle like that of 1962. Even then, the defence budget had fallen to less than 2.0 per cent of the country's GDP.

It has been empirically proved that defence expenditure up to 2.5 to 3.0 per cent of the GDP has a positive impact on the growth rate of a country's economy. The government must gradually provide more funds for defence to enable the armed forces to acquire the combat capabilities that are necessary to fight and win tomorrow's wars.

Simultaneously, the government must pull out all the stops to genuinely encourage indigenous manufacture of weapons and defence equipment. India's aspirations to be counted as a regional power capable of maintaining peace and stability in the Indo-Pacific in conjunction with its strategic partners and as a nation striving for world power status, cannot possibly be realised without self-reliance in defence acquisition.

Brigadier (R) Gurmeet Kanwal

National Security Strategy
Imperatives for the Raksha Mantri

It is the government's most important duty to ensure that if war breaks out, the armed forces are absolutely ready to face the adversary: well equipped, well trained and in high spirits, urges Brigadier Gurmeet Kanwal.

In 2017, Prime Minister Narendra Modi handed over the reins of the Ministry of Defence (MoD) to Nirmala Sitharaman, a trusted colleague in the Union council of ministers. The minister must muster all her management skills to set the right priorities for the MoD and the armed forces. She will need to lead from the front and work closely with leadership of the armed forces, the bureaucracy and her counterparts in the other ministries to put defence preparedness back on the rails and give a fillip to the stalled process of military modernisation.

As a member of the Cabinet Committee on Security, the minister will play an important role in formulating policies to successfully manage the threats and challenges facing the country.

Defence Preparedness

The foremost item on the defence minister's agenda should be to address the 'critical hollowness' plaguing defence preparedness. This was the term used by General VK Singh, then the chief of the army staff, in the report he wrote to the then prime minister in May 2012.

Major operational deficiencies exist in the authorised war establishment of the three services. For example, several Army corps do not have independent artillery brigades that are authorised to them. These deficiencies must be made up early in order to increase combat efficiency. Large-scale deficiencies in ammunition and important items of equipment continue to hinder readiness for war and the ability to sustain operations over anticipated time periods.

The army reportedly has some varieties of ammunition for barely ten days of conflict and it will cost over Rs 25,000 crore (Rs 250 billion) to replenish the stocks to the minimum required levels. During the Kargil conflict in 1999, 50,000 rounds of ammunition had to be imported from South Africa for the Bofors howitzers. The occurrence of such a situation during a crisis must be avoided through a prudent replenishment and stocking policy.

Modern wars are fought mostly during the hours of darkness, but most of the infantry battalions and many of the armoured fighting vehicles – tanks and infantry combat vehicles – are still 'night blind'.

Warships, submarines, fighter aircraft, light helicopters, artillery guns, ground-based air defence, command and control, surveillance and reconnaissance systems, are either held in inadequate numbers or bordering on obsolescence.

National Security Strategy

Cicero had asked many centuries ago: "For if the trumpet gives an uncertain sound, who shall prepare himself to the battle?"

Unlike other major democracies, India does not have a clearly articulated national security strategy. The defence minister should take the lead in acting as the

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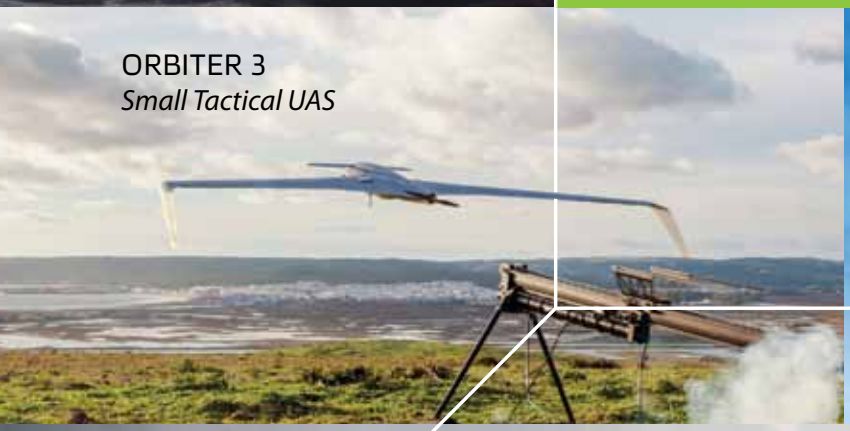

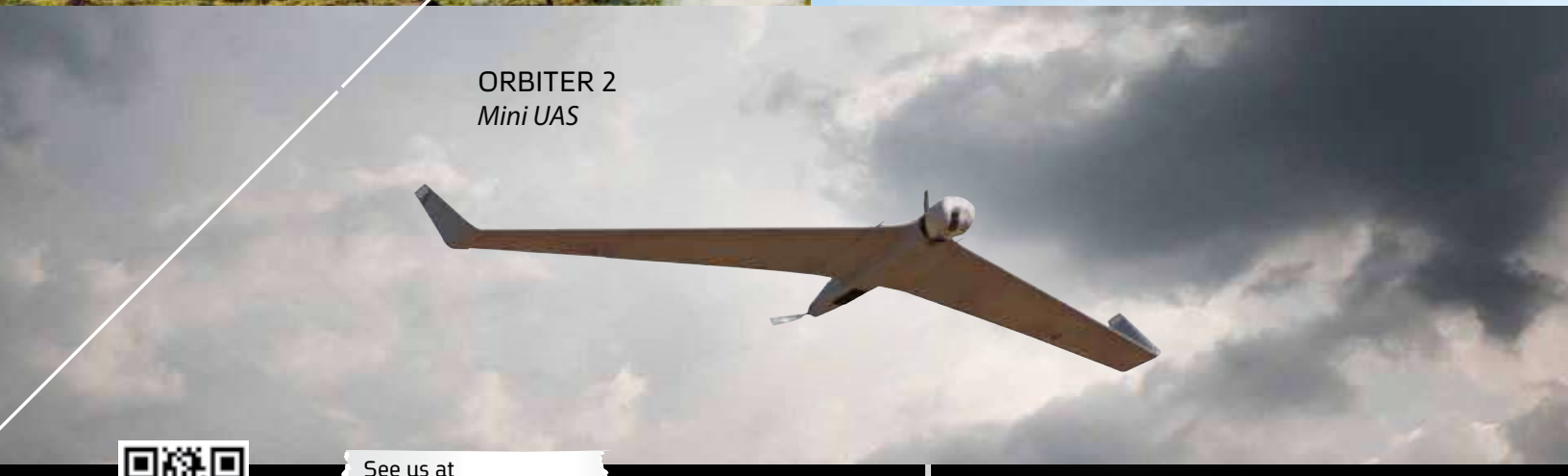

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driving force for the formulation of a comprehensive national security strategy that is inter-ministerial, inter-departmental and inter-agency in approach.

This exercise should be preceded by a strategic defence review to take stock of present and emerging threats, challenges and vulnerabilities. The national security strategy should also take into account national interests and national security objectives.

While the initial spade work can be done by the National Security Advisory Board, a component of the National Security Council, a Group of Ministers must be appointed to draft the national security strategy and present it to the Cabinet Committee on Security for approval.

Like in most other democracies, the National Security Strategy should be signed by the Prime Minister, who is the head of government, placed in Parliament and released as a public document. Only then will various stakeholders take ownership of the strategy and work unitedly to achieve its aims and objectives.

Defence Reforms

Among the structural reforms that merit the new defence minister's immediate attention, the most important issue is the appointment of a Chief of Defence Staff (CDS). First recommended by the Arun Singh Committee on Defence Expenditure in the early 1990s, and then by the Group of Ministers led by L K Advani in the wake of the Kargil conflict, the appointment of a CDS has been hanging fire since then for want of a consensus.

Recently, the Naresh Chandra Committee recommended the appointment of a permanent Chairman of the CoSC as a more acceptable alternative. The appointment of a CDS is an idea whose time has come and no further debate or discussion is necessary.

The appointment of a CDS should be followed a few years down the line by the raising of tri-Service integrated theatre commands so as to ensure 'joint' formulation and execution of operational plans.

It has now been accepted by all modern militaries that 'jointness' or 'jointmanship' leads to the optimisation of single-Service combat capabilities. Also, the Army, Navy and Air Force HQ have been only notionally integrated with the ministry of defence and are still 'attached offices' for all practical purposes.

The reforms approved for the Army in August 2017, which were based on the recommendations of the (Lieutenant General DB) Shekatkar committee, are mainly aimed at reducing the teeth-to-tail ratio but much more needs to be done to streamline combat capabilities.

Defence Planning and Military Modernisation

The 13th Defence Plan (2017-2022) is now underway, although has not yet been formally approved with full financial backing by the Cabinet Committee on Security. The government has also not formally approved the *Long-Term Integrated Perspective Plan* (LTIPP 2007-2022) formulated by HQ Integrated Defence Staff. Without these essential approvals, defence procurement is being undertaken through ad hoc annual procurement plans, rather than being based on duly prioritised long-term plans that are designed to systematically enhance India's combat potential. These are serious lacunae as effective defence planning cannot be undertaken in a policy void.

The government must commit itself to supporting long-term defence plans or else defence modernisation will continue to lag and the growing gap in military capabilities vis-à-vis China's People's Liberation Army will assume ominous proportions.

This can be done only by reviving the dormant National Security Council as defence planning is in the domain of the NSC and not the CCS, which deals with current and near-term threats and challenges and reacts to emergent situations. The NSC must devote the time and energy necessary to undertake long-term defence planning.

Modernisation of the armed forces has been stagnating owing to the inadequacy of funds, the black-listing of several defence manufacturers and bureaucratic red tape. Military modernisation has two major facets: The replacement of obsolete and obsolescent weapons and equipment with modern ones, which results in increasing combat effectiveness; and the qualitative upgradation of combat capabilities through the acquisition and induction of force multipliers.

As the defence budget is invariably much smaller than the requirement, military planners face a major dilemma: How to improve operational preparedness while simultaneously making concerted efforts to modernise. Logically, operational preparedness must take precedence over modernisation.

The art of leadership lies in finding an optimum balance so that all efforts that are made to enhance operational preparedness also contribute substantively to modernisation.

The inability to speedily conclude major defence contracts to enhance national security preparedness in the face of growing threats and challenges, exemplifies the government's challenges in grappling with systemic flaws in the procurement procedures and processes. Despite having promulgated the Defence Procurement Procedure (DPP) and the Defence Production Policy (DPrP), the government has been unable to reduce bureaucratic red tape and speed up acquisitions.

The DRDO

The government must relinquish its monopoly on defence research and development. The DRDO should undertake research in strategic technologies that even the closest strategic partners are unwilling to share – such as ballistic missile defence technology. It should design and develop weapons platforms in conjunction with strategic partners and should completely outsource low-tech research to the private sector. The MoD should also progressively move away from its excessive reliance on the inefficient public sector for defence production. The Defence PSUs should be gradually privatised to make them more efficient and quality conscious. The private sector must be encouraged and incentivised to contribute to the national quest for self-reliance in defence production.

Plans for defence modernisation must lead to substantive upgradation of India's defence technology base and manufacturing capability, or else the country's defence procurement will remain mired in disadvantageous buyer-seller, patron-client relationships. No new defence acquisition should be undertaken without insisting on the transfer of technology (ToT), which, naturally, has a cost attached to it. However, without ToT in cutting edge technologies, India's defence technology base will remain low.

The government has done well to announce its intention to promote defence exports. Formal instructions to give effect to this policy should be issued early and it should be ensured that India abides by the

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Defence Minister Sitharaman chairing an IAF Commanders' Conference in October 2017

provisions of the Arms Trade Treaty even though it is not a signatory to the treaty. The national aim should be to make India a design, development, manufacturing, servicing and export hub for weapons systems and other defence equipment over the next 10 to 15 years in conjunction with the country's strategic partners.

Financial Management

Financial management too needs a major overhaul. The defence budget has dipped below 1.60 per cent of the country's GDP, the lowest since the disastrous 1962 war with China. Parliament's Standing Committee on Defence and the armed forces have repeatedly recommended that defence expenditure should be raised to at least 3.0 per cent of GDP if India is to build the defence capabilities that it will need to face emerging threats and challenges and discharge its growing responsibilities as a regional power in Southern Asia.

Financial powers must be delegated to the services with appropriate checks and balances. Large portions of the budgetary allocations earmarked on the capital account for the modernisation of the armed forces continue to be surrendered year after year with complete lack of accountability.

This can be overcome by setting up a rolling, non-lapsable defence modernisation fund of about Rs 50,000 crore. In the interim budget presented by the previous NDA regime in February 2004, the finance minister had earmarked a sum of Rs 25,000 crore for the modernisation fund; however, the UPA government that came into power after the election in May 2004 did not accept the proposal. It is time to revive and implement the concept of a rolling defence modernisation fund.

Issues undermining morale

The relatively softer issues that can adversely affect the morale of soldiers, sailors and airmen must also be given due attention. These include the large-scale shortage of officers, the grossly inadequate availability of accommodation for married personnel, the long-pending construction of a National War Memorial at India Gate in New Delhi, the setting up of the National Defence University and the long-pending 'one rank, one pension' (OROP) request of armed forces Veterans that has been accorded approval but not in full measure.

The defence minister must ensure that the anomalies created by the Fifth, Sixth and Seventh Pay Commissions are resolved to the satisfaction of the personnel of the three services. The minister should in due course take stock of the numerous cases that the MoD is fighting in various courts against retired armed forces personnel, especially those against disabled veterans. A nation that fights its veterans in the courts of law over small claims shows itself to be unworthy of their selfless sacrifices.

The present state of affairs has come about because of the flawed defence planning and defence acquisition processes in existence, a grossly inadequate defence budget and the inability to fully spend even the meagre funds that are allotted.

Over the 70-year history of post-independence conflicts with India's neighbours and prolonged deployment for internal security, the Indian Army and its sister services have held the nation together. Dark clouds can once again be seen on the horizon, but the efforts being made to weather the gathering storm are inadequate. The government must immediately initiate steps to build the capacities that are necessary for defeating future threats and challenges.

It must take the opposition parties into confidence as a bipartisan approach must necessarily be followed in dealing with major national security issues. The government should appoint a National Security Commission to take stock of the lack of preparedness of the country's armed forces for future conflict and to recommend measures to redress the inadequacies in combat capabilities that might lead to yet another military debacle.

In fact, such reviews should be undertaken periodically. The nation must not compel a future army, navy or air force chief to say 'We will fight with what we have', as General VP Malik was forced to say on national television during the Kargil conflict in 1999. It is the government's most important duty to ensure that when war breaks out, the armed forces are absolutely ready to face the adversary – well equipped, well trained and in high spirits.

Geo Politics

What we must worry about in 2018

The polycentric new world order, which was gradually emerging since the end of the Cold War, has begun to fray at the edges. The primary causes for this situation are the growing friction among the major powers, the triumphant rise of ultra-right wing political parties, dilution in the forces of globalisation and free market economies and the international community's inability to comprehensively defeat the forces of radical extremism.

North Korea's continuing nuclear warhead and ballistic missile tests in 2017 – in flagrant violation of United Nations Security Council resolutions – and US President Donald J Trump's threat to unleash "fire and fury' like the world has never seen," have brought the Korean peninsula to the brink of war.

Although the probability of nuclear exchanges is low, the possibility of conventional conflict cannot be wished away.

In West Asia, while the progress made in liberating ISIS-controlled areas in Iraq and Syria has forced the Islamic caliphate to retreat geographically, its virulent ideology continues to flourish unabated.

In fact, a cyber caliphate is emerging gradually. It is potentially more dangerous than its geographical counterpart owing to the ability of a handful of the 'faithful' to radicalise large sections of vulnerable youth using the Internet.

In Southern Asia, the tenuous security environment in Afghanistan and along the Af-Pak border is the greatest cause of instability. The strategic stalemate between the Afghan government and the remnants of NATO forces on one side and the Taliban and Pakistan-sponsored terrorist organisations like the Haqqani network on the other, is likely to endure. The Taliban now control 50 per cent of rural areas in Afghanistan.

President Trump has reversed his predecessor's decision to draw down the number of US forces and eventually pull out of Afghanistan. He has decided to continue operations till al Qaeda is finally defeated. He has also called on Pakistan to stop playing double games and to eliminate the anti-Afghan Taliban from its soil.

2018 is likely to witness more US drone strikes inside Pakistan and perhaps even Special Forces raids and air-to-ground strikes to destroy terrorist hideouts.

China's growing nexus with Pakistan and the two countries' unresolved territorial disputes with India continue to pose a formidable national security threat to India. In the year gone by, the intensity of this threat did not diminish as has been the case since the Kargil conflict of 1999.

In fact, the Doklam standoff near the India (Sikkim)-Tibet (China)-Bhutan

North Korea continues ballistic missile tests

trijunction in June-August 2017, further vitiated the security environment.

Despite misgivings in both countries, the China-Pakistan economic corridor (CPEC) has begun to take shape. Passing through Gilgit-Baltistan in Pakistan-occupied Jammu and Kashmir (PoJK), the CPEC will link Xingjian province in China with Gwadar on the Makran coast west of Karachi.

Though Pakistan is raising a Division of approximately 12,000 personnel to provide security for the CPEC against terrorist attacks, eventually Chinese soldiers are bound to be inducted for this purpose like in Gilgit-Baltistan. Large-scale PLA presence in Pakistan will greatly destabilise the region.

Surprisingly, from India's point of view, India's long-time strategic partner Russia has expressed its support for the CPEC, although denied later in a Facebook post.

From the Internet

Russia also held a low-level military exercise with Pakistan and has offered to sell arms to the country. These developments are detrimental to India interests and could to some extent be attributed to the previous US administration's anti-Russia policies. These policies have driven Russia closer to China.

The nuclear deal that Iran signed with the US has held for over a year despite strong opposition from several regional neighbours of Iran like Israel and Saudi Arabia.

Arguably, getting Iran to give up its ambition to acquire nuclear weapons was the most significant foreign policy achievement of the US since the Camp David accords of 1978.


Doklam standoff

It is not yet clear whether the nuclear deal will survive machinations of the Trump administration. He has not yet unilaterally abrogated the agreement. If either signatory walks out, the world is likely to soon witness the arrival of another nuclear power – with attendant negative consequences. A nuclear-armed Iran is unlikely to be acceptable to the Trump administration or Prime Minister Binyamin Netanyahu or to the Saudis.

Forgotten in the shadow of the conflict in Syria and Iraq is the civil war in Yemen. The Houthis and their allies, who seized Sanaà in September 2014, are locked in a bitter fight with a Saudi-led coalition comprising mainly Arab nations from the Gulf.

The Saudis accuse the Houthis of having fired two Iran-supplied ballistic missiles into Saudi Arabia and claim to have intercepted both successfully.

General Raheel Sharif, the former Pakistan army chief, now heads the Saudi-led 34-nation coalition assembled to fight Islamist terrorist groups. (The Pakistan Government has recently announced that Army contingents will be deployed in Saudi Arabia as well.)

Closer home, of the almost one million Rohingya Muslims who have for long been residing in Rakhine province in Myanmar, over 600,000 fled their homes due to alleged repression by the army. They have streamed across the open border into Bangladesh, many of them also attempting to sneak into India. Unless arrangements are made to get Myanmar to take them back soon, malnutrition and disease prevailing in the refugee camps in Bangladesh could escalate to insurgency.

India's red lines were repeatedly crossed by violation of the mutually agreed cease-fire of November 2003 by the Pakistan army. There was also a major increase in infiltration attempts across the LoC and increase in the incidents of violence in J&K during 2017. India continued its post-surgical strikes policy of tactical assertiveness under the umbrella of strategic restraint and dominated the LoC aggressively. Almost 200 Pakistan-sponsored terrorists were killed during the year. The LoC battles continue.

Internal instability continues to haunt the government of Pakistan and its army. Three years after it was launched, *Operation Zarb-e-Azb* in Khyber-Pakhtoonkhwa is

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Rohingya refugees in Myanmar

still to be concluded successfully. A low-grade insurgency in Balochistan, unrest in Sind and Gilgit-Baltistan, creeping Talibanisation, ethnic tensions and a weak economy are a potent mix that could lead to an implosion. Adding fuel to the fire are the army's clumsy attempts to 'mainstream' the Hafiz Saeed-led Lashkar-e-Taiba to fight the 2018 elections as a registered political party.

In October-November 2017, the Pak Army allowed the Tehreek-e-Labaik, a hardline militant Islamist group, to blockade the road from Rawalpindi to Islamabad, Pakistan's capital, despite requests from the government to throw them out. Clearly, the army continues to undermine the functioning of Pakistan's duly-elected civilian government.

Varying degrees of turmoil in other countries around India, including Bangladesh, Maldives, Myanmar, Nepal and Sri Lanka have added to regional instability.

Narco-terrorism, the proliferation of small arms, the circulation of fake currency notes, trans-border money laundering and the availability of sanctuaries for insurgents, often aided and abetted by neighbouring States, enable non-State entities to challenge duly elected governments.

The insurgent movements in India's north-eastern states are an example of this phenomenon. The prevalence of volatility in the region leads to the inevitable conclusion that Southern Asia will continue to remain unstable for some more time to come. The countries of the region must come together in their own interest and agree to systematically plug the loopholes that enable cross-border insurgent movements to flourish.

Sadly, there is too much mistrust among the neighbours. Also, with SAARC having become almost completely defunct, nor is a viable platform available to enable the conduct of long and hard negotiations that would be required.

Brig Gurmeet Kanwal (Retd)

The India-Pakistan border remains 'tense'

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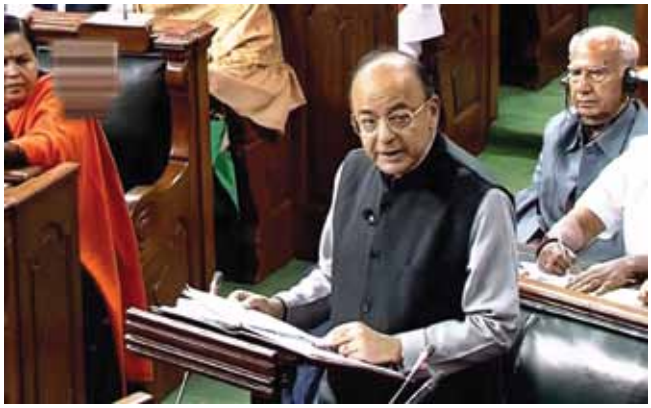
India's Defence Budget 2018-19



The Union Budget for the financial year 2018-19 presented by Finance Minister Arun Jaitley in Parliament, has envisaged a total outlay of Rs.24,42,213 crore, of which Rs 2,95,511.41 crore has been earmarked for Defence which accounts for 12.10 percent of the total Central Government expenditure for the year. This allocation represents a growth of 7.81 percent over Budget Estimates (Rs 2,74,114.12 crore) and 5.91 percent over Revised Estimates (Rs. 2,79,003.85 crore), respectively for the financial year 2017-18. In percentage terms, the new Defence budget has marginally increased by only 7.81% which works out to just about 1.58% of the projected GDP for 2018-19, "the lowest such figure since the 1962 war with China". Even as this figure has been steadily declining in percentage terms as the economy expands, defence and strategic observers opine that it should be over 2.5% to ensure the armed forces are capable of tackling the "collusive threat" from Pakistan and China.

Enhancing Defence Production

In his Budget Speech 2018-19, Finance Minister Arun Jaitley, has announced various steps for enhancing indigenous defence production. These include measures to develop two Defence Industrial Corridors in the country and bringing out an 'industry friendly' Defence Production Policy 2018 to promote domestic production by the public, private sectors and MSMEs. Defence Minister Nirmala Sitharaman, stated, "These are the first ever Defence Production Corridors being formed in the country will give a big boost to defence production in the country."

'Make in India' in Defence Sector

'Make in India' in the defence sector, primarily driven by capital acquisition of defence equipment and other policy measures have been taken to promote production of armoured fighting vehicles, combat vehicles, combat aircraft, warships, weapons, ammunition, missiles, radars, electronic warfare systems etc. "Defence Research & Development Organisation (DRDO), the Research wing of Ministry of Defence has been set up with a mandate of developing 'cutting' edge technologies and systems for India's Armed Forces as per their specific Qualitative Requirements."

"Crippling delays in arms procurement process": MoD internal report

An internal report of the Ministry of Defence, widely reported by the media has it that India's weapon acquisition process is "badly broken and beset with huge delays". The report detailed that only some 8-10% of 144 proposed programmes have fructified in the last three financial years. This scathing presentation, given by Minister of State for Defence Subhash Bhamre asserts that "the arms procurement process is dogged by multiple and diffused structures with no single-point accountability, duplication of processes, avoidable redundant layers doing the same thing again and again, delayed execution, no real-time monitoring and no project-based approach, among other things."

"The presentation said there is a tendency to find faults rather than to facilitate the process," revealed a source. Consequently, the entire 'Make in India' policy in the defence production sector continues to languish due to procedural delays, without moving forward in any concrete manner. Cognisance should be taken of these "hard, uncomfortable facts" to ensure "correctives" are put in place, with proper responsibility and accountability being fixed, according to the minister. "From fighters, drones and helicopters to submarines, minesweepers and artillery howitzers, the armed forces continue to grapple with major operational gaps owing to the convoluted procurement procedures and the lack of adequate modernisation budgets in the face of ballooning pay and pension bills."

Delays in Project P-75 II

Even eighteen months after an extension was granted by the Defence Acquisition Council for Project P-75 II, which involves the construction of six diesel-electric submarines at a cost of $10.9 billion, neither an Indian shipyard nor any foreign original equipment manufacturer (OEM) has been selected "to get cracking on the project." Six submarines planned to be constructed as part of Project P-75 (I) have a deadline coming up, even after the diesel-electric submarine project have an acceptance of necessity.

FICV project proceeds

The Defence Ministry's plan for a Future Infantry Combat Vehicle (FICV) to replace the Indian Army's Russian-origin BMP-2 infantry combat vehicle inventory is progressing. This massive project costing some of Rs 60,000 crore has been on hold for almost a decade but has recently received approval from the panel of independent expert monitors (IEMs). They have deemed that the evaluation process for selecting firms to produce prototypes of the FICV is "in order and could proceed." The MoD had earlier

approved that the public sector Ordnance Factory Board (OFB), along with two private firms would be cleared to develop prototypes and two years back, in February 2016, the MOD received responses to the EoI from L&T, Mahindra, Reliance Defence, Consortium of Tata Motors and Bharat Forge, OFB and Consortium of Tata Power SED and Titagarh Wagons Limited.

Meanwhile, the Defence Acquisition Council, chaired by Defence Minister Nirmala Sitharaman, has approved Rs 1,125 crore projects including orders for 156 infantry combat vehicles (BMP-2/2Ks) for the Army's mechanised infantry. "The vehicles will meet the operational requirement of troops in rapid deployment," said an official. DAC also approved procurement of a survey training vessel for hydrographic surveys of Indian ports, harbours and exclusive economic zones and for other 'friendly' countries.

'Defence Industry Development Meet'

The Department of Defence Production in association with HAL organised a two-day 'Defence Industry Development Meet' at Chennai on 18-19 January, 2018. The objective of the Meet was to 'forge partnerships with private industry for achieving self-reliance in defence production'. The event was inaugurated by Defence Minister Nirmala Sitharaman in the presence of Chief Minister of Tamil Nadu, Edappadi K Palaniswami. The Meet focused on "indigenisation, import substitution and technology infusion in defence production". T Suvarna Raju, HAL-CMD chaired the panel discussions on 'Session on Aerospace'. HAL supported the event by providing infrastructure, administrative and logistic support for a gathering of more than a thousand vendors and partners.

HAL invites Indian partners for ALH civil version

HAL has offered the indigenous Dhruv Advanced Light Helicopter (civil version) for manufacturing to interested Indian private companies through Transfer of Technology and the Company has invited Expression of Interest (EOI) for identification of an Indian Partner. "Considering the increasing need of helicopters in civil operations of the country, this will be a mega deal from HAL which is the OEM and Licensor", observed T Suvarna Raju, CMD, HAL.

HAL is looking for an Indian partner "having five years of experience in engineering/aerospace industry (including manufacturing and assembly), having net worth of Rs 2000 crores and minimum turnover of Rs 2500 crores, possessing skilled and qualified manpower, registered in India or having majority holding by Indian stakeholders and willing to enter strategic collaboration with HAL."

48 more Mi-17V-5 helicopters for the IAF

Sergey Chemezov, CEO of Rostec State Corporation has stated that "Negotiations with the Indian government for delivery of 48 Mi-17V-5 helicopters have been completed; we expect to sign the

corresponding contract in the first quarter of 2018. Our helicopter meets all the requirements presented in the tender documentation, and its technical characteristics exceed that of our competitors." On the matter of the Ka-226T for the Navy, he added, "We already have a solution for the naval version of this helicopter with folding blades. Owing to the project for joint production of these helicopters, there are opportunities for joint maintenance, training of pilots and mechanics and other related costs."

Boeing offers F/A-18 Super Hornets to Indian Navy

Boeing are reportedly in discussion with the Indian Navy concerning the F/A-18 Super Hornet multi-role fighters. According to Gene Cunningham, Vice-President for defence, space and security, Boeing, "A lot of technical evolution has to take place before the deal hits the final chord." Boeing is also keen to offer its KC-46 multirole tanker to meet the IAF's requirements, Cunningham added.

India and Iran agreement on Chabahar Port

The governments of India and Iran have signed a number of agreements including operational control of a part of the Chabahar port for an initial 18 months. This is seen as vital to India's strategic plans to connect with Afghanistan and Central Asian countries essentially as a trade route. The US $85 million project, just 90 km from the Chinese-built Gwadar port in Pakistan, "ensures a transit route for India to Afghanistan and resource-rich central Asian countries bypassing Pakistan." After the meeting between Prime Minister Narendra Modi and Iranian President Hassan Rouhani, the two countries signed nine pacts, including a double taxation avoidance treaty, and decided to fast-track agreements for preferential trade arrangements to boost economic ties amid US pressure to review the 2015 nuclear deal and re-impose sanctions on Tehran.

Vietnamese President in India

During his recent visit to India, Vietnamese President Tran Dai Quang lauded India's efforts in and strong commitments to its 'Act East' policy as well as to enhance the connectivity and development cooperation with ASEAN. Quang said Vietnam encourages investments from India and wants India to rank among top ten investors in the country. Quang's visit comes just over a month after Vietnamese Prime Minister's visit to New Delhi as India seeks to expand foothold in China's periphery. As the coordinator of ASEAN-India relations for 2015-2018, Vietnam has worked closely with India to drive the India-ASEAN cooperation forward.

US Air Force Chief in India

Chief of the US Air Force General David L Goldfein made a three-day visit to India, 1-3 February 2018 and held extensive talks with Air Chief Marshal B S Dhanoa and other senior defence officials. He stated that 'Quadrilateral' coalition among the US, India, Japan and Australia would provide for deeper cooperation between the Indian and US air forces. He added that "India is a 'central strategic partner' of the US in pursuing common interests in the region," and said "two of the world's largest air forces were going to jointly shift the focus on the Indo-Pacific region and asserted that the rules-based order must be preserved in the critical sea lanes."

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13, Gandhi Gram, Kanpur - 208 007 (UP) INDIA. Tel: (+91-512) 7102710. Fax: (+91-512) 7102727. email: protection@mku.com
MKU GmbH, Kampweg 9, 27419 Sittensen, GERMANY. Tel: (+49-4282) 50810-11. Fax: (+49-4282) 50810-60. email: protection@mku.eu

French President in India, 14 agreements signed

French President Emmanuel Macron was on a state visit to India from 9 March 2018 during which time he and Prime Minister Narendra Modi signed 14 agreements, covering a number of areas from security, nuclear energy and protection of classified information to education, environment, urban development and railways. However, the India-France joint statement did not mention any acquisition of another 36 Rafale fighters despite President Emmanuel Macron's insistence that "the defence contract is at the heart of the strategic partnership between the two countries. India had made a sovereign decision in this respect and we are monitoring progress in the field. We very much want to continue the programme. It is a long-term contract which is mutually beneficial. I personally consider it as the heart of the strategic partnership," Macron stressed.

36 additional Rafales offered

Prior to President Macron's visit, French defence minister Florence Parlyhad had suggested to her Indian counterpart Nirmala Sitharaman that France "is keen to initiate discussions on the proposal of providing an additional 36 Rafales to the IAF, with a very significant share of Make in India". She had added, "A message to this effect during the visit would be particularly appreciated."However, according to Indian MoD sources, "no decision has yet been taken" on whether to go in for the acquisition of additional Rafales but that in the future "it will be taken at a later stage once the delivery of the first 36 jets begins".

The first batch of 36 Rafales are slated for induction at Air Force Stations Hasimara and Ambala between November 2019 and mid-2022. Apart from the Rafales, France is also one of the four contenders for Project-75 (India), under which six advanced stealth submarines are to be built indigenously through a collaboration between a foreign ship-builder and an Indian shipyard for an estimated Rs 70,000 crore ($10.9 billion). French Naval Group-DCNS is already constructing six *Scorpene* submarines at Mazagon Docks in Mumbai under the Rs 23,000 crore Project-75.

SpiceJet in engine contract with CFM

On 10 March 2018, SpiceJet and CFM signed a $12.5-billion agreement for purchasing LEAP-1B engines to power the 155 Boeing 737 MAX airliners on order, along with spare engines to support the fleet. The airline also signed a 10-year Rate per Flight Hour (RPFH) agreement with CFM Services that covers all LEAP-1B engines powering SpiceJet's 737 MAX aircraft. SpiceJet currently operates a fleet of more than 38 CFM56-7B-powered Boeing 737 NG family aircraft."From what we have seen so far, the LEAP-1B is living up to its promises for efficiency and reliability," stated Ajay Singh, SpiceJet Chairman and Managing Director.

IAF C-17 Globemaster at Tuting

The Indian Air Force's largest transport aircraft, the Boeing C-17 Globemaster III operated from Arunachal Pradesh's Tuting Advanced Landing Ground (ALG) in the Upper Siang district

of Arunachal Pradesh on 13 March 2018. This is assumed as part of the IAF's move to augment logistic support operations in the strategically important border state as the landing ground is only 30 km from the Tibetan border. After this trial landing, the C-17 carried out an operational mission, airlifting 18 tonnes of load.

Chief of the French Air Force in India

Air Chief Marshal André Lanata, Chief of the French Air Force visited India 5-8 February 2018. He called on Air Chief Marshal BS Dhanoa, followed by meetings with Defence Secretary Sanjay Mitra, and General Bipin Rawat, COAS. "The excellence of these meetings reaffirmed the close and long standing ties between the Indian and French armed forces with regard to inter-services cooperation and sharing operational experiences," said Ambassador Alexandre Ziegler.

Demonstration flights of Tejas LCA

There have been several 'VIP' demonstration flights in the Tejas LCA trainer. Beginning with the Singapore Defence Minister, who was given a sortie on the Tejas LCA at Kalaikunda AFS in late November 2017, the USAF chief flew in the two-seater LCA from Jodhpur on 3 February 2018, followed by the French Air Chief on 7 February 2018. Singapore's Defence Minister Ng Eng Hen had described the Tejas as "excellent and very impressive" and praised skills of the pilot Air Vice Marshal AP Singh, Project Director at the National Flight Test Centre, (ADA). On 3 February 2018, General David L Goldfein, Chief of the US Air Force, was flown in the LCA at Jodhpur Air Force Station, again by Air Vice Marshal AP Singh, General Goldfein being the first foreign Air Chief to fly in the Tejas (*see picture*). Some days later, on 7 February, 2018, the French Air Chief General Andre Lanata, flew in the LCA trainer again from Jodhpur with Air Vice Marshal AP Singh at the controls.

Colours for IAF Units

The President of India Ram Nath Kovind conferred the President's Standard to No. 51 Squadron and Colours to No. 230 Signal Unit of the Indian Air Force on 22 March 2018 at AFS Halwara.

NAL Saras continues test flights

The Saras light transport aircraft developed by NAL has made its second test flight from the HAL airport, Bangalore piloted by Wing Commander U P Singh, Group Captain R V Panicker and Group Captain K P Bhat of the IAF's Aircraft and System Testing Establishment. "This was the second of the 20 test flights planned for Saras PT1N, before finalising the production version," stated Union Science & Technology Minister Harsh Vardhan. This follows the first flight test on 24 January 2018. Design and development of the Saras is undertaken by the CSIR-National Aerospace Laboratories under directorship of Dr JJ Jadhav. Some years earlier, the Indian Air Force had committed to procure an initial batch of 15 Saras.

LCH flight with indigenous AFCS

Maiden flight of HAL's Light Combat Helicopter (Technology Demonstrator-2) with own designed and developed Automatic Flight Control System (AFCS) has taken place with

test pilots Wg Cdr (Retd) Unni K Pillai, Chief Test Pilot and Gp Capt (Retd) Rajesh Verma at the controls. The AFCS is a digital four axis flight control system for the control & stability augmentation function and auto-pilot modes of helicopters. The indigenous development of the Hardware, Software and Control Law is a fully in-house effort of HAL R&D Centres, being the RWR&DC and MCSRDC at Bengaluru, SLRDC at Hyderabad and Korwa Division.

Hot refueling trial-cum-sortie of Tejas LCA

Towards achieving Final Operational Clearance (FOC) of the Tejas LCA, Hindustan Aeronautics Limited carried out a hot refueling of the aircraft followed by a sortie at Bangalore on 26 February 2018. Hot Refueling is a single point pressure refueling of the aircraft with the engine in operation, a process by which a fighter aircraft is refueled (in between sorties) while its engine is running, thereby cutting down the refueling time by half and the turn-around time significantly.

Hawk-i with indigenous RTOS

HAL's Hawk-i with indigenous Real Time Operating System (RTOS) has been flown, this being the first time that an indigenous RTOS has been certified by CEMILAC. RTOS is the system software which provides a standard run-time environment for real-time applications execution in a safe and reliable manner. The RTOS performance has been validated on the Mission Computer of the Hawk-i trainer, the HAL-RTOS to be operated as a standard Real Time Operating System for any future avionics systems indigenous development.

Funding proposed by UK for 20 Hawks

For the pending procurement of additional 20 Hawk jet trainers for the IAF, which has been stalled for years reportedly owing to financial reasons, BAE Systems and the UK government have offered India a line of funding to land a contract for the aircraft, worth an estimated Rs 2500 crores. As a policy, the Indian government has not accepted 'defence aid', but instead funded all equipment from its own budget. However, the UK has recently revived its Direct Lending Facility, wherein UK Export Finance provides loans up to £3 billion to overseas buyers, enabling them to procure capital goods from UK exporters and, thereby, "support employment in the UK." According to well-informed sources, the government of India has "not accepted" the offer.

Apache AH-64E for Indian Army

The Indian Army's requirement for dedicated attack helicopters integrated with various Strike Corps is likely to be "fulfilled soon", the Government of India having issued a Letter of Request (LoR) to the US Government for purchase of Boeing Apache AH-64E attack helicopters. The LoR formally begins the FMS (foreign military sales) process which follows the US government-to-government methodology for export of US-built armament. This will be followed by the US response with a Letter of Acceptance (LoA) to take the Apache programme forward, "negotiations would follow". Although, the Indian Army has long projected their requirement for 39 such helicopters, the initial batch of six Apaches is seen as an important breakthrough in the Army's case for integral attack helicopters.

Earlier in 2015, the Government of India had placed orders for 22 Apaches plus 15 Chinook heavy lift helicopters to be operated by the Indian Air Force but these are essentially to support the Indian Army's Strike Corps.

Tata Boeing Aerospace inaugurate Apache facility

On 1 March 2018, Tata Boeing Aerospace Limited (TBAL), a joint venture between Boeing and Tata Advanced Systems Ltd. (TASL) inaugurated its modern facility in Hyderabad, which will be

Left to right, Sukaran Singh, K T Rama Rao, Ratan N Tata, Nirmala Sitharaman, Minister of Defence, Pratyush Kumar, President, Boeing India

the sole global producer of fuselages for AH-64 Apache helicopters delivered by Boeing to its global customers including the US Army. The facility will also produce secondary structures and vertical spar boxes of this multi-role combat helicopter. The delivery of the first fuselage is expected in 2018. TBAL, Boeing's first equity joint venture in India, is the result of a 2015 partnership agreement with TASL. Construction of the manufacturing facility began in 2016 and was completed on schedule. In addition, Boeing and TASL have worked closely to develop a pool of highly skilled aerospace talent through skill development initiatives."I congratulate Tata and Boeing for taking this bold step towards 'Make in India' and making this substantial investment in the defence space," stated Nirmala Sitharaman, Minister of Defence. "The manufacturing of advanced defence platforms and being integrated with the complex global supply chain will help our aerospace industry acquire technology, build local capability, provide employment and become a global exporter."

Rustom II test flight

Test Flight of DRDO's Rustom II medium altitude long endurance unmanned aerial vehicle (MALE) has reportedly taken place on 25 February at the Aeronautical Test Range in Chalakere in Karnataka. The Rustom II is designed for surveillance and reconnaissance with payloads to include synthetic aperture radar, and electronic intelligence systems. According to DRDO, "This flight assumes significance owing to the fact that it is the first flight in user configuration with higher power engine". The Aeronautical Development Establishment (ADE) have been developing unmanned aerial vehicles (UAVs) for several decades. The Rustom I, derived from the NAL's LCRA (Light Canard Research Aircraft) was developed under leadership of Prof Rustom Damania, its first flight taking place on 16 November 2009 from Hosur.

Second HAL Dornier 228 civil variant

The second HAL-built Dornier 228 civil variant (VT-ENQ) made its first flight from Chakeri (Kanpur) on 28 February 2018, flown by Air Commodore KA Muthana, HAL's Chief of Test Flying. In two days, the aircraft was flown for over two hours, this aircraft joining the first civil variant and awaiting full DGCA certification. These aircraft are powered by Honeywell TPE 331-10 engines, flat-rated for hot and high operations. It is learnt that the Ministry of Civil Aviation are in process of ordering 10 HAL-Dornier 228s for operation by Alliance Air under the UDAN scheme.

Tejas LCA production deliveries

HAL Bangalore Complex will have delivered nine series production LCA Mk.Is (IOC) to the Indian Air Force by 31 March 2018 from its two production sites. These will join the earlier

Tejas aircraft handed over to No.45 Squadron, raised on the type, which continues to operate from the HAL airport at Bangalore. It is learnt that the balance single-seater Mk.Is (IOC) will be produced in the next financial year but there will be considerable delay in manufacture of the four two-seat LCA trainers as part of the order, since their production drawings have reportedly not been frozen. The next batch of 20 LCA Mk.I (FOC) also includes four twin-seat operational conversion trainers.

DRDO proposal for new AWACS

According to sources in DRDO, the proposal to develop an AWACS system using the Airbus A330 as platform is to be progressed, with the Defence Minister chairing a high level meeting shortly *(seen in model form at a recent Aero India Show).* As per plan, the DRDO and Airbus would jointly modify two aircraft, to be followed by another four. The AESA radar system, yet to be identified, will be mounted on a rotodome, similar to that on the IAF's current Israeli-Russian Ilyushin A.50, also referred to as the *Phalcon.*

New engine developments at HAL

HAL are concurrently developing two new aero engines, with its Aero-engine Research & Design Centre (AERDC) carrying out a test run of its HTFE-25 (Core-2) engine on 10 January, 2018. The Core-2 engine has an improved HP Compressor spool configuration leading to development of the twin spool development. This engine is projected to meet the requirement for HAL's HTT-40 turboprop trainer aircraft, which is currently under flight development tests.

The second engine is the HTSE-1200 (Hindustan Turbo Shaft Engine) aimed at powering 3.5 ton single engine class and 5-8 ton twin engine-class helicopters. Both projects are expected to reach fruition by around 2020-21 and would meet HAL's upcoming projects: the HTT-40 trainer; the Light Combat Helicopter, the Light Utility Helicopter and the future ALHs (Advanced Light helicopters). The ALH and its variants are presently powered by HAL/Turbomeca Shakti (called the Ardiden 1H).

Siemens Medium Voltage Lab

On 24 January 2018, Admiral Sunil Lamba, the CNS inaugurated the Medium Voltage (MV) Lab at INS *Valsura*, the ceremony also attended by V Adm AR Karve, FOC-in-C (South) and Bhaskar Mandal, Executive Vice President and Head, Process Industries & Drives, Siemens India, who said, "We are very proud to be part of this prestigious project for the Indian Navy. Siemens has played a pivotal role in the transformation process of the Indian Navy from diesel-mechanical turbines to an efficient electric propulsion, which will further build stealth and endurance to the fighting vessels as well as reducing its carbon footprint."

ATAGS winter trials in Sikkim

According to Ministry of Defence sources, procurement of the first batch of 40 howitzers, developed by DRDO in association with two Indian companies, is imminent. These Advanced Towed Artillery Gun System (ATAGS) "performed very well in winter trials in Sikkim." The MoD had sanctioned the ATAGS project in September 2012 and the DRDO partnered with Bharat Forge and TATA Power (Strategic Engineering Division) SED to develop two prototypes of the towed artillery guns.

Enhanced full body armour for soldiers

To enhance body protection of soldiers, the Indian Army is evaluating options for Individual Protection System, comprising ballistic helmets, body suits and shoes. The Army intends to procure about 60,000 of such Individual Protection System but "must ensure easy mobility and reduced fatigue." The protection should include safety against blasts and even as ensuring personal health parameters.

New assault rifles to replace INSAS

The DAC headed by Defence Minister Nirmala Sitharaman has approved proposals valued at approximately Rs 15,935 crore for 740,000 assault rifles for the three services. These rifles will replace the present indigenous INSAS and also be produced in India by the Ordnance Factory Board as also the private industry at an estimated cost of Rs 12,280 crore. The DAC has fast tracked procurement of the three main personal weapons, including rifles, carbines and light machine guns.

BSF to acquire UAVs

The Border Security Force (BSF) will acquire eight tethered unmanned aerial vehicles (UAVs) and a number of ground surveillance radars (GSRs) to enhance its capability "for maintaining constant vigil." Tethered UAVs, unlike their conventional rotor wing multi-copter counterparts, are connected to a ground control station with a cable for continued power supply as well as exchange of command and data. Though their mobility and the area of surveillance is restricted, such machines have greater flight endurance and can stay aloft for many hours.

GE and Tata's *Centre of Excellence*

At a ceremony on 12 February 2018, GE and the Tata group initiated establishment of a Structural *Centre of Excellence* (COE) focused on aero-engine components. The manufacturing facility will be located in Adibatla, Hyderabad and will incorporate "latest technologies from GE and best manufacturing practices to deliver complex high precision aero-engine components to the world's fastest-selling jet engine, the CFM LEAP engine." This is part of the strategic partnership signed in November 2017 between GE Aviation and Tata Advanced Systems Limited (TASL) to join forces for manufacturing, assembling, integration and testing of aircraft components.

The agreement for manufacturing LEAP components and establishment of TASL as a COE provides the opportunity for TASL to expand into other GE product lines in both commercial and military engines in the future. GE currently provides power plants and marine gas turbines for the Tejas LCA Mk.1, Boeing P-8I and P-17 *Shivalik*-class frigates. In the near future, several other applications for GE engines in India include the LCA Mk.2, the P-17A and P-71 warships and AH-64 Apache attack helicopters.

QuEST Global in "unprecedented growth"

QuEST Global's Vice President - Aero Defence Offsets, Ashok Baweja, formerly Chairman of HAL has stated that the Company "is uniquely positioned to capture a significant share of the international Aero Engine engineering services market this year with multiple contract wins in the pipeline from leading Aero Engine OEMs in North America, Europe and Asia. Leveraging their industry expertise and strong talent pool, which are among the most competent and the largest in the industry, QuEST has been partnering with most of the leading Aero Engine OEMs across the globe like General Electric, Rolls Royce, Safran Aircraft Engines, empowering them with pivotal support services ranging from design, development, and manufacturing engineering to aftermarket services of Aero Engines, thus contributing to their high standards of reliability and safety." According to Baweja, "The Make in India initiative is currently prompting Aero Engine OEMs to increasingly partner with Aerospace service providers based in India, as it envisages the production of a certain percentage of the aircraft in the country. With the robust experience of having worked with global OEMs for the past two decades through our unique local global delivery model, these upcoming wins will be a significant opportunity for QuEST to showcase our expertise."

Thales and IIT Madras sign MoU

Thales and the Indian Institute of Technology Madras have signed a Memorandum of Understanding (MoU) to create a jointly supervised PhD fellowship programme in coordination with CNRS, the ceremony held in the presence of Prakash Javadekar, Minister of Human Resource Development, and M Frédérique Vidal, Minister of Higher Education, Research and Innovation, Government of France, at *The Knowledge Summit*. "Thales and IIT Madras look forward to strengthening Indo-French scientific collaboration while contributing towards the development of highly specialised technical skills in India."

"IN watch on the IOR"

The Indian Ocean Region (IOR) is becoming a new arena of rivalry between India and China even as there were reports of 11 Chinese warships entering the Indian Ocean "amid a constitutional crisis in the tiny tropical island chain of Maldives, now under a state of emergency". Although Indian Navy sources stated that the Chinese convoy had thereafter turned back to the South China Sea, the IN has kept close watch on all the 'choke' and entry points of the IOR. An Indian Navy spokesperson said, "The Indian Navy has robust maritime domain awareness and has a clear picture of what happens in the IOR".

Indian Navy "well equipped to counter Chinese threats"

Admiral Sunil Lanba, CNS has said that the Indian Navy is closely tracking increasing Chinese naval presence in the Indian Ocean Region (IOR) "and is well prepared to counter any threat to national security". The CNS said that there has been noticeable increase in the deployment of Chinese ships, submarines and research vessels in the IOR. While the early Chinese deployments were projected as anti-piracy deployments, the setting up of bases and the increasing presence of ships and submarines have implications for the regional security environment. "The Indian Navy constantly evaluates the maritime security environment in our areas of interest and manages its own deployments to address new challenges."

L&T launches second Offshore Patrol Vessel for ICG

Larsen & Toubro launched the second Offshore Patrol Vessel (OPV) CGS *Vijaya*, of a series of seven OPVs for the Indian Coast Guard at the company's defence shipyard at Kattupalli, near Chennai on 20 January 2018. The first OPV was launched in October 2017 and is presently undergoing trials. These OPVs are long-range surface ships embarking a helicopter and their roles include coastal and offshore patrolling, policing maritime zones of India, control and surveillance, anti-smuggling and anti-piracy, but with limited wartime roles.

India and Russia contract for 4 new stealth frigates

India and Russia have finalised contracts for four new stealth frigates for the Indian Navy for some $3 billion per vessel. Designated the *Upgraded Krivak III*-class, the first two frigates will be built at the Yantar Shipyard, in Kaliningrad, Russia, followed by two at Goa Shipyard Ltd (GSL). Delivery of the first frigate will begin within four years of signing the contract. The IN already operates six *Krivak* III frigates, the first three being commissioned between June 2003 and April 2004, followed by another three between April 2012 and June 2013.

Exercise 'Milan 2018'

Exercise Milan 2018 was conducted during 6-13 March 2018 in the strategic area around the Andaman and Nicobar Islands in the Bay of Bengal. "We have gradually expanded the scale and scope

to include other Indian Ocean Region littoral nations", Admiral Lanba stated. The crucial sea phase of the exercise was conducted from 11-13 March 2018. "This year, we provided much greater operational focus, including maritime interdiction operations and maritime search and rescue," said the Navy Chief while talking about addition to the growing complexities of the Milan series which had commenced with just four nations in 1995. As many as 23 nations were invited this year, another part of the exercise focussed on "enhancing regional cooperation for combating unlawful activities at sea". As for non-participation of the Maldives, this was deemed to be "owing to the internal political crises in the island republic."

INS *Karanj*: third submarine of *Scorpene*-class launched

The third *Scorpene*-class submarine, INS *Karanj* was launched at Mazagon Dock Shipbuilders Ltd (MDL), Mumbai, on 31 January 2018, being built by MDL under Project 75 of the Indian Navy. In all, six *Scorpene*-class submarines are being indigenously built at MDL under Project 75 with help of French naval defence

and energy company DCNS. The first of these, *INS Kalvari* was commissioned in December 2017 and second, *INS Khanderi* is undergoing sea trials. Remaining 4 submarines will be inducted gradually by 2020.

Torpedo decoy systems

To enhance the anti-submarine warfare capabilities of Indian Naval ships, the DAC has approved procurement of torpedo decoy systems for the Navy. The *Mareech* system has been developed by Defence Research and Development Organisation and has completed trial evaluations and will be produced by Bharat Electronics Limited at an estimated cost of Rs 850 crore.

Agni-II missile test fired

On 20 February, the medium range nuclear-capable Agni-II missile with a range of 2,000 km was test fired from the test site off the Odisha coast, conducted from a mobile launcher at the Launch Complex-4 of the Integrated Test Range (ITR). The Intermediate Range Ballistic Missile (IRBM) has already been inducted into the Services and this test was carried out by the Army's Strategic Forces Command (SFC) with logistic support provided by the Defence Research and Development Organisation (DRDO).

The 20-metre long Agni-II ballistic missile has a launch weight of 17 tonnes and can carry a payload of 1,000 kg over a distance of 2,000 kms. The entire trajectory of the trial was tracked by a battery of sophisticated radars, telemetry observation stations, electro-optic instruments and two naval ships located near the impact point in the down range area of the Bay of Bengal.

HAL and BEL in defence IPOs

Hindustan Aeronautics Limited are planning to raise about Rs 4,000 crore while Bharat Dynamics is estimated to raise about Rs 1,800 crore through IPOs in capital markets, a development which comes after some three decades. "Road shows for both these IPOs are already begun and there was an overwhelming response for them from both domestic and foreign institutional investors as both these companies are unique in nature, with no domestic competitors," said an investment banker associated with the public offers. There are nine central public sector undertakings under the administrative control of the Department of Defence Production, Ministry of Defence, of which Hindustan Aeronautics is the biggest. BEML was the first defence PSU to be listed followed by Bharat Electronics. "Despite a volatile secondary market, both of these IPOs will get a good response especially from institutions as the valuations in secondary market are stretched," opined bankers.

BEL wins 'Governance Now' Awards

Bharat Electronics Ltd (BEL) has received five 'Governance Now' Awards for Business Diversification, Adoption of Technological Innovations, HR Excellence, Environmental Sustainability and Research and Development. The 'Governance Now' Awards recognises the efforts of Public Sector Undertakings (PSUs) that have been key to the country's growth.

The awards were received for BEL by MM Joshi, Executive Director (National Marketing), BEL, from Mansukh L Mandaviya, Union Minister of State for Road Transport & Highways, Shipping, Chemical & Fertilisers and Krishna Raj, Union Minister of State for Agriculture and Farmers Welfare at the 5th 'Governance Now' PSU Awards held on 27 February 2018, at New Delhi.

Seen above are MM Joshi, receiving the "Governance Now' Awards from Mansukh L Mandaviya and Krishna Raj

Amity Leadership Award for BEL CMD

M M Joshi, Executive Director (National Marketing), BEL, receiving the 'Amity Leadership Award for Business Excellence' on behalf of Gowtama MV, at the IEEE Conference

Gowtama MV, Chairman & Managing Director of Bharat Electronics Ltd (BEL), has been conferred the 'Amity Leadership Award for Business Excellence' by the Amity School of Engineering and Technology, Uttar Pradesh *(picture above)*.

Alliance Air in engine support agreement for PW127M

On 7 February 2018, Alliance Air signed a three-year agreement with Pratt & Whitney Canada (P&WC) to deliver fleet maintenance services and support for PW127M engines. Customised specifically for Alliance Air, the engine maintenance agreement will support the company's technical and business needs as well as help in lower maintenance costs and simplify fleet operations management.

Mahindra and Viking Air in strategic alliance

On 23 February 2018, Mahindra Aerospace and Canada's Viking Air signed a Memorandum of Understanding to form a strategic alliance to "support and take advantage of India's growing regional air connectivity opportunities." Under this alliance, Mahindra Aerospace and Viking will work together to support each other's non-competing aircraft business to boost market penetration in identified territories and provide potential customers with multiple options based on specific operational requirements. Viking produces the former De Havilland Canada Twin Otter Series 400, a 19-passenger, twin-engine utility turboprop aircraft. Mahindra Aerospace have been working on the Airvan 8 utility piston aircraft and the 10-seat turboprop utility Airvan 10.

In the photograph are (l-r): Rob Mauracher, Executive Vice President, Sales and Marketing Viking Air Ltd.; Arvind Mehra, Executive Director & CEO, Mahindra Aerospace; David Curtis, President & CEO of Viking Air Ltd. and SP Shukla, Group President – Aerospace

Israel "supports" Air India direct flights to Tel Aviv

The Israeli government is making a one time grant of €750,000 to Air India for launching direct flights from New Delhi to Tel Aviv. "The Ministry of Tourism will approve a grant to Air India in response to their request and according to the conditions of the directive, which includes a grant of 250,000 Euros per weekly flight, up to a total of three weekly flights," stated Lydia Weitzman, a spokesperson for the Israeli Ministry of Tourism.

Vistara to expand fleet

Vistara are reportedly in discussion with both Airbus SE and Boeing for ordering new airliners worth some US $8.5 billion. These involve some 50 narrow-body airliners and up to 10 wide-bodied types. Meanwhile, low cost carriers IndiGo and SpiceJet are also evaluating various wide-bodied aircraft as they prepare for international flights.

Government to "divest" in Air India

The Government of India is proposing disinvestment of between 51% to100% in Air India and has listed four possible options while inviting expressions of interest. "There are four options in the EoI draft: the government can keep 49%, 26%, 24% or 0% stake in Air India post divestment," said a senior aviation ministry official. While Air India will include its core aviation assets packaged with low-cost subsidiary Air India Express and AI-SATS, a ground handling joint venture with Singapore Airport Terminal Services (SATS), Alliance Air and the ground handling and engineering subsidiaries will be sold separately. Reportedly, all non-core assets, such as the Air India building in Mumbai and other offices, will not be part of the sale but become part of the special purpose vehicle (SPV), which will also house the working capital debt of the company. IndiGo is the only airline that has officially expressed interest in acquiring Air India, while the government has said that "an unnamed foreign carrier" has also evinced interest. The Tata Group, which has stakes in Vistara and AirAsia India, has also been mentioned as possible bidders.

Delhi airport among 20 busiest in the world

Domestic Air Passenger Traffic in India crossed the 100 million mark in 2017, with Delhi's airport handling about 64 million passengers, making it to the 'Top 20' busiest airports in the world, surpassing airports in Singapore, Seoul and Bangkok. "India's aviation industry is largely untapped with huge growth opportunities, considering that air transport is still expensive for a majority of the country's population, of which nearly 40% is the upwardly mobile middle class." According to the International Air Transport Association (IATA), India will displace the UK for the third place in 2025.

Foundation laid for Navi Mumbai Airport

Prime Minister Narendra Modi has laid the foundation stone for construction of Mumbai's second airport to be built at Rs 16,700 crore. The PM also inaugurated India's largest container terminal at Jawaharlal Nehru Port Trust (JNPT), built at a cost of Rs 4,719 crore. The new airport will ease congestion at the existing Santa Cruz airport in north Mumbai.

Direct Amritsar-Birmingham flights

Air India has resumed non-stop flights between Amritsar and Birmingham after a gap of eight years, the flight operating twice-a-week with Boeing 787s. According to officials, "The flight will prove to be a boon for the state. During the Congress government in 2010, the flight was stopped just to provide financial benefits to the Delhi international airport. The reintroduction of this flight will save five to six hours as well as well as higher costs to passengers."

More UP airports in the regional air connectivity scheme

Then Minister for civil aviation Ashok Gajapathi Raju stated that "Nine more operational airports will come up in Aligarh, Azamgarh, Bareilly, Chitrakoot, Jhansi, Moradabad, Myurpur (Sonbhadra), Allahabad and Shravasti in 15 months." He added that nine out of 25 routes finalised by the Centre under the regional connectivity scheme. Allahabad will be connected to 13 cities of the country. The minister said 56 more airports would be added in the country in next 15 months and helipads would be developed at tourist destinations like Vrindavan, Mathura, Naimisharanya, Chandra Prabha, Mahoba, Chunar and Deogarh.

IndiGo, Vistara apply for international flights

IndiGo and Tata-Singapore Airlines(SIA) JV Vistara, have applied for international flights. IndiGo, which has been flying its single-aisle A-320s to neighbouring countries, has now sought clearance to operate wide-body aircraft to a number of European sectors like London (Gatwick), Manchester, Birmingham, Brussels, Milan, Rome, Zurich, Madrid and points in France and Germany. Vistara wants to start international operations using its A320s to a number of places in the Gulf and southeast Asia like Hong Kong, Singapore, Bangkok and Dubai. However, both the airlines' plans, which they hope to start implementing in 2018, depend on whether they bid for Air India which has almost 50 widebody aircraft, and the airline which will own it, would not have to place order for twin-aisle planes for their medium-to-longhaul flights.

IndiGo to acquire 40 aircraft in 2018

Airbus' decision to halt the delivery of A320s after a series of problems on the Pratt & Whitney manufactured geared turbofan engine powering the type, is unlikely to impact IndiGo's

"aggressive expansion," as it plans to induct around 40 aircraft next year, including leasing of around 25 A320 ceo and acquisition of 15 new ATRs. While the plan has been revised from the original target of adding 60 aircraft, it is still higher than the previous year. IndiGo added 24 new aircraft in 2017 and 24 as of date in 2018.

Air Deccan bought by GSEC Aviation

The Ahmedabad-based GSEC Aviation and Monarch Networth Capital have bought over the GR Gopinath-promoted Air Deccan, besides jointly acquiring majority stake in Air Odisha, which is set to launch its services on regional routes. Significantly, GSEC Aviation is owned by relatives of the $11-billion Adani Group chairman Gautam Adani. Under the new structure, both the airlines will be owned by a new company called GSEC Monarch Aviation in which Gopinath's Air Deccan will hold 50 per cent stake while the rest will be held by GSEC Aviation and Monarch Networth.

First Indian woman fighter pilot

Flying Officer Avani Chaturvedi has become the first Indian woman to fly a fighter aircraft, this achievement being in February 2018, the officer flying a MiG-21bison of No. 23 Squadron from Jamnagar airbase. Avani is from the first batch of three women officers, also including Bhawana Kanth and Mohana Singh, who were commissioned as fighter pilots in the force in June 2016.

Appointments

Rear Adm Philipose George Pynumootil is FONA

Rear Admiral Philipose G Pynumootil took over as Flag Officer Naval Aviation on 10 February 2018. As a helicopter pilot, he is qualified on the Sea King 42 B/C and Alouette, has commanded INAS 330, the Carrier borne ASW Sea King Squadron and was the commissioning CO of the Naval Air Station, INS *Shikra*. He has commanded the 1241 RE corvette, INS *Nashak*, the Missile Corvette INS *Kirpan* and the Guided Missile Frigate INS *Brahmaputra,* besides a tenure as Executive Officer of the Guided Missile Destroyer INS *Delhi.* He was Principal Director Aircraft Acquisition and his 6-year tenure saw the induction of 8 Boeing P-8Is, 45 MiG-29Ks and 17 Hawk AJTs, besides the conclusion of crucial contracts including those for four Boeing P-8Is Option Clause, P-8I Simulator, 16 ALHs, 12 Dornier 228s, 8 Chetaks, 12 Microlights and 10 Kamov 28 MLUs.

Rear Admiral DS Gujral is ACNS (Communications Space and Net-Centric Operations)

Rear Admiral DS Gujral, has taken over as Assistant Chief of Naval Staff (Communications Space and Net-Centric Operations) at Integrated Headquarters of MoD (Navy). He is a communication & electronics warfare specialist; his afloat appointments include that of EXO of INS *Nashak* and INS *Delhi*, and Command of INS *Nishank,* INS *Karmuk* and INS *Trishul.* He has held appointments of Directing Staff at Defence Services Staff College Wellington, Officer-in-Charge of Signal School, Deputy Director Naval Signals, Director Naval Operations and Principal Director Network & Space Operations.

Vice Admiral RB Pandit becomes Commandant Indian Naval Academy

Vice Admiral RB Pandit took over as the Commandant, Indian Naval Academy (INA) on 19 February 2018. He is a specialist in anti submarine warfare and has commanded INS *Nirghat*, INS *Vindhyagiri*, INS *Jalashwa* and the 22nd Missile Vessel Squadron at Mumbai and has been the Naval Adviser at the High Commission of India at Islamabad, Pakistan. He has also held important staff assignments such as ACNS (Foreign Cooperation and Intelligence) at IHQ MoD (Navy) and Chief of Staff, Southern Naval Command. He was Flag Officer Commanding Western Fleet at Mumbai, prior to being appointed as the Commandant of Indian Naval Academy.

Air Marshal RKS Shera takes over as Air Officer-in-Charge Maintenance

Air Marshal RKS Shera took over as Air Officer-in-Charge Maintenance, IAF. A post graduate from IIT Kanpur in Electrical Engineering, he was part of the induction team in Russia for the MiG-29 in 1986. Air Marshal RKS Shera was Senior Maintenance Staff Officer at HQ Maintenance Command before taking over as Air Officer-in-charge Maintenance at Air HQ. During his career of 37 years, the officer has held several important command and staff assignments that include Assistant Chief of Air Staff (Engg A), SMSO HQ WAC, Station Commander TETTRA School, Director MiG-29 Weapon Cell at Air HQ, Chief of Aircraft Production at Base Repair Depot, Inspector in Directorate of Air Staff Inspection (DASI), Chief Engineering Officer of a fighter base and Instructor at the Technical Training School, Botswana (Africa).

Rear Admiral Atul Anand is ACNS (FCI)

Rear Admiral Atul Anand has been appointed as Assistant Chief of Naval Staff – Foreign Cooperation and Intelligence. The Admiral is a specialist in Navigation and Direction, has also attended the Advance Security Cooperation Course at the Asia Pacific Centre for Security Studies in Hawaii, USA. He has held several command appointments including command of Torpedo Recovery Vessel IN *TRV A72*, Missile Boat INS *Chatak*, Corvette INS *Khukri* and the Destroyer INS *Mumbai*. He has also served as Navigating Officer of INS *Sharda, Ranvijay* and *Jyoti*. In addition, he was Direction Officer of *INAS 300* with Sea Harriers and Executive Officer of the Destroyer INS *Delhi*. His important Staff appointments include Joint Director Staff Requirements, Directing Staff at the Defence Services Staff College, Wellington, Director Naval Operations, Director Naval Intelligence (Ops), Principal Director Naval Operations and the Principal Director Strategy, Concepts and Transformation.

Chandrayaan-II Rover to spend 14 days on the moon

The Indian Space Research Organisation's ambitious next moon mission, Chandrayaan-II will include the country's first lunar landing. ISRO has recently given details on the Chandrayaan-II launch, which is to take place in the month of April 2018, with the chairman Dr K Sivan stating that they have identified two potentials locations for the landing. After launch from Sriharikota, the orbiter will take over a month to reach the moon's orbit. "The Rover has been designed to spend a lunar day or 14 Earth days on the moon's surface and walk up to 150-200 km. It will do several experiments and on-site chemical analysis of the surface," Dr Sivan said.

"Augmenting fighter squadrons top priority"

VAYU Interview with

Air Chief Marshal Birender Singh Dhanoa, Chief of the Air Staff, IAF

In this composite picture, Air Chief Marshal BS Dhanoa, the CAS IAF is seen with the six fighter types currently in operational service with the IAF : MiG-21, MiG-27, MiG-29, Jaguar, Mirage 2000 and Su-30MKI

VAYU : You have repeatedly flagged the issue of IAF's falling fighter numbers. Are the combination of Rafale, Light Combat Aircraft and the proposed 'Make in India' single-engine fighter assessed as sufficient to address this quantitative shortfall in the near-to- medium term? Kindly elucidate on mitigating strategies in place, given the present geo-political scenario and palpable concern about threats on both the western and north eastern borders.

CAS: Our focus is on required *Capability Development* to counter a two front threat. The IAF is prepared 24x7 for any threat and is ready for a befitting response to any contingency. The IAF has already proposed a roadmap to the MOD for induction of fighter aircraft to build up to the sanctioned strength of 42 fighter squadrons and also modernisation. Augmenting the strength of our fighter squadrons is our top priority. To achieve this, the IAF is looking at new inductions and mid-life upgrades. Towards this, MiG-29, Jaguar and Mirage 2000 aircraft are being upgraded in a phased manner to enhance their combat capability. Weapon shortfalls are being made good. The induction of fighter aircraft contracted for includes the Light Combat Aircraft, Rafale and the balance of Su-30MKI aircraft. Acceptance of Necessity (AoN) has also been granted for procurement of LCA Mk.1A. Further, the Government of India plans to procure fighter aircraft through the 'Strategic Partnership' model and other suitable options are also being considered to ensure that the IAF attains the authorised strength of fighter squadrons. If all the inductions take place as planned, the IAF is expected to achieve its authorised strength of fighter squadrons by end of the 15th Plan (2032).

VAYU : At what stage is the 'Make in India' single-engine fighter programme, and what steps remain before technical and commercial offers can be accepted, deliberated and acted upon?

Tejas Light Combat Aircraft at Yelahanka

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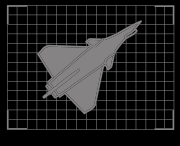
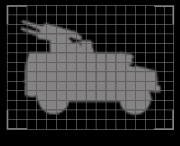
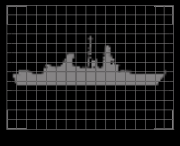


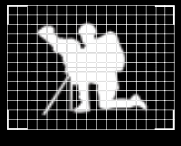
AIR DEFENCE



MARITIME SUPERIORITY



BATTLEFIELD ENGAGEMENT



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CAS: The procurement of the Single Engine Fighter Aircraft is envisaged under the 'Fighter Aircraft Segment' of the recently issued 'Strategic Partnership' model of Chapter VII of the Defence Procurement Procedure-2016. The Request for Information for the acquisition is about to be issued. Timelines as per the DPP will be followed.

VAYU : Earlier, officials from HAL and Russia's UAC revealed plans to upgrade the Su-30MKI. What will be the extent of the IAF's involvement in such a programme, and what is the time-frame envisioned for the induction of these upgraded Sukhois?

CAS: The operational and technical requirements for upgrading the Su-30 MKI to increase its operational capability are being finalised. A Project Team of the IAF will oversee the implementation of the project. The timeline of at least 5 years is expected for completion of the Design and Development activities. Series modification of the aircraft to the upgraded standard will commence thereafter at HAL Ozhar.

VAYU : The Indo-Russian FGFA/ PMF programme also appears sluggish. Is the IAF reviewing alternatives – whether domestic or foreign - and could you share a roadmap for induction of next-generation fighters?

CAS: The case for procurement of the Fifth Generation Fighter Aircraft (FGFA) from Russia is with the MoD. The IAF is supporting the indigenous Advance Medium Combat Aircraft (AMCA) programme wholeheartedly. This programme is at the D&D phase. The procurement of the Single Engine Fighter Aircraft is envisaged under the 'Strategic Partnership' model.

VAYU : A scale model of the Advanced Medium Combat Aircraft (AMCA) was unveiled as far back as 2009 by ADA. Given the lessons of the three-decade-plus LCA programme, what obstacles is the IAF looking specially to avoid with this R&D programme, and how, different, if at all, will the IAF's approach be to this programme?

CAS: All lessons learnt from the LCA programme will be incorporated in the AMCA programme to ensure speedy timelines. Realistic goals have also been set to ensure that the programme moves as envisaged.

VAYU : The Jaguar in IAF service has been progressively upgraded, and a third major upgrade is currently under development in the form of DARIN III. However, there has been little movement on the issue of new engines for this aircraft. Is the effort to re-engine the Jaguar still active, and if so, what is the status of the project?

CAS: Yes. The project is presently at Contract Negotiation Committee (CNC) stage.

VAYU : It is understood that supply of MiG-29 upgrade kits from Russia have delayed the MiG-29 UPG programme. What are the IAF's options at this point to ensure completion of this upgrade effort?

CAS: In the last one year, owing to the proactive measures undertaken by the MoD/ IAF in various high level forums such as IRIGC-MTC and the positive response by the RAC 'MiG', there has been a significant impetus to the upgrade programme. RAC 'MiG' is in the process of delivering the upgrade kits and is likely to complete the delivery soon.

VAYU : You recently visited France and flew a 2v2 engagement in a Rafale B fighter. Please share your impression from the cockpit! Is the IAF looking to expand its order beyond the 36 already contracted for, and if so, what are the procedural steps required to make this happen?

CAS: My flying mission reassured me that the Rafale aircraft is a capable, technologically advanced and a versatile weapon platform. The decision to buy Rafale aircraft was taken by the

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The Air Chief flew the Rafale in July 2017

Government to meet the IAF's critical operational necessity. For further build up, we are focussed on the single-engine fighter programme.

VAYU : The 'Avro replacement' programme has been protracted. What has caused this delay, and what is the expected outcome? Can this programme be expanded to encompass the 'An-32' replacement case?

CAS: The HS 748 'Avro replacement' programme is the first initiative of the GOI in the defence sector towards the 'Make in India' programme. This is the first time a private industry will be manufacturing a world-class tactical airlift transport aircraft in India. The 'Avro replacement' programme was delayed initially after the issue of Request for Proposal (RFP) due to several factors. Thereafter, the case has progressed and the technical field evaluation has been completed. The case is presently at the Contract Negotiation Committee (CNC) stage. In this programme, 16 aircraft will be delivered in flyaway condition from the 2nd to the 4th year after the contract signature and 40 aircraft will be manufactured in India. The replacement of the An-32 aircraft will be reviewed prior to its phasing out and based on the capabilities of 'Avro replacement' aircraft at that point of time.

VAYU : Notwithstanding the more 'expeditionary' posture of most western air arms, the IAF operates a disproportionately small number of tankers, AEW aircraft, SIGINT platforms and so on. A number of acquisition programmes in these areas have been aborted or stalled over the years. Is this simply a matter of budgetary prioritisation or procedural issues? Does the lack of support/special mission aircraft give any cause for concern?

CAS: The IAF's Force Structuring is guided by the Long Term Integrated Perspective Plan (LTIPP), which caters for the emerging threats and expected response. The critical equipment is given due prioritisation and the IAF is modernising at a fast pace. The IAF is ready 24x7 to respond to any contingency that threatens our national interests.

Dassault Rafale with afterburners on at Aero India 2017

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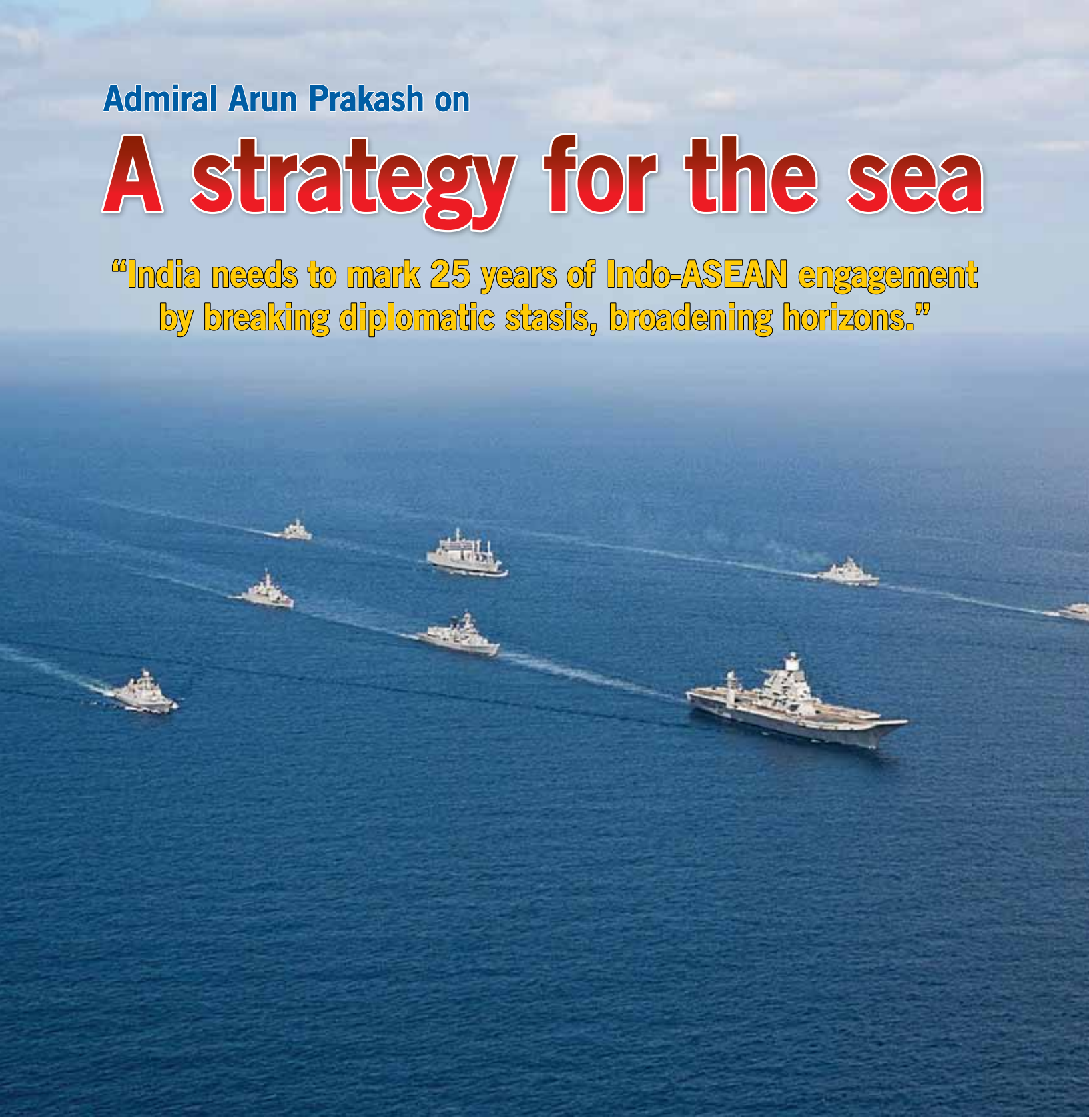
Admiral Arun Prakash on

A strategy for the sea

"India needs to mark 25 years of Indo-ASEAN engagement by breaking diplomatic stasis, broadening horizons."



"But India is not performing!" was the remark of a panelist at a recent conference of the CSCAP (Council for Security Cooperation in the Asia-Pacific) held in Thailand. He was responding to a query about ASEAN's subtle resistance to the concept of 'Indo-Pacific', and preference for 'Asia-Pacific', which, by definition, seems to exclude India. The scholar went on to add; "First, you had a 'Look East' and then an 'Act East' policy, but to us it seems that you are simply 'At ease' !"

Valid or not, such views need to be addressed by our foreign policy establishment, because we are at a defining moment in the Indo-ASEAN relationship. Not only was 2017 the golden jubilee year of ASEAN's founding, it also happens to mark 25 years of Indo-ASEAN engagement, and 15 years of summit-level meetings. Most importantly, 10 ASEAN leaders were the guests of honour at India's 2018 Republic Day celebrations, and their confabulations could decide the future course of this relationship.

The CSCAP is the Track II organ of ASEAN's security-related bodies, such as the ASEAN Regional Forum, East Asia Summit and the ASEAN Defence Minister Plus Forum. India was accorded CSCAP membership in 2000 and participates in periodic conferences that act as a forum for regional scholars and experts to exchange views and often provide useful policy option inputs for Track I.

In keeping with Asian cultural norms, a unique modus operandi, known as "the ASEAN way", has emerged over the years. By the continuous employment of consensus and compromise, ASEAN has largely managed to avoid overt shows of disagreement, and rarely is any nation seen to "lose face". While the 'ASEAN Way' has ensured an appearance of cohesion, some detractors blame it for having engendered a false sense of complacency and for sidestepping hard security issues. The 2012 ASEAN Summit saw emerging fissures, with the Philippines, Cambodia and Laos breaking ranks, under Chinese pressure, on South China Sea issues.

There is also criticism that having painstakingly built a set of multilateral processes in the security arena, ASEAN has failed to develop proactive agendas that would take the grouping beyond trade and commerce, towards collegiate diplomacy and collective conflict management.

In addition to the acerbic comment about India, the December 2017 CSCAP General Conference, that included representatives of the US, China, Russia, Japan and India, saw numerous tell-tale signs of barely suppressed tensions. In an unusual departure from the "ASEAN Way", the keynote speaker, a former ASEAN minister, offered his blunt view that an "emerging China" had transmuted into an "erupting China", an alarming phenomenon that, he felt, called for multilateral efforts to "bring under control". Subsequent speakers repeatedly expressed the fervent hope that a "rules-based order" would be resolutely upheld to ensure the peaceful rise of China.

In his response the following day, a former Chinese diplomat delivered a strong riposte, expressing displeasure that such "uncomplimentary and unwarranted" remarks should have come from the representative of a friendly nation. Other Chinese speakers unambiguously declared that rules were not immutable, and that changed circumstances definitely demanded the drawing up of new rules. They left little doubt, amongst the gathering, that China would avail the earliest opportunity to create a new "rules-based order", framing international laws and rules that not only provide retrospective endorsement of its conduct, but also facilitate its vision of the new "China Dream".

For over six decades, peace, stability and prosperity in the Asia-Pacific had been underwritten by a *Pax Americana*, sustained by US naval presence. This utopia having been shattered by China's assertive behaviour, neither the US "pivot to Asia" nor the subsequent "rebalance"

A pax Americana (above) in the Indo-Pacific may well give way to a pax Sinicas with China at the fore (below)

has served to restore regional equilibrium. China's creation of artificial islands in the South China Sea and their militarisation are now a *fait accompli* unlikely to be reversed. This blatant disregard of UN Laws of the Seas as well as the international justice system has brought into sharp relief President Trump's withdrawal from internationalism, triggering regional fears about the impending imposition of a pax Sinica on the region.

Having stood up to China, on Doklam as well as OBOR, India's supporters in ASEAN visualise it as a rising economic and military entity worth having on their side. Others argue that India has, so far, brought little to the ASEAN table, and point to its diplomatic stasis, that stands in stark contrast to Chinese activism on the Rohingya and North Korean issues.

Some hard questions need to be asked here. One, why, for all our noble intentions, have we, for 25 long years, been unable to identify tangible avenues of cooperation with our eastern neighbourhood? Two, have we allowed the geo-physical Malacca Strait barrier to overwhelm us mentally and thwart Indo-ASEAN integration? And most importantly, has PM Modi's 'Act-East' vision been allowed to lose steam due to sub-continental and domestic distractions, as well as an understaffed and overstretched diplomatic corps?

However, there are 'low-hanging fruit' to be plucked, if we look seawards. India's domain of maritime interest—now stretching right across the Indo-Pacific—offers a cornucopia of opportunities quite apart from the nascent 'quadrilateral'. In 2015, PM Modi had defined his vision of 'Sagar' as "a future for the Indian Ocean that ensures security and growth for all in the region". This vision needs to be unshackled from its Indian Ocean moorings and adapted for an all-round maritime outreach. Sustaining "good order at sea" is a vital enterprise that demands collaborative multi-lateral action. Safety of shipping, anti-piracy operations, search-and-rescue and disaster relief are responsibilities—so far outsourced to the Americans and Europeans—which Indo-Pacific navies must jointly shoulder.

Without relying on the crutch of US endorsements about its status as a 'global power', India must envision broader horizons for itself. The initiation of an 'Indo-Pacific Maritime Partnership' that seeks mutually-beneficial maritime security cooperation with ASEAN nations will put it in a leadership role. But slogans need to be backed up by strategies—and India has yet to craft a National Maritime Strategy.

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INS Karanj, third *Scorpene*-class submarine is launched

On 31 January 2018, in the presence of Chief of Naval Staff Admiral Sunil Lanba, and CMD MDL Commodore Rakesh Anand (retd.), *Karanj*, the third of P75 *Scorpene*-class submarine was launched. After the successful commissioning of INS *Kalvari* on 14 December 2017, this launch confirms the remarkable success of indigenous submarines built by Indian shipyard Mazagon Dock Shipbuilders Limited (MDL) through technology transfer and partnership with Naval Group, in line with the Indian Government's 'Make in India' policy.

Post launch, the completion of setting to work will be undertaken by the trained and skilled teams of MDL and thereafter sea trials will commence. The second boat INS *Khanderi* is already undergoing sea trials and will be commissioned in the coming months. All these boats have been fitted with critical equipment, built in India by qualified and highly trained industrial MSMEs, which forms the sound base of submarine building ecosystem of India.

While attending the event at Mumbai, Alain Guillou, Senior Executive Vice President, Naval Group said,"This is a remarkable feat achieved by India, and MDL is indeed grown to be among the rarest of shipyards around the world to have mastered such unique competence of submarine building. We are glad to partner with such a shipyard, which can boast of competence and infrastructure which allows them to build 12 submarines at a time, thus proving an industrial marvel and an asset for Indian Navy and Indian government."

The *Scorpene*-class is a 2000-tonne conventional-propulsion submarine designed and developed by Naval Group for all types of missions such as surface vessel warfare, anti-submarine warfare, long-range strikes, special operations or intelligence gathering. Extremely stealthy and fast, it has a level of operating automation that allows a limited number of crew, which reduces its operating costs significantly. Its combat edge is highlighted with 6 weapon launching tubes, 18 weapons (torpedoes, missiles, mines).

With 14 submarines sold internationally by Naval Group, the *Scorpene*-class is an essential reference product in the area of conventional attack submarines (SSK) for navies across the globe. The product is easily adapted for improvements requested by any naval customers. The progressive improvement through dedicated and experienced designers of Naval Group ensures this seamless advances and modern technology integrations.

India's Submarine Arm

Towards a Nuclear Fleet

INS Chakra, India's sole nuclear attack submarine, seen during TROPEX 2014

One of the first Asian navies to operate a credible submarine arm, the Indian Navy (IN) currently operates nine Russian-built *Kilo*-class (Project 877EKM 'Paltus') and four German-built Class 209 Type 1500 *Shishumar*-class diesel-electric submarines. However, the IN has remained strongly focussed on a possible nuclear submarine fleet for long because of the inherent rapid speed and "unlimited" range and endurance achieved by a nuclear powered fleet to encompass the Indian Ocean Region (IOR) with dominance.

Efforts of the IN to secure a nuclear-powered hunter-killer submarine (SSN) in its fleet may be traced back to 1984 with reports of discussions with erstwhile Soviet Union on the supply of more advanced, possibly nuclear-powered submarines and the training of IN crews in the Soviet Union. Vice Admiral Tahiliani, then Vice Chief of Naval Staff, took a leading role in talks in Moscow in September 1984, after which official sources stated that the defence relationship had taken on "a new dimension" indicative of possible access to nuclear-powered submarines.

Meanwhile, a design of the Rubin Central Maritime Design Bureau at St Petersburg, the first Russian Type 877EKM *Kilo*-class diesel-electric hunter-killer (SSK) submarine INS *Sindhughosh*, entered Indian Navy service in 1985. The submarine is a robust single-shaft vessel with an albacore/teardrop shaped double hull (a prominent feature of SSN types) with a seven-blade fixed-pitch propeller. The Type 877EKM has a displacement of 2,300 t surfaced and 3,950 t submerged and a maximum diving depth of 300 metres. Top speed is 17 knots when submerged. Reputed to be a 'black hole' for excellent stealth capabilities, the bow planes are positioned close to the midship to improve the performance of the MGK-400 sonar. To reduce the submarine's acoustic signature, the flooding ports have been removed from the fore body and the hull is covered with rubber 'cluster guard' anechoic anti-sonar protection tiles to reduce the risk of detection. The combat information system consists of a multipurpose MVU-110EM computer which allows for five targets to be tracked simultaneously, two automatically and three manually. In 2015, at the naval exercise *Malabar* between the navies of India and the United States, Type 877EKM INS *Sindhudhvaj* reportedly managed to track USN *Los Angeles*-class SSN USS *Corpus Christi* and score a simulated kill without being detected.

The Type 877EKM has six 533 mm torpedo tubes and carries 18 heavyweight torpedoes (six in the tubes and 12 on the racks), with an automatic rapid loader. Two targets can be engaged simultaneously. Two of the launch tubes can fire the TEST-71MKE TV electric homing torpedo, which has an active sonar homing system with TV guidance which allows the operator to manually switch to an alternative target, and can manoeuvre in two axes. It weighs 1,820 kg with a 205 kg explosive charge.

The submarine is also fitted with UGST wake-homing torpedoes, weighing 2,200 kg with a 200 kg explosive charge. It has a range of up to 40 km, and a depth of search of up to 500 m. The tubes are also capable of deploying 24 mines.

The Indian vessels are fitted with the 220 km-ranged Novator 3M-54E1 Anti-Ship Missile (AShM) with a 450 kg High Explosive (HE) warhead as part of the

INS Kalvari, the first of six Scorpene-class boats, seen at sea during her delivery trials

Klub-S missile system. Sub strategic reach is provided by the Novator 3M-14 Land Attack Cruise Missile (LACM), with a 499 kg warhead. While surfaced a launcher with eight Strela-3 or Igla Surface-to-Air Missiles (SAM) can be deployed. As apparent, Type 877EKM features multiple SSN features albeit with diesel-electric propulsion.

Beyond conventional submarines, a formal agreement was signed to lease a *Charlie-II*-class customised for export (Project 670M/06709) nuclear-powered cruise missile armed submarine (SSGN) from the Soviet Union sometime in 1985. In January 1988, All-India Radio announced that the Soviet Union had leased a nuclear-powered submarine to India with IN taking delivery of INS *Chakra* in the Soviet port of Vladivostok. Initially reported to be of *Victor* I Class SSN, published photographs clearly identify INS *Chakra* as a *Charlie* Class SSGN designed to carry eight P-80 Zubr/Ametist (SS-N-7 Starbright) Anti-Ship Cruise Missiles (ASCM), capable of being launched even while the SSGN remained submerged. Leased for a period of three years from January 1988, the SSGN was based at Visakhapatnam Naval Base and was returned in January 1991. In the aforesaid period, the submarine travelled 133,000 km with the reactor active for 430 days and fired five Ametist ASCM and forty-two torpedoes. Thirty Soviet instructors maintained key posts on the SSGN and forty Soviet industrial specialists were involved in servicing it.

On 23 January 2012, Russia handed over the much-awaited Russian Project 971A *Schucka-B* (NATO: *Akula* II) Class nuclear-powered attack submarine (SSN) K-152 'Nerpa' to the Indian Navy on a ten year lease worth $920 million, with the signing ceremony undertaken at the Bolshoi Kamen ship building facility in the (Far East) Primorye region. Although back in 2008 then IN Chief of Naval Staff (CNS) Admiral Sureesh Mehta laid stress on to training of IN personnel on how to operate nuclear reactors and platforms and other systems, an *India Today* report stated that "the impending acquisition of the *Akula* (christened INS *Chakra* in Indian Navy service) gives India the long-awaited third leg of the nuclear triad…widely regarded as the most survivable mode of launching nuclear weapons." The *India Today* report further asserted that the *Chakra* would be armed with "indigenously built nuclear-tipped cruise missiles with a range of over 1,000-km." At least another *Akula*-class SSN is likely to enter IN service in due course.

In the process, an international training centre was "expanded" in Sosnovy Bor, situated 70-km west of St. Petersburg, with the initial aim of imparting training to 300 Indian Naval officers selected for operations aboard the *Akula* SSN. The training reportedly started sometime in 2001. The centre incidentally trains Russian naval officers and houses working marine nuclear reactors and is used to test nuclear fuel and other technologies applicable to nuclear submarine reactors. Thus the accommodation of Indian naval officers at the Centre does indicate far-reaching consequences beyond leasing of the *Akula*-II SSNs and possibly aimed at imparting sufficient training and expertise to enable the Indians to develop nuclear-powered submarines that includes the *Arihant-II* Class 'Ship Submersible Ballistic missile armed Nuclear-powered' (SSBN) that appears to share technology of *Akula*-class SSN. Although initially and decades ago, the IN requirement for SSNs were to acquire the only credible counter to United States Navy (USN) presence in the Indian Ocean, in recent times, its value as multipurpose "stealthy and mobile thus invulnerable" strategic platform have taken predominance in response to rapidly shifting geo-political scenario with new equations. INS *Arihant* SSBN incidentally initiated deterrent patrol in August 2016. Powered by a 83 MW pressurised light-water reactor, the submarine has four vertical launch tubes to accommodate Submarine Launched Ballistic Missies (SLBM).

Led by *Akula I K-284 Akula* (Shark), the Russian-origin steel hulled third-generation Project 971 *Shuka-B* Bars Class SSNs are known in the West as the *Akula* Class. The design was initiated in 1976 and developed by St. Petersburg-based Malakhit Marine Engineering Bureau under their outstanding Chief Designer Georgy Chernyshev. A traditional *follow-on to Victor* III SSN design, the *Akula*-Class SSNs along with Project 945 *Sierra*-Class SSNs for the first time posed a serious challenge to western navies in terms of overall submarine technology. From the outset, acoustic silence was top priority among Russian naval designers (the noise level of *Akula* SSN is considerably lower than 110-decibels as widely believed) in which the western navies traditionally enjoyed a decent lead. At 110-metres long *(Akula II)*, the *Akula* SSN is double-hulled with considerable distance between the outer and inner hulls, in the process reducing possible damage to the inner hull. To further complicate the problems of their adversaries, the *Akula II* with a dived displacement of 13,800-tons nevertheless sports a maximum submerged speed of at least 35 knots, owing to the main machinery that consists of a VM-5 pressure water reactor with a model OK-650B high-density reactor core rated at 190 to

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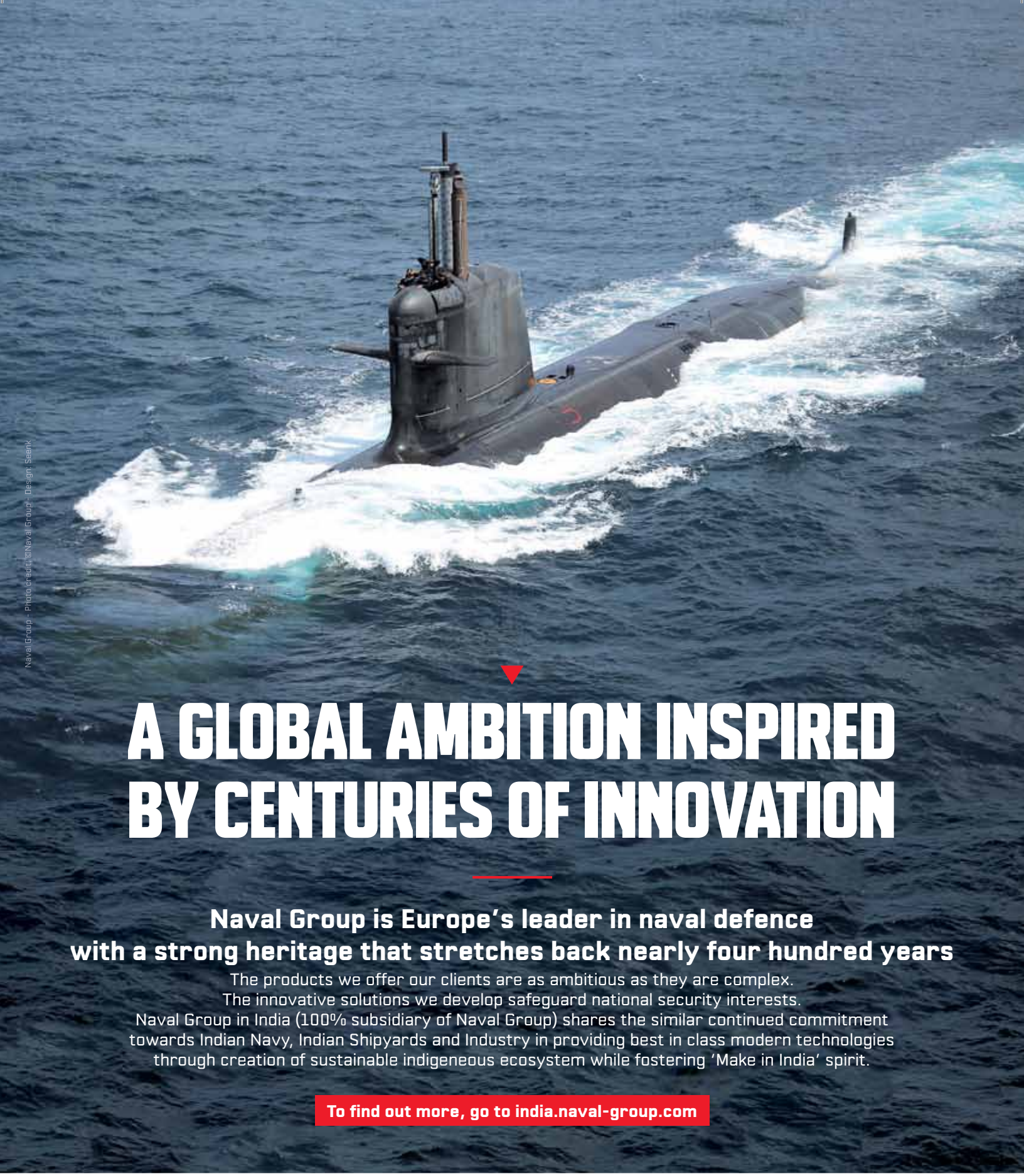
INS Kalvari underway in the ocean

200 MW with a GT3A turbine developing 35 MW driving a seven-bladed fixed-pitch propeller. The operational diving depth is reported to be 520 metres that extends to the maximum diving depth of 600 metres. Thus if deployed in a more offensive role, the high underwater speed along with a deep diving capability enables the *Akula* SSN to evade a considerable spectrum of enemy ASW defences by passing beneath them. Surface-launched ASW weapons such as homing torpedoes would take a long time to reach the operating depth of the *Akula* SSN that the later by then would have passed out of range of their acoustic homing device.

Significantly, the *Akula* retains capability to approach the permanent thermo cline layers in the oceans, and in case of *Akula II* to exploit its formidable MGK-540 Skat-3 (Shark Gill) sonar suite with additional flank array extending for about one-third of the hull. The sonar suite provides automatic target detection in broad and narrow band modes in active mode while in passive, listening mode hostile enemy sonar faces risk of detection. The sonar signal processor is flexible enough to detect and automatically classify targets as well as reject spurious acoustic noise sources and compensate for variable acoustic conditions. The 'thermo cline' thermal layer in oceans has a major influence on ASW operations as it affects the velocity of sound and in permanent 'thermo cline', (found at depths of 300 to 400 metres in equatorial areas and 500 to 1,000 metres in sub-tropical areas) the velocity reaches the minimum. This layer of minimum velocity, known as the deep sound channel, has a variety of effects, and it is theoretically possible that a submarine can operate in this deep sound channel, exploiting this effect to achieve very long-range detection. In addition, in later *Akula* submarines a number of prominent non-acoustic sensors appear on the fin leading edge and in the forward casing capable of carrying out wake tracking of the enemy surface units under surveillance. To complement the formidable sensors, *Molniya*-M/Pert Spring Satellite Communications (SATCOM) provides greater situational awareness, critical in pursuit and interception missions of hostile fleet.

The MGK-540 Skat-3 sonar suite enables *Akula II* SSNs to enjoy considerable stand-off distance as against enemy submarines and such a capability is duly complemented by their plunge-fly-plunge ASW missiles consisting of Novator Tsakra (SS-N-15 'Starfish') and the Novator Vodopad (SS-N-16 'Stallion'). The Starfish, fired from the six 533-mm tubes, has a target range (inertial flight) of 45-km while the Stallion, fired from the four 650-mm tubes, has a longer range of up to 100-km. Both the Stallion and the Starfish enjoy the choice of a 200-kt warhead or a Type 40/45 torpedo in response to tactical circumstances. Wake homing torpedoes if deployed, will inherently be less dependent upon accurate targeting solutions as they need to be fired at target's wake rather than at the target itself.

Known countermeasures are the standard gas-producing decoy units, a holdover from the German *Pillenwaffer*, sonar jamming, and an ingenious acoustic decoy commonly referred to as the nixie



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cunningly emulating the sound signature of the parent sub while veering from the submarine's track at three knots effectively obscuring the actual noise generated by the parent submarine. While the tracking submarine is deceived into tracking and launching on a decoy, the *Akula* may silently alter course and counterattack as also, a nixie will force opposing submarines to track multiple targets, uncertain which is the *Akula*.

The key weapon of INS *Chakra* is likely to be the sub strategic variant of the RK-55 Granat (SS-N-21 Sampson), the 3M-14E (SS-N-30) which is already in Indian Navy service. The 3M14E LACM has been designed to destroy ground-based targets and consists of a booster stage and a subsonic low-flying sustainer stage. The 3M14E is intended for use against stationary ground targets such as administrative and economic centres, weapon and petrochemical storage areas, command posts, seaports, and airports. Once the mission data needed by the mid-course navigation system has been prepared, it is loaded into the missile›s onboard computer prior to launch. The missiles are launched under the power of a tandem solid-propellant rocket booster fitted with four small lattice stabilisers. Once the missile has reached flying speed, it is powered by a small turbojet engine. Launched from a depth of 30 to 40 metres below the sea surface, the onboard control system includes a barometric altimeter used to maintain altitude in terrain-following mode (making the weapon stealthier than designs which rely on radar altimeters), plus a receiver for the GLONASS Satellite navigation system now jointly developed by Russia and India and used alongside a Global Positioning System (GPS) to provide a backup and extra security in case of interferences such as deliberate jamming. The missile has a low flight altitude, 20 metres above sea and 50 to 150 metres over land.

For most of the flight to the target area, the missile flies autonomously, following the pre-programmed route and turning points. Once over land, it uses a terrain-following flight path that will make it a difficult target for enemy air defences. This low-level flight mode poses a higher load on the wings and missile structure than flight over the sea surface, so the land-attack missile variant has slightly redesigned wings of shorter span and deeper chord, plus a stronger structure.

At the terminal stage of the flight, the guidance is effected by the 'Korrelatsionaya' system. This guidance system employs a Scene Matching Area Correlator package, which guides the missile to a set of coordinates within a pre-programmed image surrounding the target and is similar technology to the Digital Scene Matching Area Correlator (DSMAC) in the BGM-109 Tomahawk. European sources claim this guidance package can hit completely hidden targets with 400-kg high explosive providing their location is well known relative to visually prominent features surrounding the aim point.

The Naval Group *Scorpene*-class SSK INS *Kalvari* also prominently features characteristics of SSN including the albacore shaped hull and associated noise reduction measures. The submarines are likely to be fitted with a fuel cell Air Independent Propulsion (AIP) system in due course to extend their endurance over pure diesel-electric types. A shroud of secrecy cover the IN operated four German HDW Class 209 Type 1500 submarines, ideal for clandestine coastal operations. With a submerged displacement of 1,850 tonnes, the types are armed with AEG SUT torpedoes and encapsulated UGM-84 Harpoon AShM, and were equipped from outset with United States supplied fire control systems.

With more nuclear powered submarines likely to enter IN service, both from foreign lease and collaborated domestic production, it is likely that IN may operate a predominantly nuclear submarine fleet by 2040 if marine nuclear propulsion technology can be acquired through 'package' deals involving other prominent weapon systems.

Sayan Majumdar

MBDA's tube-launched SM39 Exocet AShM arms the new Kalvari-class (Scorpene) submarines

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India's Missile Arsenal: an overview

The Agni V ICBM on parade in New Delhi

On 18 January 2018, personnel of the Indian armed forces test-fired the 5,000-km-plus Agni-5 Interim Range Ballistic Missile (IRBM). The test, conducted from Kalam Island in the Bay of Bengal, achieved all the mission parameters that had been stipulated. The last test of Agni-5 had been conducted on 26 December 2016. After additional user trials over the next twelve to eighteen months, the nuclear-capable Agni-5 missile will be inducted into India's Strategic Forces Command (SFC). Normally, five to seven tests are carried out, including technical trials and user trials, before a missile is inducted into the arsenal. After operationalisation of Agni-5, all targets in China will come within range of India, with the Chinese reportedly concerned at this development.

The 4,000-km Agni-4 IRBM had been successfully test-fired by personnel of the SFC from the same launch facility on 2 January 2017. After these two tests, the credibility of India's nuclear deterrence has received a boost.

A Prithvi SRBM launch

Under the aegis of its Integrated Guided Missile Development Programme (IGMDP), which was approved by the Government on 26 July 1983, India has achieved considerable success in ballistic missile development. The Prithvi Short Range Ballistic Missile (SRBM) (1-metre diameter, 150 km to 350 km range, liquid-fuelled) and multiple models of the Agni IRBM (800 km to 5,000 km range, solid-fuelled) have provided India with an assured retaliation capability. Though exact details are not known in the public domain, DRDO spokespersons have shared sufficient information to allow for an assessment of the missiles' capabilities. While the Agni-5 is still under development, the Agni- 4 is reported to be ready for deployment. According to a Ministry of Defence press release, "Agni-3 was inducted to strengthen India's strategic might and joined Agni-1, Agni-2, Prithvi-2 and Dhanush (the naval version of Prithvi capable of being launched from ships even under extreme sea conditions)."

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Agni is the mainstay

Agni IRBMs are mainstay of the surface-to-surface component of India's strategic forces. With the exception of the Agni-1, all Agni missiles are fully solid-fuelled with carbon composite heat shields for re-entry protection. All of the Agni variants are known to be extremely accurate and use navigation systems based on a combination of ring laser gyros and inertial navigation. Presently, at least two Agni missile groups are reported to be in service.

India's successful experience in space research, particularly the launch of multiple satellites on a single rocket, has endowed scientists with the capability to master MIRV (multiple independently targetable re-entry vehicles) technology. In view of recent R&D developments in China, it was considered expedient to commence a research programme on MIRV systems as a technology demonstrator. Costing Rs. 100 crore per missile, the Agni-5, with a range of 5,000 km-plus, is known to be capable of carrying MIRV warheads. At its maximum range, the Agni-5 can even reach Harbin, China's northernmost city (according to Chinese officials, the maximum range of Agni-5 is 8,000 km). A canisterised version of the Agni-5 was first test-fired on 15 January 2015. The process of canisterisation implies that the warhead will be mated with the missile for storage, not stored separately and mounted on the missile shortly before launch.

Dr VK Saraswat, the former DRDO chief, said the Agni-5 had 'ushered in fantastic opportunities in…building Anti-Satellite (ASAT) weapons and launching mini/micro satellites on demand'. The Agni-5, like the Dongfeng 31A, is a canisterised, road mobile missile. According to Avinash Chander, Director, Advanced Systems Laboratory, Hyderabad, 'With the canister having been successfully developed, all India's future land-based strategic missiles will be canisterised as well.' The DRDO is also reported to have plans to develop the Agni-6 Inter-Continental Ballistic Missile (ICBM), which will be capable of carrying a 3-ton payload of MIRVs and manoeuvrable re-entry vehicles (MaRVs). The range of this missile, made of light weight composite materials, is expected to be over 5,500 km. However, the existence of such a programme is as yet officially denied!

Prithvi-1 (150 km-range), Prithvi-2 (250 km, IAF version) and Prithvi-3 (350 km) Surface to Surface Missiles (SSM) are all nuclear-capable. Prithvi missiles are liquid fuelled with strap-down inertial guidance and a manoeuvrable trajectory; accuracies are claimed to be in single digits and the circular error probability (CEP) is likely to be less than 100 metre. These dual-use missiles are capable of carrying 500 kg to 1,000 kg warheads. It is now increasingly believed that the Prithvi-1 missile was never intended to carry nuclear warheads. Six Prithvi missile groups are reported to still be in service.

Agni V in test launch

As soon as Agni-1 regiments are fully operational and the missiles have been produced in the required numbers, it should be possible to retire the Prithvi missiles from service with the SFC. However, these missiles are likely to continue to be used for conventional conflict and as part of the ballistic missile defence (BMD) technology development programme till these become obsolete. A modified Prithvi missile is the interceptor in the Prithvi Air Defence (PAD) system for exo-atmospheric interception. It is also used as a target for an incoming missile.

India has some other missiles in its arsenal. The Dhanush SSM is a ship-to-surface variant of Prithvi-3 with a maximum range of 350 km, while Nirbhay is a subsonic (Mach 0.7) cruise missile with a maximum range of 1,000 km. Of the Tomahawk and Kh-57 class, it carries a 450 kg high-explosive warhead and was successfully tested in November 2017. Prahar is a highly manoeuvrable, precision-strike tactical SSM with a range of 150 km and is armed with a conventional warhead. Comparable to the US Army Tactical Missile System (ATACMS), it has been conceived as a quick-reaction battlefield support weapon system that fills the range gap between multi-barrel rocket launchers (MBRLs) and SRBMs. All of these missiles have been indigenously developed by the Aeronautical Development Establishment (ADE), Bengaluru, and have been produced by Bharat Dynamics Limited (BDL), Secunderabad. The rate of production of Agni missiles is reported to be twelve to eighteen per annum.

India does not maintain its missile launchers on hair-trigger alerts as India's 'no first use' posture does not require launch-on-warning (LoW) and launch-through-attack (LTA) capabilities. Alert levels are planned to be progressively raised based on intelligence inputs or for the purpose of signalling. As India shares its western borders with Pakistan, the time of flight of ballistic missiles ranges from eight to thirteen minutes for a target between 600 km and 2,000 km away. Deployment sites – hides and firing positions – are selected keeping this in mind, besides other tactical parameters. Depending on the level of alert being maintained, preparation time for launch can vary from one to four hours. When deployed, missile batteries would be provided logistics support by the nearest field formation of the Army and helped with their local defence where feasible.

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An Imperative

Joint Communication Command for the Indian Armed Forces

Joint tri-service institutions are not new to the Indian Armed Forces. The National Defence Academy, Defence Services Staff College and the National Defence College stand testimony to fact that our predecessors were alive to the emerging challenges and created institutions far ahead of the times. The Armed Forces Medical Service is another example of tri-service integration. However, jointness at other functional levels has languished for decades, which was severely exposed during the 1999 Kargil war.

The Kargil Committee Report published in the second half of 2000, was brutally critical of the lack of integration between the services and the need to evolve joint response mechanisms. Since then, proposed restructuring of the Indian Armed Forces including the Higher Defence Organisations (HDO), has been in the limelight and a matter of intense speculation and debate. A few cautious steps towards achieving jointness have been taken wherein Headquarters Integrated Defence Staff (HQ IDS), Strategic Forces Command and the Andaman and Nicobar Command have been created. An implementation of the balance of the recommendations has seen the emergence of insurmountable differences within the Government, strategic community and the uniformed fraternity, resulting in limited progress. However recently, positive developments have emerged which indicate a concerted attempt by all stakeholders to push through this matter which has a deep bearing on national security. Media reports have suggested that on 17 January 2017, during the Combined Commanders Conference at the Indian Military Academy Dehradun, which was attended by the Prime Minister, the Raksha Mantri and the National Security Advisor, the agenda was focussed upon.

More recently, media reports have indicated that as a follow up of the deliberations, a new Cyber Agency under the HQ IDS and headed by a Major General or equivalent rank officer is in the process of being established. This Agency will have both offensive and defensive capabilities and is expected to evolve into the eagerly awaited *Joint Cyber Command*.

Positive developments are also expected in the creation of the Chief of Defence Staff/Permanent Chairman Chiefs of Staff Committee, Joint Operational Commands, creation of a Special Forces Command and the Aerospace Command. It is in this context and as a corollary, the creation of a Joint Communication Command (JCC) is being proposed.

Why Communication?

Modern warfare, which essentially is net centric will arguably turn completely net dependant in the near future. If an attempt is made to strip the complexities of modern warfare to the first principles, it can visualised as the interplay between five major components, namely, sensors, shooters, decision-makers, information nodes (where data is stored/ processed) and finally, the ubiquitous network. The desired characteristics of the network, which may seem as utopian in the present day Indian Armed Forces are enumerated as follows: (a) Extend over multi- dimensional space. (b) Boundary less and not restricted by ownership. (c) Accessible to all stakeholders equally. (d) Fully plug and play. (e) Support diverse systems. (f) Utilise uniform protocols including security.

Present Configuration

Present net centric capabilities of the Indian Armed Forces are weighed down by legacy networks which are individually extensive and complex. Since the complete migration to new all pervasive tri-service networks would be a technical and logistic nightmare, the current approach is focused on achieving basic functional efficiency using the existing individual service networks with gateways to suitable overlay networks. Recently a tri-service network overlay (Defence Communication Network [DCN]) has been created at the apex level as a step towards

integration. This state-of-the-art network will function under control of the HQ IDS with tentacles extending to the army corps and the air/naval bases. However, in spite of such positive developments and efforts, it would not be misplaced to suggest that functional integration especially at the operational and tactical level is still lacking.

A simple example would amplify the contention. In the era of data link enabled modern fighters capable of delivering precision accuracy, a present day combat team commander in the Tactical Battle Area (TBA) cannot seek and obtain an air strike in support of ground operations, using automated processes. In spite of the fact that individual service level communication systems are fairly modern and capable, the only reliable means of communication between ground and air elements, remains the plain old Radio Telephony (It is a matter of separate debate whether the pilot on modern fighter platform has the time for a radio conversation in the complex multi-tasking environment, he/she is operating in). Hence, the isolated nature of networks is in a way compromising the overall kinetic effect which can be delivered in a truly integrated environment. It can arguably be stated that after years of joint services training, the mind of commanders at all levels is no longer a limitation to integration. Every commander fully understands the need for integration and means to achieve the same. However, the constraint is the nature of networks, as is extant.

Hiring of communication circuits is a major component of expenditure for communication directorates of the respective services. Since advanced communication technology now enables far greater number of voice/data channels over the same circuit or media, rationalisation of hiring of circuits is urgent need of the hour. An example would amplify the contention. There are a large number of stations which have formations/units of the army co-located with air and naval bases/other units of the IAF or IN. However, individual services have hired separate circuits for respective elements and consequently a large number of circuits exist between the same two locations, running in parallel. While utilisation patterns may differ, the need for holistic planning cannot be overemphasised in order to achieve savings to the exchequer. Extending the same analogy to the terminal end, separate Local/ Wide Area Networks and voice exchanges are functioning in the same station. Ideally, these modern exchanges and switching devices which offer immense capacity could be shared, resulting in better functional integration. In addition, communicators across the board will invariably indicate the following critical problems areas while operating in an integrated environment, which makes joint communication a major challenge: (a) Variety of equipment. (b) Incompatible communication standards and protocols. (c) Incompatible security codes and algorithms.

It is evident that there is a huge gap between what exists and what is needed. Existing organisations and processes do not lend to tri-service communication integration and a status quo may result in further silo-based development in future.

The US military employs multiple joint communications units: Joint Communications Support Element airman seen here (photo: USAF)

Addressing the Need

Communicators across the three services are of similar breed. At the basic level, they speak the same language. However, even if there is a genuine inclination of communicators to integrate the disparate networks, existing technical profile prevents the same. Hence, the moot questions which arise are :

(a) Whether incompatible communication is the first and primary barrier to integration, especially at the operational and tactical levels? (b) Is there a case to suggest that the first aspect to be given a thrust towards jointness should be communications? (c) Towards this, would it be prudent to consider a Joint Communication Command (JCC) for the Indian Armed Forces, wherein communicators from the three services operate under the same tri-services umbrella? Certain select communication functions may be brought under ambit of the JCC which have a direct bearing on integration and joint operations.

The author of this article is sanguine that this aspect has been thought over and deliberated earlier; however, the sheer scale of integration problems, both technical as well as HR related, would have resulted in this being a non-starter. Individual services would have found the proposal daunting alongside the fear of loss of intimate communication support. It could however be argued that this apprehension and even fear needs to be discarded at the earliest if the Armed Forces desire to fight and win the future war in a truly networked environment. It would be foolish to stay cocooned in individual service comfort zones and derive strength in legacy systems, which give a false sense of functionality in peacetime. The old adage: 'if it ain't broke don't fix it' will not work in this context. The stakes are immense and there is need for drastic change and not depend on small incremental steps to effect such transformation.

Proposed Framework

The proposed JCC is recommended for evolution in two stages, with the threefold aim of addressing joint communication planning, joint procurement of systems and joint manpower planning including training. Stage 1: The fielding of the DCN provides a unique opportunity and a stepping stone to achieve tri-service communication integration. In Stage 1, the staffing, management, exploitation and

operations of DCN down to the furthermost nodes, may be taken on by signallers drawn from all services. The control element under HQ IDS could form the nucleus of the JCC. Stage 2: As the next step, certain elements of the communication directorates functioning under the respective service HQs are recommended to be brought under the umbrella of the JCC. Core communication planning, procurement, and manpower planning staff of respective directorates may be placed under the JCC, while the balance staff may be retained at respective directorates as earlier. This would ensure minimum turbulence, while at the same time result in congruent communication and manpower planning. A limited number of communication training establishments could be earmarked for joint training and placed under the control of the JCC. Initially, the control footprint of the proposed JCC is recommended to be limited to the level of existing Command HQs, Air and Naval Bases. To avoid being saddled with a vast and unwieldy setup, further amalgamation and joint manning especially in field units/sub-units in all services is not recommended till such time further clarity emerges in the evolution of other joint structures. The proposed JCC framework would also facilitate the setting up Joint Operational Commands as and when created.

How does this help?

The proposed changes are likely to offer the following advantages:
(a) Joint Communication Planning. It is undeniable that apex level communication planning needs to be a joint effort. A joint communication planning cell will ensure that duplication is avoided, common protocols and standards are adhered to, common cipher codes are evolved and functional integration of networks down to the lowest level is ensured.
(b) Procurement and Introduction of Systems: In the current setup, any new system visualisation is likely to only address requirements of the HQ at which it is being planned. Presently, tri-service needs are inadequately addressed owing to the lack of a suitable empowered organisation like the JCC. The following illustration would amplify the contention. In the early part of the century, the US Armed Forces faced the problem of integrating individual tactical data links such as different weapon data links, platform data links, and unit

Indian troops with communication equipment in the field

data links. While individual systems could operate using their own data links there was severe lack of compatibility. In order to surmount the integration issues, the Joint Battle field Airborne Communication Node (BACN) programme was conceptualised and made operational. Presently, this involves the deployment of a versatile and flexible communication pod fitted under an aircraft or UAV which is deployed over the TBA and enables seamless integration of disparate data links, thus enabling net centricity and is a major force multiplier effect. Similar issues plague the Indian Armed Forces too; however, the visualisation of such problem areas and the development of advanced technical solutions can fructify only if suitable empowered structures like the JCC are put in place.
(c) Manpower issues including training. A JCC would be able to identify the critical nodes where deployment of suitable trained joint signallers would be required. Such nodes may be held under the direct control of the JCC to ensure seamless integration.

Manpower and Resource Optimisation

With an emphasis on fresh raisings, any proposed organisational change needs to be examined through the prism of manpower requirements. The proposed changes would involve a realignment of staff functions which could be achieved by shifting certain functions from existing service specific communication directorates to the JCC. Since no major changes are proposed at the level of lower HQs and units/sub-units, no major effect on manpower is envisaged. This would however still result in considerable resource optimisation and savings, while at the same time achieve the greater aim of integration. Certain areas which could see positive developments are in the rational use of satellite resources, sharing of surveillance data, use of crypto systems and devices, use of radios and other communication systems, hiring of circuits, use of training facilities, etc.

'Purple Communicators'

While the debate on implementation of recommendations of the Kargil Committee Report is alive, it would be prudent to examine the component(s) of the future battlefield, which would require to be integrated for enhanced effectiveness. It has been accepted that aspects like cyber, special forces and aerospace require integration and efforts are in place to achieve the same. There is also a need to consider communications in the same light. Communications are the nerve of the battlefield and more so in an age of net-centric warfare. Hence, to suggest that integrating communications should be the first realistic step in the overall aim of 'Jointness' would not be misplaced. While communication systems by their very nature lend themselves to integration and compatibility, experience has shown that this potential has largely remained unrealised owing to organisational structures, procurement procedures, incompatible training and archaic mindsets. The proposed JCC manned by 'Purple Communicators' could indeed provide the much needed top down thrust so that existing networks start "talking" to each other, data and info flow is seamless, resources are conserved and new networks are designed with the overall aim of achieving tri-service integration. The proposed JCC could certainly be the cornerstone in evolution of the Indian Armed Forces becoming a truly integrated force.

Colonel Subhasis Das,
(Courtesy: CLAWS)

Fluttering, not soaring!

Sangeeta Saxena (Aviation & Defence Universe) in her 'On-the Spot' report, writes:

It is the first afternoon at *Wings India 2018* and the feel at the Old Airport Begumpet is dull and desolate. After attending the previous versions of *India Aviation* for so many years, which although small but expectancy and vibrancy in the air was always good and the participation reasonable; this year the new avatar reiterates a thought that it is high time the Ministry of Civil Aviation clubbed this with *Aero India* and concentrated on making their presence at that show better rather than having a dismal show and take some credit for it. And an airshow with no flying display is the ultimate anti-climax.

Then unfortunately the inaugural got trampled by politics of the nation when the Minister for Civil Aviation Ashok Gajapati Raju resigned, with TDP pulling out support from the BJP government. With the Minister of State for Civil Aviation, Jayant Sinha also not present, the inauguration ceremony was lack lustre despite the Secretary for Civil Aviation RN Choubey taking the lead and steering the discussions knowledgeably well. The only excitement palpable was the local media going crazy with the presence of the charismatic KT Ramarao the Cabinet Minister for IT E&C, MAUD, Industries & Commerce, Mines & Geology, Public Enterprises and NRI Affairs who was the last minute "surprise Chief Guest" owing to developments in Delhi.

Some international industry did show up and the presence of aircraft manufacturers like Boeing, ATR, Embraer, Honda Jet, SAAB, Dassault Aviation, Gulfstream and Airbus along with the engine makers including Rolls Royce, Pratt & Whitney, GE actually saved the organisers of some major embarrassment. The bleak presence of airlines in the exhibition area (though their CE's would have been there at the CEOs Forum) added further bleakness to the event. In a buyer-seller platform the buyer actually seemed missing! The General Aviation industry seemed to be the only saving grace as the parked aircraft were nearly all from this industry segment and many customers seemed to be keeping their sales teams busy.

Hindustan Aeronautics Limited, Pawan Hans Limited, Air India, Club One Air, National Aerospace Laboratory (NAL), Deccan Charters, Maini Global Aerospace and a few more Indian public and private companies were there, displaying their products. Flying Training Schools seemed to be the only majority institutions and surprisingly all discussions at the show were centred around pilot training and skills development. Good theoretically but how much is incorporated practically has yet to be seen.

Then, there was the CEO's Forum which held discussions behind closed doors and so no announcements and pondered points were sent to the media for disbursement. It is very nice to follow the West and have closed door forums but one should also learn to hold post forum media briefings on the forum discussions as per major shows of the world. The event managers have to be more decent instead yelling "anyone not having an invitation get out of the room". They sure need some lessons in inter-personal skills.

So overall, Wings India's wings seemed to flutter and not soar. It is hoped that both FICCI and the MOCA get a message and improve upon a lot of aspects and fill a lot of missing gaps at a- planning stage, if they want *Wings India* to follow *India Aviation's* example.

Dassault's Falcon 8X makes an appearance

Dassault Aviation showcased its ultra long range Falcon 8X at this year's edition of *Wings India* which was the first appearance of the 6,450 nm/11,945 km trijet at an Indian event. The first Falcon 8X was handed over to an Indian customer early last year and is now operating in all major markets, including the US, Europe, the Middle East, Brazil and China and now, India. With 26 Falcon aircraft currently in service, Dassault is the 'large cabin' market leader in India, where the company has long enjoyed a strong brand image, in part thanks to the Indian Air Force's long association with Dassault combat aircraft. The relationship received a further boost last October when a joint-venture created by Dassault Aviation and Reliance Aerospace Limited broke ground on a new production plant in Nagpur, Maharashtra. To be ready by the end of 2018, the facility will manufacture parts and component sub-assemblies for the in-production Falcon line and then move on to assemble Falcon as well as possibly Rafale fighters in the future.

The majority of new Indian Falcon orders are for longer-range models like the Falcon 8X and the very-long range Falcon 7X. The Falcon 8X has benefited from a remarkably smooth market introduction, thanks largely to the high level of maturity of its onboard systems. Dassault also anticipates strong demand among Indian customers for the Falcon 6X. Due to enter service in 2022, the 5,500 nm/10,186 km range 6X will feature a cabin six feet, six inches (1.98 m) high and 8 feet 6 inches (2.58 m) wide, the highest and widest cross section in a purpose built business jet. Currently, Dassault's popular Falcon 2000 widebody twinjet still accounts for the largest part of the present Indian fleet. Indian demand is currently dominated by second hand sales. Two pre-owned Falcon 2000s were recently handed over to operaters in the region, including one delivered on 9 February to Club One Air, the fourth to be flown by that operator.

CFM adds LEAP-1A/LEAP-1B capability to Training Centre

Ten years after it was officially inaugurated, CFM International has expanded the scope of the CFM Training Centre at Hyderabad to include both the LEAP-1A and LEAP-1B engines as the fleet in India continues to grow."We built the Hyderabad CFM Training Centre to meet a promise we made to our customers more than a decade ago and it has been a big success," said Gaël Méheust, President and CEO of CFM International. "To date, the Centre has provided world-class line maintenance training for more than 1,300 students from airlines throughout the region."The LEAP-1A entered service in India last February with Air India, which now operates a fleet of 15 A320neo airplanes. Vistara followed in May 2017 and operates five LEAP-1A-powered A320neos. Jet Airways will be the first airline in country to introduce the LEAP-1B-powered Boeing 737 MAX later this year. This state-of-the-art training centre represents an investment of more than $15 million by CFM over the past decade, including initial start-up costs. The CFM Training Centre, which welcomed its first students on 8 March 2010, was the fourth such engine maintenance training centre for CFM customers worldwide and has the capacity to train 500 engineers annually and mirrors those in China, France, and the United States. The Training Centre initially provided advanced hands-on courses in line maintenance and bores cope inspection for CFM56-7B and CFM56-5B engines, which power Boeing Next-Generation 737 and Airbus A320 families aircraft, respectively.

P&W's GTF Engine Courses at Hyderabad

Pratt & Whitney have announced its PW1100G-JM Geared Turbofan (GTF) and V2500 engine technical training courses have been certified by the European Aviation Safety Agency (EASA). India's Directorate General of Civil Aviation (DGCA) has certified the GTF training

Falcon 8X

Making the best better

Trent 7000 for the Airbus A330neo

Created specifically for the Airbus A330neo, we took the unsurpassed Trent 700 experience and fused it to the architecture of the Trent 1000 and the engine technology of the Trent XWB: the most efficient in the world.

Pioneering the IntelligentEngine

as well, complementing the DGCA certification of V2500-A5 training obtained in early 2017. The certified courses will take place at the Pratt & Whitney Customer Training Centre in Hyderabad, India and will provide enhanced opportunities for aviation skill development. The Hyderabad Training Centre has a capacity of 5,000 student days per year. In addition, in support of the government of India's national skills development campaign, *Skill India*, Pratt & Whitney will offer customised training for students as well as development programmes for college and university faculty members.

Business and GA in India

The Business and General Aviation (BA/GA) industry is finally seeing a movement forward as the Government of India accelerates its efforts to improve air connectivity and tourism in India. This priority focus holds tremendous promise for the BA/GA industry that includes helicopters, and will define the direction in which the industry will steer in times to come. "The Business Aviation industry has undergone a sea change over the past decade in India and has gained much recognition in the recent years. The utility of business aviation, as a productivity tool and contributor to economic development, is becoming more evident and should serve as the prime rationale to put in place an appropriate framework enabling industry's growth and its role in channelising economic and social benefits throughout India", stated Rohit Kapur, President, Business Aircraft Operators Association (BAOA).

Embraer 2017 deliveries

Embraer had delivered a total of 210 aircraft in 2017, of which 101 were commercial aircraft and 109 were executive jets (72 light and 37 large). The deliveries were within the outlook ranges for the year of 97 to 102 commercial jets, 70 to 80 light business jets and 35 to 45 large business jets. In the last quarter of 2017, Embraer delivered 23 commercial jets and 50 executive jets (32 light and 18 large). As of 31 December 2017, the firm order backlog totaled $ 18.3 billion.

ATR's "Outstanding 2017 results"

ATR has announced 'outstanding' commercial results in 2017, booking firm orders for 113 aircraft, along with 40 options. The level of firm sales in 2017 tripled the number of orders received in 2016 (36). In 2017, ATR turboprops once again ranked first among all the sales of regional aircraft below 90 seats. The turboprop manufacturer delivered 80 aircraft (70 new ATR 72-600s, 8 new ATR 42-600s and 2 second hand ATRs) and also stabilised its annual turnover at US$ 1.8 billon, recording the best performing financial results in its 35-year history.

Russian Helicopters venture into Regional Aviation

Russian Helicopters (part of Rostec State Corporation), the Ministry of Industry and Trade of the Russian Federation, the Ministry of Transport of the Russian Federation have signed an agreement for operating on local air routes. The document stipulates launching production of TVS-2DTS light airplanes and creating an airline-operator. The agreement provides creation of TVS-2DTS production at Ulan-Ude Aviation Plant by 2019 with the plant to deliver some 200 such aircraft for regional aviation from 2021 till 2025. The new airline company, which will be part of Yakutia airlines, will become the operator. Moreover, Russian Helicopters and Polar Airlines based in Yakutia will sign a contract on delivery of 200 TVS-2DTS aircraft in order to develop regional services. The TVS-

The TVS-2 DTS

India's civil aviation industry: some vital statistics

- India is one of the fastest growing aviation markets and currently the ninth largest civil aviation market in the world with a market size of around US$16 billion.
- India is projected to become the third-largest aviation market by 2026 and the largest by 2030.
- There were some 1.4 lakh scheduled international aircraft movements of Indian airliners in FY17, 9.7% growth over FY16.
- During 2017, domestic air passenger traffic growth year over year was 20 percent.
- The airlines operating in India are projected to record a collective operating profit of Rs. 8,100 crore (US$ 1.29 billion).
- During 2017, domestic passenger traffic increased by 22 per cent in comparison with growth rate of 21.24 per cent in 2016.
- India's air cargo is estimated to grow at 9 per cent over the next few years.
- Domestic air traffic is expected to grow 25 per cent and cross 130 million in financial year 2017-18.

2DTS will replace An-2 biplanes which have been abundantly used in regional aviation and whose production was shut down in the USSR in 1971 (they were also manufactured in Poland up to 2002).

Thales AVANT for Garuda

Garuda Indonesia, the country's flag carrier, are introducing an "all new and enhanced passenger experience" with Thales AVANT IFE System on board the carrier's A330neo airliners. Garuda's choice of Thales's IFE system will help drive the airline's strategic positioning to attract more passengers as Indonesia expects to see a double-digit increase in passenger growth this year. At a recently held ceremony, Thales and Garuda announced their partnership to equip their new Airbus A330neo with the AVANT IFE system featuring powerful new lightweight High Definition (HD) monitors. "Business class passengers will also enjoy the Avii touchscreen handsets, the most advanced android-based smartphone-like controller in the sky." The agreement is a first for Thales and Garuda Indonesia and paves the way for both industry leaders to collaborate and deliver ground-breaking innovations to the aviation sector.

CFM orders surpass 3,300

Orders for CFM International's two product lines achieved near-record levels in 2017, with the company booking orders for a total of 3,344 engines, including 474 CFM56 engines (commercial, military and spares) and 2,870 LEAP engines (including commitments and spares). The LEAP engine continues to be the 'powerplant of choice' for new single-aisle aircraft, garnering more than 14,270 total engine orders and commitments (excluding options) at a value of more than $206 billion at list price since 2011. Total CFM production remains "high," with the company delivering a total of 1,444 CFM56 engines and 459 LEAP engines in 2017.

Boeing capabilities highlighted

Boeing highlighted its innovative commercial products such as the 737 MAX, 787 Dreamliner and 777X at *Wings India 2018*. "India is one of the world's fastest growing aviation markets and Boeing is proud to have been a strong partner for more than 75 years enhancing the country's aerospace sector," stated Dinesh Keskar, senior vice president, Asia Pacific & India Sales, Boeing Commercial Airplanes. "We look forward to this year's airshow and the opportunity to highlight Boeing's fuel efficient, reliable and capable airplanes that have, and continue to, enable airlines in India to open new routes and stay profitable in this ever-competitive market." Boeing's theme was on the company's 'fuel-efficient airplanes and world-class services' to meet the needs of its customers in India and around the region. Airliner models highlighting Boeing's commercial capabilities were on display as well as virtual and mixed reality headsets for attendees to experience.

Boeing 737 MAX 10 reaches major milestone

Boeing's 737 MAX 10 has reached a major milestone as the MAX programme completed firm configuration on the airplane. "This means engineers now have all the design requirements in place for what will be the largest member of Boeing's single-aisle family." The 737 MAX 10, which will use a stretched fuselage that is 66 inches longer than the 737 MAX 9, now moves into the detailed design phase prior to the start of production. The airliner can carry up to 230 passengers.

CFM engines in final assembly

Boeing HorizonX India Innovation Challenge

Boeing and T-Hub have announced the last lap of the *Boeing HorizonX India Innovation Challenge*. Launched in November 2017, the "challenge" aims to discover and accelerate potentially transformative aerospace innovation from India. "13 startups out of 80 shortlisted entries and six teams from Boeing's research and technology centre have made it to the final round of the innovation challenge." The selected startups and internal teams

will now work on perfecting their ideas and concepts to develop disruptive solutions and tackle complex challenges in multiple areas of aerospace, including autonomous and unmanned systems, advanced manufacturing, industrial IOT and automation, analytics, artificial intelligence (AI) and machine learning (ML). The winners will be declared after the teams successfully complete their accelerator programme.

As part of a showcase session organised for the finalists, global startups associated with Boeing's HorizonX and Indian startups presented their innovations to an audience that comprised of potential customers and investors. "Boeing is excited about India's potential for step-change innovation which could define the future of aerospace across the globe," stated Pratyush Kumar, President, Boeing India. "We are building the future of aerospace, incubated and started right here in India by partnering with innovative companies." Launched in April 2017, Boeing HorizonX functions as a pathfinder organisation for Boeing. The team makes targeted investments in new ventures and startups, seeks unique business opportunities for the company's aerospace technology and assesses disruptive innovations and business strategies.

First Ultra Long Range A350 XWB makes debut

The first Ultra Long Range version of the A350 XWB has rolled out of the company's final assembly line in Toulouse. The latest variant of the Airbus A350 XWB Family will be able to fly further than any other commercial airliner and will enter service with launch operator Singapore Airlines later this year. Altogether, Singapore Airlines has ordered seven A350-900 Ultra Long Range aircraft, for non-stop flights between Singapore and the USA, including the world's longest commercial service between Singapore and New York. With a maximum take-off weight of 280 tonnes, the A350 XWB Ultra Long Range is capable of flying up to 9,700 nautical miles or over 20 hours non-stop.

Leonardo and Era Group mark entry of AW609 tiltrotor

Leonardo and Era Group have signed a landmark agreement to launch the AW609 into service in the US commercial market and demonstrate its capabilities on a wider scale. Building upon their previous

efforts in helping to mature the design, development and supportability of the AW609, Era will take delivery of two aircraft in 2020 plus a dedicated training package. These aircraft, in a 9-passenger utility configuration, will be used for numerous applications, including offshore/utility, VIP, EMS and SAR missions in the US.

Honeywell forecasts 4,000 new civil helicopter deliveries

With better long-term global economic outlook this year, customers are holding firm in their intentions to invest in new helicopter purchases over the next five years. In its 20th annual 'Turbine-Powered Civil Helicopter Purchase Outlook,' Honeywell forecasts that 4,000 to 4,200 new civilian-use helicopters will be delivered from 2018 to 2022, aligning with the five-year forecast from 2017. "In addition to better global economic conditions expected in the coming years, potential positive impacts of US tax reform on new helicopter demand and lower volatility in oil and gas-related markets have helped fleet managers confirm what they told us last year," stated Ben Driggs, president Americas, Honeywell Aerospace. "With the expectation of stable purchase plans for new helicopters over the next five years, Honeywell is focused on bringing increased value to operators' current and new fleets by offering Connected Helicopter engines, Health and Usage Monitoring Systems, and avionics solutions that help boost a platform's efficiency and availability."

Metro Aviation order 25 EC145e helicopters

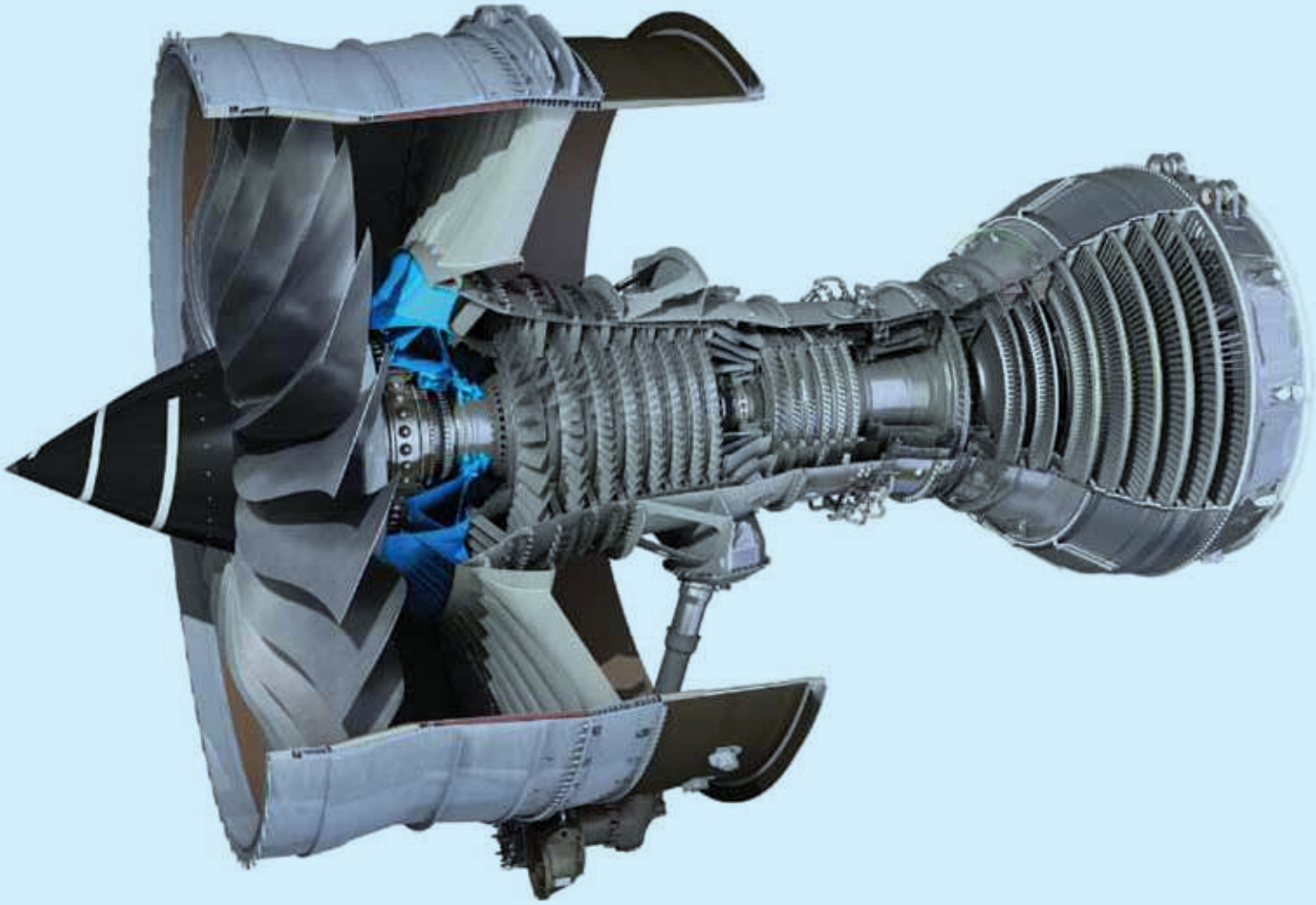
Airbus Helicopters have confirmed that Metro Aviation Inc. had ordered an 'unprecedented' 25 EC145e helicopters for providing air medical transport and other aerial services. "It is one of the larger commercial helicopter orders ever booked by the US based company." Metro was the first customer in the world for the lighter weight and lower cost version of the EC145 when it was launched by Airbus Helicopters in 2015, placing an initial order for six aircraft. The helicopter was initially launched only for Visual Flight Rules (VFR) operations and Metro has put it to work in air medical transport and utility markets.

Sikorsky's 300th S-92

Sikorsky has delivered the 300th S-92 helicopter to the Era Group Inc., configured for offshore oil worker transportation. Assembled in Coatesville, Pennsylvania, this will join Era Group's fleet of eight Sikorsky helicopters. In 2016, Sikorsky recognised Era Group as being the first operator to enter revenue service with a Gross Weight Expanded (GWE) S-92 helicopter.

Rolls-Royce at 'Wings India'

"India's civil aviation experiencing phenomenal growth"



Cutaway of the Trent XWB

The Indian civil aviation industry is experiencing "phenomenal growth" and this is expected to continue for the years to come. Some of the key reasons driving this growth are India's robust economy which is giving way to a rising middle class; several supportive policies and changes introduced by the Indian government leading to increased travel demand both domestically and internationally and lastly, the emergence of low-fare airlines which have enabled reduction in the overall cost of travel and have also provided travel access to a larger population segment leading to increase in passenger traffic.

According to Rolls Royce, "To manage the increased passenger traffic and maximise operational efficiencies, there is expected to be increased demand for widebody aircraft by airlines in the coming years. In line with our vision to pioneer the power that matters to our customers, we are well-positioned to offer our strong portfolio of more efficient and cleaner products and solutions and play a key role in India's growing aviation sector. Our Trent engines power the leading widebody aircraft and have a strong track record of delivering outstanding performance and reliability."

'Wide bodies' are the key

A competitive environment demands that operating costs be kept low which will bring down ticket costs and attract more passengers. As India's air traffic grows, airlines can deploy widebody aircraft to address the ever-increasing passenger volumes as they provide carriers more revenue per available seat mile and also prove to be a high-yield option. To maximise operational efficiency, airlines can replace multiple flights of smaller aircraft with an optimised flight at the right time, the right size and in the right place. Widebodies also provide significant advantage at airports with restricted infrastructure,

enabling airlines to carry more passengers to airports with limited slots. Airlines can also take advantage of their widebodies to free up a substantial amount of narrow-body fleets which can be used on newly opened regional routes.

Additionally, widebody aircraft enable airlines to offer the highest levels of passenger comfort and an optimal experience through better value-added services and more deck space – something that is becoming a deciding factor in passengers' airline choices.

"Trent engines are the ideal choice for India"

Rolls-Royce's Trent engines, powering leading widebody aircraft, offer a combination of fuel efficiency, reliability and environmental performance. Trent 7000 which powers the Airbus A330neo is not only 6dB quieter than the Trent 700, which powers the Airbus A330, it also features a 10% specific fuel consumption improvement.

The latest version of the Trent 1000 incorporates technologies from the Trent XWB and advance engine programmes contributing to the Dreamliner achieving a 20 per cent greater efficiency than the aircraft it replaces, as well as having half the noise footprint of previous-generation aircraft.

"Our more efficient and cleaner products, position us to play a significant role in India's growing aviation sector", stated Antony Szafranek, Vice President Customer - Civil Aerospace at Rolls-Royce

The Trent XWB is the world's most efficient large aero engine flying today, and includes advanced materials and the latest fan system technology. It balances fuel efficiency and life cycle costs while delivering weight savings and improved aerodynamics. The Trent XWB is also the fastest selling widebody jet engine extant, with over 1,700 engines ordered by 45 customers.

"With a strong track record of delivering outstanding performance and reliability, our Trent engines are the ideal choice to meet the requirements of growing aviation sector and support the transformation of aviation landscape in India."

Showcasing cleaner and more efficient power at 'Wings India'

Rolls-Royce is pioneering the power that matters so that its customers can give a cleaner, more efficient and reliable experience to travellers. At *Wings India* 2018, Rolls-Royce showcased its latest Trent aero engines including the Trent 7000, Trent 1000 and Trent XWB which offer the "very latest in aero engine technology delivering fuel efficiency and environmental performance to support India's growing civil aviation industry". The Rolls-Royce booth also featured a visualisation of a Carbon Titanium (CTi) fanset being developed for Rolls-Royce's next generation UltraFan engines and a quarter scale model of Trent 7000 engine that exclusively powers the new Airbus A330neo, along with interactive audio-visual content.

As Ewen McDonald, Rolls-Royce, SVP, Customers and Services (APAC) – Civil Aerospace, stated: "With rapid growth in India's civil aviation industry, we expect a significant demand for widebody aircraft by airlines to meet increased passenger growth and operational efficiencies. Our Trent engines, powering leading widebody aircraft, are much more fuel-efficient, cleaner and quieter than previous engines, allowing airlines to improve operational efficiency as well as offer better passenger experience. In line with our vision to pioneer the power that matters to our customers, we are well-positioned to offer our strong portfolio of more efficient and cleaner products and solutions and play a key role in India's growing aviation sector."

According to the Directorate General of Civil Aviation (DGCA), India's domestic air traffic nearly doubled to 117 million passengers in 2017 compared with 67 million in 2011, driven by a strong economy and low-fares and most airlines are pursuing expansion plans to support this rapid growth in passenger traffic. Rolls-Royce, which in the next decade expects to power more than 50 per cent of in-service widebody passenger aircraft, has a strong track record of supporting airlines' growth and helping their transition from narrowbody to widebody fleets.

In India, Rolls-Royce has been steadily building its capabilities across engineering, manufacturing, supply chain, digital and customer support to support local growth. The Aerospace Engineering Centre in Bangalore has over 600 engineers contributing to global aerospace engine programmes. Rolls-Royce's R^2 Data Labs, an acceleration hub for data innovation which set up a facility in Bangalore last year, develops data applications that unlock design, manufacturing and operational efficiencies and creates new service propositions for customers. A growing footprint coupled with its 'strong commitment to India, enables Rolls-Royce to offer the right combination of experience and new technologies and contribute towards India's growth ambitions'.

Rolls-Royce pioneers in cutting-edge technologies that deliver "the cleanest, safest and most competitive solutions to meet the planet's vital power needs." The company has customers in more than 150 countries, comprising more than 400 airlines and leasing customers, 160 armed forces, 4,000 marine customers including 70 navies, and more than 5,000 power and nuclear customers. Annual underlying revenue was £13.8 billion in 2016, around half of which came from the provision of aftermarket services. The firm and announced order book stood at £82.7 billion at the end of June 2017. In 2016, Rolls-Royce invested £1.3 billion on research and development. "We also support a global network of 31 University Technology Centres, which position Rolls-Royce engineers at the forefront of scientific research."

Rolls-Royce employs almost 50,000 personnel in 50 countries. More than 16,500 of these are engineers. The Group has a strong commitment to apprentice and graduate recruitment and to further developing employee skills. In 2016, the company recruited 274 graduates and 327 apprentices through our worldwide training programmes.

Courtesy: Rolls-Royce

Qatar Airways A350-1000

with Rolls-Royce's Trent XWB-97 engines

Rolls-Royce, together with Airbus and Qatar Airways celebrated delivery of the first Airbus A350-1000 to enter service, powered by Trent XWB-97 engines. Akbar Al Baker, Group Chief Executive, Qatar Airways, Fabrice Brégier, Airbus and Chris Cholerton of Rolls-Royce attended a formal aircraft handover ceremony at Airbus headquarters in Toulouse, France.

The Trent XWB-97 is the 97,000lb higher thrust version of the Trent XWB, the "world's most efficient large civil aero engine flying today and is also the fastest selling widebody jet engine ever, with over 1,700 engines ordered by 45 customers worldwide." The other version of the Trent XWB, rated at 84,000lb, powers the A350-900 which first entered service in January 2015, again with Qatar Airways as the global launch customer. Today 290 of these engines are in service with airlines worldwide, having accumulated more than 1.3 million flying hours and achieving "the best entry into service performance of any widebody engine, with outstanding reliability." The event marked start of first aircraft deliveries for Rolls-Royce, with its engines also due to power the Airbus A330neo and the Boeing 787-10 into service in the coming months.

As Akbar Al Baker stated, "As an airline known for delivering innovation and world firsts Qatar Airways is proud to be the global launch customer for the Airbus A350 XWB-1000 and to take delivery of our first aircraft today. As the *World's Best Airline* we look to work with the world's best partners so I am pleased to be here today with Airbus and Rolls-Royce to celebrate this milestone in aviation history. We look forward to providing our customers with continued award-winning service from day one with this latest aircraft."

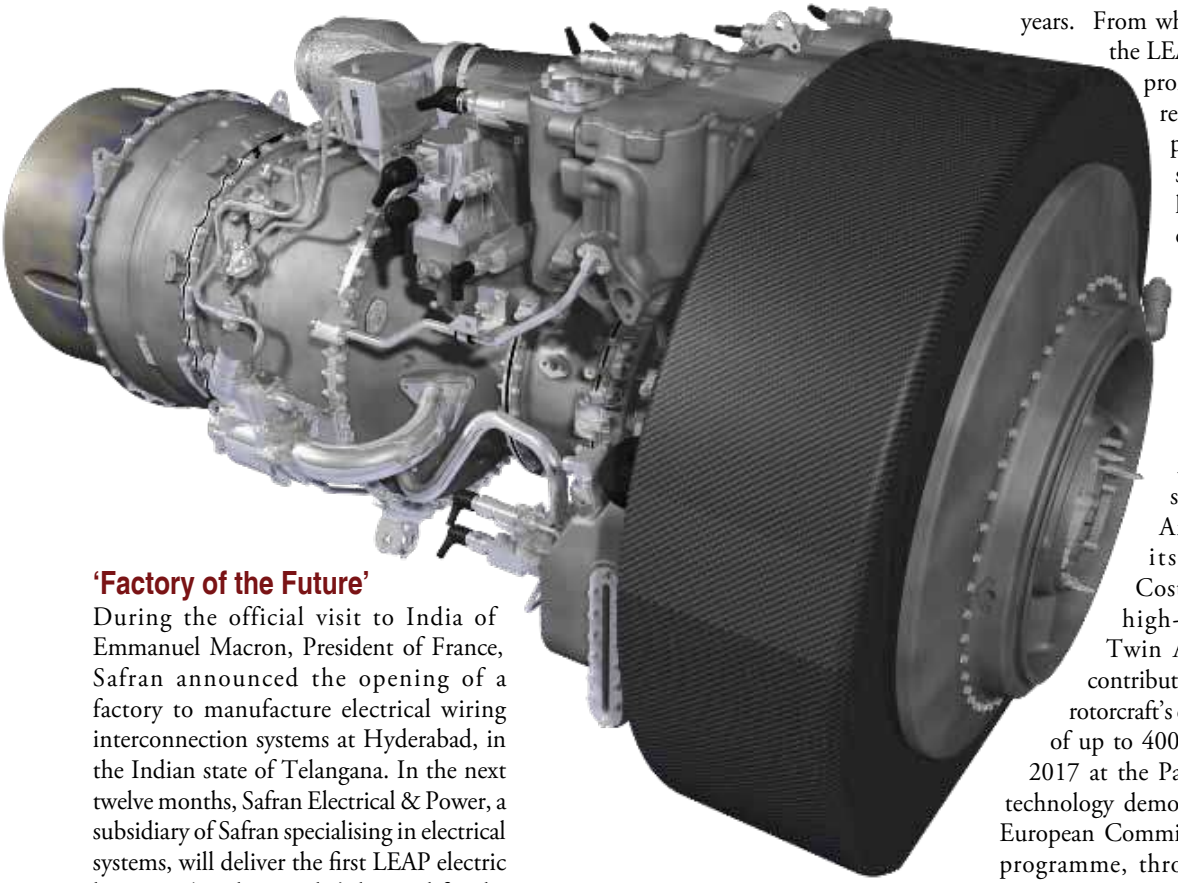
In his speech, Fabrice Brégier stated, "It gives us huge pride at Airbus to deliver the very first A350-1000 to our launch customer Qatar Airways. This is another great moment for Airbus and I would like to thank Rolls-Royce for its continued support in providing this latest version of the fuel-efficient and quiet Trent XWB engines. As the most powerful engine ever developed for an Airbus aircraft, it's yet another great feat of engineering from Rolls-Royce."

Chris Cholerton said, "We are very proud to have worked with Qatar Airways and Airbus to deliver the engines for the latest version of the A350 XWB. Both are highly valued partners to Rolls-Royce and today marks another important step forward in our relationship together. We are excited to see the latest version of the Trent XWB entering service with Qatar Airways and look forward to this engine continuing to provide outstanding levels of reliability."

Trent XWB – incredible engineering by numbers

- It sucks in up to 1.3 tonnes of air, the equivalent of a squash court, every second at take-off.
- The force on a fan blade at take-off is equivalent to a load of almost 90 tons, the same as nine London buses hanging off each blade.
- High pressure turbine blades inside the engine rotate at 12,500 rpm, with their tips reaching 1,200mph – twice the speed of sound.
- At take off each of the engine's 68 high pressure turbine blades generates around 900 horsepower per blade – the equivalent to that of a Formula One racing car.
- At full power, air leaves the nozzle at the back of the engine travelling at almost 1000 mph.

Safran's 'Made-in-India' programmes



'Factory of the Future'

During the official visit to India of Emmanuel Macron, President of France, Safran announced the opening of a factory to manufacture electrical wiring interconnection systems at Hyderabad, in the Indian state of Telangana. In the next twelve months, Safran Electrical & Power, a subsidiary of Safran specialising in electrical systems, will deliver the first LEAP electric harnesses 'Made in India' destined for the flourishing narrow-body aircraft market. The factory's production will also make it possible to meet any potential needs of the programmes in which the Group is involved in the region. The Hyderabad-based factory will be an integral part of the Group's strategy to establish itself in India in order to serve an extremely buoyant local market as well as the existing European and American markets.

This factory, operating to the 'highest international standard of competitiveness', will also make use of the Group's latest industrial technology. The 'Factory of the Future' will already become a reality in this site, which gives pride of place to digitalisation and the standardisation of operators' work stations. The factory, stretching across 4 000m^2 / 43,055 ft^2 will eventually employ 250 people. Philippe Petitcolin, the Group's Chief Executive Officer, stated,"Safran is proud to further reinforce its relations with India, a historical market player and a leading aeronautical supplier worldwide. This new factory reasserts our commitment to products 'Made in India', and it completes our industrial grid in the region with a new, high-performance production site."

SpiceJet and Safran/CFM agreement

SpiceJet and CFM International announced a $12.5 billion agreement that finalises the purchase of LEAP-1B engines to power a total of 155 Boeing 737 MAX airliners, along with spare engines to support the fleet. The airline also signed a 10-year Rate per Flight Hour (RPFH) agreement with CFM Services that covers all LEAP-1B engines powering SpiceJet's 737 MAX's. Under the terms of the agreement, CFM will guarantee maintenance costs for all SpiceJet's LEAP-1B engines on a pay -by-the-hour basis. "We are looking forward to introducing the new LEAP-1B into our fleet," stated Ajay Singh, Chairman and Managing Director, SpiceJet. "The CFM56 engines we currently operate have been a highly valued asset for us over the years. From what we have seen so far, the LEAP-1B is living up to its promises for efficiency and reliability. We hope they provide us unmatched service reliability while keeping our costs in check to ensure profitable operations."

Safran's Aneto to power Airbus Helicopters' Racer

Airbus Helicopters has selected Safran's new Aneto engine to power its Racer (Rapid and Cost-Efficient Rotorcraft) high-speed demonstrator. Twin Aneto-1X engines will contribute significantly to the new rotorcraft's cruise speed performance of up to 400 kph. Unveiled in June 2017 at the Paris Airshow, Racer is a technology demonstrator funded by the European Commission's H2020 research programme, through the Clean Sky 2 initiative.

The 2,500 shp Aneto-1X is one of a family of engines unveiled last October and will offer significant benefits: Because of an 'exceptional' power-to-volume ratio, it delivers 25 % greater power than existing engines of the same volume. This results in increased mission capabilities, especially during those requiring more power (such as offshore transport, search and rescue, fire-fighting or military transport), as well as better performance in "hot and high" conditions.

The Racer will be the first rotorcraft to feature Safran's Power Pack *Eco Mode* configuration, whereby its engines exploit hybrid technologies to enable more efficient use of the power generated. Developed in partnership with Safran Electrical & Power and the result of a study funded by France's civil aviation authority DGAC (Direction Générale de l'Aviation Civile) the Power Pack *Eco Mode* configuration allows a pilot to 'pause' one engine while in the cruise, generating fuel savings of around 15% and greater mission range.

India's MRO Sector

The opportunities ahead

Despite the very fast growth and successful implementation of national aviation policy, India's maintenance, repair and overhaul (MRO) sector is still struggling to develop an analogous MRO network. Although India is well-established as one of the world's fastest air transport growth regions, with commercial airlines operating more than 400 aircraft, Jet Airways and other Indian private carriers are heavily reliant on foreign MRO service providers for maintenance, mainly engine management contracts, component contracts and heavy checks.

Airworks' engineers performing maintenance work on civil aircraft

According to Civil Aviation Secretary Rajiv Nayan Choubey, 90% of an MRO workscope goes outside of India. "The government estimates Indian carriers alone generate MRO business worth Rs. 50 billion ($745 million) annually, and most of that is spent in countries such as Sri Lanka, Singapore, Malaysia and the Middle East as India lacks MRO facilities," Choubey stated.

With the fleet size of Indian scheduled and non-scheduled operators likely to double by 2020, the need for a strong domestic MRO industry is critical, he added.

Government backing

The new National Civil Aviation Policy, formulated by the Indian government in 2017, is likely to propel the domestic airlines to maintain aircraft within the country, as the MRO sector has been given exemption from paying taxes such as customs duty, an airport royalty and value-added tax (VAT). The policy also made provisions to enable international carriers to keep their aircraft in India for MRO work for up to six months. However, the aircraft during that time cannot be used for any kind of commercial activity, and carriers need permission from the authorities if the duration exceeds six months. The policy also ensures that adequate land be made available for MRO service providers at all future airports. Aviation experts have applauded the move, noting that allocation of space for maintenance and repair of aircraft can make life easier for airlines and reduce costs."This is the first time that the MRO industry has received such detailed attention in a policy proposal," opined Dubey. "It is therefore likely to bring in significant investments, infrastructure, technology and employment over the next 3-5 years."

Lowering or eliminating taxes or duties on imported materials, such as parts, and the extension of duty-free spares storage from one year to three years are other important features of the policy. "Taxes on needed materials such as tooling and spare parts brought into the country to perform work have hampered local suppliers' abilities to compete with their counterparts in places like Indonesia and Singapore," Dubey added.

Investment opportunities

According to data released by the Department of Industrial Policy and Promotion (DIPP), FDI inflows in the air transport (including air freight) sector between April 2000 and September 2017 was US$ 1.59 billion. India is estimated to see an investment of US $25 billion in the next decade in the airports sector, and traffic growth of 13 per cent, according to a Morgan Stanley report. According to them, the share of air travel in air and rail travel combined in India will grow to 15.2 per

cent by 2027 from 7.9 per cent presently. Capex plans to the tune of Rs 65,000 crore (US$ 10.08 billion) have been finalised by the Airports Authority of India (AAI) with Rs 17,500 crore (US$ 27.13 billion) for the next five years and around Rs 22,000 crore (US$ 3.41 billion) for 'brown field' expansion in Delhi, Mumbai, Hyderabad and Bengaluru by private operators and around Rs 21,000 crore (US$ 32.55 billion) for greenfield airports.

The Road Map Ahead

Owing to the fast-growing domestic aviation market, leading MRO services provider Air Works expects revenues from Indian clients to grow nearly two-fold, to 4.5 billion rupees, by March 2019. The company's total revenue this fiscal year is likely to be around Rs. 7-7.25 billion, of which Rs. 2.4 billion is expected to come from domestic operations, says Vivek Gaur, Air Works managing director and CEO.

"In two years, April 2017 to March 2019, we would expect our revenue from India operations in the range of Rs. 3.5-4.5 billion," Gaur stated. Air Works, which has 17 MRO hangars across India, the UK, the US, France and the Slovak Republic, provides a range of services including airline and business aircraft MRO and commercial and business aircraft asset management.

"Indian MROs have developed capabilities and infrastructure to provide up to 2.5 million maintenance worker hours, which is equivalent to the workforce capacity of Evergreen Aviation Technologies, Taiwan and Turkish Technik. Successful implementation of the provisions of the National Civil Aviation Policy, along with other structural reforms in the MRO sector, would endow the Indian MRO industry with the capability to generate up to US$ 975 million in revenues, as against the current revenues of US$ 92 million," stated Amber Dubey, Head of the Global Infrastructure Airports Practice, KPMG.

HAL-Safran launch JV MRO service unit in Goa

Promoting the 'Make in India' initiative, Hindustan Aeronautics Ltd. has tied up with French aerospace firm Safran Helicopter Engines and launched the Helicopter Engines maintenance, repair and overhaul (MRO) Pvt. Ltd. (HE-MRO) at the Sattari District in North Goa. The JV was finalised with the Goa Industrial Development Corporation (GIDC) giving a green signal to transfer the land to the aerospace firm."The land at Honda industrial estate has been transferred to HAL from Goa Auto Accessories Limited through EDC," stated GIDC Managing Director Narayan Gad. "The application for transfer of a plot has to go to the screening committee and since there was no screening committee and board formed, the transfer application could be approved only in late November."

IATA: "2017 marked by strong passenger demand"

Spicejet Boeing 737

Air Freight Demand up 9% in 2017

The International Air Transport Association (IATA) has announced global passenger traffic results for 2017 showing that demand (revenue passenger kilometres or RPKs) for the year ended 31 December 2017 rose by 7.6% compared to 2016. This was well above the 10-year average annual growth rate of 5.5%. While the rate of demand growth slowed to 6.2% in December 2017, compared to December 2016, this largely was owing to less favorable comparisons to the even stronger growth trend seen in the year-ago period. Full year 2017 capacity rose 6.3%, and load factor climbed 0.9 percentage point to a record calendar-year high of 81.4%.

"2017 got off to a very strong start and largely stayed that way throughout the year, sustained by a broad-based pick-up in economic conditions. While the underlying economic outlook remains supportive in 2018, rising cost inputs, most notably fuel, suggest we are unlikely to see the same degree of demand stimulation from lower fares that occurred in the first part of 2017," stated Alexandre de Juniac, IATA's Director General and CEO.

In 2017, international passenger traffic soared 7.9% compared to 2016. Capacity rose 6.4% and load factor climbed 1.1 percentage points to 80.6%. All regions recorded year-over-year increases in demand, led by the Asia-Pacific and Latin America regions.

Asia-Pacific carriers posted annual demand growth of 9.4%, compared to 2016, driven by robust regional economic expansion and an increase in route options for travelers. This was the first time since 1994 that Asia-Pacific led all the regions in annual growth rate. Capacity rose 7.9%, and load factor climbed by 1.1 percentage points to 79.6%.

European carriers' international traffic climbed 8.2% in 2017 compared to the previous year, underpinned by buoyant economic conditions in the region. Capacity rose 6.1% and load factor surged 1.6 percentage points to 84.4%, which was the highest for any region.

Middle East carriers' traffic increased 6.6% last year. The region was the only one to see a slowdown in annual growth compared to 2016, and the region's share of global traffic (9.5%) fell for the first time in 20 years. The market segment to/from North America was hit the hardest owing to factors including the temporary ban on large portable electronic devices in the aircraft cabin as well as the proposed US travel bans affecting some countries in the region. Capacity climbed by 6.4% and load factor rose 0.1 percentage point to 74.7%.

North American airlines had their fastest demand growth since 2011, with full year traffic rising 4.8% compared to 2016. Capacity climbed 4.5%, and load factor edged up 0.3 percentage point to 81.7%. The comparatively robust economic backdrop supported outbound passenger demand. This was somewhat offset by a slowdown in inbound travel partly attributable to the new immigration and security restrictions put in place for travel to the US, as well as the extreme weather events that hit the US later in the year.

Latin American airlines' traffic climbed 9.3% in 2017, the fastest rate since 2011. However, the upward trend weakened towards the end of the year, partly owing to disruption caused by the severe 2017 hurricane season that also hurt travel to the US. Capacity rose 8.0% and load factor increased 1.0 percentage point to 82.1%, second highest among the regions.

African airlines saw 2017 traffic rise 7.5% compared to 2016. Capacity rose at less than half the rate of demand (3.6%), and load factor jumped 2.5 percentage points to 70.3%. While indicators in South Africa are consistent with falling economic output, Nigeria has returned to growth, helped by the recent rise in oil prices.

Domestic air travel climbed by 7.0% last year. All markets showed annual growth led by India, China, and Russia, albeit with wide variation. Capacity increased 6.2% and load factor was 83.0%, up 0.7% percentage point compared to 2016. "In 2017, more than 4 billion passengers used aviation to reunite with friends and loved ones, to explore new worlds, to do business, and to take advantage of opportunities to improve themselves. The connectivity provided by aviation enables goods to get

Indigo Airlines' Airbus A320neo

to markets, and aid to be delivered to those in need. Aviation, truly is the business of freedom, liberating us from the restraints of geography to lead better lives. Aviation can do even more in 2018, supported by governments that recognise and support this sector's activities with smarter regulation, fairer taxation, cost efficient infrastructure and borders that are open to people and trade," added Mr. de Juniac.

The International Air Transport Association (IATA) also released full-year (2017) data for global air freight markets showing that demand, measured in freight tonne kilometres (FTKs) grew by 9.0%. This was more than double the 3.6% annual growth recorded in 2016. Freight capacity, measured in available freight tonne kilometers (AFTKs), rose by 3.0% in 2017. This was the slowest annual capacity growth seen since 2012. Demand growth outpaced capacity growth by a factor of three. Air cargo's strong performance in 2017 was sealed by a solid result in December 2017. Year-on-year demand growth increased 5.7%. This was less than half the annual growth rate seen during the middle of 2017 but still well above the five-year average of 4.7%. Freight capacity grew by 3.3% year-on-year in December.

"The outlook for airfreight in 2018 is optimistic"

In 2017, demand for air freight grew at twice the pace of the expansion in world trade (4.3%). This outperformance was a result of strong global demand for manufacturing exports as companies moved to restock inventories quickly. "Air cargo had its strongest performance since the rebound from the global financial crisis in 2010. Demand grew by 9.0%. That outpaced the industry-wide growth in both cargo capacity and in passenger demand. We saw improvements in load factors, yields and revenues. Air cargo is still a very tough and competitive business, but the developments in 2017 were the most positive that we have seen in a very long time," stated de Juniac. "The outlook for air freight in 2018 is optimistic. Consumer confidence is buoyant. And we see growing strength in international e-commerce and the transport of time- and temperature-sensitive goods such as pharmaceuticals. Overall, the pace of growth is expected to slow from the exceptional 9.0% of this year. But we still expect a very healthy 4.5% expansion of demand in 2018. Challenges remain, including the need for industry-wide evolution to more efficient processes. That will help improve customer satisfaction and capture market share as the expectations of shippers and consumers grow ever more demanding," concluded Mr. Alexandre de Juniac.

Courtesy: IATA

50 Irkut MC-21s for Aeroflot

Aeroflot will become the largest customer for the latest Russian-built medium-range aircraft, the MC-21. The landmark contract for 50 of the state-of-the-art passenger aircraft was signed between Aeroflot and Rostec. Rostec leasing subsidiary Aviacapital-Service will supply Aeroflot with 50 MC-21-300 aircraft on operating leases. The leasing payments and reserves for maintenance will total more than USD 5 billion.

The aircraft will be configured for Aeroflot to carry 169 passengers, with 16 business-class and 153 economy-class seats. In the first phase of the contract, the aircraft will be delivered with engines produced outside Russia. From the 26th aircraft, Aeroflot has the option to receive aircraft with new Russian-built PD-14 engines, which are currently undergoing certification testing.

The first aircraft is scheduled for delivery to Aeroflot in the first quarter of 2020, with the order planned to be completely fulfilled by 2026. Each aircraft will be leased for a term of 12 years, with the option of two-year extensions on the lease no more than three times. Aeroflot plans to operate the aircraft on both domestic and international routes.

Sergey Chemezov, CEO of Rostec said, "This agreement underscores that Russia's civil aviation industry is making a comeback and taking its place among leading global manufacturers. The MC-21 represents a genuine breakthrough achievement for the aviation industry. The aircraft uses cutting-edge materials and the latest generation of systems, created by leading Russian companies. Elements of the MC-21 that Rostec produces include titanium and composite parts, on-board electronics, chassis components, other systems, and the 'heart' of the aircraft – the PD-14 engine. We believe that this engine will be selected by Aeroflot as the primary power plant for the MC-21."

Vitaly Saveliev, CEO of Aeroflot stated,"The signing of a firm order for 50 MC-21 aircraft is a landmark event not just for our two companies, but for our country. Russian manufacturers have created the first next-generation passenger aircraft, marking Russia's return as a global leader in the aviation industry. It is noteworthy that the signing of a firm order between Aeroflot and Rostec coincides with a no less significant achievement, namely Aeroflot's return to the global aviation elite, as one of the top 20 largest airlines in the world. In today's geopolitical context, we believe it is essential that there is competitive Russian-made technology, and that it is of the highest quality and competitively priced. For this reason our partnership with Rostec, our largest partner and a shareholder of Aeroflot, is of critical importance."

The MC-21 is a medium-haul, narrow-body aircraft produced by Irkut Corporation (part of United Aircraft Corp., UAC) in cooperation with leading Russian manufacturers. Rostec subsidiaries involved in the production of the aircraft were VSMPO-AVISMA, United Engine Corporation, Technodinamika, Concern Radio-Electronic Technologies, and RT-Chemcomposite.

The MC-21 boasts an innovative ergonomic cabin for pilots and improved capabilities owing to the unique engineering solutions deployed. It is the first aircraft of its type in the world to make use of polymer composites in the construction of the wings. Composites account for more than 30% of the MC-21, which significantly increases the useful load.

The MC-21 simulator at the recently concluded Singapore Airshow 2018

Airbus: "Resounding Production Achievement"

Airbus' Commercial Aircraft deliveries in 2017 reached a new company record of 718 aircraft delivered to 85 customers for the 15th year in a row. Deliveries were more than four percent higher than the previous record of 688 set in 2016. The 2017 total comprises: 558 single aisle A320 Family (of which 181 were A320neo – an increase of 166 percent over 2016); 67 A330s; 78 A350 XWBs (up by nearly 60 percent from 2016) and 15 A380s. Furthermore, to cap this resounding annual production achievement, Airbus achieved 1,109 net orders from 44 customers. At the end of 2017, Airbus' overall backlog stood at 7,265 aircraft valued at US$1.059 trillion at list prices.

As exemplified by its 2017's performance, Airbus has steadily built on deliveries year on year, with 15 consecutive years of production increase. From its four A320 Family plants in Hamburg, Tianjin, Mobile, and Toulouse, Airbus is on track to achieve rate 60 per month on single-aisle by mid-2019. Meanwhile, the A350 XWB is equally on track by the end 2018. Airbus' healthy order intake in 2017 resulted in a 'book-to-bill' ratio of 1.5.

There were many industrial milestones achieved by Airbus Commercial Aircraft in 2017, which included delivery of the 100th A350 XWB; the delivery of the 50th A320 Family aircraft from its FAL in Mobile; delivery of Emirates' 100th A380; first flight of the A330neo; certification of the A350-1000; first A321neos delivered with CFM and P&W engines; inauguration of the new A330 Completion and Delivery Centre in Tianjin, China, with two first deliveries; and structural completion of the first Beluga XL. On internationalisation, the partnership with China is expanding while the Americas footprint is equally extended. Moreover, in the provision of services worldwide Airbus is significantly enhancing its local presence to be closer to its customers.

Emirates contracts for up to 36 additional A380s

Dubai-based Emirates Airline has signed a Memorandum of Understanding (MoU) to acquire up to 36 additional A380 aircraft. The agreement was signed at the airline's headquarters in Dubai by HH Sheikh Ahmed bin Saeed Al Maktoum, Chairman and Chief Executive, Emirates Airline and Group, and John Leahy, Chief Operating Officer - Customers, Airbus Commercial Aircraft. The commitment is for 20 A380s plus an option for 16 more with deliveries to start in 2020, valued at US$16 billion at latest list prices.

Following delivery of its first A380 in July 2008, Emirates took its 100th A380 on 3 November 2017 in Hamburg, Germany. The A380 is an 'essential part of the solution to sustainable growth', alleviating traffic congestion at busy airports by transporting more passengers with fewer flights. "The A380 is the 'best way' to capture growing world air traffic, which doubles every 15 years." The A380 flies 8,200 nautical miles (15,200 kilometres) non-stop and can accommodate 575 passengers in four classes.

A330neo programme development on track

Following the first flights of the first A330neo test aircraft (MSN1795) on 19 October 2017 and the second (MSN1813) on 4 December 2017, both are fully operational and now flying on a daily basis, having already accumulated more than 290 flight hours and over 80 flights (as of 24 January 2018). This represents a very strong start to the campaign and confirms that the aircraft perform in line with predictions. Much has been achieved: the aircraft flight envelope has been fully opened (normal and direct laws); anemometry has been calibrated; engine calibration points

have been completed in high and low speed; flutter tests and loads calibration have been performed; stall tests have been performed and strake configuration has been frozen; autopilot tests have started (including automatic landing) and climb and high speed performance tests are fully underway

In the meantime, Airbus is progressing rapidly on readying the next A330neo aircraft to fly which is the third flight test-aircraft and the first A330-800. This aircraft has now completed its structural assembly and flight-test instrumentation installation is on-going. Shortly, the aircraft will enter the painting hangar to receive its external livery. Moreover, production aircraft are progressing according to plan in the Final Assembly Line and Airbus has completed the installation of the first brand new airspace cabin.

New A330-800 rolls-out

The newest member from the A330neo Family, the A330-800, has rolled out from the paintshop, on track for its first flight in mid-2018. The A330-800 is the new generation 250-seater from Airbus' twin-aisle family. With its 242-tonne Maximum Take-Off Weight as the base variant, the A330-800 can operate routes of up to 7,500nm and with the recently launched 251-tonne MTOW variant, the aircraft can operate ultra-long-range routes of up to 8,150nm. The A330-800 will leverage the A330-200's 'proven versatility, popularity and reasons for success, offering new-generation economics'.

Building on success of the A330-200 with over 600 aircraft in operation, the A330-800 brings new-generation economics and comfort in addition to 'unprecedented' range to the 250-seat aircraft market. Together with the larger 300-seat A330-900, they share 99 percent commonality, having the same airframe, engines and cross-crew training. This gives operators great flexibility to use either aircraft in their fleet according to network needs in size and range. Both of these widebody aircraft incorporate new Rolls-Royce Trent 7000 engines, zero-splice nacelles, titanium pylons, new wings and new Airspace by Airbus cabins. The most visible new features of the A330neo wings are the specially developed curved wingtip Sharklets, which draw on A350 XWB technology, extending the wingspan to 64 metres, providing state-of-the art aerodynamic characteristics.

First A350-1000 for Qatar Airways

Airbus has delivered the world's first A350-1000 widebody airliner to Qatar Airways at a delivery event in Toulouse, France. The aircraft is the first of 37 A350-1000s ordered by the carrier and is the first ever Airbus aircraft fitted with the 'revolutionary' new

Qsuite seats, offering the first ever double bed in Business class. Qatar Airways is the world's largest A350 XWB family customer with 76 aircraft on order and the largest A350-1000 customer. "The A350-1000 fits seamlessly alongside Qatar Airways' growing fleet, including 20 A350-900s today. Both aircraft are complementary and provide for maximum commonality with unmatched operating efficiencies and the same unique passenger experience in their Airspace cabin. Flyers will benefit from absolute well-being in the cabin, with more personal space, optimised cabin altitude, more fresh air, controlled temperature and humidity, integrated connectivity and the latest generation of in-flight entertainment system", says the company.

The A350-1000 is Airbus' latest and largest widebody in the twin-aisle category. With a 7-metre longer fuselage, the A350-1000 space for premium cabin products is 40% larger than its smaller sibling the A350-900. In Qatar Airways configuration, the A350-1000 offers 44 additional seats. The A350-1000 features a modified wing trailing-edge, new six-wheel main landing gears and more powerful Rolls-Royce Trent XWB-97 engines.

Airbus Helicopters in 2017: 409 helicopters delivered

Airbus Helicopters delivered 409 rotorcraft and logged gross orders for 350 helicopters (net: 335) in 2017, with a strong commercial performance on the heavy and super-medium segments. The company booked 54 orders for helicopters of the Super Puma family and 19 orders for the super-medium H175, confirming those types as best-sellers on their respective market segments. Bookings also included 168 orders for light-single engine helicopters and 105 orders for the H135/H145 light-twins. At the end of 2017, the overall backlog stood at 692 helicopters.

2017 saw major progress being made on new products, including the H160 – first of the 'H Generation' – with three prototypes now in flight-testing ahead of certification in 2019. A full-scale firing campaign of the HForce weapon system was also carried out successfully on the H145M, which will benefit from improved and modular military capabilities by the end of 2018. The year was also marked by the launch of ACH (Airbus Corporate Helicopters) through which the company is able to offer high quality design and specifications across its range of helicopters to private and business customers.

Airbus Helicopters' 1300th helicopter from the H135 family

Airbus Helicopters delivered the 1300th helicopter from the H135-family, a number underlining the multipurpose lightweight twin-engine helicopter's worldwide success. The global fleet of this type has accumulated a total of more than 4.5 million flight hours since the entry into service of the first helicopter in 1996. More than 300 customers in 60 countries use helicopters from the H135 family for a wide range of missions including Emergency Medical Services (EMS), law enforcement, corporate transport, offshore wind and military flight training. The majority of the lightweight twin-engine helicopters of this type are operated in Europe (641), followed by North America (316) and Asia (195).

H145M launches 70mm LGRs

The capability enhancement for the H145M continues. In December 2017, Airbus Helicopters demonstrated the ability to fire laser guided rockets (FZ275 LGR from Thales) with its new H145M platform at the Älvdalen test range of the Swedish Defence Materiel Administration Flight test Centre. In a rough and challenging environment, the system performed flawlessly. The electro-optical system (MX-15D) from L3 WESCAM with embedded laser designation enabled a deviation of less than a meter for all rockets fired at a distance of up to 4.5 km. This 70mm laser guided air-ground rocket enhances the H145M's engagement capabilities. It fulfils the precision strike needs of the armed forces worldwide by reducing the risk of collateral damage, particularly during asymmetric combat operations.

First A321LR in flight

The first A321LR (Long Range) airliner took off for its maiden flight from Hamburg Germany; the aircraft was powered by CFM LEAP-1A engines and entry into service is targeted for Q4 2018. The A321LR features a new door configuration, enabling its operators to accommodate up to 240 passengers in Airbus' widest single aisle fuselage in the sky. The new Airspace by Airbus cabin available on the A320 Family additionally enhances the passengers' 'unrivalled travel experience'. With further options, combining an increased Maximum Take Off Weight (MTOW) of 97 tonnes and a third Additional Centre Fuel Tank (ACT), the aircraft's range extends to 4,000nm (7,400 km), allowing airlines to tap into new long range market opportunities.

Brazil orders additional Airbus C295 for SAR

Brazil has ordered an additional Airbus C295 search and rescue (SAR) aircraft that will eventually take to 15 the number of C295s in service with the Brazilian Air Force (FAB). This latest order constitutes the firming of an option included in an earlier contract in 2014. The three SAR aircraft will serve alongside 12 transport-configured C295s already delivered. The first of the three SAR aircraft was delivered last year and performed a successful five week tour through four continents before arriving in Brazil. The aircraft demonstrated its maritime patrol and search and rescue capabilities in a wide range of environments and recorded 100% availability during the tour. The second FAB C295 SAR will be delivered in 2019 and the third in 2020. More than 200 C295s have now been ordered by 26 countries.

Enhanced Eurofighters for Spanish Air Force

Airbus Defence and Space has delivered to the Spanish Air Force the first two Eurofighter Typhoons to be produced in the latest configuration with enhanced air-to-surface capabilities. The aircraft were manufactured at the Getafe Final Assembly Line in the P1Eb FW (Phase 1 Enhanced Further Work) configuration which marks a key step in the overall Eurofighter evolution plan. This same configuration is being retrofitted to in-service aircraft by other Eurofighter nations. It provides increased integration of a variety of air-to-surface weapons and enhanced targeting among other improvements. Spanish procurement agency DGAM took delivery of the aircraft on 22 December 2017 and they were subsequently ferried to Albacete air force base to enter service. The remaining six of the 73 aircraft currently contracted by Spain will be delivered to the same P1Eb FW standard during 2018 and 2019.

Flight demonstration of 'Skyways'

Airbus Helicopters' Skyways unmanned air vehicle has completed its first flight demonstration at the National University of Singapore (NUS). The drone took off from its dedicated maintenance centre and landed on the roof of a specially designed parcel station where a parcel was automatically loaded via a robotic arm. Once loaded with the parcel, the Skyways drone took off again and returned to land, demonstrating its automatic unloading capability.

This inaugural flight demonstration follows the launch of the experimental project with the Civil Aviation Authority of Singapore (CAAS) in February 2016 to develop an urban unmanned air system to address the safety, efficiency, and sustainability of the air delivery business in cities such as Singapore. The collaboration was subsequently extended in April 2017 with *Singapore Post (SingPost)* becoming the local logistics partner to the project.

An experimental project aimed at developing a safe and economically viable aerial unmanned parcel delivery system for use in dense urban environments, Skyways is one of a number of innovative Urban Air Mobility projects currently being researched at Airbus. These also include the Racer high-speed helicopter demonstrator, as well as the Vahana and CityAirbus autonomous flying vehicle concepts.

The specially painted blue F-15SG was unveiled at the launch of RSAF50 on Day 2 of the Singapore Airshow 2018

Singapore Airshow 2018

Lead picture: RSAF's F-15G and F-16Cs in joint aerobatic manoeuvres at the Singapore Airshow 2018 (photo: Experia Events)

The Singapore Airshow 2018 (6-11 February) concluded its trade segment on an optimistic note with strong commendations of "the wide range of extensive opportunities to connect stakeholders, disruptive technologies to drive change and unique interaction platforms to shape the future." The show saw an over 10 percent increase in trade visitors, as well as 287 VIP delegations with over 70 percent of exhibitors committing to return to the Singapore Airshow 2020!

"The biennial Singapore Airshow plays a vital role in supporting the aviation ecosystem in Singapore and Asia Pacific upon which so many skilled jobs depend. It's the place for current and potential customers and suppliers to meet, network, do business and evaluate new opportunities together. It's also a great showcase for new technologies and important to encourage the next generation of aviation talent to seek employment in aviation. By focusing on next generation technologies, encouraging start-ups to exhibit for the first time and promoting the capabilities and offerings around Southeast Asia and beyond, the show provides a time-efficient way to develop new business," stated Richard Brown, Principal, ICF International.

Halimah Yacob, President of the Republic of Singapore, takes a 'wefie' with Defence Minister Ng Eng Hen, Chief of Air Force, Major General Mervyn Tan, Second Minister for Defence Ong Ye Kung, Senior Minister of State for Defence Dr Mohamad Maliki bin Osman, and senior Republic of Singapore Air Force (RSAF) Officers at the launch of the RSAF' 50th anniversary celebrations at the Singapore Airshow 2018

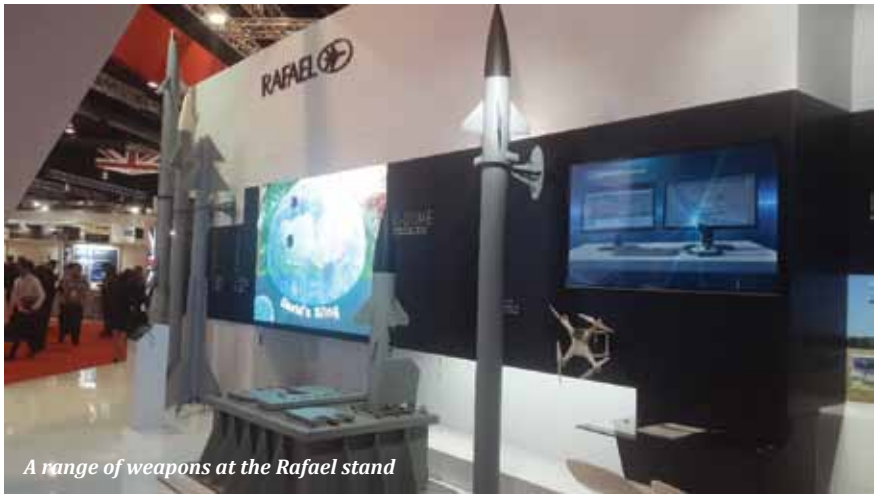
Rafael's Spyder in arsenal of the Singapore armed forces

Two USAF F-22 Raptors at the static display

Strategic partnerships established at the Airshow included focussed discussions and showcased around digital data revolution to drive intelligence across the entire value-chain of the aviation industry. Examples included Airbus' Skywise Predictive Maintenance Services which enable open aviation data platform for full aircraft data and advanced predictive analytics and Rolls-Royce's Intelligence Engine, an all-encompassing digital strategy which represents a paradigm shift in the way it designs, produces and supports propulsion systems. "We have been very satisfied with this year's Singapore Airshow and in particular with the high-level visitor profiles, with customers and partners from across the region and beyond, and for every part of our business," observed Sean Lee, Head of Communications, Asia-Pacific, Airbus.

Marking its unwavering commitment to the aviation industry in the region, more than 100 companies were featured at the US pavilion, making it the largest US presence

Two F-35B Lightning IIs were there as well



A range of weapons at the Rafael stand

Israel's IAI Heron 1 in Singapore armed forces service

ever at the Singapore Airshow. More than 60 of these participating companies comprising contractors, integrators, equipment manufacturers, small to medium enterprises and maintenance specialists were new to the Airshow. "The Singapore Airshow had a buzz right from the start. It has always been good, but 2018 is the best it has been in 10 years. The Singapore Airshow 2018 has been a tremendous success for the participating companies at the US pavilion centered around high quality of strategic dialogues and potential partnerships focused on new technologies and innovations," stated Tom Kallman, President and CEO, Kallman Worldwide, Inc., US Representative and Organiser of the USA Partnership Pavilion.

The 2018 edition also saw the participation of new global exhibitors such as the Turkish Aerospace Industries. "Our debut at the Singapore Airshow has been a fulfilling one with many opportunities for us to introduce Turkish Aerospace Industries' services and products while also establishing strong collaborations within the industry," stated Fahrettin Ozturk, Vice President, Strategy and Technology Management, Turkish Aerospace Industries. "For our participation at the next Airshow, we will bring a more extensive showcase, including our training jet and helicopter."

The show attracted nearly 80,000 visitors over the public day weekend on 10 - 11 February. Changi Exhibition Centre (CEC) hosted visitors from across the world of different ages to marvel at the spectacular aerial display performances and the latest commercial and military aircraft. Visitors to the Airshow were treated to aerobatics during the flying display performances including those by the Republic of Singapore Air Force (RSAF)›s integrated aerial display team, comprising an F-15SG with a special livery to commemorate RSAF's 50th anniversary, along with two F-16Cs fighters. They performed 15 exact manoeuvres, showcasing the high degree of precision and coordination required between the three aircraft. Their routine included six new integrated manoeuvres that was performed for the first time ever in public, such as the 3-aircraft *Dedication Pass* and the *Golden Salute*. Other flying displays included the Indonesian Air Force (TNI-AU) Jupiter Aerobatic Team's KT-1B, the US Air Force (USAF)'s F-16 and B-52 Stratofortress, the Sukhoi Su-30MKM from the Royal Malaysian Air Force (RMAF), and Royal Thai Air Force (RTAF)'s JAS-39 C/D Gripen, which made their first appearances at Singapore.

At the Static Aircraft Display Area, visitors were given opportunities to get up-close and personal with the wide range of commercial and military aircraft including a special livery RSAF F-15SG with a predominantly blue colour scheme that was specially designed and painted to commemorate the RSAF's 50th anniversary. Key highlights of the static aircraft display included the F-35B Lightning II, the world's first supersonic short takeoff/vertical landing (STOVL) stealth aircraft, making an appearance at an Airshow in Asia for the first time. Other military aircraft that made their appearance at an Airshow for the first time in Asia, was the Royal Australian Air Force E-7A Wedgetail Airborne Early Warning aircraft, the Royal Thai Air Force's Gripen and the United States Air Force RQ-4B Global Hawk unmanned aircraft system (UAS).

There were a range of business and commercial aircraft which appeared for the first time at an Airshow in Asia. Among them were the Gulfstream G500 and G600 aircraft, Textron Aviation Cessna Citation Longitude and Embraer's fourth prototype of a next-generation narrow-body jet – the E-190 E2 prototype. Nicknamed the "profit hunter", the prototype had a brilliantly painted tiger's face on its nose (below).

Boeing at the Singapore Airshow

Boeing showcased a wide range of products and services at this year's Singapore Airshow. The scale of the company's presence at the show reflected "the strong growth prospects and opportunities across its commercial, defence and services businesses in Asia-Pacific." The Asia-Pacific region is arguably Boeing Commercial Airplanes' fastest growing market with a strong demand for both single and twin-aisle airplanes. In addition to models of the 737 MAX and 787 airliners that have been delivered to numerous operator in the region, the Boeing exhibit also showcased a model of the new 777X now in development.

Boeing Defense, Space & Security had a robust line-up of Boeing products on static display. The Republic of Singapore Air Force displayed the F-15SG multi-role fighter, the CH-47 Chinook and AH-64 Apache helicopters. The US Department of Defence exhibited the P-8A Poseidon and the F/A-18 Super Hornet, alongside the Integrator unmanned aircraft system from Insitu. The Boeing exhibit also included the Insitu ScanEagle and the Wave Glider, an ocean surface robot with seabed-to-space autonomous capabilities from Liquid Robotics.

Chinook CH-47

AH-64D Apache

C-17 Globemaster III of the USAF

Participation by Airbus

From the digitalisation of maintenance operations to aerial data collection by drones, Airbus' growing portfolio of services took centre stage at the airshow, with a particular focus on the Asia-Pacific region. Announcements during the six-day biennial aerospace industry event included the sign-up of additional airline customers for Airbus' predictive maintenance and flight hour services, the launch of Asia-Pacific operations for the company's commercial drone services, and a new partnership to support military and police helicopters in Thailand.

Airbus' Skywise open-aviation data platform increased its user base with the announcement that AirAsia, Asiana Airlines and Etihad Airways would become the first airlines to use full aircraft data and advanced predictive analytics – with each signing a premium subscription contract covering Skywise Predictive Maintenance. A Skywise-equipped aircraft captures vast amounts of performance data and this quantity of information can be used by airlines to anticipate their maintenance needs with high levels of accuracy, and well in advance, thus maximising the operational reliability and utilisation of their jetliners.

Airbus' expanded focus on unmanned aerial vehicles (UAVs) was underscored at the Singapore Airshow, where the company officially launched its Asia-Pacific operations for Airbus Aerial commercial drone services. Singapore will serve as the region's base of Airbus Aerial services, joining existing hubs in Munich, Germany and at Atlanta in the United States. Airbus Aerial is expanding from its initial focus on developing new

imagery services, thereby leveraging the latest software and aerospace technologies to offer data and analysis from information provided by drones, satellites, high altitude aircraft and other sources.

Airbus' UAV focus was on the emerging business of package delivery, with the company's Skyways UAV successfully completing its first flight demonstration at the National University of Singapore during the same week as the Singapore Airshow. During the demonstration, the drone lifted off from its dedicated maintenance centre and flew to the roof of a specially designed parcel station, where a parcel was automatically loaded via a robotic arm. The drone took off again and landed, showing its automatic unloading capability.

The Skyways drone concept, which also was displayed on Airbus' exhibit stand at the Singapore Airshow, is designed for flight along aerial corridors to avoid collisions, while the central ground operations centre continuously monitors flight operations and unmanned air traffic. Airbus has arranged a trial project with Singapore's postal service – SingPost – as its logistics partner to deliver parcels along designated stations at National University of Singapore.

The Singapore Airshow also highlighted the increased popularity of Airbus' flight hour services in the Asia-Pacific region. It was announced that Hong Kong Airlines has selected Airbus' FHS-TSP (Flight Hour Services - Tailored Support Package) for the carrier's fleet of 21 Airbus A350 XWB widebody aircraft. The FHS-TSP contract provides integrated and guaranteed services ranging from the supply and repair of components to the manufacturer's unique Fleet Technical Management service. An onsite Airbus team will manage daily maintenance activities, including spares, warehousing, and engineering.

Making its public debut: Airbus' all new A350-1000


An RMAF A400M Atlas on static display


AS332M Super Puma of the RSAF

For the rotorcraft business sector, Airbus and Thai Aviation Industries (TAI) announced an agreement at the Singapore Airshow to support all Airbus-built military and law enforcement helicopters in Thailand for two years. Under this arrangement, the Thai-owned maintenance and logistics support company will become main service provider in the country for Airbus helicopters operated by the Royal Thai Armed Forces and Royal Thai Police. The Royal Thai Armed

Forces and Royal Thai Police currently operate a fleet of some 40 helicopters, which includes the Airbus-built light single engine H125M, the twin-engine H145, H145M and UH-72; the medium twin-engine AS365, H155 and H175; and heavy tactical H225M. These helicopters are utilised for various missions within the Royal Thai Air Force, Army, Navy, Police and the Survey Department.

At the Singapore Airshow's static display line, Airbus' all-new A350-1000 jetliner made an extended stopover amid a 12-city tour throughout the Middle East and Asia-Pacific region. Certified in November 2017 by both the European and American airworthiness authorities (EASA and FAA), the A350-1000 will enter service soon with launch operator Qatar Airways.

Also on display at the Singapore Airshow was an Airbus A400M Atlas military airlifter in colours of the Royal Malaysian Air Force.

Textron Aviation's Cessna Citation Longitude

Textron Aviation Inc. have committed to strengthen its investment in the Asia-Pacific region, and displayed several of its commercial and special mission products. Notably, the Cessna Citation Longitude made its regional debut at the event *(in picture below)*.

Gulfstream G500 and G600 make their debut

The two newest aircraft from Gulfstream Aerospace Corp. made their Asia debut at the airshow. The Gulfstream G500 and Gulfstream G600 flight-test aircraft were part of the Gulfstream static display, joining the flagship Gulfstream G650ER, the high-performing Gulfstream G550 and the Gulfstream G280. There are more than 330 Gulfstream aircraft in service in the Asia-Pacific region, 280 of them large-cabin.

The Embraer E2 at Singapore

The company presented its products and solutions for the commercial aviation, business aviation and defence and security sector. Embraer's presence at the Show included a pavilion featuring the full-scale cabin interior mock-up of the latest E-Jets E2 commercial aircraft family displaying the various seating configurations and a Virtual Reality booth where one could pilot the E-Jets E2 aircraft. Embraer has more than 330 aircraft in 17 countries in Asia Pacific and China. The Embraer E190-E2 made its first appearance at the Singapore Airshow, this commercial aircraft, dubbed as the "profit hunter" by Embraer featured a tiger's face spray-painted on its nose – "depicting Asia"! Also on display were some of Embraer's business jets such as the Legacy 500, Phenom 300 and Legacy 650.

Bombardier's presence at Changi

Bombardier Commercial Aircraft displayed a Philippine Airlines dual-class 86-seat Q400 regional turboprop, as well as an airBaltic CS300 aircraft. The Asia-Pacific region is Bombardier Commercial Aircraft's fastest growing market with strong demand for small, single-aisle aircraft like the C Series, as well as larger regional turboprops and jets. Singapore is headquarters for Bombardier's operations in the Asia-Pacific region and the company has been steadily growing its after-sales support in Asia-Pacific to keep pace with the ever-increasing fleet of its aircraft. The company's Customer Services network for commercial aircraft in the region includes five Regional Support Offices in Shanghai, Tokyo, Delhi, Singapore and Sydney. Bombardier-authorised Service Facilities are operated by STAECO in Jinan, China, Hawker Pacific in Cairns, Australia and GMR Aero Technic in Hyderabad, India.

Bombardier's products at the airshow also showcased a Challenger 350 and Global 6000 corporate aircraft.

The CS300 aircraft

Bombardier Q400

Saab at the Singapore Airshow 2018

Saab displayed its air defence and surveillance product line-up including the Gripen fighter, Swordfish MPA, GlobalEye AEW&C, RBS 70 NG air defence system and Giraffe 1X radar. "The Asia Pacific region, with Singapore as a hub, is a dynamic and fast-growing market where Saab is pursuing opportunities across all of its product domains." At the show Saab displayed how in today's complex and turbulent world, "Saab's thinking edge delivers the innovative and advanced solutions that safeguard people and society."

Saab's stand at Changi

The Royal Thai Air Force came to Changi with a pair of Gripens, a two-seater on static display while a Gripen C carried out an awesome display over the Straits

Dassault's Falcon 8X in first appearance

Dassault Aviation featured its new flagship, the Falcon 8X, at this year's Singapore Airshow which was the first appearance of the ultra-long range Falcon 8X at the six day event. The 8X was presented alongside a Falcon 2000LXS twinjet. All Falcons, and in particular late generation models like the Falcon 8X and 2000LXS, draw upon Dassault's extensive experience with combat aircraft – a heritage unique among business jet manufacturers. "Falcons and Rafales are designed by the same engineering teams and built on the same production lines to the same exacting quality standards." Falcons also benefit from the advances in aerodynamics, structural design, digital flight control and the man-machine interface conceived for Rafale fighters, keeping them "on the cutting edge of executive aircraft technology."

Leonardo at Singapore

With an established presence in Singapore, Malaysia, Republic of Korea, Australia, Japan and Indonesia, Leonardo "considers the Singapore Airshow a major opportunity to showcase its range of solutions that can meet the requirements of both government and commercial customers." Leonardo is targeting the growing demand for border security, maritime patrol, air traffic control and rotorcraft in the region, offering comprehensive advanced technology solutions. The Company's presence at the Singapore Airshow was part of its plan to further develop existing long-standing relationships and develop new ones with future customers.

"Leonardo is proud to have a successful association with the Republic of Singapore. In 2010 the Republic of Singapore Air Force became the first export customer for Leonardo's M-346 Advanced Jet Trainer (AJT). The flight envelope, high thrust/weight ratio, the ability to develop high angles of attack and extreme manoeuvrability allow the M-346 to offer flight conditions comparable to those of new-generation combat aircraft. This maximises training effectiveness and reduces the need to fly sorties on the far more expensive and complex variants of frontline

The Leonardo AW189

types. These features make the M-346 an optimal solution also for the Aggressor and Companion Trainer roles. The aircraft, already ordered by the Air Forces of Italy, Singapore, Israel and Poland in its AJT configuration, will soon be available in a fully operational configuration (M-346 Fighter Attack), as well."

Leonardo also presented its state-of-the -art Air Traffic Control (ATC) systems. The most recent contract was a multi-million Euro deal, signed in 2015, to enhance air traffic control surveillance at Singapore's Changi Airport. Leonardo ATC Systems are also operating in other South East Asia Countries including Thailand, Malaysia, Indonesia and Vietnam.

Leonardo's' excellence' in rotorcraft was represented by successful helicopters such as the AW189, the market-leading super-medium helicopter and the intermediate models AW169 and AW139, comprising the Family of Leonardo's new generation helicopters. Over 450 Leonardo helicopters of all types have been ordered to date by defence, government and commercial operators in the region. These aircraft carry out naval, utility, national security, search and rescue, EMS, transport and maritime patrol missions. Especially strong is its presence in Malaysia, Japan, Australia, Indonesia and Republic of Korea.

ATR sees further growth potential in Asia Pacific

ATR forecasts huge growth potential for the company in the Asia Pacific region. The manufacturer anticipates a demand for some 750 turboprops within the next two decades in the region (excluding China). Asia Pacific is ATR's largest market globally accounting for over one third of the global fleet. As of today, there are nearly 1,200 ATRs around the world, of which some 420 are in Asia Pacific. The region ranks first in terms of number of ATRs in operation. Of the top ten countries in the world, in terms of ATR fleet size, four are in the Asia Pacific region. The biggest country globally, in terms of number of ATR aircraft in operation, is Indonesia with 99 aircraft. The other countries in Asia Pacific that made the global top ten are: Malaysia with 47 aircraft (No. 5 globally), India with 46 aircraft (No. 6 globally) and Myanmar with 34 (no. 10 globally). In addition, about one half of the ATR's order backlog is from operators in Asia Pacific.

Rolls-Royce launches its "Intelligent Engine"

Rolls-Royce launched its IntelligentEngine vision at the Singapore Airshow. With more people flying than ever before and an increasing demand for more efficient travel, Rolls-Royce has defined "a vision for the future of aircraft power that will help deliver passengers more reliably and more efficiently than ever before." The IntelligentEngine vision is based on a belief that product and service have become so closely connected that they are now inseparable. This trend was first identified when Rolls-Royce introduced the market-defining TotalCare service in the 1990s and, since then, advancements in digital capability have accelerated this change and further blurred the boundary between the two.

The coming together of product and service, supercharged by digital technology, offers Rolls-Royce a wealth of opportunities to improve the way it provides power to its customers. In addition to designing, testing and maintaining engines in the digital realm, the IntelligentEngine vision sets out a future where an engine will be increasingly connected, contextually aware and comprehending, "helping to deliver greater reliability and efficiency."

Dominic Horwood, Rolls-Royce, Director, Customer and Services, Civil Aerospace, stated, "We are determined to pioneer the power that matters for our customers and our IntelligentEngine vision will allow us to do this. "We have the right people, the right skills and the right infrastructure to grasp this opportunity and deliver world-beating digital insight, helping us to deliver even greater value for our customers."

The IntelligentEngine vision enables Rolls-Royce to find new ways of pioneering power, whether that is through its engines installed today, through its future UltraFan engine design, or even through the hybrid-electric concepts of the future.

Rolls-Royce's R^2 Data Labs, an acceleration hub for data innovation launched in December 2017, will play a key role in achieving the aims of the IntelligentEngine. Using advanced data analytics, industrial Artificial Intelligence and machine learning techniques, R^2 Data Labs develops data applications that unlock design, manufacturing and operational efficiencies within Rolls-Royce, and creates new service propositions for customers.

The Rolls-Royce stand at the event

Elbit Technologies and Capabilities showcased

Elbit presented a wide array of advanced and tested solutions at the Singapore Airshow. Some key highlights were: MUSIC airborne self-protection systems that provides high-performance operationally proven Direct Infrared Counter Measure (DIRCM) protection for all types of rotary and fixed-wing aircraft against MANPADS.

J- MUSIC designed for distributed installation on a variety of aircraft types, in a single or multi-turret configuration. Its open architecture allows integration with various Missile Warning Systems (MWS) enabling it to provide a comprehensive level of protection in the civil and military market.

C- MUSIC is a Civil Aviation Authority certified, laser-based, fully automatic and autonomous DIRCM system that provides large jet aircraft with comprehensive protection against advanced heat-seeking ground-to-air missiles, C-MUSIC is currently in use on VIP, Heads of State and commercial aircraft.

Mini-MUSIC is a well-tested DIRCM system in a compact and lightweight package that protects small and medium rotary and fixed wing aircraft. Mini-MUSIC can also be integrated with various Missile Warning Systems (MWS) for reliable and affordable protection.

SPECTRO XR payload is an ultra-long-range, day/night, multi-spectral electro-optical ISTAR system, that provides 20" payload performance in a 15" payload. SPECTRO XR combines multiple cameras into one, allowing it to significantly improve performance without increasing size and weight.

Light SPEAR (a multimedia presentation) is a unique Electronic Attack (EA) and self-protection system for Unmanned Aircraft Systems (UAS), being compact, extremely lightweight self-protection jamming system.

Skylark 3 is a tactical mini-UAS optimised for either dismounted or vehicle-based operation, delivering organic airborne Intelligence, Surveillance, Target Acquisition and Reconnaissance capabilities to the division, brigade and battalion levels (100 km Line Of Sight) enabling force, convoy and strategic infrastructure protection.

Brightnite enables intuitive head-up, eyes-out orientation flight in extreme low visibility conditions.

Targo and EVA package a fully embedded training experience can be achieved using the Targo Helmet Mounted Avionics (HMA) combined with EVA (Embedded Virtual Avionics). Targo is an HMA system that enables pilots to plan, rehearse, fly and debrief using their personal helmets.A complete package of Software Defined Radio (SDR) systems that enables robust communication across units and echelons, comprising of E-LynX family of multi-waveform tactical IP radios including MCTR-7200, PNR-1000 lightweight personal network radio.

PRC-648 PLB Personal Locator Beacon (PLB) is an advanced Over-the-Horizon (OTH) Cospas-Sarsat (C/S) locator, for non-combat search and rescue (SAR) missions. Carried in the pilot's emergency vest, the PRC-648 provides ultra-reliable performance in severe environment. An internal G-Switch automatically activates the beacon upon bailout, while a lanyard-actuated switch provides for additional activation options.

PRC-434G/CS 'All-In-One' Personal Survival Radio (PSR) is lightweight, handheld GPS embedded PRC-434G/CS transceiver capable of responding to interrogations transmitted by the ARS-7000 Airborne Locator System.

Personnel Recovery Device (PRD) is an Alert and Notification device for use by ground forces and issued to soldiers on risk of becoming isolated, missing, or captured.

Aeronautics presents its newest UAS in Singapore

The Orbiter 4

For the Aeronautics group, highlight at the Show was the Orbiter 4 that has high transportability without the need for a landing strip. This 'most advanced' UAS Orbiter 4 has advanced technological capabilities including the ability to carry and operate 2 payloads simultaneously, endurance of 24 hours, use of satellite communication, cellular interception sensor that is fully operational from take-off throughout the mission until landing under GPS-denied conditions, Synthetic Aperture Radar (SAR) and Controp's advanced XR electro-optic payload. Amos Matan, CEO of Aeronautics Group, stated: "We provide a comprehensive set of advanced and complete solutions for various defence missions. Our products are operated by more than 50 military and security forces worldwide, and have already completed hundreds of thousands of operational flight hours. We are pleased to participate this year in the Singapore Airshow and to strengthen our relationship with customers in Asia".

The Orbiter 1K is a loitering unmanned system. Given a specific waypoint, the loitering Orbiter 1K can detect and destroy a moving or a stationary target. The system can also operate based on a given area range: the Orbiter 1K independently scans the area, detects and destroys the target, again moving or stationary. In case the target was not detected or in any change of plans, the system's recovery capability allows it to return to its base and land safely using a parachute and an airbag. Launched from a catapult, the Orbiter 1K can fly for 2-3 hours, carrying a multi-sensor camera with day-and-night channels.

The Orbiter 2 UAS is a compact and lightweight system, which offers extended endurance and range. The Orbiter 2 UAS carries a multi-sensor camera with day-and-night channels and a laser pointer, and is gyro-stabilised with tri-sensor and zoom payload, and has an endurance of 4 hours up to 80km. Easy to operate and quickly assembled, the system is launched from a catapult and lands using a parachute and an airbag.

Aeronautics stand at the Singapore airshow

The Orbiter 3 STUAS is a compact and lightweight system for military and homeland security missions, providing an operational range of up to 100 km and up to 7 hours of endurance. Carrying a triple sensor payload with day-and-night, thermal image and laser pointer, the system has significant tactical UAS capabilities in a mini-aerial platform body. Assembled in 20 minutes, the fully autonomous, vehicle-mounted system enables static and on-the-move operations. Providing a tri-sensor and stabilised EO/IR payload, it uses a catapult for take-off and a parachute and airbag recovery and is electrically powered for silent covert operations.

The Orbiter 4 STUAS/NSUAS is an advanced multi-mission platform with an ability to carry and operate two different payloads simultaneously. With an open architecture, the Orbiter 4 can be adjusted to the needs of each client or mission.

Pegasus 120 is Aeronautics' first multi rotor platform. With a maximum payload weight of up to 75 kg and an ability to carry multiple payloads including COMINT, VISINT and logistics, the Pegasus 120 is designed especially for defence and security missions. Thanks to its 'extraordinary' carrier and endurance capabilities, the Pegasus 120 is unique in the category of heavy lifters VTOL UAS's, and is ideal for defence, homeland security and civil missions, as well as for Special Forces and special missions.

The next edition of the Singapore Airshow 2020 will be held from 11 to 16 February 2020, again at Changi Exhibition Centre. *Vayu* will be there!

ASEAN is as ASEAN does

India's 'no show' at Singapore Airshow 2018 is reflected upon

Taking off from the lament about lack of interest by Indian aviation entities to participate at important 'near home' Airshows such as Dubai (see Vayu Issue I/2018), the 'no show' again by HAL, DRDO, ADA, NAL and other pertinent organisations at the recently held Singapore Airshow at Changi in early February 2018 has been reflected upon by many.

The biennial Airshow at Changi, considered by most professionals as "Asia's most important Aviation event" took place just days after the Government of India had hosted all ten ASEAN heads of state as Chief Guests at the 2018 Republic Day Parade. Prior to this event, these ASEAN leaders were in New Delhi to commemorate the 25th Anniversary of ASEAN-India Dialogue Relations under the theme of 'Shared Values, Common Destiny'.

This was not the first time that the Indian Government had organised such a seminal event for the foreign dignitaries, going back to May 2014 when all SAARC leaders were invited for the new Government's swearing-in ceremony, hosting of the BRICS summit

Indian Army marches down Rajpath with flags of the ASEAN nations on Republic Day 2018

in October 2016 and then an outreach summit organised with all seven leaders of BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation).

During these summits, the agenda included political, economic, social-cultural matters which were discussed and agreements were signed. But the main focus remained on "maintaining peace and security of the region." As per the Delhi declaration, the two entities (ASEAN and India) "agreed to ensure compliance with United Nations Security Council resolutions on counter-terrorism, and to note the efforts made towards the formation of the Comprehensive Convention on International Terrorism." Also agreed was that the first ASEAN-India Cyber Dialogue would be held in 2018.

Prime Minister Narendra Modi with heads of ASEAN nations at the Commemorative Summit 2018 in New Delhi

Indian Navy HAL-Dornier 228 maritime patrol aircraft : the type which would be a most cost effective addition to air arms of the ASEAN

The ASEAN nations and India "also agreed to cooperate for the conservation of marine resources, in the aviation and maritime transport sectors, promote growth of micro, small and medium enterprises, deepen relations in science and technological exchange, implement an ASEAN-India Space Cooperation Programme, and encourage private sector investment".

Considering the expansive nature of the various formal declarations, it would have been most appropriate for India to have showcased at least some of the products manufactured by its aviation industry at the Singapore Air Show. Case for the export of HAL-Dornier 228 light transport aircraft variants to countries in south east Asia is obvious enough, considering the urgent need for maritime air surveillance of the South China Sea. The Philippines, Vietnam, Malaysia, Indonesia and Brunei have stated requirements which the Indian Government could well support with this indigenously-produced aircraft of which more than fifty numbers currently operate with the Indian Navy and Coast Guard in special versions.

ASEAN leaders at Singapore in February 2018

Again, the HAL Dhruv advanced light helicopter (ALH) with its several variants is another potential 'winner' in the region but again there was little obvious attempt by the Indian Government and its agencies to promote this aircraft.

Instead, the Indian 'no show' at Changi was too obvious to ignore especially when the Singapore Prime Minister Lee Hsien Loong, fresh from his visit to New Delhi, thereafter hosted Delegations from all 10 ASEAN member states for the Defence Minister's Meeting Retreat on sidelines of the Show itself.

Would it therefore surprise anyone that Singapore Defense Minister Ng Eng Hen also hosted visits by the Chinese minister of national defence, General Chang Wanquan who was at Singapore for the Air Show? It would surely have been appropriate for Indian Defence Minister Nirmala Sitharaman to have visited the Singapore Air Show as well.

ASEAN theme at Singapore Airshow


Left to right: On home ground, the Republic of Singapore Air Force pulled out all stops to display various aircraft types and helicopters at Changi, including their F-16s and F-15s commemorating 50 years of the RSAF; the squadron insignia on tail of a F-16 showing Falcons over the Island, 'Our Home Above All'


United colours of the RSAF : fighter pilot and air defence operator at the Show


Gp Capt Nattawut Duangsung ('Neon'), former CO of 701 Squadron, Royal Thai Air Force displayed their Gripen at the Air Show. Based at Surat Thani in eastern Thailand, the RTAF maintenance support team at Changi were effusive about high servicability rates of the Gripen in service


The Indonesian industry are promoting their N219 19-seater light transport aircraft for inter-Island air services as also maritime patrol. On the left is Chief Test Pilot Capt Esther G Saleh while Indonesian beauty queens greeted visitors at the Indonesian Aerospace stand

The China factor loomed: AVIC International had a large stand in the main hall, with models of various aircraft types on display

Egyptian Rafales in action

The Egyptian Air Force have established an operational flying training centre for the Rafale fighter at Gebel El Basur Air Base, outside Cairo. Egypt had ordered 24 Rafales from Dassault in 2015 and in late November 2017 received its final three single-seat Rafale EM fighters, which joined 34 Squadron 'Wild Wolves', a unit assigned to 203 Tactical Fighter Wing 'Storm' also based at Gebel El Basur. Egypt has so far ordered 16 two-seat Rafale DMs and eight single-seat Rafale EM fighters. Six Rafale DMs are in service and the type has been committed in action, conducting air strikes against Islamic State in Libya. Egypt is to exercise options for another 12 Rafales.

Shenyang J-16s into service

The Shenyang J-16 multirole fighter is reported to have entered service with the PLAAF in increasing numbers, but with little publicity. Recent images at a parade and exercise at Cangzhou in China's northeastern Hebei province confirm that another two air regiments have converted or are in the process of converting to the J-16, bringing the total to three such formations. These include the 172nd and 176th Brigades of the PLAAF's Flight Test and Training Centre, which is "assigned the task of developing flight techniques, combat tactics and training programmes for new aircraft and equipment." The third unit operating the J-16 is the 98th Brigade based at Chongqing in China's southwest.

The Shenyang J-16 is a Chinese reverse-engineered version of the Sukhoi Su-30 multirole fighter, currently operated by the PLAAF and PLAN. Unlike the Shenyang J-11B/BS, which is based on the earlier Sukhoi Su-27, the J-16 has multi-role capability and is powered by the indigenous WS-10 Taihang turbofan engine, and equipped with an AESA radar.

Another PAF JF-17 squadron formed

The Pakistan Air Force formed its sixth unit with the JF-17 Thunder fighter, on 28 February 2018, this being the newly raised No.28 (Multi-Role) Squadron at Samungli (Quetta) whose squadron emblem is the 'Phoenix'. The PAF CAS Air Chief Marshal Sohail Aman, reviewed the parade commanded by Wg Cdr Amir Imran Cheema even as four JF-17s made a formation fly past. The new squadron joins the existing resident unit, No.23 Squadron with F-7 PGs at Samungli.

Belgium orders Airbus A330 MRTT

In mid-February, Belgium confirmed its joining the European/NATO Multinational Multi-Role Tanker Transport Fleet (MMF) programme, which already consists of the Netherlands, Luxembourg, Norway and Germany, it having ordered an aircraft taking the total number to eight. An amendment to the original MMF contract adds an aircraft to the seven previously ordered for the MMF programme, the contract also including three additional options to enable other nations to join the programme and provides for two years of initial support. The programme is funded by the five nations who will have the exclusive right to operate these NATO–owned aircraft in a pooling arrangement. The aircraft will be configured for in-flight refuelling, the transport of passengers and cargo, plus medical evacuation flights. Airbus Defence and Space will deliver the eight aircraft from its tanker conversion line at Getafe, near Madrid, between 2020 and 2024.

Upgradation of ROC F-16 Fighting Falcons

Republic of China Air Force (Taiwan) F-16 Fighting Falcons have been upgraded by Aerospace Industrial Development Corp to the new F-16V standard. Four legacy F-16A and F-16B fighters have so far been upgraded to F-16V standards, including the APG-83 Scalable Agile Beam Radar, the upgrade including new mission computers, navigation equipment, large colour multifunction displays, advanced identification friend or foe transponders, an upgraded electronic warfare suite and a Link 16 tactical data link. AIM-9X Sidewinder air-to-air missiles form part of the package for Taiwan. The new version of the Sidewinder missile, with its improved seeker head, capable of high off-boresight cueing via a helmet-mounted display, is more maneuverable and has longer range.

Canada to acquire ex-RAAF Hornets

The continuous (and controversial) evaluation of a new combat aircraft for Canada has moved ahead with the choice of second-hand ex-Royal Australian Air Force F/A-18 Hornets, pending decision on 88 new aircraft to replace the existing fleet of 77 CF-18s. Having rejected an earlier government's plan to purchase the F-35A Lightning II, Canada's Innovation Minister Navdeep Singh Bains said the government wanted "a trusted partner" in any future deal. The inference was on Boeing's complaints about Bombardier's deal to sell airliners to Delta Airlines and the US government's subsequent imposition of an 80% trade tariff on the import of this aircraft. The former RAAF aircraft are very similar in terms of age and equipment fit to the ones they will be joining in the Royal Canadian Air Force and any work required to bring them up to the same standard can be carried out in-house by Canadian enterprises. The Australian aircraft will be delivered to Canada in 2018 and enter service in the early 2020s after such work is done as is needed to achieve fleet commonality. The new fighters will be assigned to 3 Wing at Bagotville and 4 Wing at Cold Lake.

New aircraft for Myanmar

The Commander-in-Chief of Myanmar's Defence Services, Senior General Min Aung Hlaing, recently inspected ten new aircraft including six Yak-130s, two Fokker 70s and two ATR 42s, received by the Myanmar Air Force and commemorating its 70th anniversary on 15 December 2017. The Yaks have been delivered in two batches of three in 2016 and 2017 and more are expected in 2018. The Russian-built trainers are "a perfect fit" as lead-in fighter trainers for Myanmar's Sino-Pak JF-17 fighters expected to be delivered to the air force later in 2018. The two Fokker 70s, delivered late in 2017 for use as executive transports, are former KLM Cityhopper aircraft, but the provenance of the ATR-42s, is unknown. Noting that Myanmar's air force lags a technological generation behind those of other countries in the region, the C-in-C, speaking at the Air Training School at Meiktila Station near Mandalay, stressed the importance of air power in the current area of assymetric warfare around the world.

Sukhoi Su-30s ordered by Myanmar

The Sukhoi Su-27/30/35 family continues its export successes in Asia, with Myanmar being the latest to acquire the type. Russian Deputy Defence Minister Lt. Gen. Alexander Fomin

has recently announced that Myanmar will acquire six Su-30s but did not disclose the variant. The Myanmar Air Force has recently acquired 12 Yakovlev Yak-130 advanced jet trainers which now operate alongside a small number of MiG-29s, recently supplemented by a number of JF-17 Thunders (see photograph).

Bulgarian fighter RFI includes JF-17s

The Bulgarian Air Force have issued request for information to companies in the USA, Sweden, Italy, and reportedly Pakistan, for 16 new generation fighters for replacing its current fleet of MiG-21s. According to reports from Bulgaria, Pakistani-built JF-17s will be considered alongside F-16s, Gripens and Typhoons (tranche 1), the Thunders being considered as of 4+ generation but considerably lower in price than the other three types.

RAF receives new Typhoons

New production Typhoon FGR4s have recently been delivered from the factory in Warton, Lancashire to RAF Coningsbay, Lincolnshire. Eight were initially delivered to the Typhoon Maintenance Unit at Coningsby to be prepared for operational service. The RAF has recently confirmed that it will reduce its 16 two-seat Tranche 1 Typhoons "to spares" under a project to generate £50m worth of parts from the airframes. Meanwhile, RAF Typhoons have participated in Exercise *Red Flag 18-1* at Nellis Air Force Base, Nevada in mid-January, supported by a pair of Voyager tankers.

Saudi order for 120 AH-6As

Upto 120 AH-6SA helicopters are being ordered by the US Army on behalf of Saudi Arabia, including those for the National Guard (SANG) as also other allied customers. A final contract would include spares, ground support equipment, training and transportation. Among the weapons noted in the RFI are M260 Hydra 70mm unguided rockets, Advanced Precision Kill Weapons System (APKWS) II guided rockets, AGM-114 Hellfire missiles, GAU-19B 12.7mm Gatling guns and M134D 7.62mm Miniguns. Mission equipment encompasses AN/APR-39 radar warning receivers, AN/AVS-6 night-vision goggles, Goliath internal auxiliary fuel tanks, external plank seating and an electro-optic/infrared (EO/IR) sensor system.

Surplus SuperCobras for export

A notification on the Federal Business Opportunities website reveals that the US government is now offering surplus AH-1W SuperCobras to international customers. The attack helicopters will be provided via either Foreign Military Sales (FMS) or Direct Commercial Sale (DCS) channels as the US Marine Corps progressively retires them in favour of the AH-1Z Viper.

Second E-550A for Italy

A second E-550A (based on the Gulfstream 550) was delivered to the *Aeronautica Militare* (Italian Air Force) on 22 January. The aircraft was modified to Conformal Airborne Early Warning (CAEW) configuration by Israel Aerospace Industries (IAI) and its ELTA Systems subsidiary in co-operation with Leonardo. The pair of E-550As were earlier ordered as part of a military and industrial offset agreement signed between Italy and Israel in 2012 and worth around $1bn. The aircraft will be assigned to the 14° Stormo, 71° Gruppo, based at Pratica di Mare. The E-550A contract had followed Israel's decision to purchase 30 M-346 trainers from Italy.

Peru to order Hercules

Peru is to acquire C-130J Hercules transports for the *Fuerza Aérea del Perú* (FAP, Peruvian Air Force). The FAP has a requirement for six units and is also interested in securing two KC-130J tankers. Currently, the *Escuadrón de Transporte* 842 at Lima-Callao operates three L-100-20 Hercules that entered service in 1972, while four ex-US Air Force C-130As and two C-130Ds received in the mid1980s were withdrawn in 2001.

Upgrade of Oman's F-16s

Omani F-16s are to be modernised with the Operational Flight Profile (OFP) upgrade and Identification Friend or Foe (IFF) Mode 5 equipment. The US State Department had approved a possible Foreign Military Sale (FMS) to Oman of items and services to support an incremental OFP software upgrade as well as IFF secure communications equipment for Mode 5 operations. The package covers modernisation work on 23 Royal Air Force of Oman (RAFO) F-16C/Ds at an estimated cost of $62m.

Saudi orders more Black Hawks

Seventeen UH-60M helicopters are to be delivered to the Saudi Arabian National Guard (SANG) and nine to the Royal Saudi Land Forces Airborne Special Security Forces. The US Department of Defence announced the $193.85m Foreign Military Sales (FMS) contract for Sikorsky on 11 January, work on the aircraft scheduled to be completed by 31 December 2022. In October 2010, the US Defence Security Cooperation Agency (DSCA) had notified US Congress of the possible sale of 72 UH-60Ms to Saudi Arabia as part of a $25.6bn package of helicopters for the SANG.

Qatar orders more Hawks

Qatar is increasing its requirement for Hawk advanced jet trainers to nine aircraft. Plans to acquire an initial six Hawks were announced last year, alongside the deal to potentially supply 24 Typhoon fighters to the Qatar Emiri Air Force. Meanwhile, deliveries of Hawk Mk166s to the Royal Air Force of Oman (RAFO) were completed in early December 2017, the aircraft being part of a $3.28bn order for eight Hawks and 12 Typhoons placed in December 2012.

Jordan receives Mi-26

The Royal Jordanian Air Force (RJAF) has received the first of four Mi-26T2 heavy-lift helicopters ordered from Russian Helicopters (with options for two more) in 2016. The operating unit is No. 8 Squadron at Amman. The Mi-26T2 is an improved civil/military version of the *Halo* with new avionics that permit a reduction in flight crew from four to two. The previous separate flight control and navigation systems are replaced by a new NPK-90-2 flight/nav complex that includes five multifunctional cockpit displays.

Upgraded Su-25s for Kazakhstan

Kazakhstan has received refurbished Su-25 attack aircraft after repair and modernisation at the 558 Aircraft Repair Plant (ARZ) in Baranovichi, Belarus. The aircraft are operated by the 602nd Air Base at Shymkent, where Kazakh Su-25s are based.

Afghanistan orders AC-208 Eliminator

The AC-208 Eliminator has been ordered by the Afghan Air Force making Afghanistan the first confirmed customer for the Cessna C-208B Grand Caravan derivative. The seven AC-208s for the AAF will be completed in an armed intelligence, surveillance and reconnaissance (ISR) configuration. In May 2011, Cessna was awarded an $88.5m contract that included the supply of 26 Cessna 208Bs to Afghanistan. Delivery of the first three aircraft took place in October that year and the final four Grand Caravans from the order were delivered in mid-December 2012.

T-50THs for Thailand

The first two T-50THs for the Royal Thai Air Force have been delivered to Takhli Air Base in January 2018. The two T050THs are part of an initial order for four, for which Thailand signed a $110m contract on September 2015. Another eight examples were ordered in July 2017 in a deal valued at $260m. Once in service, they are expected to replace the L-39ZA Albatros with 401 Squadron.

Sri Lanka Kfir upgrade

The Sri Lanka Air Force (SLAF) will contract with Israel Aerospace Industries for upgradation of its Kfir fleet. The SLAF requires the latest airframe upgrade, the Kfir Block 60, which is a further modernised version of the Kfir C10, with active electronically scanned array (AESA) radar. If finalised, the programme will likely involve the SLAF's surviving three Kfir C2, one C7 and two TC2 versions.

Japan orders Boeing KC-46

Japan Air Self-Defence Force (JASDF) has selected the KC-46 as the winner of its requirement for KC-X aerial refuellers, the first for a non-US customer. The contract also provides for non-recurring

engineering and integrated logistics support; contract completion is expected on 21 February 2021. The KC-46 will add to the JASDF's current fleet of four KC-767J tankers and more KC-46As are likely to be ordered by Japan. First flight of a fully-configured KC-46 tanker took place in September 2015.

Poland's new fighter competition

Poland's Ministry of Defence has received responses from five companies for the supply of new fighters by 2025 under its *Harpia* programme. The Typhoon is being offered by the Eurofighter consortium led by Leonardo, comprising BAE Systems and Airbus. Saab is offering its latest JAS 39E Gripen, already in production for Brazil and Sweden. US types include Boeing, with its F/A-18 Super Hornet and Lockheed Martin, which is expected to offer both the F-35A Lightning II and its upgraded F-16V.

Upgrade of Dutch Chinooks

Boeing is to modernise six Royal Netherlands Air Force (RNLAF) Chinooks to the latest CH-47F standard, the work to provide commonality across the RNLAF's future fleet of 20 F-model Chinooks. The six modernised Chinooks are planned to be re-delivered beginning in 2021. The upgrade will include the Common Avionics Architecture System cockpit with an integrated digital automatic flight control system. The RNLAF currently operates 11 CH-47Ds that it began to receive in 1995 and which are shortly due to be retired.

FAA certification for KC-46 tanker

The US Federal Aviation Administration (FAA) has granted an Amended Type Certificate (ATC) for Boeing's 767-2C aircraft configuration and verifies that the basic design of the KC-46 tanker "is safe and reliable". The ATC is one of two FAA airworthiness certifications required for the KC-46 programme. A combined Boeing/USAF team has also been working on completing Supplemental Type Certificate (STC) work, which encompasses the military systems installed on the 767-2C.

More Su-30SMs for Kazakhstan

The Kazakhstan Air Defence Force will receive an additional 12 Su-30SM fighters from an order announced in September 2017. The former Soviet republic previously took delivery of six Su-30SMs from a batch ordered in 2014.

Ex-IAF Su-30Ks in Angola

The first Su-30K has been delivered to Angola. In February 2014, it was confirmed that 12 former Indian Air Force Su-30Ks had been sold to the *Força Aérea Nacional de Angola* (FANA, national Air Force of Angola) under a contract signed in October the previous year. Taken from storage at the 558 Aircraft Repair Plant (ARZ) at Baranovichi in Belarus, these are being refurbished and upgraded to the Su-30KN standard. Angola is also reported to be looking at purchasing a further six Su-30Ks from the same source.

MD530Gs for Lebanon

The Lebanese Armed Forces (LAF) will receive six MD530G attack helicopters as part of a $120m arms package from the United States, the US also supplying the LAF with six more ScanEagle UAVs together with communications and equipment and computers valued at a total of $11m. According to US sources, "This equipment will help the army build on its capability to conduct border-security and counter-terrorism operations and, importantly to defend the country and the people of Lebanon."

36 Boeing F-15 QAs for Qatar

Boeing has received a major contract to complete 36 F-15QA Advanced Eagles for Qatar, the Foreign Military Sales (FMS) package announced by the US Department of Defence on 22 December. All the aircraft will be delivered to the Qatar Emiri Air Force (QEAF) by 30 December 2022. Along with an associated weapons package and related support, equipment and training, the estimated cost was given as $21.1bn. An agreement was concluded in Washington on 14 June 2017, by US Defence Secretary Jim Mattis and Qatari minister of State for Defence Affairs Khalid au-Attiyah. At the time, the Qatari government put a price of $12bn on the deal, which was to include 36 aircraft.

Indonesian Block 25 F-16s

"Regeneration work" for the last six Block 25 F-16C Fighting Falcons for Indonesia has been completed, the jets now delivered as part of the aircraft acquisition and refurbishment agreement approved by the US government. In total, 24 Block 25 F-16Cs and F-16Ds have been handed over to the *Tentara Nasional Indonesia – Angkatan Udara* (TNI-AU, Indonesian Air Force). The aircraft, formerly operated by US Air Force and Air National Guard units, had been in storage at the Ogden ALC's 309th Aerospace Maintenance and Regeneration Group (AMARG) located at Davis-Monthan AFB in Tucson, Arizona.

Additional F-35s for Korea

The Republic of Korea Air Force (ROKAF) plans to acquire 20 additional F-35As. Citing "multiple government sources", a report has stated that the Defence Acquisition Programme Administration (DAPA) has begun a preliminary study for the subsequent phase of the ROKAF's next-generation fighter programme. South Korea has ordered 40 F-35As for $6.7b under the previous part of the programme, F-X Phase III. Deliveries are scheduled to begin later this year. South Korea originally planned to introduce 60 advanced fighters by 2021. Although various options will be assessed for the follow-on phase, the Lightning II is said to be the only aircraft that meets "the DAPA's requirements for stealth capability, enabling attacks on critical North Korean facilities." The ROKAF plans to induct the new fighters from 2023.

More M-346s for Italian Air Force

Delivery of the Italian Air Force's eighteenth M-346 took place at Leonardo's Aircraft Division site located at Venegono Superiore (Varese), joining the Galatina's 61st Air Wing (Lecce) where Italian fighter pilots are trained together with personnel from other countries including the United States, Spain, France, Austria, The Netherlands, Poland, Singapore, Argentina, Greece and Kuwait. The operational training, mostly carried out on the T-346A, is preparatory for the aero-tactical line, prior to flying fighters such as the Eurofighter or F-35. The Italian Air Force base also utilises LVC (Live, Virtual and Constructive Simulation) technology. Owing to LVC it is possible to link simulators to live sorties, allowing a pilot flying a full-motion training device on the ground to act as the wingman or as a target for an aircraft already in the air. The M-346 ordered by the Italian Air Force, Republic of Singapore Air Force, Israeli Air Force and Polish Air Force is the basis of the T-100 Integrated Training System, the solution offered by Leonardo DRS in the T-X competition for the US Air Force's integrated training system programme.

First Il-78M-90A tanker

Aviastar-SP has completed the first Il-78-M-90A tanker aircraft for the VKS, the aircraft rolled out at Aviastar's Ulyanovsk production facility in November 2017. The Il-70M-90A is a modernised version of the Il-78, with four PS-90A-76 turbofans replacing the original D-30KP-2s and also features modern avionics, including flight, navigation, radio communications, lighting and other equipment. The wing has been modified, a strengthened bulkhead installed in the rear fuselage and two additional 50-metric-ton fuel tanks incorporated in to the cargo compartment to increase fuel capacity. The additional fuel tanks and refueling equipment are removable for deployment as a standard cargo transport.

Turkish TFX specifications

Turkish Aerospace Industries (TAI) has now officially released specifications of its TFX, *Mili Muharebe Uçağı* (National Combat Aircraft). The twin-engine, all-weather, fifth-generation air-superiority fighter is designed to complement the *Turk Hava Kuvvetleri's* (Turkish Air Force's) future fleet of F-35 Lightning IIs and replace its F-16s. Production is expected to run until 2070. First flight of the largely indigenously built aircraft is scheduled for 2023. BAE Systems was awarded a contract worth over £100 million in January 2017 to help design the TFX. Under the four-year contract, BAE systems is to provide 400 man hours of engineering consulting and technical support to TAI. Upon its completion, BAE Systems is expected to receive another contract to support

the development of the TFX in Turkey. Rolls-Royce was for a long time considered sharing the larger part of the engine design effort through co-operation with Kale Group. The two companies share 49% and 51% respectively of TAEC *Uçak Motor Sanyasi* AS, which was formed in May 2017 to provide turbofan engines for the TFX. However perhaps, in the light of Lockheed Martin's experience with the F-35, the Turks have decided to keep their options open on engines and other systems.

New engine flown on Su-57

A prototype of the Su-57 fighter made its first flight powered by the new NPO Saturn Izdeliye 30 (product 30 engine) on 3 December 2017. The 'second-stage' powerplant, flown on the portside of prototype Su-57 '052' (T-50-2), will be used on a series production aircraft from 2020. The 17-minute maiden flight with the new engine was conducted at the Gromov Flight Research Institute at Zhukovsky, with test pilot Sergei Bogdan at the controls. Sukhoi has so far completed and flown nine flight-test prototypes of the Su-57 powered by NPO Saturn Izdeliye 117 engines, derived from the AL-41F-1S which powers the Su-35. It was previously announced that the Izdeliye 30 would first be tested on an Il-76LL test bed.

Tu-160M2 in maiden flight

Maiden flight of the prototype upgraded Tu-160M2 strategic bomber was on 25 January. The first Tu-160M2 was earlier rolled out at the Kazan Aviation Factory's SP Gorbunov assembly facility in Kazan, in southwest Russia on 16 November 2017, the aircraft to be delivered to the Russian Air and Space Force by the end of 2018. The Tu-160M2 incorporates the same basic airframe as the existing Tu-160, but will integrate all-new avionics, electronics, cockpit, communications and control systems, as well as new weapons. New NK-32 series 02 engines of increased thrust are also to be installed. The Russian defence ministry have announced an order for ten Tu-160M2s, estimated to be worth some $2.7bn and that series production of the improved Tu-160M2 will begin in 2019 followed by deliveries of new aircraft in 2023.

Bangladesh releases RFP for UAVs

The *Biman Bahani* (Bangladesh Air Force) has released a request for proposal for a fixed-wing unmanned aerial system for intelligence, surveillance and reconnaissance (ISR) and air-to-ground attack operations. According to the RFP, "BAF has identified the need for UAVs for ISR to meet future challenges and also to fulfill the requirement of the *Force Goal 2030*. A suitable UAV has been an outstanding requirement since the advancement of defence technology and its future implication in the BAF." *Force Goal 2030* is an ongoing programme to substantially modernise Bangladeshi armed forces. The required system is described as comprising a "medium-altitude long-endurance UAV, ground control station (GCS), sensor subsystems and air-to-surface munitions."

Maiden flight of Bell V-280 Valor

First flight of Bell's V-280 Valor next-generation tiltrotor aircraft took place in Amarillo Texas on 18 December. The V-280 programme is part of the US Army's Joint Multi-Role Technology Demonstrator (JMR-TD) initiative, which serves as a science and technology precursor to the US department of Defence's Future Vertical Lift programme. The JMR-TD will include a series of flight trials continuing until 2019.

20th Anniversary of Global Hawk

Northrop Grumman Corporation marked 20th anniversary of the first flight of its autonomous Global Hawk high altitude long endurance aircraft, which remains operational around the world and is one of the premier providers of persistent intelligence, surveillance and reconnaissance information "supporting the United States and its allies." In active operation with the US Air Force since 2001, Global Hawk has amassed more than 250,000 flight hours with missions flown in support of military and humanitarian operations. Able to fly at high altitudes for greater than 30 hours, Global Hawk is designed to gather near-real-time, high-resolution imagery of large areas of land in all types of weather, by day or night.

Russian Helicopters tests Mi-171E2

Russian Helicopters (part of Rostec State Corporation) has successfully completed flight tests of Mi-171E2, this new multipurpose helicopter with a new power unit and rotor system,

developed by the Mil Moscow Helicopter Plant and to be produced at the Ulan-Ude Aviation Plant (UUAP). The Mi-171E2 designed for air transportation by international agencies is a new step in the creation of a new generation of Mi-17/171 helicopters. Key feature of the Mi-171E2 is its new power unit and rotor system, with "high-altitude" VK-2500PS-03 engines and the FADEC digital control system. Mi-171E2 will be exported under the designation Mi-171E.

Russian Helicopters to export 7 Ka-32A11BCs

Russian Helicopters (part of State Corporation Rostec) will deliver 7 multirole Ka-32A11BC helicopters to 'foreign customers' in 2018, the machines being built at the Kumertau Aviation Production Enterprise (KumAPP). By December 2017 Russian Helicopters had delivered two Ka-32A11BC helicopters to Fire Department of the Department of Public Safety in Qingdao, China, and two more machines will be handed over to United Helicopters, China in 2018. The first Ka-32A11BC is being prepared for delivery to Kaan Air, Turkey; the second and third machines will be handed over to the operator this year.

Leonardo helicopters for Bangladesh

The AW109 Trekker

Leonardo is delivering five helicopters to Bashundhara Airways of Bangladesh, comprising three AW109 Trekkers and two AW119Kx, to be used for EMS, utility, law-enforcement, surveillance, VIP, corporate and passenger transport applications and are all scheduled to be delivered before the end of 2018. Bashundhara Airways has also been appointed exclusive distributor of Leonardo civil helicopters in Bangladesh and will establish a Service Centre for the country.

HMS *Queen Elizabeth* on sea trials

The Royal Navy's new aircraft carrier sailed from Portsmouth for the first rotary-wing at-sea trials on 2 February, with a Royal Navy Merlin HM2 helicopter from 820 Naval Air Squadron embarked. This had earlier been employed at Royal Naval Air Station Culdrose, Cormwall and has been training with HMS *Queen Elizabeth* in Portsmouth Naval Base as part of the carrier's rotary-wing trials. The Merlin was used to put flight deck crews through a series of aviation drills and procedures as part of the trials.

First F-35B for Italian Navy

The first F-35B short take-off and vertical landing (STOVL) jet was delivered to the *Marina Militare* (Italian Navy) during a ceremony at the Cameri production facility on 25 January, the first Italian-built F-35B variant having been rolled out at the factory

on 5 May 2017. To date, nine F-35As and one F-35B have been delivered by the FACO at Cameri. Four of these are currently at Luke Air Force Base in Arizona, assigned to the international pilot training programme and five are stationed at Amendola air base in southern Italy. Thirty F-35Bs are planned for the *Marina Militare* and the *Aeronautica Militare*.

JMSDF US-1A replaced by ShinMaywa US-2 amphibians

Japan's Maritime Self-Defense Force (JMSDF) retired its last operational US-1A amphibious search and rescue aircraft on 13 December 2017. The search and rescue mission will now be conducted by the US-2-equipped Hokutai 71 (Air Rescue Squadron 71) based at Atsugi Air Base. Since the US-1A entered service with the JMSDF in 1976, the type has rescued 827 people. Manufactured for the JMSDF by Japanese aircraft manufacturer ShinMaywa, the PS-1 and US-1A are designed for anti-submarine warfare and air-sea search and rescue missions.

BAE Mk4 Naval Guns for Finland

BAE Systems will produce and deliver Bofors 40 Mk4 Naval Guns for the Finnish Navy and its *Hamina*-Class Squadron 2000 fast attack craft, under a contract with Patria, the prime contractor for the vessel's mid-life upgrade and overhaul programme. With this contract, Finland adds the 40 Mk4 to its installed base of BAE Systems naval guns, including both previous versions of 40mm L/70 systems and 57mm Mk3 systems. The compact and low weight Bofors 40 Mk4 Naval Gun is a flexible, multi-purpose system offering a high rate of fire with the ability to switch between optimised ammunition types, including the programmable 40 mm 3P all-target ammunition.

Safran's systems for Dutch submarines

Following an international bidding process, Safran's integrated inertial navigation system (including Sigma 40 inertial navigation units and the associated computers) was chosen to modernise the Royal Netherlands Navy's *Walrus*-class submarines. Inertial systems from Safran Electronics & Defense are deployed by more than 40 navies worldwide, having provided inertial navigation systems for both surface ships and submarines for more than 70 years. Combining outstanding reliability and performance, these systems are now used on more than 600 ships in service or on order around the world.

Thales next-generation sonar system for French Navy

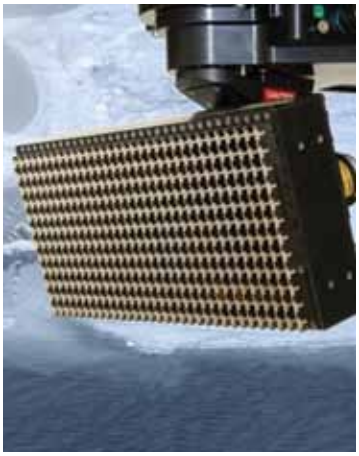
The French defence procurement agency (DGA) has awarded Thales a 42-month contract to conduct a set of studies and technological developments for a sonar system to be equipped on France's future third-generation nuclear-powered ballistic missile submarine (SNLE 3G). These developments take into account the current and future threat environment and support Thales's efforts to complete design and qualification of a large antenna system and related processing capabilities "made possible by advances in algorithms and the digital revolution."

Safran's role in OCEAN2020 project

Safran is one of the main participants in the OCEAN2020 consortium, which won a major contract as part of the European Commission's 2017 Preparatory Action on Defence Research (PADR) initiative. This European Commission's OCEAN2020 project, with 35 million euros in funding, aims to develop a technology demonstrator that will validate the concept of deploying a complete array of drone systems (air, surface and submarine) for surveillance in a maritime environment. The Leonardo-led OCEAN2020 consortium "won this contract by uniting companies

of all sizes, along with academic institutions and government representatives from 15 European Union countries." The winning team will conduct two demonstrations involving the operation of new surveillance systems and integrated information processing systems, deployed in several European naval exercises, first in the Mediterranean during 2019, then in the Baltic Sea in 2020. During these naval operations, Safran will deploy a maritime surveillance version of its *Patroller* drone, the only fixed-wing, long-endurance drone taking part in these demonstrations.

Bangladesh Navy Do-228s with Leonardo's AESA radars



Leonardo will provide the Bangladesh Navy with its Seaspray 5000E Active Electronically Scanned Array (AESA) radars for the two new production model Dornier 228 MPAs on order. Seaspray, which can detect small targets in rough seas, will be used by the Bangladesh Navy to conduct anti-smuggling and anti-pollution missions and for the prevention of illegal fishing and migration.

A321neo orders surge

The Airbus 321neo's market dominance of the single-aisle airliner market has been further boosted with the recent order for more than 300 new aircraft. The Delta Air Lines order for 100 A321neos was followed by Indigo Partners firming a commitment for 156 examples, Qatar Airways signing for 50, then VietJet ordering 42 and the Turkish low-cost carrier Pegasus Airlines purchasing 25. The orders have taken Airbus's total backlog for the A321neo to

more than 1900 aircraft. Delta will use its A321neos, which will be powered by Pratt & Whitney PW1133G-JM geared turbofan engines to replace its McDonnell Douglas MD-90s and MD-95s on its domestic network, with deliveries to start in 2020. Most of the airline's A321neos will be assembled at the Airbus US manufacturing facility in Mobile, Alabama, from where Delta's 50th A321ceo was delivered in December 2017. The A321neos ordered by Indigo Partners are part of a deal for 430 aircraft, the largest single aircraft order ever placed, which will be split between the company's low-cost carriers Frontier in the US, JetSMART in Chile, Volaris in Mexico and Wizz Air in Europe. Aircraft will be delivered to Indigo from 2019. Qatar Airways' A321 neo commitment replaces a previous order placed in 2011 for 50 of the smaller A320neos.

Bombardier CS 300s for Korea

The Bombardier C Series has entered service with Korean Air Lines, the carrier's first example arriving at Seoul Incheon on Christmas Day 2017 with the two airliners scheduled to start flying domestic services from Seoul in mid-January. Korean expects to receive the other eight CS300s from its ten-aircraft order by the end of 2018. Korean's CS300s are configured with 127 seats, with 102 in economy and 25 in a premium economy layout offering an 18.5-19-inch (470-480mm) seat width depending on seat location.

ATR–600s for Silver Airways and NAC

Twenty ATR–600 aircraft have been ordered by Silver Airways, of which 16 will be ATR 42-600s and four will be ATR 72-600s. This follows a deal between ATR and Nordic Aviation Capital (NAC) for the purchase of 15 ATR -600s, of which 12 will be ATR 42-600s and three will be ATR 72-600s.

Boeing 737 MAX 7 debuts

Boeing marked a development milestone with debut of the first 737 MAX 7 at the company's Renton, Washington factory. The MAX 7 is the third and newest member of Boeing's 737 MAX family, designed for up to 172 passengers and a maximum range of 3,850 nautical miles, which is the longest range of the MAX airplane family. Technology improvements allow the MAX 7 to fly 1,000 nautical miles farther and carry more passengers than its predecessor, the 737-700, while having 18 percent lower fuel costs per seat.

Dash 8 firefighters for France

France will procure six Dash 8 Q400 Multirole aircraft from Conair, to replace Turbo Firecats currently used for firefighting by the Ministry of Interior's *Sécurité Civile* (SC). The SC already operates two Dash 8s that can deliver 22,046lb (10,000kg) of water or retardant, but will also be able to carry 64 passengers or a mix of passengers and freight. Additionally, they will have a medical evacuation capacity, transporting upto 10 casualties on litters, plus another 15 seated patients. The SC firefighting fleet consist of 12 CL-415s, nine Turbo Firecats and two Dash 8s.

Elbit to supply EW Systems

Elbit Systems has been awarded a contract from a 'European country' to supply a range of advanced ground-based Electronic Warfare (EW) and Signal Intelligence (SIGINT) systems, the contract to be performed over a four-year period. Edgar Maimon, General Manager of Elbit Systems EW and SIGINT - Elisra stated, "We are proud of this contract award that attests to the Company's technological and operational advantage and to the maturity of our solutions. We are encouraged by the growing demand from European customers and believe that our portfolio positions us well to serve their needs".

Support contract for Eurosam

The OCCAR (Organisation for Joint Armament Co-operation) has notified a New In Service Support (N-ISS) contract with the Franco-Italian consortium Eurosam, which is co-owned by MBDA and Thales. This replaces the first ISS contract that has

been in place since July 2012 and has been a premiere in a major multinational armament programme. OCCAR and Eurosam have collaborated to create a support community that is operationally compliant with the requirements of the three nations and five end users (armies, navies, air force). The N-ISS contract, which runs for five years from 2 January 2018 will include in-service support for French and Italian land and naval systems (SAAM-Fr, SAAM-It, PAAMS and SAMP/T) as well as all ASTER missiles (ASTER 15, ASTER 30 and ASTER 30 Block 1) from France, Italy and the United Kingdom.

Elbit Battle Management Systems for Australia

Elbit Systems of Australia was awarded a $150 million contract by the Australian Department of Defence's Capability Acquisition and Sustainment Group to provide Through Life Support (TLS) services to the Australian Defence Force (ADF) for its Battle Management System Command and Control (BMS C2). The contract is for a five-year base period and optional extensions of up to seven years may be exercised in the future.

BAE IFV CV90 MkiV

BAE Systems has presented the next phase of development for the CV90 Infantry Fighting Vehicle (IFV) with the launch of its fifth generation CV90 MkIV. The new MkIV offers substantial capability upgrades, including increased drive train capabilities and active damping technology to improve battlefield speeds and handling, and also features the latest NATO-standard Electronic Architecture to meet demands for sensor integration and the implementation of autonomous systems. BAE Systems intends to offer the CV90 MkIV to the Czech Republic in the ongoing armoured vehicle competition to replace the Czech Army´s legacy fleet of BMP-II IFVs.

Nammo takes ownership position in MAC LLC

Nammo has taken an ownership position in MAC LLC, being a leader in the development and production of lightweight polymer cartridge cases for small and medium calibre ammunition. "Managing the weight of weapons and ammunition continues to be a major challenge for today's armed forces, causing fatigue for individual soldiers, while reducing range and endurance for vehicles and aircraft." Responding to this challenge, MAC LLC has spent several years developing and commercialising lightweight, polymer-based solutions for military and aerospace markets, significantly reducing the weight of military ammunition products. "Nammo, as one of the leading providers of specialty ammunition for military and commercial customers in the western world, believes that this technology will strengthen its ability to provide a reliable advantage to its customers." As Morten Brandtzæg, President and CEO of the Nammo Group stated, "Our ownership position in MAC LLC is perfect for Nammo. Their technology and products are complementary to our product portfolio and we see a strong future for lightweight solutions. MAC LLC will strengthen our group's strategic position in the US and international ammunition markets."

Reijo Bragberg, Executive Vice President of Nammo Small and Medium Calibre Ammuniton stated: "This is a very exciting opportunity for Nammo. We are now joining with a company that is the frontrunner in development of lightweight technologies, which are of great importance for our defense customers".

Safran's land robot demonstrators for French armed forces

Safran Electronics & Defense has won the contract for the *Furious*, which is a major project of the French defence procurement agency DGA (*Direction Générale de l'Armement*) Science & Technology project. Covering a period of five years, this project is designed to lay the groundwork for the integration of land robots in French armed forces, as part of the Scorpion modernisation programme. Safran Electronics & Defense are leveraging the connect between robotics and drone technologies to meet the requirements of this preliminary design project. The company's core areas of expertise–navigation, electro-optical systems (optronics) and safety-critical onboard electronics–are the basic building blocks in both robotics and drone systems.

The DGA's *Furious* project involves the development of three robot demonstrators, of different sizes and with different mission profiles for a variety of environments (for example, exploring buildings, carrying loads for infantry soldiers, etc.).

Thales Australia's new Bushmaster MR6

Thales has launched its new protected vehicle, the Bushmaster Multi Role 6 (MR6), this new platform building upon the proven pedigree and Bushmaster's success with even greater levels of survivability "to protect soldiers' lives". Designed and manufactured by Thales Australia, the new Bushmaster MR6 builds on Bushmaster's battle-proven capability and continues its record of safety and reliability. Bushmaster's true 'deep V-Hull' deflects blast energy away from the crew providing tremendous protection against land mines and IEDs. This protection has proven itself in numerous operations such as in Iraq, Afghanistan or Mali. Now in service in 8 countries, the Bushmaster is used in more than a dozen variant configurations for multiple roles.

PAC-3 Missiles to be upgraded

The United States and allied military forces will upgrade their missile defence capabilities under a $524 million contract for production and delivery of Lockheed Martin Patriot Advanced Capability-3 (PAC-3) and PAC-3 Missile Segment Enhancement (PAC-3 MSE) interceptors. The contract modifications include PAC-3 and PAC-3 MSE missile deliveries, launcher modification kits, associated equipment and spares. PAC-3 currently provides missile defense capabilities for 11 nations, including the US, Germany, Kuwait, Japan, Qatar, the Republic of Korea, Kingdom of Saudi Arabia, Taiwan, the Netherlands, United Arab Emirates and Romania.

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Rafael Spike misiles for Latvia

The Latvian MOD has signed a contract with EuroSpike GmbH, for production and delivery of a variety of Spike Family Missiles comprising 4th and 5th generation electro-optical missile systems, providing high precision and high lethality against various targets, including advanced MBTs. The Spike system was developed by Israeli company Rafael Advanced Defense Systems Ltd., which

is also involved in the deal as a subcontractor through EuroSpike with Diehl Defense GmbH & Co. KG and Rheinmetall Defence Electronics GmbH. Spike is in operational use in over 29 countries, including many NATO countries, with over 29,000 missiles supplied. Approximately 5,000 Spike missiles have been fired in combat and in training. Spike has been integrated on more than 40 platforms, aerial, vehicular and naval, including from modern remote-controlled weapon stations.

SIGNALIS integrated with Airbus

SIGNALIS, a subsidiary of Airbus since its creation in 2011, has been fully integrated into the Airbus CIS (Communications, Intelligence and Security) business becoming the *Maritime Surveillance Centre of Competences* within Airbus Defence and Space from 3 January 2018. The move is Airbus Defence and Space's response to its growing interest in serving the maritime surveillance market comprehensively. Airbus has decided to integrate the subsidiary in line with its 'one brand' strategy to ensure customer satisfaction and to secure the future of the business. Digitisation and digital services are key and strategic components for Airbus Defence and Space. "The company is bringing its various maritime players together and linking its services to create a new digital offering that will provide a powerful competitive differentiator."

Navantia Concept Design for USN's FFG(X) programme

A contract has been awarded to United States shipyard General Dynamics Bath Iron Works (GDBIW), in association with the Spanish ship designer and shipyard Navantia, for a conceptual design for the FFG(X) programme, involving acquisition of 20 frigates with construction in the United States. The GDBIW and Navantia will use as reference to design the Australian variant of the F-100 frigate and adapt it to the requirements of the US Navy. There are currently 11 F-100 *Alvaro de Bazán*-class frigates serving in different navies including its variants, the Australian AWD *Hobart*-class and the Norwegian F310 *Fridtjof Nansen*-class.

NGC-built G/ATOR approved for early deployment

The Northrop Grumman Corporation AN/TPS-80 Ground/Air Task-Oriented Radar (G/ATOR) has been approved for early fielding by the United States Marine Corps. This milestone follows delivery of the final Lot 1 and Lot 2 Low Rate Initial Production (LRIP) G/ATOR system to the Marines. The USMC will field their first two systems by delivering them to Marine Air Control Squadrons 1 and 2 for operational use. Northrop Grumman has delivered six G/ATOR systems with Gallium Arsenide technology to the Marine Corps in Lots 1 and 2. Beginning with Lot 3 deliveries and including all Full Rate Production systems, G/ATOR will incorporate high power, high efficiency Gallium Nitride (GaN) antenna technology "that can further enhance operational capabilities."

Strategic Partnership Policy

A Defining Initiative

The *Strategic Partnership Policy* (SPP) approved in May 2017, is a milestone that unequivocally displays the resolve of the Government to give the desired push to 'Make in India' drive in the Defence Sector. In fact, the Defence Minister, Nirmala Sitharaman has herself proclaimed that 'Make in India in the Defence Sector' is one of her top priorities.

The stated aim of the SPP is "To progressively build indigenous capabilities in the Private Sector to design, develop and manufacture complex weapon systems for the future needs of the Armed Forces". Many domestic as well as foreign companies are reportedly keen to invest in Defence manufacturing and have welcomed the approval of SPP by the Government. However, the industry still has certain apprehensions on a few unresolved issues viz. the Foreign Direct Investment (FDI) Limit and the resultant Ownership Issue, joint responsibility for the Quality of Product, Transfer of Technology (ToT), Funds for the Project/ Research & Development (R&D), Future Orders, Assurance of Transparency and a Level Playing Field amongst others. In order to ensure successful implementation of the policy, these concerns expressed by the Industry in media and various other forums need to be addressed on priority.

The issues, assessed implications and recommendations are discussed in subsequent paragraphs.

FDI Limit and Ownership

Issue: The current policy implies that the maximum permitted FDI shall be forty nine percent (49%). No pyramiding of FDI in Indian holding companies or in Indian entities subscribing to shares or securities of the Applicant Company or the Strategic Partner (SP) shall be permitted. Indirect foreign investment shall be accounted for, in counting the forty-nine percent (49%) FDI.

Implication: This restriction, by design, ensures that the ownership remains firmly with Resident Indians. Most foreign companies have not taken this restriction favourably and are reluctant to enter into partnership with potential SPs.

Recommendation: It is strongly recommended to retain the restriction on the FDI at forty-nine percent (49%) in the best interest of the Nation, the Armed Forces as well as the domestic private industry. However, the limit may be relaxed in exceptional circumstances, on case to case basis, in consultation with the Armed Forces/ respective Service HQs.

Transfer of Technology (ToT)

Issue: ToT by the foreign OEMs to the potential SP for development of complex and highly sophisticated weapon systems to meet the future requirements of the Armed Forces, is a pre-requisite for the success of the Policy. The Industry seeks clarification about the methodology, if any, likely to be adopted for costing of technology and quantum of ToT.

Implication: The OEM(s) expect appropriate incentive(s) for offering a higher percentage of ToT. Costing of technology is another area which requires detailed analysis and bench marking.

Recommendation: Higher quantum of ToT, if offered by OEM(s), may be accorded appropriate weightage. The incentives should be clearly stated to send positive signals to the environment. Methodology for costing of technology and quantum of ToT is required to be worked out unambiguously, without leaving things to speculation/ manipulation.

Future Orders

Issue: Strategic Partnerships would require large investments and patience till the production begins. Though limited security in terms of initial orders does exist, however, there is no assurance whether the SP would be able to receive future orders, in a particular segment.

Implication: Visible reluctance on part of the Private Industry, due to requirement of huge initial investments and a real possibility of drying up of future revenue stream, as the future order(s)/ quantities are not assured.

Recommendation: Consolidated requirement of particular weapon system(s) in a particular segment for the next 10 years, can be assessed in advance by the Perspective Planning Directorate of the Army in conjunction with other stakeholders and by similar organisation(s) in the Navy and Air Force. Phased procurement contract, to meet requirements for up to ten years, may be worked out with clearly defined goals for product up-gradation and establishment of maintenance/ repair facilities. The segment could be thrown open for other competitors, post delivery of ordered quantities over an initial period of ten years of the Strategic Partnership.

Funds for Projects

Issue: The potential SPs are expected to raise funds for projects all by themselves. Whether the Government would be willing to financially support the project and subsequent R&D, is a question that needs to be clarified to reassure the potential SPs.

Implication: As the investments for manufacture of complex weapon systems by the Strategic Partners are likely to remain 'Non-Performing' assets till production starts, the risks that the potential SPs face are intimidating. Further, the R&D for

up-gradation/ product improvement also requires substantial amount of funds.

Recommendation: The Government may consider partial funding of projects for supporting the SPs in initial phases. The funds could be made available in the form of advance and adjusted against orders in a phased manner. A separate corpus may be created by the Government for funding of R&D by the Private Industry and Educational Institutions/ Universities to stimulate research in selected segments.

The potential SPs may also explore various innovative ways to generate sufficient funds for projects. Some of the suggested ways include: Issue of bonds in consultation with the Government; bank credit; debt financing; public offers etc.

Eco-System of Domestic Manufacturers

Issue: The SP is expected to submit a plan for developing tiered industries in each segment by developing partnerships or entering into teaming agreements with Micro, Small & Medium Enterprises (MSMEs), Defence Public Sector Undertakings (PSUs), Ordnance Factory Board (OF Board), Defence Research & Development Organisation (DRDO), other PSUs and foreign companies for development of an Eco-System of domestic manufacturers and repair/ maintenance facilities. However, the implementation will be monitored by the Ministry of Defence (MoD).

Implication: The potential SPs have apprehension about the degree of freedom that is likely to be available for carrying out vendor development in accordance with the approved action plan and level of deviation that may be permitted in case MSME or any other team partner fails to perform to the desired level. Whether the relationship between an SP and local vendors would be fixed or open, needs clarification. Monitoring by the Government/ MoD, is an area of concern.

Recommendation: All relevant aspects about development of Eco-System need to be clarified by the Government. Limited monitoring by the Government with a view to ensure adherence to the approved plan for developing tiered industries is an inescapable requirement. However, the relationship between a SP and MSME(s)/ local vendors should generally be 'open' to allow sufficient flexibility to the SP.

Joint Responsibility for Quality

Issue: The OEMs have in various forums expressed reservations about joint responsibility for the quality of product in view of foreign stake being limited to 49%.

Implication: Quality of product has been accorded the highest priority by the Armed Forces in all procurements. Lack of joint responsibility could eventually jeopardise the entire effort.

Recommendation: Joint responsibility is vital to ensure that the final product and subsequent upgrades are of the desired quality. Any let up on this issue would virtually permit the OEM to abdicate all responsibility for the quality of product, which may not be acceptable. Clarification may be issued on the subject by the MoD.

Level Playing Field

Issue: The Private Industry (both Domestic and Foreign) is apprehensive of the Government's contention in keeping open the option to consider the role of Defence PSUs/ OF Board/ DRDO in conjunction with SP or separately, for development of the weapon system(s).

Implication: The Private Industry seeks assurance that overly protectionist policies with respect to 'Government Controlled Enterprises' will not be arbitrarily adopted, which could jeopardise the efforts and investments of the SP and OEM.

Recommendation: The Government has already taken a slew of measures to provide a 'Level Playing Field' for the Private Industry. Imposition of taxes on products of Defence PSUs and OF Board is an example of the sincerity displayed by the Government on this issue. It is recommended that specific conditions in which the DRDO, Defence PSUs/ OF Board may be involved in production of the weapon system(s) subsequently, are required to be clearly stated ab-initio. This would put to rest the apprehensions of potential SPs with respect to intent of the Government. Overly protectionist policies of the Government with respect to Defence PSUs, OF Board and DRDO are required to be avoided to exhibit the Government's resolve to provide 'Level Playing Field' to the Private Industry.

Transparency

Issue: The Private Industry has been requesting higher degree of transparency.

Implication: Enhanced transparency will undoubtedly contribute towards building up the required degree of confidence in the Industry about sincerity of the Government with respect to successful implementation of the SPP and 'Make in India' initiative.

Recommendation: It is widely acknowledged that analyses, deliberations and recommendations by Collegiate(s) are invariably more productive and reliable, than appreciation/ opinion(s) of individual officers in the decision making chain. Hence, for issues specific to Costing of Technology, Quantification of ToT, Road Map for Indigenisation, Defence Exports and other relevant aspects that may crop up prior to or during the implementation of the SPP, a 'Committee of Experts' (CoE) should be appointed. A suggested composition of the CoE is as under:

Chairman – Defence Secretary

Members – Vice Chiefs of Army, Navy and Air Force, Secretary Defence Production, Master General of Ordnance (and equivalent officers from Indian Navy/ Air Force for segments pertaining to them), Director General Weapons & Equipment (and equivalent officer from Indian Navy/ Air Force for segments pertaining to them), Director General Acquisition, Financial Advisor Defence Services, representatives of DRDO, OFB, Defence PSUs (as applicable), representatives of potential strategic partners, any other member(s) as deemed necessary by the Chairman

Member Secretary – Acquisition Manager in MoD The formulation of segment-wise CoEs would send positive signals to the environment on the seriousness of the Government about enforcing transparency. The Raksha Mantri would inevitably have the final word on all issues while according due consideration to the recommendations of the CoE.

A Defining Initiative

The SPP is indeed a defining initiative of the Government, aimed to give a fillip to defence manufacturing and building indigenous capabilities in the Private Sector to meet future needs of the Armed Forces. Acceptance of the above recommendations is likely to allay the apprehensions of the Private Industry (both Domestic and Foreign Industry) and create conducive environment for effective and successful implementation of the Policy.

Sushil Chander, Courtesy: CLAWS

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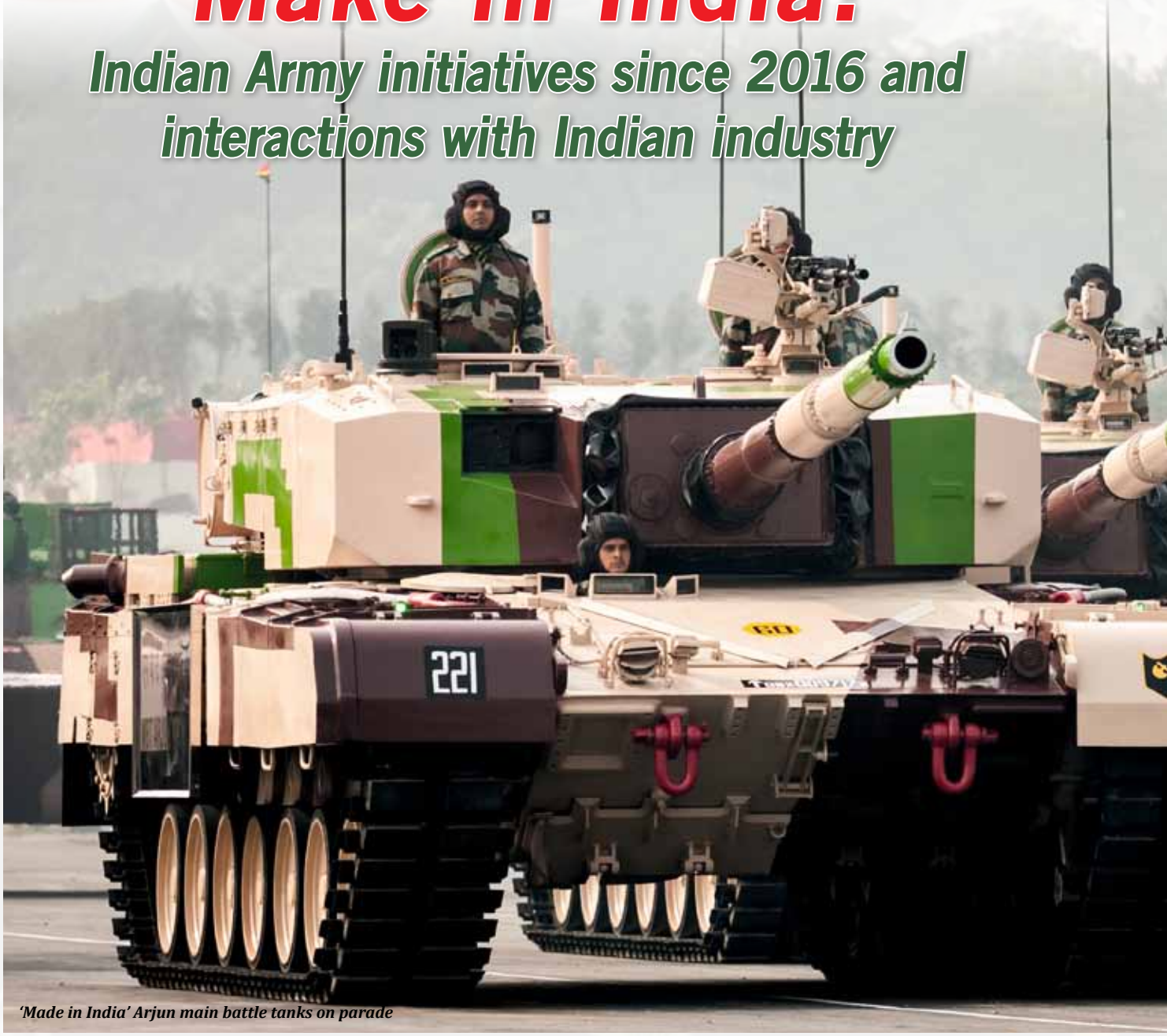
"Make in India!"

Indian Army initiatives since 2016 and interactions with Indian industry



'Made in India' Arjun main battle tanks on parade

Since January 2016, the Indian Army has begun an unusual and extraordinary interaction, generally miles away from the 'Holy Cow' syndrome that the Army is generally accustomed to. Based on the Prime Minister's clarion call for *Make in India*, a term probably now used to its full extent, the Indian Army has been reaching out to private industry which in itself is a welcome change as hitherto, industry giants have been wanting to present their products and waiting in line for a chance to be heard. A decade ago, there used to be a school of thought in the Armed Forces, which said: "my job is to defeat the nation's enemies, and I don't care if I do it with an Indian bullet or an imported one. Just make sure that I have a bullet that works, and that its there when I need it !" Now this may sound incredibly shortsighted, but reflects the soldier's impatience with delays, which have become endemic in our procurement system. Still, over the years, the User has become wiser and learnt through bitter experience, that in the long term, it is only the metaphorical 'Indian bullet' which will actually defeat the enemy and truly "save the nation." The aim of the Army was to actually discover capability of the industry in producing products which were made in India. In other words, it could be termed as an Indian solution to the Indian Army's problems.

How was this conducted?

These interactions commenced with regional interactions with representatives of the industry conducted through the chambers of commerce associations like the CII and

FICCI among others. These interactions were held in various hubs of the industry spread all over India at Chennai, Jammu, Coimbatore, Ahmedabad, Mumbai, Kolkata, Hyderabad, Pune, Bengaluru and Bhubaneshwar. Apart from these, there were many more interactions during the *Defence Expo 2016* at Goa and subject specific seminars in New Delhi directly with the industry especially the MSMEs.

But what was the specific activity conducted in these interactions? These interactions were generally during weekends (Army Headquarters being closed) and apart from talks and presentations, industry was facilitated by organising their visits to workshops in the field. In these interactions, the Indian Army had categorised their requirements into three main classifications, the first being big ticket items, which due to lack of an industrial base are mostly imported. Therefore, an immediate aim was to get the second or the small ticket items and also the third category of equipment required immediately for current and ongoing operations. The purpose of the interaction was precise. The Indian terrain and situations where current operations were on, required typical Indian solutions. This is precisely the category where Indian industry could help with design and development of equipment. The aim was to promote understanding of modernisation requirements of the Indian Army by industry, thus making the latter discover its capability. This of course is a two way process. In the defence sector, the Indian Army provides a chance to the industry to make a wide range of products, huge volumes and a technological spread of items. Future requirements would be R&D intensive and therefore indigenous R&D is also need of the hour. Such interactions actually gave an impetus to the industry by instilling personal rapport and mutual understanding to incubate a relationship between the army and the industry. In this process the Army has even set up an Army Design Bureau, recently inaugurated by the COAS. This institution is expected to be a central repository of technology and requirements, an agency which collates the operational qualitative requirements (QRs), generates long term research needs and identifies projects to be worked upon by the DRDO. It would be facilitating interaction with the Defence PSUs, academia, user, Ordnance Factories and private industries apart from the DRDO.

To borrow a phrase from the address by then Deputy Chief of the Army Staff (Policy and Systems), these were termed as 'Upstream' and 'Downstream'. The 'upstream' was to take the technology required for a system earlier on to cater for the next to next generation equipment for the Indian Army. This also included the participation of intellectuals from the academia wherein visits to IIT Madras and Indian Institute of Science, Bangalore were productive. It also helped in painting the idea in these institutions that the technology developed for civilian uses could also help the Army. The idea was to emphasise the fact that the Indian Army requires huge inventories of varied equipment varying from helmets to helicopters and air defence missiles. Compared to the other two services, the army requirements could be termed as comparatively less capital expensive in most sectors, in the range of less than Rupees 150 crore. Thus, there could be more participation to make these products by private players including MSMEs. Also, technologically such requirements were comparatively easier to achieve.

Launch of a Scorpene-class submarine at Mumbai

Other requirements could be categorised as 'downstream' where the Indian industry would solve the existing problems being faced in existing equipment or solutions for day-to-day problems in varied terrain.

Mutually Beneficial Interactions

In these interactions, various arms of the Indian Army along with their respective tasks would be explained to the industry, followed by projection of the equipment requirements to carry out various functions for mobility, survivability, sustainability, training needs, lethality and logistics. This was indeed of great help since it was realised early on that industry had hardly any idea about the Army's requirements or their functioning. There also were some hilarious situations where the difference between mortar and motor had to be explained ! The Industry was not aware of simple requirements like advanced first aid kits, high calorific rations for the glaciers, ballistic helmets, specifications of bullet proof jackets and support logistics. During these interactions it was realised that there was also need for the industry to physically see the equipment held by the Army. To cater to this need, a new term called as 'Reverse Defence Expo' was coined ! The first of these was held in July 2016 at Ahmednagar in Maharashtra showcasing the equipment held by the Mechanised Forces. The expo was indeed very useful and attended by more than hundred representatives of Indian industry. It actually gave a chance for the designers and engineers to inspect the equipment held by the army and "get a feel." The next in the series was planned and executed at Gopalpur in Odisha showcasing the equipment held by the Army Air Defence. This was followed by visiting the Infantry at Mhow in Madhya Pradesh.

The essential idea through numerous interactions with private industry was to 'open up' the defence sector more so that they germinate ideas which then can bloom. The 'Reverse Defence Expo' has now taken root. It helps in explaining the functionalities of systems and sub systems and existing technologies to young engineers and entrepreneurs of the Industry. As they say, one look is better than ten lectures, with such interactions helping in the long run and contributing towards focused orientation of the industry on equipment. The availability of cutout models, platforms, class room variants help in realising challenges and find a way forward in upgrades. With DPP-2016 as an evolving document which facilitates industry initiatives, it still needs time to address challenges in Indian defence industry. Therefore, such interactions have takeaways like evolving a relationship for permanency and longevity.

We have to look at any new equipment over a life time of 30 years. The concept is to have a complete eco system for each and every major equipment in the form of design, development, manufacture, upgradation and overhaul. As technology changes, the equipment goes through four quarters during its life service. So there is an intervention every 8 to 10 years on the equipment in terms of sub systems and product upgrade, overhauls and full or major system upgrades. So the industry and ancillaries do get an opportunity to continue with business. However, for remaining relevant in business the industry has to keep the concept to product cycle as short as possible in comparison with the technology cycle. Thus upgrades have to be modular, form fit type and a field configurable variant which brings us to the point that sub systems need to fit into the existing system with military grade quality, life time support and sustainability.

So are our defence industry manufacturers in a position to meet the challenge? The expectations from the industry for defence equipment must be realistic as per their capability in terms of technology and timelines, enhanced investment in research and development or tie ups with foreign manufacturers for technology, induction and availability of critical technology in India, lifetime support from foreign vendors including simulators and training facilities, timely support for upgrades and exploiting the present L1, T1 model. Similarly, the defence industry also has some expectations from the armed forces in terms of creating a fair and transparent environment, collaborative and realistic approach in terms of QRs, availability of existing infrastructure and equipment for use by the industry for testing and upgrade development and need for volumes of new schemes over 10 to 15 years in terms of equipment, spares, simulators and other training aids. This necessitates development of Defence Industry Parks for interaction at selected location.

It is felt that such military and industry interactions in todays liberalised FDI policy, highest priority for Buy (IDDM) category in the DPP, private industry being the production agency and simplification in Buy & Make (Indian) categories, would enhance the 'Make in India' objective in the defence industry field. In the future, initiatives such as enabling provisions for single vendor case, sharing of government held IPR with private industry and continuous process of pruning the list for licensing will certainly accelerate this process for getting Indian made defence products.

Brigadier MKK Iyer (retd)
Courtesy: CLAWS

The HAL Dhruv ALH and its armed variant (pictured here) are a 'Make in India' success story

Not made in India

The licence-built Sukhoi Su-30MKI is still reliant on outside support for through-life sustainment

Admiral Arun Prakash writes that "continuing dependence on foreign arms, coupled with a dysfunctional acquisition process, is eroding the combat readiness of India's armed forces"

India's acute dependence on imported arms and ammunition, 60-70 per cent of Russian origin, will constitute a grave handicap and vulnerability in an armed conflict.

The public is often bemused on hearing senior military leaders make gratuitous public pronouncements regarding India's readiness to "fight a two-front war". Bewilderment, however, turns into trepidation on reading media reports that the army is looking for eight lakh rifles, carbines and machine-guns, in the international market, to equip its 13-lakh jawans! Our uninhibited Comptroller and Auditor General (CAG) leaves little to the imagination, as he tables annual reports in Parliament, exposing India's deficiencies in military wherewithal.

Further proof of our "readiness" comes from the previous Raksha Mantri, who revealed to the media that days before the Indian Army's cross-border raids into Pakistan, he had to send officers abroad, "…with authority to carry out on-the-spot purchases." If a relatively minor army operation (hyperbolically described as "surgical strikes"), involving a few dozen soldiers, required urgent "on-the-spot purchases" from abroad, how would India manage to sustain half a million troops deployed in an intense and protracted conflict on two separate fronts? While this conundrum does not seem to trouble our decision-makers, the tax-payer needs to reflect on some facts about our two potential adversaries, China and Pakistan.

Pakistan has the world's seventh largest army, and even though permeated by religious fundamentalism and embroiled in politics, its professional capabilities cannot be ignored. Those who sneer at the Pakistani "deep state" overlook its strategic master-stroke, whereby, as a military-client of "all-weather friend", China, it has ensured steady

arms transfers to all wings of the Pakistani military. Having created a high level of equipment commonality with the People's Liberation Army (PLA), Pakistan can go to war, confident that its attrition losses will be expeditiously replaced from PLA stocks.

By comparison, India's acute dependence on imported arms and ammunition, 60-70 per cent of Russian origin, will constitute a grave handicap and vulnerability in a conflict. Over the years, not only have Indo-Russian relations become purely transactional, but the (post-Soviet) Russian arms industry has been found incapable of providing timely support for its products; a fact repeatedly pointed out in the CAG reports. Other foreign suppliers may prove equally unreliable in wartime.

Coming to India's main adversary, the Chinese PLA constitutes the world's largest military organisation, with formidable capabilities in the conventional, nuclear, cyber, maritime and space domains. Of greater significance is the fact that China is self-sufficient in major weapon systems, and has surpassed Britain, France and Germany as an exporter of arms, 70 per cent of which are supplied to neighbouring Pakistan, Bangladesh and Myanmar. Ironically, in 1949, when the People's Republic of China (PRC) came into being, India was industrially well ahead, because the demands of WW II had led to the establishment of arms, ordnance and aircraft production facilities to support the Allied war effort world-wide.

So, how did China overtake us? In the early 1950s, a fraternal Soviet Union commenced a massive transfer of arms to the PLA, under a Sino-Soviet Treaty of Friendship. However, as ideological fissures emerged and the Soviets threatened to stop aid, the Chinese leadership ordered seizure of hardware as well as drawings and technological data relating to Soviet weapons. Once the split actually occurred, in the mid-1960s, the Chinese leadership took a far-sighted decision to launch a project for attaining self-reliance in arms, through reverse engineering (*guochanhua* in Mandarin), as a national endeavour.

The first phase of *guochanhua* helped China establish, by the mid 1980s, serial production of Soviet-origin tanks, artillery, submarines, jet fighters and bombers, as well as strategic systems like ballistic missiles and nuclear submarines. Manufactured without Soviet licences, many of these products had serious flaws and contained imported Western components. But they were "Made in China" and constituted a "great leap forward" towards self-reliance.

China has, subsequently, launched repeated cycles of *guochanhua*, with the aim of acquiring the latest military and dual-use technologies; legitimately, if possible, but through industrial espionage and violation of intellectual property rights, when required. At the turn of this century, China had reached a level of technological development surpassing Russia's. Today, China has stunned the world by its ingenuity, exemplified by the world's fastest super-computer (the Sunway Taihu-light), J-31 fifth generation stealth-fighter, an electro-magnetic aircraft catapult to equip its new aircraft-carrier and huge strides in robotics, artificial-intelligence and drones.

India, by a quirk of circumstance, has become a military and economic entity with great-power aspirations, before it has become a significant industrial power. Consequently, it is in the anomalous situation of being a nuclear-weapons state with the world's fourth-largest armed forces, but having to support their operational needs through massive arms imports. All this, inspite of a vast military-industrial complex, with a large pool of DRDO scientists and a network of sophisticated laboratories, backed by advanced production facilities of the defence PSUs.

The Bangladesh War was really won only because General Manekshaw sought a grace of nine months to equip his troops. The brief Kargil War required desperate replenishment of ammunition, midway through the operation. India's continuing dependence on foreign arms, coupled with a dysfunctional acquisition process has eroded the combat readiness of our armed forces. Foreign arms purchases, considered a 'golden-goose' for political war-chests, have also engendered a morally-corrosive system of corruption at many levels.

Our myopic failure to learn from experience, and to acknowledge the deleterious impact of this void on India's national security, may cost us dearly vis-a-vis future machinations of the China-Pak axis. It is a pity that not one of our post-independence political leaders showed the foresight to launch a strategic initiative that could make India self-reliant in weapon-systems. Today, we do have the dream of 'Make in India', but it awaits fulfilment by a languid bureaucracy and a complex document, the 'Defence Procurement Procedure', which, after six iterations, has failed to deliver anything substantive to the military.

What we need is a 50-year vision for self-reliance in weaponry and a clear-cut strategy, for its implementation by an empowered 'czar'. To those who ask, "Isn't it too late?" one can only say, "If we never make a start, how will we ever get there?"

The T-90S MBT has been subject of progressively increasing indigenisation

"Nuclear power plant gives the widest range of capabilities"

VAYU Interview with

Igor Vilnit, CEO Rubin Design Bureau

VAYU : It is expected that the RFP for P75(I) will be issued to foreign bidders in the near future. How confident is Rubin?

Igor Vilnit: We gave complete response to all queries of the RFI in due time. Now we are waiting for the RFP to prepare comprehensive answers to all points within the specified time frame as well. Our proposal to the Indian Navy is based on Project *Amur*-1650 and fully meets all customer's requirements. In the process of this work Rubin had discussions with Indian shipyards as well as designers and manufacturers of various equipment.

A long standing cooperation ties Rubin with the Indian Navy: first it was building and delivering batches of submarines,nowadays it is a support to their service life extension. During the ship's refits and modernisation various Indian equipment is installed in them. Owing to these activities we are fully aware of the situation in the fast developing shipbuilding industry in India.

In accordance with the bidding process rules in particular and logic of *Make in India* programme in general, a foreign partner selection is a prerogative of Indian yards. We respect this policy. Nevertheless we have to and we will participate in international tenders announced by the Government of India and offer the customer the most competitive products and the most profitable conditions.

VAYU : Rubin is designer of nuclear and conventional submarines. Have you managed to utilise practices pertaining to nuclear shipbuilding for the benefit of non-nuclear navies and vice versa?

Igor Vilnit: This really gives us big advantage when compared with companies that work in only one of these fields. A

The lead ship of the Lada-class, 'Saint Petersburg', seen underway (photo: Rubin)

submarine is one of the most sophisticated engineering products in the world. Irrespective of the power plant it has, be it a nuclear or non-nuclear one, basic principles of the underwater shipbuilding development remains the same. Working in two directions simultaneously, we are capable of technical solutions being practised both for nuclear and non-nuclear submarines.

As design of nuclear and non-nuclear submarines takes place within the same company, the search for new solutions, both engineering and scientific, never ceases. Our team is stable because of a steady flow of orders, and at the same time we work in constant cooperation with various construction yards and wide range of suppliers. If one link in the chain of suppliers is lost, it will take long time and will be very expensive to recover this, together with a dozen of other inter-linked OEMs. As far as we can judge, India is oriented towards similar engagement of its own industry: designers, so that the search for ideas would not stop; shipyards, so that the qualified personnel would not leave; metallurgy, because the steel used for civil shipbuilding is not suitable for submarines; suppliers of individual systems starting from the most complicated acoustics to simple pressure gauges.

In 2016, it was 50 years since the first Russian nuclear strategic missile submarine cruiser was commissioned by the Russian Navy, and in 2011 it was half a century since the first attack nuclear submarine armed with cruise missiles was inducted. These submarines were designed by Rubin and throughout this period we have been continuing improvements of all systems of submarines of different types.

VAYU : Is it possible to unify nuclear and non-nuclear submarines?

Igor Vilnit: This unification is a continuous process. As nuclear submarines came about later than conventional ones, it is logical that nuclear subs borrowed everything (except the power plant) from diesel-electric submarines. After that, and quite the contrary, nuclear subs became 'pioneers' in new technologies. The fact is that in the very beginning any new system is characterised by big dimensions and weight and it consumes considerable amount of power. For a nuclear submarine it is a lesser problem than for a conventional one with its limited power balance. After that when any equipment undergoes improvements and becomes better and more compact, less power-hungry and requires less maintenance by the personnel, it is transferred to a conventional submarine.

For the operator of non-nuclear submarines it is beneficial: technologies have been already proven and thus the customer knows what he is paying for. Besides, the number of non-nuclear submarines being constructed exceeds the number of constructed nuclear ones, and this provides resources for improving systems; moreover, that competition at the export market literally forces one improve own proposals. Further, these improvements are integrated in nuclear submarines. There are dozens of examples: integrated combat systems, missile firing from torpedo tubes, an echoing coating, towed antennas, optronic masts and other systems right up to air conditioning systems.

Only three countries in the world including Russia, which are constructing diesel-electric submarines, have the industrial experience in creating ships with vertical launchers. It's not a simple

A Rubin-designed Delta IV class ballistic missile submarine (photo: Oleg Kuleshov)

issue, there are numerous aspects. The pressure hull with missile tubes responds to water pressure in different manner, calculation of stresses for such a hull have considerable differences. Missile tube hatches and their drives shall work reliably under largely varying conditions that emerge throughout the service life of the submarine. There is also a system of data inputs to missile, system of missile ejection from a container, system of post-firing stabilisation of the submarine and a great number of other systems in absence of which missile carrying submarines cannot be created. Apart of that, it is required to create infrastructure on the shore to provide storage, tests, loading and unloading of missiles. Rubin with its regular construction of nuclear submarines, possesses and retains all necessary skills and these can be offered to the customer.

VAYU : Are there any technologies which nuclear submarines borrow from conventional ones? Or does the process move in one direction only?

Igor Vilnit: Yes, there are. Power consumption restrictions onboard a diesel-electric submarine demand to resolve problems of energy efficiency faster. Until recently electric propulsion motors have been in demand for diesel-electric submarines only, so that equipment was developed just for their use. Storage batteries, essentially lithium-ion batteries, were developed for diesel-electric submarines because they are much more required there.

There is one more interesting matter of interference between nuclear and non-nuclear submarines: dynamics and manoeuvring control. It was the emergence of nuclear submarines with their high speeds that demanded our attention on the hull lines and manoeuvrability. The works were done using prototype diesel-electric submarines, because it was easier and cheaper. Various complexes and systems, even missiles for *Typhoon*-class SSBN, were tested on numerous *Whiskey*-class conventional submarines.

VAYU : India's DRDO is developing an indigenous AIP system. What do you think about the possibility of AIP integration into your design or the possibility of joint work on AIP?

Igor Vilnit: I am absolutely sure that the Indian Navy is anxious to integrate indigenously-constructed AIP on its own ships. We are ready to help with integration of the Indian AIP or facilitate its creation.

VAYU : However, if we continue to draw a parallel between nuclear and non-nuclear shipbuilding, is not a nuclear reactor the best type of AIP?

Igor Vilnit: Nuclear power plant is quite complex, but it indeed gives the submarine the widest range of capabilities. As far as we know, India is quickly advancing in the creation of a national nuclear fleet and this is the indication of the serious technological level of the country. There are three types of submarines in a navy, with strategic submarines, attack submarines ensuring domination in blue waters and tactical purpose submarines solving a wide range of tasks at sea makes the Navy well-balanced and allows rational use of such ships for the best solution of tasks. A similar approach is followed by the Russian Navy.

Russia's Ministry of Defence selected AIP based on the diesel fuel reforming technology for developing and fitting on non-nuclear submarines. Only in the case of diesel fuel reforming the submarine is an opportunity to store one type of fuel only

The Indian Navy's INS Sindhuraj arriving at Severodvinsk for a major refit (photo: Oleg Kuleshov)

and to use it for both diesel-generators, if any, and the AIP system. Hence, the submarine's operational cost reduces. Even for diesel submarines the expenses for fuel during 30 years of service life is a major part of operating expenditure.

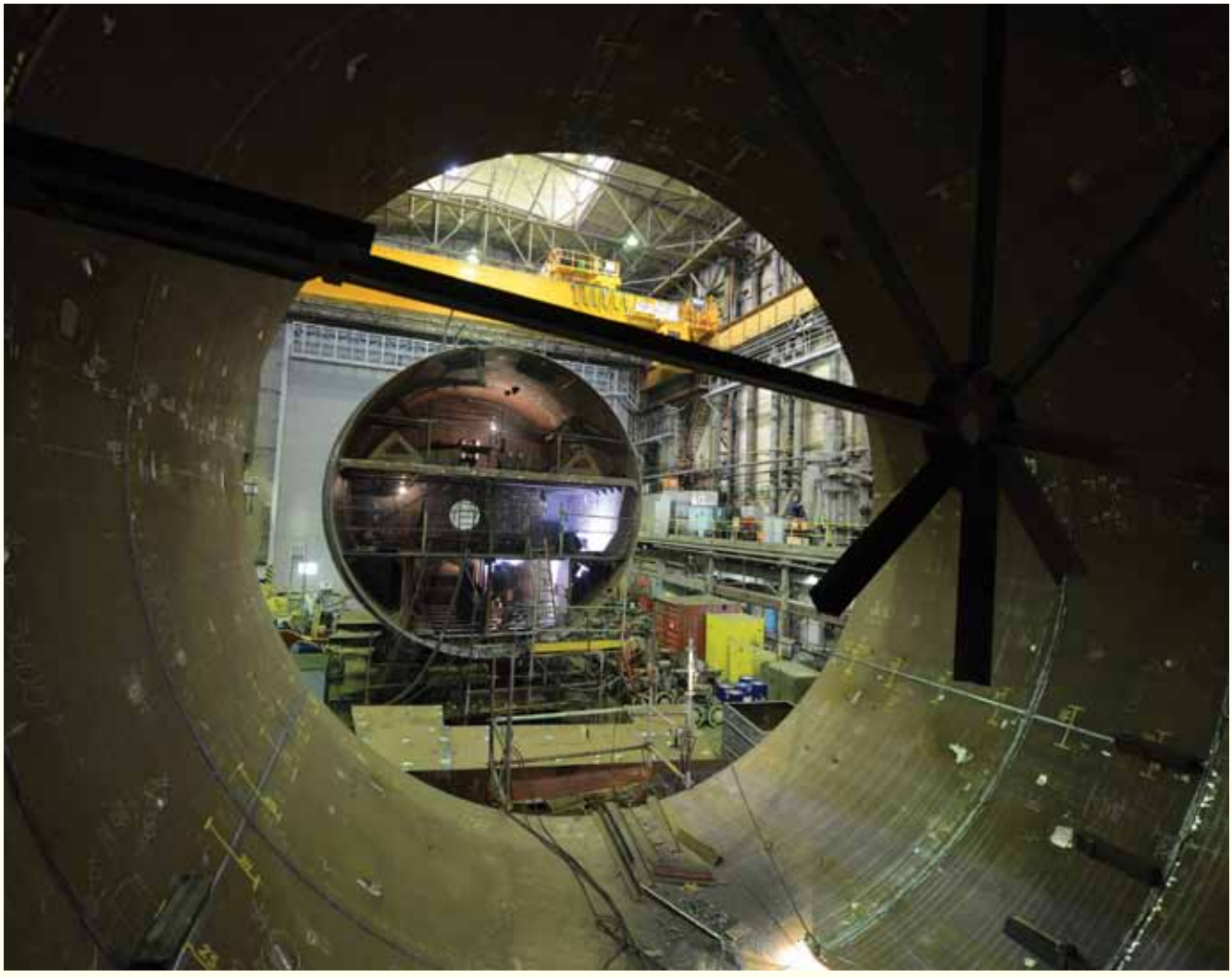
Diesel fuel reforming ensures required submerged endurance. This is a possibility for non-nuclear submarines to operate in open theatres at considerable distance from the bases, not being able to use unstealthy modes, including during transit, avoiding threats from numerous and a skilful enemy. Russian submarines' operational conditions are distinctly different from West European ones, which operate in enclosed theatres at short distances from patrol areas to own bases and in presence of allied forces. However, as far as we known, both France and Germany have started work in the field of reforming, so time has proven the correctness of the Russian Navy's choice.

Lithium-ion batteries facilitate the increase of patrol time in submerged conditions as well. Lithium-ion batteries developed by us have been adopted for manufacture and are used on the Russian Navy's submarines.

VAYU : As reported by the Russian Ministry of Defence, starting from December 2015 almost all Rubin's non-nuclear submarines of Project 636 have participated in the Syrian campaign. What did the combat conditions reveal?

Igor Vilnit: It has demonstrated high performance of our submarines, in particular, high efficiency of the *Kalibr* complex at long ranges. Russian non-nuclear submarines are the only ones in the world which have fired missile salvos in anger.

The submarine which we are offering to the Indian Navy will be equipped with the export version of this complex, *Club*. As far as we can judge India needs submarines with all-purpose weapon systems, which are capable of fighting both surface ships and submarines and, if need be, of attacking land-based targets. Meanwhile, none of the European countries are offering a submarine for export which is equipped with a missile complex capable of attacking land-based targets. This kind of weapon is under developed all over the world, however, export of such systems is complicated enough not only from the technical point of view but also from the positions of political interaction. Presence of the missile complex onboard the Russian-designed submarine which allows powerful strikes both against surface and shore targets located at a considerable distance, is in our opinion, attractive for the country that will select suitable proposal to build the state-of-the-art submarine force.



A Project 636 (improved Kilo) submarine under construction in Saint Petersburg (photo: Admiralty Shipyards)

Russia's DSRV Quest

Igor Belousov at sea (photo: Admiralty Shipyards)

This year, Russian divers will go down to a depth of 400 metres from the ocean-going rescue ship *Igor Belousov*, which is in service with the Russian Pacific Fleet. Divers are already preparing for the mission, which is expected to take place in the summer or fall of 2018.

Last year, seven deep-water divers performed an experimental dive in a diving bell to a depth of 317 metres and landed on the seabed – unprecedented in history of the Russian Navy. While submerged, they investigated the area, and during the 16-day mission, underwent compression, adaptation and then decompression in the decompression chambers of *Igor Belousov*. "This event opens a new page in the modern history of search and rescue services of the Russian Navy. Our unique school of aquanauts is seeing its revival," stated Russian Navy Commander-in-Chief Vladimir Korolyov.

The Russian Ministry of Defence is planning to order three more ships of this type – one per fleet. In November 2017 Deputy Commander of the Russian Navy Viktor Bursuk informed that building of a second rescue ship is included in the Russian State Armament Programme for 2018–2027 and the vessel is expected to be delivered after 2023. As reported, based on operational data from *Igor Belousov*, the Almaz Design Bureau has made improvements for series production boats of the class. The main goal is to improve operating conditions for the *Bester-1* deep-water rescue vessel and the diving bell with hoisting device. Almaz has improved the design of the bottom door on the diving bell in order to minimise the exposure to external forces in operational conditions. A remotely operated vessel will be placed on a slipway, while on the *Igor Belousov,* this is placed on an open platform. Habitability conditions will be improved, and there will be more rooms for the crew and expedition participants. The hull length will be increased by 3.2 m, resulting in an overall length of 110 m, while displacement will go up by 150–200 tons. Propulsion, manoeuvrability and seaworthiness will not be affected, while cruising endurance is expected to increase.

The deep-sea diving complex is also undergoing improvement, as was stated in June 2017 by Rear Admiral Vladimir Tryapichnikov, the head of the Russian Navy's Shipbuilding Directorate. The head of the search and rescue operations of the Russian Navy, Captain 1st rank Damir Shayhutdinov, said that the *Bester-1* submersible, which is a part of the diving complex, is able to rescue sailors as well as pump water from a vessel in distress.

At a meeting of the Defence Ministry Board in December 2017, which was attended by the Supreme Commander-in-Chief Vladimir Putin, the Navy Chief Vladimir Korolyov particularly emphasised the achievements of *Igor Belousov*. "Out of more than 40 vessels built for search and rescue operations, the one worth a special consideration is the rescue ship *Igor Belousov* equipped with the deep-water rescue vessel *Bester-1*, which allowed diving operations at depths of more than 300 metres for the

first time in Russian nautical history. The preparation for missions below 400 metres is underway," he said.

In the fall of 2017 *Igor Belousov* participated in an expedition of the Russian Geographical Society. Using remotely operated search and rescue vessels and unmanned submersible reconnaissance drones, specialists aboard the ship detected the US submarine *Herring*, which was lost to Japanese coastal artillery not far from Matua island in 1944. The submarine was thoroughly investigated by Russian divers. The exact coordinates of the submarine were given to US authorities, so as to consider the location a memorial site.

In December the Russian Pacific Fleet announced that *Igor Belousov* was searching for small Soviet submarines lost during World War II in the Bay of Peter the Great (the largest gulf of the Japanese Sea off the Russian coast). This submarine search was conducted in order to determine limits of the ship's capabilities in the Pacific environment (the equipment has been tested earlier in the Baltic Sea and Atlantic Ocean).

Since the total area of the surface exceeds 400 square kilometres, the search area is divided into sectors. *Igor Belousov* will continue searching for sunken submarines in areas bordering the Posyet Gulf in 2018.

Bester-1 DSRV (photo: Admiralty Shipyards)

Igor Belousov joined the Russian Fleet in December 2015. The ship was built in St. Petersburg at the Admiralty Shipyards. Interestingly, the majority of Indian Navy submarines were built at Admiralty Shipyards – from the old *Foxtrot*-class boats to *Kilo*-class submarines, which form the backbone of the conventional submarine force.

Russia has offered India the *Igor Belousov*-class ship, for its own DSRV capability, and negotiations are in process. In 2015, Indian Navy purchased two *James Fisher* submersible vessels, which require a ship to deploy them, and Admiralty Shipyards has confirmed to the Indian Navy that it can integrate the British vessels with the Russian ship (*see Vayu IV/2017*).

Igor Belousov at Admiralty shipyards in Saint Petersburg (photo: Admiralty Shipyards)

Infantry Modernisation and Light Weapons for Low Intensity Conflict

A US Marine fires a M72 Light Anti-Tank Weapon at the Pohakuloa Training Area, on the big island of Hawaii

Operational Context

India's regional security environment is marked by instability in Afghanistan, Bangladesh, Myanmar, Nepal, Pakistan and Sri Lanka. Instability around India emanates from Afghanistan's prolonged civil war despite US intervention and the overthrow of the Taliban regime; tense relations of Afghanistan with Iran and the Central Asian Republics (CARs); Pakistan's struggle against the remnants of al Qaeda and the Taliban, fissiparous tendencies in Balochistan and Pakhtoonkhwa, the rise of Jihadi Islam, increasing levels of Shia-Sunni violence and Pakistan's gradual slide towards becoming a 'failed state'; Sri Lanka's continued inability to find a solution to the issue of Tamil *eelam* (autonomy); Bangladesh's gradual emergence as a new centre of Islamist fundamentalist terrorism and its struggle for economic upliftment; the volatility of Nepal's Maoist-dominated fledgling democracy; the simmering discontent in Tibet; and, Myanmar's polarisation between the military junta and democracy. The foremost causes of regional instability are the collusive nuclear weapons-cum-missile development programme of China, North Korea and Pakistan, the rise of Islamist fundamentalism, the nexus between narcotics trafficking and terrorism, the proliferation of small arms, the instability inherent in the rule of despotic regimes and a host of other vitiating factors.

With personnel strength of approximately 1.1 million soldiers, the Indian army and the central armed police forces (CAPF), including the BSF, ITBP, CRPF and the state police forces, have made a huge contribution towards keeping the nation together, particularly in facing internal security challenges. India's first-rate army has been saddled for long with obsolescent weapons and equipment, despite heavy operational commitments on border management and in counter-insurgency operations that require large numbers of manpower-heavy infantry battalions. Similarly, the CAPF are ill-equipped to face militant organisations that are often well armed and need to be modernised. However, like army modernisation, police modernisation has also been virtually at a standstill.

Imperatives for Infantry Modernisation

Despite unresolved territorial and boundary disputes with both China and Pakistan, there is stability at the strategic level.

Though the possibility of conventional conflict cannot be ruled out, the probability of either China or Pakistan attempting to resolve their respective territorial disputes through military force is low. Even globally, the pendulum is tending to swing from state-on-state conventional conflict to sub-conventional conflict or LIC in which non-state actors pose a serious threat. (See Chart 1). Proxy war with China, insurgencies in the northeast and left wing extremism in central India are likely to continue in the short to medium term (Chart 2).

As the Indian army is extensively engaged in ongoing internal security and counter-insurgency operations and simultaneously needs to prepare itself for a future border conflict that may spill over to a larger conventional war in the plains, there is a need to upgrade the internal security and counter-insurgency capabilities of infantry battalions as well as to enhance their firepower-mobility-EW (electronic warfare) punch for a possible war in the plains or mountains.

Despite its large-scale deployment on border management and extensive commitments in internal security and counter-insurgency operations, modernisation of the army's cutting edge infantry battalions has been languishing for several decades. Modernisation plans are aimed at enhancing their capability for surveillance and target acquisition at night and boosting their firepower for precise retaliation against infiltrating columns and terrorists holed up in built-up areas. The army plans to equip them with several force multipliers,including a modular weapon with a thermal imaging sight, UBGL, a modern rocket launcher and laser range finder that will replace the INSAS rifle, a combat helmet equipped with a head-up display and communications head set, a smart vest with a body monitoring system, a back pack with integrated GPS and radio and protective footwear. Plans also include the acquisition of hand-held battlefield surveillance radars (BFSRs) and hand-held thermal imaging devices (HHTIs) for observation at night. Stand-alone infra-red, seismic and acoustic sensors will be acquired in large numbers to enable infantrymen to dominate the Line of Control (LoC) and detect infiltration. The new combat system is expected to be built indigenously with COTS components and is expected to cost over Rs 25,000 crore to equip 350 infantry battalions. Almost 65 Rashtriya Rifles (RR), about 45 Assam Rifles battalions as also 30 Territorial Army battalions are also to be modernised.

Chart 2: Sub-conventional Conflict Scenario

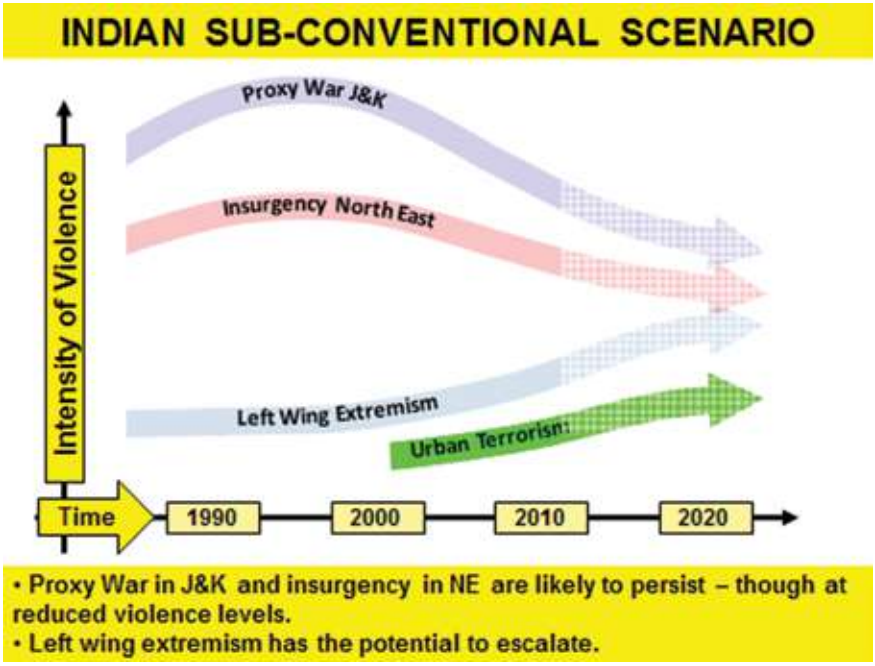
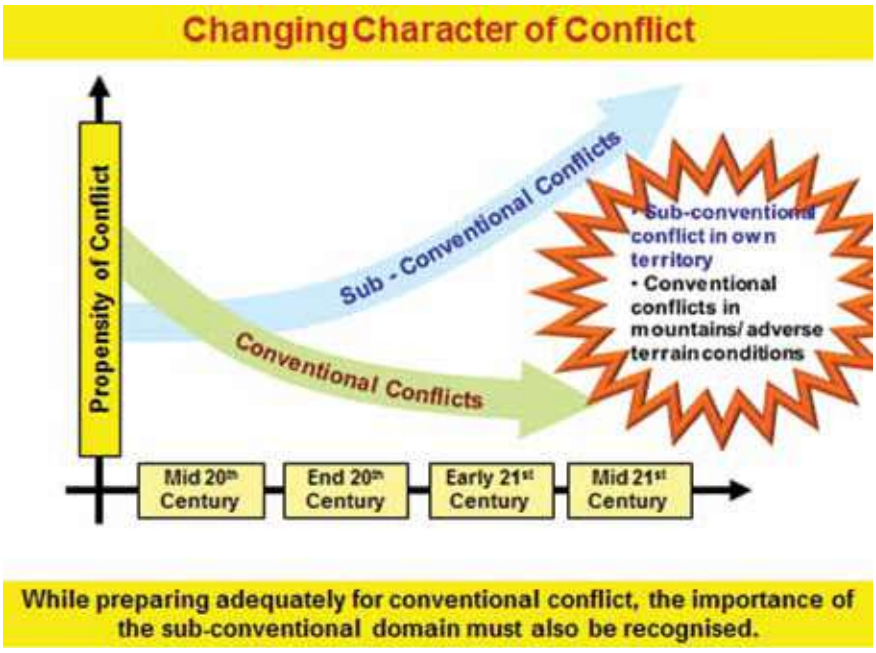


Chart 1: Changing Character of Conflict



5.56 mm or 7.62 mm Assault Rifle: The Calibre Dilemma

During battle an infantryman is required to close-in with the enemy and his basic weapon for close combat is an assault rifle. Since 1998, the Indian army has been equipped with the 5.56 mm Indian National Small Arms System (INSAS). During and after the Kargil conflict in 1999, many problems were reported while using INSAS rifles. Complaints of frequent jamming, the magazine cracking due to the cold and the rifle going into automatic mode when it was set for three-round bursts have been commonplace. There is also the

issue of oil being sprayed into the eye of the soldier and injuries have been reported during firing practice. Though the DRDO has tried to resolve these issues, the user has not been satisfied.

The army's efforts to replace the malfunctioning 5.56 mm INSAS rifle, with a fault-free modern assault rifle, have been hanging fire for over ten years, partly because the army kept vacillating between 5.56 mm and 7.62 mm as the standard calibre for its future assault rifle. One school of thought hypothesised that it is better to injure enemy soldiers during war rather than killing them as an injury means four soldiers will get involved in casualty evacuation. On the other hand, in counter-insurgency operations it is the other way around. A stage came when it was being debated whether both 5.56 mm and 7.62 mm inter-changeable barrels should be issued to infantry battalions.

While the infantry is going back to the 7.62 mm calibre, which is heavier and has a longer range, according to Ajai Shukla, a defence analyst, the second type of weapon, which will arm personnel in infantry battalions other than those in the four rifle companies and the commando platoon plus all non-infantry units, is optimised for counter-insurgency operations, being lighter and with a smaller bullet that a soldier can carry in larger numbers. This implies that the rest of the army will be equipped with an indigenously manufactured 5.56 mm rifle. While the solution may be cost effective, the provisioning, stocking and replenishment of two types of ammunition will certainly be a logistics challenge. Handling two types of ammunition within the same infantry battalion will be a nightmare for the Quarter Master and his staff.

Procurement Plans

The army needs to procure approximately 800,000 assault rifles at a cost of about Rs 16,000 crore for its 450 infantry and Rashtriya Rifles battalions (each battalion has 800 personnel). Till recently It had been believed that the army planned to import 65,678 larger calibre 7.62 mm rifles that are more lethal, with another 120,000 to be made in India. There have been repeated cancellations of ongoing acquisitions in recent years due to various glitches in the procurement process. The salient cancellations include the acquisition of 65,678 assault rifles and 44,600 carbines, in 2015 and 2016, respectively.

Lt Gen P C Katoch (Retd) wrote in early 2013: "The assault rifles under consideration were the Heckler & Koch, G 36 modular 5.56 mm assault rifle (German), the Beretta 70/90 (Italy), SAR 21 of Singapore Technologies, XM 8 (USA), Steyr A3 (Austria), Tavor TAR 21 5.56mm and IMI Galil 7.62mm from Israel, Arsenal AK-74 (Bulgaria), Herstal F-2000 (Belgium) and SIG SG 551 (Switzerland) among others."

In an interview with Ajai Shukla, General Bipin Rawat, the COAS, had said in November 2017 that he had decided to import only 250,000 state-of-the-art assault rifles. These rifles of 7.62 mm calibre would be issued to combat infantrymen who are required to close-in with the enemy. The COAS said, "Since a state-of-the-art assault rifle will cost about Rs 200,000 each in the global market, let us issue these only to frontline infantry soldiers who confront the enemy armed only with their rifles… Let us provide a cheaper indigenous option to other soldiers, for whom the rifle is not a primary weapon." The army is working along these lines.

It was reported in August 2017 that the MoD had retracted the RfP (Request for Proposal) for the acquisition of 44,000 7.62 mm Light Machine Guns (LMGs) on the grounds that "it had become a single-vendor situation with only the Israeli Weapons Industries (IWI) left in the fray after protracted trials from December 2015 to February 2017." Approximately 4,400 LMGs were to be imported; the rest were to be manufactured in India with ToT. All of these acquisitions were cancelled after a long-drawn tendering process and protracted trials. The projects have been delayed by five to seven years.

As the private sector is being gradually permitted to manufacture arms and ammunition and even export these, Indian companies are coming forward to form joint ventures with MNCs. In the field of small arms, among others, Punj Lloyd is collaborating with Israel Weapon Industries (IWI) to manufacture small arms under a technology transfer arrangement. The first plant will manufacture weapons like the Ace, X95 and Tavor assault rifles (Tavor is already in service with India's Special Forces), the Galil sniper rifle and the Negev light machine gun. As Indian engineers and managers begin to gain experience in the design, development and manufacture of weapons systems, such ventures will contribute to achieving self-reliance in defence acquisitions.

Other Infantry Acquisitions

A global tender for 43,000 close-quarter battle carbines was issued in early-2008. The acquisition was to be followed by the local manufacture of approximately 1,17,000 carbines. However, the acquisition fell through. Other plans include the procurement of approximately 250 Kornet-E anti-tank guided missiles (ATGMs) with thermal imaging sights, which will substantially increase the anti-tank capability of infantry battalions and 200 hand-held BFSRs with practical ranges up to seven to eight km where clear line of

Nammo M-72 being used by US forces preparing for overseas deployment

sight is available. These will be followed by the acquisition of 2,000 hand-held thermal imaging devices (HHTIs) with ranges up to 2,000 metres for observation at night and stand-alone infra-red, seismic and acoustic sensors with varying capabilities will enable infantrymen to dominate the Line of Control so completely that infiltration will come down to almost a trickle.

The newly acquired weapons, which complement surveillance and observation devices, include: 1,500x84 mm rocket launchers, including some disposable ones; 1,000 AMRs (anti-material rifles); 8,000 UBGLs (under-barrel grenade launchers); 4,000 new generation carbines; 300 bullet proof vehicles; and several hundred accurate sniper rifles. However, the numbers acquired and the ammunition stocks are still inadequate and need to be augmented rapidly. While the INSAS 5.56 mm assault rifles have now been in service for almost 10 years, the light machine gun (LNG) version is still facing teething problems and the carbine version for close quarter battle has not found favour with the army. New 5.56 mm assault rifles of bull-pup design with an integrated laser range finder and grenade launcher are under development. Efforts are also being made to provide infantry platoons and sections with integrated GPS-based navigation system, secure light-weight walkie-talkie radio sets and better protective gear with a helmet that incorporates a built-in head-up display.

The army's infantry battalions also need their own mini or micro UAVs like Elbit's Skylark or Rafael's Skylite, among others, to partly reduce the extent of patrolling necessary in internal security environment and to improve their surveillance capability in conventional conflict. These UAVs should have a range of about 10 to 15 km, should be light-weight (less than 10 kg), hand-launched, carry a single payload, e.g. a daylight video camera or infra-red camera for night operations, and should be inexpensive enough to be dispensable. A mini ground control station should be authorised at battalion HQ for planning and control. Ideally, these should be indigenously designed and developed and locally manufactured.

A new DRDO project, that is reported to be ongoing, aims to equip future soldiers with lightweight force multipliers. Soldiers of the future will have miniaturised communication and GPS systems, small power packs, weapons platforms and smart vests with fibre-optic sensors. The soldiers will also have better and lighter combat fatigues, boots, belts, ammunition pouches, rucksacks and rations in the form of ready-to-eat-meals.

Rocket Launchers: Handy Platoon and Section-level Firepower

Ultimately an infantryman has to be prepared to engage in close combat and firepower and mobility can make a difference between life and death. In recent conflicts soldiers have had to operate autonomously at section and platoon level. Units could be fighting in a city or jungle in one tenure and in mountainous terrain during the next. Some of these skirmishes are conducted at less than 100metres in an urban environment. Such actions require engagements against light and heavy masonry walls, earthen fortifications and vehicles. Other engagements take place at extended range, beyond several hundred meters, rendering conventional firearms and grenades marginally effective. The size and weight of existing weapon systems to handle these scenarios are prohibitive for dismounted operations. Flexibility is a key characteristic of modern infantry tactics. Infantry must be able to quickly and efficiently respond to any threats they encounter.

Indian Army jawans during counter-insurgency operations

Indian Army and Shoulder Launched Munitions

The Indian army has over 50 years of experience in counter-insurgency operations. Its counter-insurgency doctrine emphasises the use of minimum force. Troops are permitted to use only light weapons such as rifles and carbines against insurgent groups. When there is no choice but to use heavier calibre weapons like machine guns and rocket launchers, senior commanders must personally approve their use. It is often said that the army fights with one hand tied behind the back.

The Indian infantry's standard heavy weapon at the platoon level is the 84 mm Carl Gustav rocket launcher, an older version that weighs roughly 13 kg. The army inducted the Carl Gustav in the late 1980s and since then, these weapons systems have become a vital part of the infantry, as also of the CAPF.

The 66 mm Nammo M72 SLM weighs roughly 3.5 kg. Due to its weight to power ratio, this weapon is truly an infantryman's friend. The M72 is considerably lighter that the existing competitors and is combat proven, lethal and simple to use. The US Military (regular and special forces) has successfully used the M72 family of weapons since the Vietnam War and the weapon is in extensive use in conflicts such as Iraq and Afghanistan.

The M72 Lightweight Assault Weapon (LAW) provides unmatched firepower to the dismounted Soldier. The M72 LAW is disposable, effective, easy to use and importantly highly portable. The

lightweight and compact nature of the weapon enables soldiers to carry multiple M72's at one time. This allows light infantry, early entry, airborne and Special Forces Users 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 armor and reinforced concrete walls.

The M72A5/A7 shaped charge penetrator is designed for light armour, vehicles and light clad buildings with armour penetration of 300mm or 150mm respectively. Other deep armour penetrator variants are available if required. The M72A9 Anti Structure Munition or M72 ASM Reduced Caliber are specifically designed to penetrate buildings and detonate with increased pressure and fragmentation (M72A9 only).

M72s is highly sought after choice among today's modern military forces. The Nammo systems provide even small military forces with the capability to quickly and decisively respond to any threat, large or small, through a mix of these highly effective force multiplier systems. Military leaders can feel confident they've made the right choice when selecting a Nammo weapon system.

The current threats facing India, both internal and external, clearly point to the fact that India needs to re-define its arsenal of infantry weapons and look at lighter weapons with not only increased punching power, but importantly a weapon that also limits collateral damage. Limiting collateral damage is important as most of the current conflicts in which India is engaged are in urban or semi-urban areas, where the loss of an innocent life can have long term repercussions. The newly formed mountain division that will eventually be facing China will also need to be equipped with an arsenal that supports soldiers moving in high altitude terrain and facing an enemy that may have a superiority in numbers. A few M72s on the back of a platoon could possibly stop the advancing enemy, giving enough time for reinforcements to arrive.

Concluding Observations

Infantry modernisation plans received a major boost when the Defence Acquisition Council (DAC), chaired by N. Sitharaman, Raksha Mantri, accorded approval in principle to several weapons systems for the infantry. These include the procurement of Light Machine Guns for the three Services through the Fast Track Procedure at an estimated cost of Rs 1,819 crore. The balance quantity will be procured under the 'Buy and Make (Indian)' category.

The procurement of 7,40,000 Assault Rifles was approved under the 'Buy and Make (Indian)' category at an estimated cost of Rs 12,280 crore. The DAC also approved the procurement of 5,719 Sniper Rifles for the Indian Army and Indian Air Force at a cost of Rs 982 crore under the 'Buy Global' category. However, while the ammunition for these will be initially procured from abroad, subsequently it will be manufactured in India. According to a Ministry of Defence (MoD) press release of February 2018, "In the last one month, to equip the soldiers on the border with modern and more effective equipment, the DAC has fast tracked procurement of the three main personal weapons, i.e., Rifles, Carbines and Light Machine Guns."

As the Indian Army is deployed in large numbers on border management and internal security duties, even as it trains for a two-front war, the inordinate delays in the replacement of the army's obsolescent weapons and equipment and the inability to undertake qualitative modernisation to meet future threats and challenges are worrisome. The modernisation plans of India's cutting edge infantry battalions, which are aimed at enhancing their capability for surveillance and target acquisition at night and boosting their firepower for precise retaliation both in conventional conflict and against infiltrating columns and terrorists holed up in built-up areas, were till now stuck in an acquisition quagmire. Hopefully, these will now gather some momentum.

Gurmeet Kanwal (The author is former Director, Centre for Land Warfare Studies (CLAWS), New Delhi).

Nammo M-72 shoulder launched, lightweight assault weapon

Elettronica's Electronic and Cyber Warfare Solutions

Italy's Elettronica Group "works with the armed forces and governments of 28 countries around the world, providing advanced EW and cyber warfare solutions across land, air and sea. The firm's products are regarded for their high sensitivity and accuracy, as well as by their dedicated functions for automatic surveillance and data processing for ELINT intelligence analysis."

Elettronica is engaged in a number of important European Naval Cooperation programmes, including the *Horizon*-class and FREMM frigates, where it is present together with Thales Systemes Aeroportes within the SIGEN Consortium as a supplier of EWS systems. The active subsystem supplied by Elettronica is the Nettuno-4100, an advanced state-of-the-art radar ECM installation scalable according to on-board space limitations.

To meet the growing complexity of naval warfare demands, Elettronica, through its CY4Gate venture with Expert System, itself a global leader in semantic computing, provides intelligence, law enforcement and electronic warfare command levels with a range of solutions providing superior, fast and comprehensive structured analysis of non-uniform data streams from ELINT to Tactical/Strategic COMINT and Open Source (OSINT), virtual HUMINT, Meta Data Analysis, Data Mining and Fusion, all integrated within both defensive and offensive cyber applications.

The Company's key programmes include Virgilius, an ESM/ECM system that exploits the latest digital signal processing techniques together with COTS components to perform emitter detection, classification and identification to counter a broad range of threat types: including radar-controlled Anti-Aircraft-Artillery (AAA), Surface to Air Missiles (SAMs) as well as Early Warning, search and modern Multifunctional Radar. A modular design approach makes it possible to tailor the solution to specific end-user needs.

The ELT/160 family of low cost Radar Warning Receivers (RWRs) provides self-protection for utility and combat aircraft and helicopters during operations in insecure areas, anti-tank missions and ground vehicle escort. This family of RWRs – in all versions, from 'light' to 'combat' – detects, analyses and identifies intercepted electromagnetic emissions that can pose a threat to the platform, both with extreme speed and outside of the attack envelope of the weapons system. Like all of Elettronica's passive defence systems, the ELT/160 RWR extractor performs perfectly in absence of pre-flight information. The system's EW manager can coordinate LW, MW and C/F dispensers for a complete integrated suite.

Elettronica's ELT/572 DIRCM (Directional Infrared Countermeasures) is designed to counter shoulder-launched MANPADS (Man Portable Air Defence Systems) missiles, one of the major modern threats to airborne platforms, especially in asymmetric conflict environments and in terrorist actions. The fibre laser technology of the ELT/572 improves performance, efficacy, reliability and efficiency in countering this evolving threat, as well as overcoming the weak points of older DIRCM suites by reducing installation constraints and the even more critical and complex set-up, alignment and maintenance operations.

The Naval Jamming Antenna and Source Subsystems (JASS) offer a scalable architecture applicable to ECM installations according to customer needs. These can be supplied according to on-board space limitations in two possible configurations, *Split* and *Monomast*. The *Split* configuration is composed of two separately installable (JASS) while the *Monomast* solution, as the name suggests, is applicable to single mast installations.

On the cyber side, the CY4Gate D-SINT is able to analyse structured and unstructured data through an integration of hardware and software tools that can handle different data formats coming from any kind of sources, but also possible to receive and manage information coming from private repository. The D-SINT helps operatives better manage the Intelligence Cycle (planning and direction, collection, analysis, production and dissemination), and decision makers take better decisions.

From an operational point of view, the platform is required to provide at least the following functionalities: creation and management of investigation tasks; real time ingestion of high-volume data, from different sources (structured, unstructured and multi-structured), semantic analysis of text acquired from the above different sources, extraction of hidden relations among entities, correlation among data and entities across different domains (e.g. time, space, etc), highlighting of weak signal from chaotic data, fusion and dissemination of intelligence results in an interactive graphical interface.

Inputs from Elettronica

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Saab Systems : in the air and at sea

First Saab GlobalEye AEW&C Aircraft

On 23 February 2018, Saab rolled out the first GlobalEye Airborne Early Warning & Control (AEW&C) aircraft for display to the media at its Linköping site, Sweden. GlobalEye is an advanced, swing-role airborne surveillance system based on a Global 6000 jet aircraft from Bombardier, after a thorough modification programme to adapt it for this role. The rollout marked a significant milestone on the programme. Saab is currently producing the GlobalEye AEW&C, combining air, maritime and ground surveillance "in one single solution." GlobalEye combines a full suite of sophisticated sensors including the powerful new extended range radar (Erieye ER), with the ultra-long range Global 6000 jet aircraft. This first aircraft is equipped and being prepared for ground and flight trials to gather aerodynamic data as part of the ongoing development and production programme.

The development and production contract was awarded at the Dubai Air Show November 2015 by the United Arab Emirates with an initial order for two systems. An additional order by the UAE for a third system was announced in 2017. The GlobalEye solution brings extended detection range, endurance and the ability to perform multiple roles with one solution, including tasks such as search and rescue, border surveillance and military operations.

Saab provides Swedish Navy with additional Trackfire RWS Systems

Saab has received an additional order from the Swedish Defence Material Administration (FMV) regarding Trackfire Remote Weapon Station (RWS) for the Royal Swedish Navy. Trackfire RWS will be installed on the new Combat Boat 90 (Strb90 HSM) used by the navy's amphibian forces. "This order is further proof that the Swedish customer continues to trust Saab and our products. Trackfire RWS is a flexible system with very high precision and performance", stated Anders Carp, Senior Vice President and Head of Saab's business area Surveillance. This is in addition to a Trackfire RWS order that Saab received from FMV in August 2017.

Trackfire RWS has a very flexible construction which can be adapted to customers' needs. A combination of sensors, weapons and integration options for different platforms, in the naval- and ground domains, are available. Trackfire RWS forms part of Saab's portfolio of fire control products, together with UTAAS (Universal Tank and Anti-Aircraft Sight) for the Combat Vehicle 90. The products share common technology and sub-systems such as the Fire Control Computer, Video Tracking Module, Recoil Buffer and Stabilisation Technology.

Saab to provide Tactical Data Links to Swedish Navy

Saab has received an order from the Swedish Defence Materiel Administration, FMV, to provide Multi Tactical Data Links to the Swedish Navy valued at SEK 148 million. The Navy platforms will be upgraded with data links such as L16 and L22. This enables closer co-operation and communication with other nations at sea during missions. Saab 9LV Combat Management System (CMS) will be upgraded as part of the deliveries. "The integration of the Tactical Data Links into the Saab 9LV CMS on board the Navy's surface warfare vessels will further strengthen Swedish Navy's operational capability," stated Anders Carp, Senior Vice President and head of Saab's business area Surveillance."

Saab is a Key Partner in OCEAN 2020 Project

Saab will take part in an EU funded preparatory action project called OCEAN 2020. The project will demonstrate technologies for enhanced situational awareness in a naval environment using unmanned systems. OCEAN 2020 came out as the winning proposal under the EU Preparatory Action on Defence Research programme. The project consists of a consortium representing 15 EU Member States, led by Leonardo. During 2018-2020, two live demonstrations will be arranged. The first is scheduled to be held off the Italian Mediterranean coast in 2019, with the second live demonstration in the Baltic Sea during 2020. Saab, with the support of the Swedish Navy, will coordinate the live demonstration to be held in the Baltic Sea.

Saab contracted for Sabertooth

Saab has signed a contract for deliveries of the Sabertooth Autonomous Underwater Vehicle/Remotely Operated Vehicle (AUV/ROV) and deliveries will take place during 2018. With this contract, the customer has ordered the first vehicles in a planned fleet of Sabertooth vehicles. Under the agreement, Saab and the customer will work together to further develop this 'game-changing', innovative vehicle and its applications in the field of subsea Inspection, Maintenance and Repair (IMR), survey and intervention work. The contract comprises a suite of advanced survey sensors. The Sabertooth system has been configured to allow additional sensors, which can be quickly integrated to meet project specific applications.

FMV order for Saab Gripen development and operational support

The company has received an order from the Swedish Defence Materiel Administration, FMV, to provide operational and development support for Gripen during a period of three years, from 2018 to 2020. The order from FMV includes operating activities in rigs, simulators and test aircraft for the verification and validation of the Gripen C/D and Gripen E fighter aircraft systems, plus operational support for Gripen C/D.

Swordfish redefines Maritime Patrol Aircraft

Saab's Swordfish maritime patrol aircraft (MPA) brings a new level of operational confidence to the global MPA market. The 'winning combination' of Bombardier's Global 6000 ultra-long-range aircraft, General Dynamics Mission Systems-Canada's acoustics processor and Saab's pedigree in total airborne surveillance solutions, ensures a 'new era in maritime air power'.

"Saab's Swordfish Maritime Patrol Aircraft is a strategic, multi-role ISR system that redefines air power in the maritime domain. No other MPA on the market delivers such a high level of mission performance in such an adaptable and sustainable package. With a payload of up to six torpedoes, anti-ship missiles, over 200 sonobuoys, the world's most modern sensor suite and a mission endurance close to 13 hours, Swordfish is in a class of its own", stated company officials.

The evidence shows that large, costly airliner-type platforms are no longer needed to perform the MPA and maritme ISR role. New technology means that size, weight and power requirements have been reduced across all key mission systems. This, together with more powerful computer processing power, means less space and fewer operators are needed. This is the smart solution for a future-proof MPA, and the Bombardier Global 6000 aircraft provides the perfect platform. Saab's GlobalEye multi-role AEW&C system also uses the Global 6000 and has the same engineering base as the Swordfish.

Saab's Swordfish MPA is part of a common family of advanced airborne systems that includes Saab's GlobalEye multi-role and swing-role airborne early warning and control system. Based on a common engineering programme that is tested, proven and proceeding on schedule, both Swordfish and GlobalEye benefit from Saab's many decades of success as a supplier of large-scale, complex systems for national defence and security. A thorough process of definition, development and verification has now delivered a smart, future-proof solution for maritime air power.

"Long standing partnership strategy with India"

MBDA at Defexpo 2018

"MBDA is looking forward to another exciting and fruitful Defexpo, in line with our longstanding partnership strategy with India,"said Loïc Piedevache, Country Head, India, MBDA. As one would expect, MBDA is exhibiting a full range of its missiles and missile systems portfolio at Defexpo 2018 that could be of interest to India across the main defence domains: air, land and sea. "This Defexpo will also be particularly exciting as it will be the first time L&T MBDA Missile Systems Ltd, the joint venture formed with Larsen and Toubro in 2017, will exhibit at Defexpo. On this stand, the JV will be showcasing a number of products, including the ATGM5 and Exocet MM40 B3".

Drawing on the next generation technologies of the MMP battlefield anti-tank weapon that recently entered service in France as an advanced successor to the highly successful MILAN, the ATGM5 will be designed and manufactured in India to meet India's specific operational requirements. "It will be a true Indian Designed, Developed and Manufactured (IDDM) product, involving the transfer of next generation key technologies to India, boosting the Indian defence industry sector".

Exocet MM40 Block 3 is the latest version of the famous Exocet missile family, and includes the 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. As the Indian Navy already operates the SM 39, which is part of the Exocet family, it would be a logical step to also use Exocet in other operational areas. In doing so, it could provide significant operational, logistics and training advantages.

MBDA will exhibit its high-performing Mistral man portable air defence system (MANPADS) "that has already performed exceptionally well in firing evaluation trials for India, more than meeting India's operational requirements and what was demanded of the missile system in mountain, desert and maritime conditions". As well as the operational advantages of the Mistral missile, there are major industrial advantages being offered if Mistral is selected for India's VSHORAD requirement, with the missile to be fully manufactured under license in

Loïc Piedevache, Country Head, India, MBDA

Exocet MM40 Block 3


MICA, multi-mission air-to-air missile system

India, under a similar arrangement as for the highly successful production of MILAN in India. As Mistral has already been selected and integrated into the ATAM helicopter launch system for India helicopters (namely ALH and LCH), operating Mistral as a MANPADS system will offer major logistics and stock management advantages.

"For ground and naval air defence, we are exhibiting our VL MICA and Sea Ceptor systems, which befitting MBDA's commonality, adapt and re-use product strategy share many similarities with the air launched MICA and ASRAAM weapon systems already operated by India, something that can provide further logistical advantages to the Indian Armed Forces". Both VL MICA and Sea Ceptor are extremely high-performing air defence systems capable of defeating the most challenging of air threats, and the two systems principally differ in their launch mechanism. VL MICA utilises a traditional 'hot' launch, while Sea Ceptor uses a 'soft' launch technology that sees the missile ejected vertically into the air before the missile's rocket motor ignites.

In the air domain, MBDA will be exhibiting the MICA missile, which is an integral part of the Indian Air Force's Mirage 2000 upgrade programme and is also included in the IAF's suite of weapons to arm its Rafale, thereby not only providing operational but also logistics and stock management advantages with the same weapon being fielded across two platforms. MICA is the only missile in the world featuring two interoperable seekers (active radar and imaging infrared) to cover the spectrum from close-in dogfight to long beyond visual range. "We will also exhibit our revolutionary ramjet powered and network-enabled Meteor beyond visual range air-to-air missile, which is widely recognised as a game changer for air combat". Key to this is Meteor's throttleable ramjet engine, active radar seeker and datalink that combine to provide unmatched end-game speed and manoeuvrability at greatly extended ranges, resulting in its all-important 'No-Escape Zone' being several times greater than any other existing or planned BVR weapons. "The Indian Air Force is receiving this unrivalled system on its new Rafale aircraft, and at Defexpo, we will also be showcasing the missile for other platforms".

India has also purchased MBDA's ASRAAM air dominance weapon for its New Generation Close Combat Missile programme, and MBDA will be exhibiting ASRAAM on both the initial Jaguar platform, and for other platforms such as Hawk. With its large rocket motor and clean aerodynamic design ASRAAM has unrivalled speed and resultant aerodynamic manoeuvrability and range, ASRAAM gives it a high kinematic capability that delivers superior end-game performance for within visual range air combat.

For both the Hawk and other platforms, we will also be exhibiting other potential armaments, including the high-precision Brimstone strike weapon, which would give these, or other, platforms an exceptional ability to engage massed armoured formations or conduct pinpoint attacks in collaterally constrained environments.

"For long-range strike we will also exhibit our SCALP and SmartGlider weapons that are optimised to counter anti-access strategies and other emerging battlespace threats. SCALP provides the ability to strike at the best defended and protected targets at the longest of ranges, while SmartGlider forms a family of all-up-round glider weapons, with folding wings and a range of over 100 km allowing the combat platform to stay at safe distance from the enemy defences. With the smallest member of the SmartGlider family being just 120 kg, and a Rafale can carry as many as 18 – allowing the destruction of multiple targets or the saturation of even the most complex air defence systems".


The ASRAAM

Thales at Defexpo 2018


CAPTAS-1

Thales is participating at the 10th edition of Defexpo 2018, the biennial Land, Naval and Internal Homeland Security Systems Exhibition, from 11-14 April 2018 at Chennai. "The Indian government lays significant emphasis on defence modernisation and self-reliance in securing the country›s sovereignty. As a reliable partner to the Indian armed forces, Thales would continue to help them master every decisive moment with its high technology solutions across land, sea, air and cyber space. From equipping soldiers with the most accurate solutions to strengthening the country›s land, sea and air defence capabilities, we fully support the ambitions of the Indian armed forces. We are proud of our various solutions on which the Indian armed forces rely, and of our collaborations built with the local industry over the years. At Defexpo 2018, we will demonstrate how we help our local customers and partners master every decisive moment through our high-tech solutions" - Emmanuel de Roquefeuil, VP & Country Director, Thales in India.

Present in India since 1953, Thales has been playing an essential role in India›s growth story by sharing its technologies and expertise in sectors such as defence and aerospace among others. It has been actively partnering with the local industry for years, with business and employment generation as key value additions. Thales is highlighting its efforts in line with the government›s ‹Make in India› initiative. "The spotlight would be on our flagship PHAROS fire control radar that is jointly developed with our JV company BEL-Thales Systems Ltd. This system in line with the ‹Make in India› vision will serve both domestic Indian and international market requirements" state company executives.

In a first, visitors at the Thales stand will be able to get an insight into its 'extraordinary high-technology solutions' across land and naval defence through special digital experience kiosks. Providing an immersive experience, these kiosks will allow visitors to discover Thales› cutting-edge capabilities in air defence, radars, acoustics and optronics, armaments, land and naval communication, UAV, among others. This wide range includes solutions like multi-role missiles such as STARStreak, Lightweight Multi-Mode (LMM) and Fury, range of rocket systems, surveillance radar such as I-Master, sonars such as, CAPTAS-1 and FLASH, the airborne ISR solution AMASCOS and the latest generation of contact airborne intelligence, surveillance and security mini-drone UAV system, SpyRanger, etc.

AMASCOS


SpyRanger

BrahMos flight tested

The BrahMos supersonic cruise missile was flight tested from Rajasthan's Pokhran test range on 22 March 2018. The supersonic cruise missile and the seeker have been developed jointly by DRDO and BrahMos Aerospace. Defence Minister Nirmala Sitharaman tweeted to say "The precision strike weapon with Indian-made seeker flew in its designated trajectory and hit the target with pin-point accuracy." She congratulated the DRDO and added, "The successful test will further bolster our national security."

The precision strike weapon with indigenous seeker flew in its designated trajectory and hit the pre-set target. The flight test was conducted by the scientists of DRDO and BrahMos along with the Indian Army. A high level team led by Chairman DRDO & Secretary DDR&D Dr S Christopher was present during the flight trial, which included DG (Missiles & Strategic Systems) & SA to RM Dr G Satheesh Reddy and Director General BrahMos Dr Sudhir Mishra. Programme Director Dr Dashrath Ram and Project Director V Prameela who had led the effort for development of the indigenous seeker were also part of the team. Senior IAF officials also witnessed the successful launch of the tactical weapon.

The missile flies almost three times the speed of sound at Mach 2.8 and has a range of 290 km. The range of the BrahMos missile, an Indo-Russia joint venture, can be extended up to 400 km as certain technical restrictions were lifted after India became a full member of the Missile Technology Control Regime or MTCR in 2016. Work is underway to integrate the BrahMos supersonic cruise missile on 40 Sukhoi combat aircraft which is expected to fulfil critical needs of the Indian Air Force in the wake of evolving security dynamics in the region.

The BrahMos has been inducted into the Navy and Army from 2006 onwards, but this version is more versatile because unlike warships, which are slow-movers, a fast-moving Sukhoi-30 fighter can travel at least 1,500 km towards a target before the missile itself is fired. The missile then flies another 400 km to take out a target. The combination of the Su-30 and BrahMos means that the Indian Air Force can deliver a 'knock-out punch' in minutes, far quicker than a warship which may need to sail in the direction of a target out at sea. The air-launched variant of the BrahMos, the world's fastest supersonic cruise missile, was successfully test fired from a Sukhoi-30 combat jet on 22 November 2017, marking a major milestone to enhance the precision strike capability of the air force. The project is expected to be completed by 2020.

The missile on display at Aero India at Yelahanka

The fleet of 40 Sukhoi jets will undergo structural modifications at Hindustan Aeronautics Ltd or HAL for integration of the missile on them and the BrahMos missile will be the heaviest weapon to be deployed on India's Su-30 fighter aircraft. Once the project to integrate the weapon on the combat fleet was over, the capability of the Indian Air Force to strike from large stand-off ranges on any target in sea or land is expected to go up manifold.

Model of the air launched version of BrahMos on the Su-30MKI

Search and Rescue in the IOR

The ShinMaywa US-2 STOL Amphibian

Being evaluated by the government of India is the ShinMaywa US-2, an amphibious short take-off and landing (STOL) aircraft manufactured by Japan-based ShinMaywa Industries. Designed for air-sea rescue missions, the US-2 is presently operated by the 31st Fleet Air Wing of the Japan Maritime Self-Defence Force (JMSDF)

The ShinMaywa US-2 fleet is deployed across the remote islands of Japan's Exclusive Economic Zones to provide surveillance and emergency medical transportation services. The aircraft can quickly reach remote islands and sites of maritime accidents during search and rescue (SAR) operations. The aircraft has been offered to India in response to the Indian Navy's global request for information (RFI) for nine amphibious SAR aircraft. The US-2 is the first Japanese aircraft to be offered to the Indian defence forces.

In October 1996, ShinMaywa was nominated by the Ministry of Defence as a main contractor to develop advanced version of existing US-1 aircraft. The new aircraft was designated as the US-1A Kai. ShinMaywa formed a US-1A modification engineering team including Kawasaki Heavy Industries, NIPPI Corporation, and Mitsubishi Heavy Industries. The rigorous engineering requirements imposed on the project resulted in an advanced model which was virtually a brand new aircraft.

Final assembly of the first prototype was concluded in April 2003 and the first flight test successfully conducted in December 2003. The first prototype was delivered to the MoD in March 2004, followed by the second prototype in December 2004.

The US-2 incorporates a flexible airframe design allowing it to be converted into a fire-fighting amphibian, passenger transport aircraft, or a multi-purpose amphibian. The wings and fuselage are made of composite materials. It features a pressurised cabin for high-altitude flights. The STOL technology based on boundary layer control (BLC) helps in very-low-speed operations.

"Naval Group keen in continuing its partnership with MDL to propose best solutions for Indian Navy"

VAYU Interview with Rear Admiral R K Shrawat, CMD, Naval Group in India

VAYU : As the new head of Naval Group in India, how do you envision Naval Group meeting the demands of the Indian Navy. How do you see taking the MDL- Naval Group partnership forward in India?

RA RKS: As an Electrical officer I have served the Indian Navy for 36 years, extensively in domain of naval design, dockyard activities, strategic projects and combat system activities. Indian Navy is brewing to become self-reliant and several ambitious projects are in the pipeline. The next generation advanced submarines, heavy weight torpedoes and advanced warships are among the many possibilities for Indian Navy's future fleet. India is at the heart of Naval Group's international development and MDL is our natural partner. We cherish the partnership with MDL along with the know-how and rare skills they have achieved through dedication and passion. We are keen to continue this value added partnership in submarine building to propose best solutions for Indian Navy, while having "Make in India" deeply rooted in our heart.

VAYU : The first Scorpene submarine Kalvari was commissioned in December last year. When is the second submarine Khanderi likely to be commissioned? What is the status of the rest of the submarines?

RA RKS: Launch of *Karanj* on 31 January 2018 was a historic event, as MDL achieved another significant milestone in submarine building programme, following up on the prestigious commissioning of INS *Kalvari* by PM Narendra Modi on 14 December 2017. For India, this was the first time a third submarine of a series was entirely constructed in India. This was also crucial as MDL worked fairly independently, demonstrating the success of Transfer of Technology (TOT) between Naval Group (ex DCNS) and MDL. As indicated by Indian Navy and MDL, the programme has been on track for quite a while now. MDL has now attained the level of competence and skills to build complex submarines through successful collaboration and transfer of technology. The second submarine is undergoing sea trials and getting ready for commissioning soon. Karanj will also enter the stage of sea trials soon. Remaining three submarines are also in advanced stages of building at MDL and will be delivered to the Navy as per ensuing time.

VAYU : MDL has submitted a proposal to the Navy for building an additional line of Scorpene submarines. If the order comes through, will you be collaborating with MDL again for the additional line?

Hervé Guillou, Chairman & CEO Naval Group shaking hands with Prime Minister Narendra Modi during commissioning of Kalvari

RA RKS: Naval Group and Naval Group in India have a successful cooperation with MDL which is now the only Indian shipyard with full expertise and know how to build indigenously conventional submarines. In this framework, Naval Group will be happy to nurture the dedicated know-how and competence built at MDL through consistent transfer of technology. What is more important is to make sure that the shipyard will continue to manufacture submarines over decades, without lapse, in order to preserve, nurture and build upon their expertise and qualified skilled man power. Should there be an additional order of submarines for MDL, we will stand by side of MDL to jointly propose enhanced capabilities in Scorpene design to suit any advanced operational requirements of Indian Navy.

VAYU: What is the status of the P75i project as of now?

RA RKS: On P75I, we have answered the RFI and we hope to be one of the OEMs to receive the EOI as per the SP model guidelines. We believe that we are in a position to propose a submarine with enhanced capabilities meeting the entire requirement of the Indian Navy.

VAYU: There is a concern that the Scorpene is toothless due to the lack of a modern torpedo. We are aware that Naval Group is participating in a contest for new torpedoes - what makes Naval Group stand out from the competition?

RA RKS: INS *Kalvari* had already displayed good performance during the sea trials and one of major achievements had been the successful firing of anti-ship missiles and torpedoes already available with the Indian Navy. So to begin with, the submarine is combat ready. For new generation heavy weight torpedo, as requested by Indian Navy, Naval Group is offering their latest generation F-21 torpedoes, which have been developed to be the safest and most modern torpedo for the French Navy's SSN *Barracuda*-class submarines. Even though such torpedo integration in any submarine is a complex and costly task, with Naval Group being an integrator and developer of advanced combat management systems, the F-21 torpedo can seamlessly be integrated with the Subtics CMS family of the *Scorpene* ubmarines. It is noteworthy that this torpedo has been ordered by Brazilian Navy.

VAYU: What is the status on the contract for maintenance of Scorpene submarines?

RA RKS: Indian Navy is experienced in operating different classes of submarines including EKM and SSK. Now they will operate *Scorpene*-class submarines built by MDL under P75 project. These modern submarines benefit from a very high level of integration and automation requiring an integrated service support. Taking into account the Navy's experience and existing infrastructure at its naval bases, Naval Group is proposing to assist Indian Navy to support the P75 submarines through an onsite team comprising of Indian and French engineers to ensure optimised operability and sea time of Indian Navy's P75 submarines. We are also available at all times at the naval dockyard of Indian Navy where INS *Kalvari* is being operated from, to help them with any assistance needed to ensure best operational availability of the submarine. Further to that, discussions regarding specific tools and infrastructure, are also on.

Commissioning of Kalvari

Boeing promotes F/A-18 Super Hornet for India

"Multi-role, Combat Tested and Built for the Future"

One look at the decks of our Navy's aircraft carriers and the Royal Australian Air Force's fleet and you'll see advanced, combat-proven strike capability. The Super Hornet is the multi-role solution for the Navy and international air force customers. The Royal Australian Air Force operates 24 Super Hornets and 12 Growlers. Seven air forces around the world use the Hornets.

With combat proven multi-role capabilities, advanced survivability, with room to grow and having the lowest sustainment costs among US tactical combat fighters, the Super Hornet would be a good option for India to evaluate for its Navy and Air Force's fighter requirements.

The Super Hornet brings the latest generation of technologies to the warfighter. With designed-in stealth and a robust capability growth plan, the Super Hornet offers a path to India's Advanced Medium Combat Aircraft (AMCA) programme generating scale to close the business case of common components such as the common core engine.

Boeing is also committed to expanding its partnership by producing Super Hornets in India, further developing the country's aerospace ecosystem. Boeing will work closely with Indian industry to ensure they have the very latest technologies, applying lessons learned from the current Super Hornet production line.

Having a procurement roadmap that achieves the dual goal of capabilities for the warfighters and industrial capability to build India's aerospace industry will be good for India. India should also look at the strong interplay between the commonality of parts such as radars and engines and have the scale to build in India. We want to follow the MoD's lead on their process and will be responsive to their needs if we are asked to provide any information.

F/A-18 Super Hornet A Combat Proven Fighter

Boeing's Super Hornet is combat proven and defined to stay aligned with the US Navy's flight plan so that it continues to evolve to outpace future threats. The Super Hornet will be the work horse on the Navy's carrier decks for decades to come – being three-fourths of the Navy's strike fighter capacity into the 2030's and no less than half the carriers striking force into the 2040's.

The President of the United States in his fiscal year (FY) 2019 budget included a requirement for 110 Super Hornets over the next five years to address its strike fighter shortfall. The FY18 budget included a requirement for 24 Super Hornets, and funding for Block III capabilities, which ensure the US Navy has the capabilities needed to outpace the future threat environment.

The next-generation Block III Super Hornet comes into the US Navy and potentially international customers to fulfill its role in a complementary way to work alongside the EA-18G Growler, E-2D Hawkeye and F-35. The Super Hornet and F-35 are going to work together on the carrier decks for the US Navy, well into the 2040s.

That gives us a great opportunity to continue the programme which is evolutionary capability development from a risk perspective of low risk change that delivers revolutionary performance. We are excited to be building airplanes at a current production rate based on the US Navy demand and some other international. The President's budget requests will have the Super Hornet production line delivering aircraft into the mid 2020s.Our current

production rate is two per month. We have built and can build up to four airplanes per month so we have sufficient capacity.

Introduced in 2007, the F/A-18 Super Hornet Block II is the world's preeminent carrier capable aircraft and best suited for India's naval fighter requirements; the F/A-18 Super Hornet was designed from day one for carrier operations. It is a combat proven, supersonic, all weather multirole fighter jet with a defined US Navy flight plan to outpace threats for decades to come.

The Super Hornet's benefits of being a twin-engine aircraft help provide the warfighter a margin of safety that does not exist in a single-engine platform. A single-engine aircraft is likely lost due to engine malfunctions or loss of thrust while a twin-engine platform can lose an engine and still safely return to base or carrier. Every Super Hornet has a buddy refueling capability that can extend time on station, range and endurance. Additionally, the Super Hornet can provide close and deep air support through the Active Electronically Scanned Array (AESA) radar targeting data and reliable data links.

The Super Hornets are fully compatible with the Indian Navy's aircraft carriers. Extensive simulation has shown that the Super Hornet is capable of conducting STOBAR operations with a meaningful weapons and fuel load.

Ease of maintenance

The F/A-18 Super Hornet not only has a low acquisition cost, but it costs less per flight hour to operate than any other tactical aircraft in US forces inventory. Part of its affordability is because the Super Hornet is designed to need far less maintenance; this translates into high mission availability. Ease of maintenance (supportability) results in lower maintenance man-hours per flight hour. Plus, the Super Hornet does not require any scheduled depot-level maintenance and the engine does not require any scheduled maintenance between overhauls.

Further, Boeing's active production line and robust supply chain allow the company to offer the most affordable platform. This low cost of operation, low maintenance requirements and twin-engine based survivability allow the Super Hornet to fly to and back from harsh environments.

Prepared for future threats: F/A-18 Block III Super Hornet Capabilities

The Super Hornet is a platform that is continuously evolving to outpace future threats. Every two years Boeing and its industry partners along with the US Navy work on delivering new capabilities to the fighter. Critical mission systems such as the radar, mission computers and sensors continue to evolve to match up to the mission profiles of the future.

To address the capabilities the air wing needs to stay ahead of current and future threats, Boeing will deliver the first Block III Super Hornet to the US Navy by the end of 2020. Block III is the same aircraft as Advanced Super Hornet. The Advanced F/A-18E/F Super Hornet's multi-mission capabilities include battle-space situational awareness, counter stealth targeting, greater range and increased acceleration, improved survivability and reduced signature and room for growth.

In the 2020s, three Super Hornet squadrons and one F-35 squadron may form the airwing of carrier fleets. Currently, in the US Navy three out of four, and in most cases all four squadrons based off aircraft carriers, are Super Hornet squadrons.

These advanced capabilities can be both built into new aircraft and incorporated into existing aircraft, allowing maximum ability to field these capabilities quickly and affordably. Block III Super Hornet is built from the same airframe as Block II, providing low risk development and maintaining the lowest operating costs of any US tactical fighter. While Boeing demonstrated advanced Super Hornet capabilities in flight in 2013, the package of upgrades has evolved to stay aligned with US Navy needs that best complement F-35, EA-18G and E-2D as they will be operating together in the air wing well into the 2040s.

Key features of the Block III Super Hornet include enhanced network capability, longer range and low-drag with conformal fuel tanks, long-range detection with Infrared Search & Track, enhanced situational awareness with a new Advanced Cockpit System, improved signature reduction and a 9,000+ hour life.

A significant design evolution is the addition of conformal fuel tanks. Mounted on the shoulder of the Block III, conformal fuel tanks significantly extend the range of the Block III. Conformal fuel tanks also free up the space occupied by a centerline drop-tank. This means that the Air Force and the Navy have an additional hard-point to carry more air-to-air or air-to-ground weapons.

The Advanced Cockpit System is a next-generation use interface, which simplifies the interpretation and projection of a large quantity of information for the aircrew – both in the front and rear cockpit – making it easy to interface and manage an information network.

Making in India

We believe India has demonstrated its potential in aerospace platform development and manufacturing and has a base to build upon. Boeing has been working with suppliers in India for over two decades in manufacturing, IT and engineering services and Indian companies are integrated in our global supply chain. Today, there are more than 160 suppliers providing parts and assemblies covering commodities such as aerostructures, wire harness, composites, forgings, avionics mission systems and ground support equipment. Since 2008, Boeing's engagement with suppliers has increased substantially for commercial and defence aircraft such as the 777, 787, P-8, F/A-18 Super Hornet, F-15, Apache and CH-47 Chinook. Some of the work our Indian partners are delivering for Boeing is indicative of the complex manufacturing capabilities that Indian companies are capable of developing for the global market.

Thom Breckenridge, Vice President, Global Sales, India, Global Sales & Marketing, Boeing Defence, Space & Security

Success Story: In just 3 years Defsys becomes one of the biggest private Defence Offset providers in the country

VAYU Interview with Dmitry Bernadiner, Executive Director of Defsys

Defsys is a leading Systems Integration company supplying to the Top-50 Global Defence OEMs and to Government (Defence Services). The company manufactures airborne pods, electro-optical payloads, airborne EW systems, integrated on-board electronic systems, thermal sights/cameras, role equipment for fighter aircraft, radar and missile seeker simulators, RF test and measurement systems. We interviewed Dmitry Bernadiner, Executive Director of Defsys about the success of his company and the key enablers of Indian content creation in the new "Make in India" era.

VAYU : Can you describe the journey of your company, particularly over the past few years in the backdrop of "Make in India" and the policy changes that have been incorporated in defence procurement ?

Our cogent understanding of the industry led us to an early decision on investing in creation of the "Indian Content" enablers for the upcoming era, even before "Make in India" was formally launched by the Government in September 2014. The latest edition of the DPP ushered very important changes in the procedures which clearly exemplified the Government of India's intent of giving a fillip (boost) to turning India into a contributor in the Defence and Aerospace industry and a global manufacturing hub. Defsys had started designing and manufacturing electronic systems in the year 2007 at Bangalore and while sensing the market opportunities, we were fortunate to take the right decisions and establish our center of excellence for Electro-Optical and RF Systems in 2015 in Gurugram. Besides our flagship manufacturing projects in the field of airborne pods, smart guidance kits, E/O payloads, role equipment and EW systems, we are also the country's largest producer of Automated Test Equipment as well as an indigenous developer of the most complex RCS measurement systems.

VAYU : We believe that Defsys is arguably one of the fastest growing private companies today in the defence and aerospace sector in the country. What are your achievements and how have you been able to draw this growth trajectory?

We are proud of the fact that our market domain knowledge, the state-of-the-art infrastructure, a very precise selection of employees and their training, a conducive work environment with a constantly evolving organisational culture, the best systems, processes and procedures in place - all have been key enablers of our success. Over the last three years, we have constructed and commenced two new production facilities in Gurugram to the most advanced international standards and upgraded our legacy manufacturing facility in Bangalore, with an overall investment of more than INR 120 Crores. Defsys has grown 15 times in terms of employee strength and more than 20 times in terms of revenues in less than 36 months.

VAYU : Defsys has also come to be known for its work infrastructure which is so important not just from the point of view of 'Making in India' but also as a potential partner for any foreign OEM. How well are you equipped in terms of manufacturing infrastructure?

Defsys has a most modern and state–of–art facilities in Gurugram matching the best in the global industry standards. Our production lines are spread over 110,000 square feet and have an ample scope for future expansion. We have all required equipment for manufacturing, integration and testing of airborne ground and maritime equipment. Clean rooms, software and hardware integration laboratories equipment with very sophisticated RF test equipment, HASS Chambers, environmental test chambers, shock and vibration testing machines as well as collimator stations with blackbody and motorised target wheels are some of the many in-house equipment and capabilities that we possess.

VAYU : What are the major programmes presently being executed by your company?

Defsys is manufacturing airborne E/O pods for fighter aircraft of the Indian Air Force, which is an extremely complex and technologically advanced system. This is being done under a production transfer programme from foreign country involving complete manufacturing, assembling, integration and testing of the products indigenously. We are also assembling electro-optical guidance kits for the same customer. EW suites for helicopters are also being built in India now, based on a foreign technology. The programme commenced recently in Defsys, and we are currently delivering the FAI systems.

Defsys Radar Cross Section Measurement System

Defsys is taking a very significant part in offsets manufacturing programme of the new fighter aircraft for India and we are extremely proud that those aircraft will fly using the equipment manufactured by our company.

In the field of electro optical payloads for helicopters of various forces, we are indigenously incorporating the latest SWIR technology to meet user requirements. Smaller electro-optical payloads for small UAVs have been supplied to government PSU and with our strategic partnership Controp, Israel, we are fully achieving a very high percentage of Indigenous Content exceeding the statutory requirements of DPP. Deliveries of Defsys manufactured thermal sights for an air defence gun are nearing successful completion.

VAYU : What were the main challenges you have faced in the production of such complex products like airborne pods ?

The project was the first of its kind in India, and I am very proud to state that we have been able to set the bar very high for ourselves, and maybe for others too. It was certainly not a smooth going but was professionally very enriching and satisfying.

The first challenge was setting up the facility which was done in a record time of four months. Motivating local vendors to build something they have never done, was a task in itself, but at the end of the day, with tremendous technical support and management efforts, we were able to upskill them adequately to perform to the required standards.

Second and the obvious is the supply chain. Establishing and managing a robust and reliable supply chain is a very challenging task in India. It requires a continuous monitoring 24x7, technical assistance and procedural guidance, recurring quality audits and finally – a financial support. Despite all this, we have indigenised over 90% of the system and established this local supply chain ensuring deliveries of over 60,000 components, each at the required time and quality.

Finally, as you may assume – the Talent acquisition and Talent retention. It was, it is, and it will be the most difficult and most important process. Being a mid-size company, we are able to attract talent only from Tier 2 or even Tier 3 institutes. To get the best, we scrutinised nearly 50,000 CVs and interviewed about 8,000 candidates. After such a deep search, we were able to select the right people having a potential to contribute towards our organisational goals, both technological and cultural.

Technical training, skill enhancement and inculcating the right work culture and ethos was the main focus of Defsys management, which has borne dividends by resulting in 100% on-time deliveries with zero defects so far.

VAYU : Do you think Defsys is meeting the objectives of 'Make in India' ?

Today, Defsys can rightfully claim to be one of the leading private manufacturer and integrator in the Indian defence industry having a state-of-the-art facility and a very accomplished and competent workforce. We are proud of the fact that Defsys today meets all the objectives of the 'Make in India', namely, creation of world class infrastructure which is readily scalable, skilling employees capable of technology absorption, self-reliance, employment generation as well as saving and earning of foreign exchange. With diverse experience of very effectively carrying out a technology and production transfer programme of the most complex systems, we are very well equipped and eminently suitable for contributing to the business expectations and goals of foreign OEMs as well as meeting the objectives of 'Make in India'.

Manufacturing of UAV payloads at Defsys

Production line for Automated Test Equipment at Defsys

BEL showcases its range at Defexpo 2018!

BEL is participating in the biennial Land, Naval and Internal Homeland Security Systems Exhibition Defexpo 2018 which is taking place at Thiruvidanthai, Thiruporur Taluk, Kancheepuram, East Coast Road, Chennai.

The company is showcasing its capabilities spanning every domain of its business – radar and fire control systems, network centric systems, c^4i systems, communication systems, missile systems, electronic warfare & avionics, anti-submarine warfare systems, naval systems, electro optics and laser systems, gun upgrades, tank electronics, home land security systems, technology modules, simulators, shelters and civilian products. BEL is displaying its R&D capabilities by demonstrating some of its new products / technologies through the launch of 11 products. The theme for this year's display is 'Make in India.'

On display are a host of new radars – 3D C/D Band Air Surveillance Radar (3D ASR), Weapon Locating Radar, Active Electronically Scanned Array - Battle Field Surveillance Radar (AESA-BFSR), Ground Penetrating Radar, Through Wall Radar, 3D Low Level Light Weight Radar, Surface Surveillance Radar and Secondary Radar (Identification of Friend or Foe Interrogator –IFFI MK XII).

The Network Centric Systems on display include Trusted Network Solution-Demo, Combat Management System, C^4I technology-Demo, Air Defence Control & Reporting System and Coastal Surveillance Systems.

Communication Systems/ elements on display include the Software Defined Radio (SDR) Airborne – Live Demo, SDR Manpack, Combat Net Radio Mk II, Mine Field Recording System, Handheld Satcom terminals, IP Modem & IP Encryptor, Satcom On The Move, Secure Smart Phone, Carbon Fibre Antenna, Secure Military Wireless LAN, 100 Mbps Radio, Advanced VLF Receiver / Modulator, Beacon-Mk III and ULSB MK-III. Also on display is the Helmet Mounted Display System and Integrated Fire Detection & Suppression System.

Electronic Warfare & Airborne products on display include Modern

BEL CMD, Mr M V Gowtama

Electronic Warfare System (VARUNA), Manpack Jammer, Radar Finger Printing System (RFPS), avionics for Light Combat Aircraft (LCA) – Digital Flight Control Computer (DFCC), Air Data Computer (ADC), Pylon Interface Box – Inboard, Outboard, Laser (PIB-IB, OB, Laser), Stores Interface Box (SIB), Function Sensor Display Unit (FSDU), Multi Function Rotary switch (MFR), Multi Function Keyboard (MFK), Engine Fuel Indicator (EFI), Get-U-Home (GUH); Multi Spectral Warning System (MSWS), Radar

Radar Warning Receiver for combat aircraft

Warning Receiver (RWR) and Rustom Unmanned Aerial Vehicle (UAV) LRUs – Airborne Integrated Payload Processing Unit (AIPPU), Ground Integrated Payload Processing Unit (GIPPU), Airborne Spread Spectrum Modem (ASSM), Ground Spread Spectrum Modem (GSSM) and COMPASS (Compact Multi-Purpose Advanced Stabilised Surveillance System).

Anti-Submarine Warfare Systems on display include the Advanced Composite Communication System (ACCS) for naval platforms, USHUS-2, HUMSA NG, Hull Mounted Sonar-X, IAC MoD-C, SONAR DOME, Advanced Torpedo Defence System (ATDS)- Maareech and Transducers.

Also on display is a complete range of electro optics, laser, tank electronics and gun upgrade systems – hand held thermal imager (HHTI) with laser range finder (LRF), long range surveillance system-Prahari, passive night sight for INSAS rifle / LMG and for rocket launcher, passive night vision binocular, goggle and monocular, thermal imager sight for assault rifle (Uncooled), multi-purpose reflex weapon sight, laser warning system, laser dazzler, laser range finder – air defence higher repetition, light weight portable laser target designator

Weapon Locating Radar

(LWPLTD), EOFCS: 5PPS, electronic fuses for mortars, artillery guns and rockets, NBCRV Model, L-70 gun upgrade and remote control weapon system (RCWS).

Technology modules like MEMS pressure transducers, CTD sensors, quad T/R modules, pulsed power amplifiers, block-up converters, digital receivers and signal processors are also on display.

Other systems on display include border management system, command & control for homeland applications, new generation shelters & masts, electronic voting machine (EVM), X-Ray baggage inspection system, chemical agent monitor (e-nasika), point of sale, tablet PC and batteries. Various Simulators are also being showcased.

The highlight of BEL's Outdoor display is the 3D C/D band air surveillance radar (3D ASR), weapon locating radar (WLR), upgraded Schilka Weapon System, L-70 Gun upgrade, SATCOM on the Move (SoTM) and gunshot detection system.

Developments at Lockheed Martin

T-50A test pilot reaches 100 hours

Lockheed Martin test pilot Elliott 'Hemo' Clemence has reached a milestone logging 100 flight hours in the the T-50A, the company's offering for the US Air Force's Advanced Pilot Training (APT) competition. In February 2016, Lockheed Martin announced its plans to offer the T-50A in the APT competition and build the aircraft at a final assembly and checkout (FACO) facility in Greenville. The FACO and operations centre formally opened in August 2016.

THAAD Interceptor contract

The Missile Defence Agency (MDA) has awarded Lockheed Martin a $459 million contract modification for production and delivery of interceptors for the Terminal High Altitude Area Defence (THAAD) weapon system. The modification brings the total contract value to $1.28 billion with funding provided in 2017 and 2018. The new interceptors support US Army THAAD units and growing operational requirements. THAAD is a key element of the Ballistic Missile Defence System (BMDS), and is highly effective at protecting America's military, allied forces, citizen population centers and critical infrastructure from short, medium and intermediate-range ballistic missile attacks. THAAD employs Lockheed Martin's "hit-to-kill" technology.

Miniature Hit-to-Kill missile demos

Lockheed Martin's Miniature Hit-to-Kill (MHTK) missile successfully conducted a controlled flight test to demonstrate the interceptor's increased agility, and to validate the performance of its airframe and electronics–now common between MHTK's two configurations to drive affordability. The test at White Sands Missile Range, New Mexico, was the first ever for MHTK's updated electronics, and the second for the interceptor's next-generation airframe. Commonality between the two missile configurations (active and semi-active seeker), and the increased agility demonstrate MHTK's transformational capabilities to defeat rocket, artillery and mortar (RAM) targets with greater accuracy, reliability and range compared to current systems.

JASSM-ER on F-15E Strike Eagle

Lockheed Martin's Joint Air-to-Surface Standoff Missile (JASSM) – Extended Range (ER) achieved full operational capability on the F-15E Strike Eagle. With completion of integration and the fielding of JASSM-ER's Suite 8 Operational Flight Programme, the F-15E Strike Eagle becomes the first Universal Armament Interface (UAI)-compliant platform to field JASSM-ER. UAI-compliant aircraft feature standardised interfaces to support future weapon integration. Baseline JASSM was the first missile ever to be integrated onto a UAI platform. The US Air Force Seek Eagle Office led the F-15E Strike Eagle JASSM-ER and JASSM integration.

GA-ASI demonstrates SATCOM launch and recovery capability for MQ-9B

General Atomics Aeronautical Systems, Inc. (GA-ASI) has demonstrated its latest Automatic Takeoff and Landing Capability (ATLC) using a Satellite Communications (SATCOM) data link for its MQ-9B SkyGuardian/SeaGuardian Remotely Piloted Aircraft (RPA). The demonstration also included the first SATCOM taxi of the MQ-9B. This capability will eliminate the need for a ground control station and pilot/flight crew to be located at the aircraft's base which will drastically reduce airlift requirements when the RPA is "forward deployed."

The SATCOM-only Launch and Recovery Element (LRE) operations capped another positive year for MQ-9B development, which included an endurance flight of more than 48 hours in May 2017 and the first FAA-approved flight for a RPA in non-segregated airspace in August 2017. The MQ-9B will become the first RPA with SATCOM LRE functions when the MQ-9B Protector is delivered to the UK's Royal Air Force (RAF) in the early 2020s.

The demonstrations were conducted in December 2017 using GA-ASI's capital MQ-9B SkyGuardian. The supervisory crew and Ground Control Stations (GCS) operated out of the company's Gray Butte Flight Operations Centre near Palmdale, California., and the aircraft was flown out of Laguna Army Airfield near Yuma at Arizona. Using only a SATCOM datalink, the team successfully taxied the aircraft and initiated six auto takeoff and landing events.

SATCOM ATLC enables taxi, launch and recovery operations from anywhere in the world and will reduce required aircrew manpower and LRE footprints. With trained RPA aircrew only required at the mission control element GCS location, the overall operating cost of the RPA is reduced. It also enables rapid self-deployment of aircraft to any global runway with a Global Positioning System (GPS) surveyed file.

RAF Reaper "flies 10 years, over 100,000 hours"

Linden Blue, CEO of General Atomics Aeronautical Systems, Inc. (GA-ASI) stated "For the past 10 years, the UK MQ-9 Reaper fleet has operated over 100,000 flight hours, providing persistent, armed surveillance of the battlefield that assists military leaders in making informed operational decisions. GA-ASI looks forward to delivering the latest MQ-9 version to the RAF in the form of the new MQ-9B PROTECTOR."

The RAF Reaper Force has reached two significant milestones. The fleet of remotely piloted aircraft systems has now been serving on coalition combat operations for 10 years during which time it has flown 100,000 hours. The milestone of 100,000 hours of flying supporting coalition combat operations was reached on 4 December 2017 and equates to over 11 years airborne or travelling around the world 550 times. The ISTAR Force Commander, Air Commodore Dean Andrew, stated, "The RAF Reaper Force has now been operational for 10 years, during which it has amassed 100,000 hours of crucial support to UK and coalition combat operations in a variety of roles. The ability of Reaper to discretely observe and monitor enemy activity for lengthy periods of time provides commanders with a hitherto unheralded view of the battlespace."

Rosoboronexport to promote export of small submarines

JSC Rosoboronexport, part of Rostec State Corporation, and JSC United Shipbuilding Corporation will continue their efforts to promote small and midget submarines in the world market during 2018. As stated by Igor Sevastyanov, Deputy Director General, "Rosoboronexport notes the growing interest in small and midget submarines in South-East Asia, Africa, Latin America and the Middle East. Russia's shipbuilding industry and Navy have considerable experience in their development and operation, which gives grounds for success in promoting such boats in the world market. According to preliminary estimates, the capacity of this segment of the arms market will be approximately US$4 billion for the coming five year."

Rosoboronexport is ready to supply its foreign partners with custom-designed small and midget submarines of up to 10 different models, which include boats displacing 130 to 1000 tons to meet the needs of most potential customers. The special exporter carries out after-sales service of the delivered products under a separate contract.

"Small and midget submarines are a unique segment of the naval market. Despite their small size, they carry various weapons, including torpedoes and mines, and can be armed with cruise missiles. Advanced electronics enables them to timely detect targets and proactively attack the enemy, while remaining stealthy due to low noisiness and electromagnetic signatures" added Igor Sevastyanov.

Work is under way to fit such boats with AIP systems which will significantly extend their submerged endurance. Among the key advantages of small submarines are the low intensities of their physical fields, significantly reducing the probability of their detection by ASW forces. This is achieved through their small size, the application of appropriate materials and advanced noise reduction technologies, as well as other design solutions. For small submarines intended for special operations, a special lockout chamber can be provided through which combat swimmers can covertly leave the submarine.

The basing of small submarines will not require radical re-design of existing naval bases, so their commissioning into the navy does not entail significant capital investments to build appropriate coastal infrastructures. A specially equipped relatively small surface ship can be used as a tender for small submarines at mobile basing sites.

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, now Rosoboronexport is one of the leading world arms exporters to the international market. Its share in Russia's military exports exceeds 85 percent. Rosoboronexport cooperates with more than 700 enterprises and organisations in the Russian defence industrial complex. Russia 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 3 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, UralVagon Zavod, etc.

Small and midget submarines are designed:

- to guard coastal maritime borders through covert patrolling;
- to destroy single surface ships and vessels;
- to destroy submarines;
- to deploy (retrieve) commandos;
- to plant minefields;
- to conduct reconnaissance in designated areas and suppress enemy forces;
- to conduct electronic intelligence;
- to evacuate people from local conflict areas;
- to attack enemy shore facilities located on the coast and deep inside its territory.

MKU: Helicopter Armouring for Safety & Efficiency

With changing combat scenarios, helicopters have continually evolved from their basic transportation role in military operations to much diversified counter-insurgency and disaster control tasks. Helicopters have become workhorses as they haul supplies and troops to and from combat zones. As the pilots fly their helicopters into the combat zones, they and their machines are prone to firefrom enemy forces. The most vulnerable part of a helicopter are its underbelly, cockpit and engine, most susceptible to ground fire. Therefore, not only is it crucial to make the helicopters more ballistically tolerant, but, protect the pilots and aircrew with ballistic body armour solutions.

Helicopter armouring

MKU offers wide range of protection solutions for fixed wing and rotary aircrafts. MKU's armour is extremely lightweight and durable guaranteeing mission accomplishment and safeguarding trained aircrew.MKU offers certified solutions following NATO AQAP quality procedures. These aircraft protection solutions comply with US Federal Aviation Regulations (FAR) and the European Aviation Safety Agency (EASA) regulations. MKU provide end-users with the highest level of protection while retaining full system functionalities of the helicopter. Its technical team cooperates with several leading material developers to ensure special ballistic protection capabilities for the offered armour solutions.

MKU ensures that both its armour materials and its attachments comply with MIL 810 G standards and work closely with operators from the very start to deliver an effective and high quality solution as per the actual need. MKU is among the few companies in the world with extensive experience in armouring airborne systems, is certified according to AS 9100 C for design and development of armour solutions for airborne platforms. Keeping the multi role operations and survivability of utility and assault helicopters in mind, MKU designs helicopter armour kits using the proprietary '*Modular Schutz Technik*'(MoST). Depending upon the mission requirements, armour kits from MKU can be easily and quickly deployed in, or removed from the aircraft either in part or in full without the requirement of any special tools.

'Modulare Schutz Technik' uses precision engineered composite armour panels along with patented aero-grade attachment systems. These kits are simply installed upon the existing structure of the helicopter without making any structural changes or tampering with the aerodynamics of the Helicopter.

Areas for Armour Protection

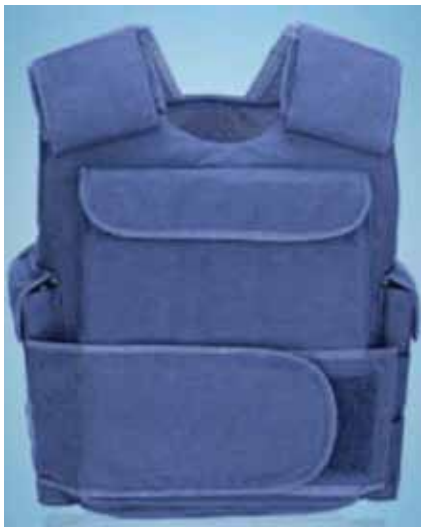
Pilot seat protection: MKU providesaircrew with optimum protection without affecting the operational ability of the machine. Pilot seat protection solutions offer crew with excellent protection against trauma sustained from turbulence and other ballistic threats.

Floor protection: MKU's innovative internal aircraft floor equipped with ballistic protection capability is easy to install, lightweight and requires minimal maintenance. Anti-ballistic flooring solution can be easily integrated into original hull without necessitating any structural changes in the platform.

Side Protection: During combat side protection and door protection is equally important as the hull of aircraft. MKU's 6th Generation Polyshield V6 armouring technology facilitates helicopters with lightweight and effective armour solution which can be easily and quickly deployed.

MKU understands the threats that pilots encounter while flying in combat,and have developed the Heli-pilot vest which offers maximum ballistic protection to the pilots. Heli-pilot vests are designed such that they offer privilege of obstruction free movement while flying aircraft from combat zones.

MKU is an Indian defence company headquartered in Kanpur, has four production facilities of which 3 are in India and the fourth one in Sittensen, Germany. The company manufactures protection and surveillance range of equipment and solutions. MKU has spent the last three decades building up a broad product portfolio that includes ballistic vests, ballistic helmets and other personal protection products for military and security forces as well as Platform armouring solutions for land-air-sea platforms. It has recently set up one of the most modern facilities for the manufacture of Night Vision Devices and Day sights. Till date, MKU has provided protection to over 2 million soldiers and 2000 platforms,its products used by 230 forces in over 100 countries worldwide.



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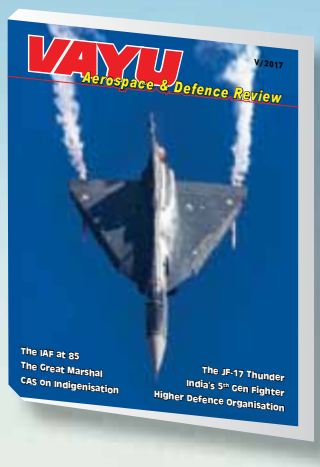

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Kuwait Aviation Show 2018

From 17 to 20 January 2018, Kuwait hosted the *Kuwait Aviation Show* (KAS) held at Kuwait International Airport, marking the first step of an ambitious plan to become a major player in the aviation industry in the Middle East. This plan includes becoming the largest cargo-handling area in the region.

The event, also marketed as "Your aerospace gateway to the GCC (Gulf Cooperation Council)," was held in an aircraft hangar and adjacent static aircraft display area. This first edition appeared to have attracted only a limited number of participants, judging by the layout of the exhibition area and the empty booths.

On 17 January, the show was opened by Sheikh Salman Sabah Al-Salem Al-Homoud Al-Sabah, the President of Civil Aviation in Kuwait. Following the opening speeches, the Kuwait Air Force (KAF) performed a fly by with three AH-64Ds from Ali al-Salem Air Base followed by a flypast of a Kuwait Airways Boeing 777 flanked by four F/A-18s. After a performance of the Turkish Air Force F-16 (*Solo Türk*), the flying display of the opening day was closed by a performance of the Saudi Hawks. Of the four days overall, two days were trade days while the last days were open to the public. With only the Saudi Hawks performing on all days, the flying display was very limited and missed a large KAF and civil participation.

Besides adding to the somewhat limited flying displays, the Kuwait Air Force presented several of its assets in the static display. Since assets of the KAF are hardly ever seen outside the country, the Kuwait Aviation Show presented a rare opportunity to view the Kuwait Air Force.

Training

Representing the training fleet of the KAF, both a Tucano T52 as well as a Hawk Mk64 were on display, while helicopter training was represented by a Gazelle.

Initial training for KAF pilots is being done abroad, in France. *Défense Conseil International* (DCI) offers training at its International Centre for Academic and Aeronautical Training (CIFAA) in Salon de Provence, in partnership with Aix-Marseille University and the French Air Force Academy in Salon de Provence. The syllabus is identical to that of the French Air Force and covers a period of two years, using civil registered Cirrus SR-20 & SR-22 aircraft.

Next steps for future helicopter pilots are also in France, as DCI-H (or International Helicopter Training Centre), the helicopter school of DCI, also provides the basic helicopter training at Dax-Seyresse and Le Luc/Le Cannet using civil registered EC120Bs. This course includes a two-week high-altitude training in the Pyrenees simulating operations in hot weather conditions. After finishing basic helicopter training, a type-conversion is done in France on ALAT Gazelles before returning to Kuwait for further training.

After finishing the DCI-course at Salon de Provence, fixed wing pilots return to Kuwait for their follow-up training.The KAF uses the Tucano T52 for training with 19 Training Squadron, based at Ali al Salem air base. Sixteen aircraft were delivered in the mid-nineties, of which twelve remain active. Fighter pilots transfer to 12 Training Squadron, flying nine Hawk Mk64s, before eventually transferring to the 61 Fighter & Attack squadron equipped with the F/A-18C/D. Besides that, Kuwait

Air Force pilots have been flying the M346 from Lecce in Italy since 2015. The Italian Leonardo company was present at the show, hoping Kuwait will become one of the new customers for the M346 lead in fighter trainer.

DCI is also heavily involved in follow-up courses including ground/simulator training at Cognac, fighter courses at Tours and Cazaux and transport specialisation at Avord.

Transport

The KAF has a long history of using Lockheed aircraft for their transport needs. Since the early seventies, two L-100-20 and later four L-100-30 were used. Since 2014 onwards, three C-130J are being operated by 41 Transport Squadron, while three of the four L-100-30 are still serviceable and being employed. A giant boost for the transport capabilities was given when two C-17As were delivered to 41 Transport Squadron in 2013 and 2014. The static park had both a C-130J and a C-17A on display.

Helicopters

The backbone of the KAF helicopter force is formed by Eurocopter (now Airbus HC) products. Eight SA330L are assigned to the 32 Helicopter Squadron at Ali el-Salem, while sister squadron 62 Utility Squadron flies five AS332B and an unknown number of AS532SC. The Gazelle also soldiers on in Kuwaiti service, with no less than fifteen SA342Ks assigned to the 33 Helicopter Squadron. Five Sikorsky S-92As are in service with the 91 Special Squadron. One of the AS532s was being used to drop parachutists on several days, while an S-92 was seen in the static display.

Dating back to 2005, sixteen AH-64D were delivered to 17 and 20 Attack Squadrons after a period of training in the United States. Besides the three AH-64Ds performing a fly-by, one helicopter could be seen in the static display.

Future fighters

When the Gulf War ended, the fighter fleet of the KAF was quickly modernised. The existing fleet of A-4 Skyhawks and Mirage F1s were replaced by 40 F/A-18C/Ds of which 26 F/A-18C and 7 F/A-18D remain active with 9, 25 and 61 Fighter & Attack Squadrons. One of the F/A-18s from 25 Squadron was on static display, while four aircraft from both 9 and 25 Squadron performed in the opening of the show.

In 2015, it was announced that the KAF had ordered 28 Eurofighter Typhoons (tranche 3, 22 single-seaters and 6 dual-seaters), to be delivered from 2019 onwards. The aircraft will be based at Ali al-Salem airbase but initial training will be done in Italy, with Kuwaiti pilots getting their training at Grosseto with 20 Gruppo.

Besides that, it was announced in November 2016 that a deal for at least 40 F/A-18E/F Super Hornets (32 F/A-18, 8 F/A-18F) was approved by US Congress. Local media suggest this deal could still be 'on' but no confirmation was given so far.

The Kuwait Aviation Show will be held again in 2020 and certainly has potential to grow, but it will take some effort to show as to what makes this show different from other shows in the region.

Text and photos: Stefan Goossens and Arnold ten pas, 4 Aviation

One of five Sikorsky S-92As in service with 91 Special Squadron was seen in the static display

Following the opening speeches on 17 January 2018, the Kuwait Air Force (KAF) performed a fly by with three AH-64Ds from Ali al-Salem Air Base

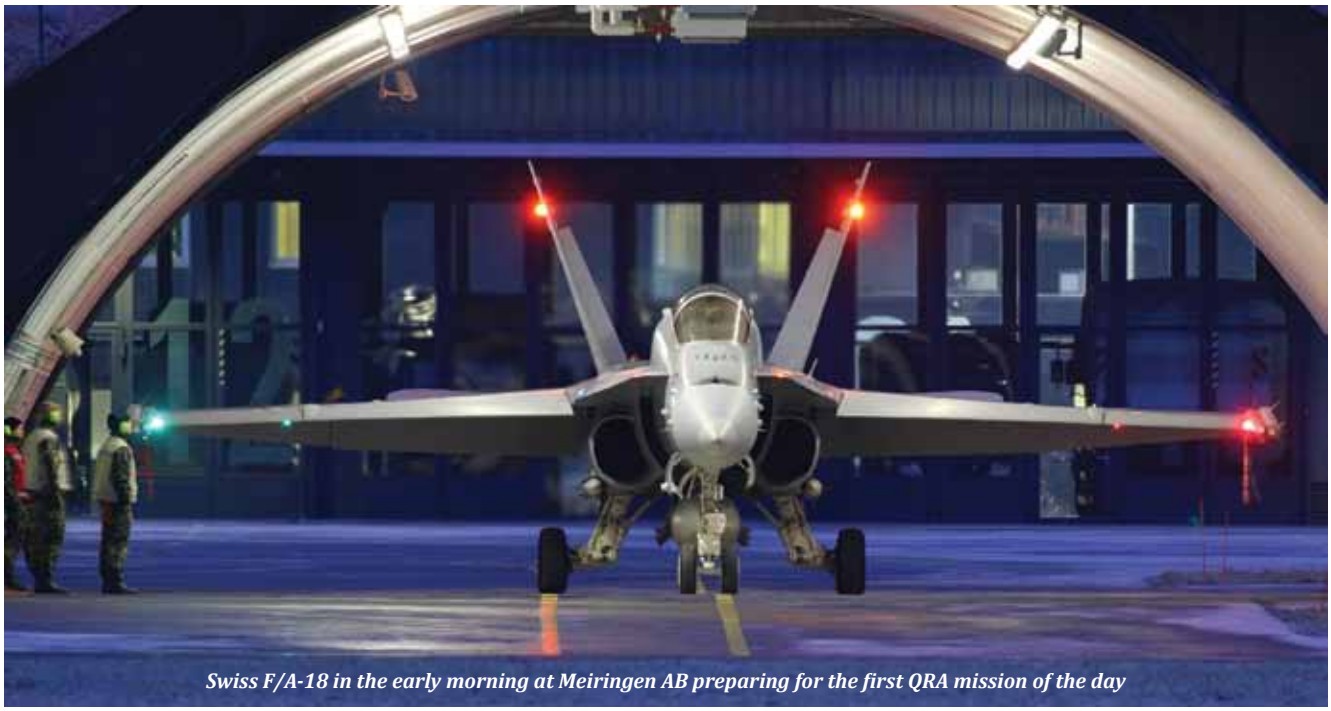
The Saudi Hawks performed every day of the Kuwait Aviation Show 2018

SWISS provide CAPs over the

WORLD ECONOMIC FORUM - 2018

Swiss F/A-18 taking-off from Meiringen AB for another QRA mission

In 2018, during the World Economic Forum (WEF) meetings the Quick Reaction Alert (QRA) was flown from Meiringen AB from 22-27 January 2018 between 0700 until 2200 hours. Every hour, a pair of fully armed Boeing F/A-18s 'Hornets' flew CAP (Combat Air Patrol) missions overhead Davos (Switzerland), where the World Economic Forum (WEF) was held with political and business leaders participating. In order to protect the Davos airspace, the Swiss Air Force in cooperation with the Austrian Air Force, flew CAP missions daily. However, for the Meiringen Airbase in the snowy mountains of the Bern Kanton, this was the last time the QRA missions were flown from here as from 2019 onwards, the WEF-QRAs will be flown from Payerne Airbase; at Payerne Airbase, a 24/7 QRA will be setup to be fully operational in 2020.



Swiss F/A-18 in the early morning at Meiringen AB preparing for the first QRA mission of the day

Swiss F/A-18 with Tiger Tail taxiing after landing at Meiringen AB after a QRA mission

During 2018, WEF-QRAs, only F/A-18s flew CAP missions unlike in previous years where the Northrop F-5s also participated. Owing to the forthcoming retirement of the F-5s, they were removed from active CAP missions.

CAP Operations at Meiringen

During the WEF, the day at Meiringen AB began just like all other days. The runway was swept by the cleaning crew and the runway and taxi tracks were thoroughly inspected. Around half past eight, the first aircraft was launched for the WEF. A yellow mobile control tower was located at head of the runway and one could see which runway direction was in use. The flight direction changed several times a day at Meiringen because the wind was very variable in the mountains close by. At end of the runway, a barrier was set up for emergency landings. At start of the day, two F/A-18s which operated from the QRA shelters at the head of the runway at Meiringen were scrambled. The start-up and taxiing out of the aircraft took place within a maximum of ten minutes. The F/A-18s which flew CAP missions were armed with live weapons underwing which consisted of two AIM-120 AMRAAM radar-guided medium-range missiles at the intake suspension points and two AIM-9 Sidewinder short-range missiles on the wing tips. Under fuselage of the Hornets, was a large fuel tank pointed with the text STBY 121.50, being the frequency at which the air traffic controls and the Swiss emergency service had access to warn aircraft being intercepted.

All fighters took off at Meiringen with full afterburners, because the runway at this airfield was only 2250 metres long. Starting at 7am, QRA missions were flown non-stop upto 10pm every day and at any given time, there were four fighters airborne.

Joris van Boven and Alex van Noye

Swiss F/A-18 landing at Meiringen AB after a QRA mission

German CH-53s at Laupheim

Jeroen van Veenendaal interviews Commanders of Helicopter Transport Wing 64, German Air Force

Evolution

Helicopter Transport Wing 64 was founded in 1966 and when the wing was disbanded in April 1994, personnel and equipment were absorbed by the other air transport wings of the German Air Force. As Helicopter Wing 64 was re-established on 1 October 2010, the helicopters previously assigned to Air Transport Wing 62 and Air Transport Wing 63 formed a new unit. In 2011, the German armed forces went through a series of structural changes. The air force absorbed the former army CH-53 and the helicopter wing staff transferred from Holzdorf to Laupheim.

The wing consisted of three flying squadrons of CH-53s and one flying squadron with the H145M. The 1st and the 2nd CH-53 squadrons are at Laupheim and the 3rd squadron of CH-53 is located at Holzdorf. The main task of the 3rd squadron is for training.

Helicopter Wing 64 is the largest flying wing within the German Armed Forces. The mammoth distance between Laupheim and Holzdorf has made the job of Lt Col Christian Mayer a challenging one. "The distance between Laupheim and Holzdorf is approximately 550kms. The wing is planning to have an extra location, which will be located at Diepholz, lower Saxony by 2019."

CH-53 versions

Within the German Air Force, there are four types of CH-53 helicopters. Lt Col Mayer stated, "We have four models: the G, GS, GE, and GA. The Gs are the oldest, they are the basic model. The GS are the workhorses in the missions abroad because they have the Electronic Warfare systems, upgraded communications systems and they have the external fuel tanks. They still fly with the analog cockpits. The GA model has a digital cockpit but lacks the range and the Electronic Warfare capabilities of the GS version. At the moment, we have only 20 GS helicopters." Owing to the age of the helicopters, maintenance consumes much time which means almost no CH-53GS versions are left in Germany. Because of the external fuel tanks, the total flight endurance is six hours. The CH-53GA is an upgraded CH-53G version with a state-of- the-art cockpit having multifunctional displays and a four-axis autopilot system. It is also equipped with satellite radios and satellite phone.

Experiencing the CH-53

During the conversation with Lt. Col Patrick Schneider on his experience in flying the CH-53 in German service, with close to 1500 flight hours on the CH-53. Schneider always wanted to be a pilot and said, "The basic fundamentals of flying

are the same for every helicopter, but of course, as we move forward, upgraded technology and high-tech systems always give over the edge experience and CH-53 is fully equipped with these attributes. The multi-crew cockpit is also a challenge for the pilot, but is really handy when you have only a part of the work to do." Schneider started as a Bo-105 pilot, "In the Bo-105, a single pilot helicopter, you as the pilot are responsible for everything including radio communication, navigation, technical supervision and taking care of the passengers. Though flying the CH-53 is easy but the real challenge is to be aware of the technical background. In case of an emergency or a malfunction of one of the systems, one needs to be fully familiar with technical background of the helicopter."

Conversion to the CH-53 rig simulator training takes part in Bückeburg at the International Helicopter Training Centre, where there are four full mission flight simulators for the CH-53. The basic flight training takes about a year. From the first theoretic training, to be a fully trained pilot in an air wing, takes about three to five years.

Special Operations

The main task of the CH-53 is for transportation of personnel and material. But special tasks also include supporting Special Forces of the army, the *Kommando Spezialkräfte* (Commando Special Forces, KSK) and the navy. In November 2016, Chief of the Staff of German Armed Forces decided that only the fourth squadron of the helicopter Wing, the H145M squadron, should be one of the Special Operations units in Germany. Lt Col Christian Mayer who recently became wing commander of the helicopter wing 64 explained, "To give SOF the whole spectrum of transport capabilities, they need a helicopter with a size like the H145M, but also like an NH90, Black Hawk or Merlin up to a heavy transport helicopter like the CH-53. But there are always missions where there is a need for the transport capabilities which only the CH-53 can provide."

Personnel recovery

CH-53s of the Air Force also perform personnel recovery. The CH-53 GS has "perfectly" fitted in the spot for personnel recovery and search and rescue requirements. Because of its massive size, it can carry medics as well as an extraction force and apart from that, is also equipped with machine guns for self-defence. The CH-53s are also equipped with an electronic warfare system. Lt. Col. Schneider gave an example of why the CH-53 is ideal for this type of missions, "When you look at Bosnia, it was of utmost importance to get pilots back safely. They were trying to do that with the UH-1 but found out that the UH-1 was not capable of covering such distance. You need an extraction force in there to go outside the helicopter, identify the personnel on the ground embark the casualties and return to operating base."

Fire fighting and flood relief

The CH-53 has the capability to carry fire buckets and sling loads under the helicopter. In the past, German CH-53 helicopters have helped control wildfires in Greece. In 2002, after a colossal flood in the Elbe River, civilians needed to be evacuated and sandbags be transported to cut off areas. "The first day I was flying with my UH-1. I was starting a mission in the morning and flew up for 8-9 hours. We had to rescue people by hoist from roofs of houses. After this first day, the rescue mission coordinator asked me to take over. At that moment, there were about 25 UH-1s and 5 CH-53s flying their missions. About five days later, we established the rescue HQ at Holzdorf, an extraordinary experience, all 20 CH-53 helicopters were flying. It was a logistic super event to see all helicopters returning in the evening. The maintenance personnel did their job and we also flew missions during night time with night vision goggles transporting sandbags to stem the high water," stated Lt. Col. Mayer

Maintenance of the German CH-53s is done by Airbus. The first four helicopters originally built by Sikorsky, were shipped from the USA to Germany and then manufactured and licenced by VFW-Fokker at Speyer in Germany.

The Future

Mayer continued: "The CH-53 is an old workhorse and we are getting to the stage where this venerable helicopter will be retired and replaced by another heavy transport helicopter." The choice is between the CH-47F Chinook and the CH-53K King Stallion. The timeline to start replacing the current CH-53s is set for 2023 and the last CH-53s should be taken out of service by 2030." The CH-47 has a lower price, but the CH-53K will have the capability to carry more personnel and cargo, the decision for the future heavy transport helicopter to be made 2019. It is possible that Helicopter Wing 64 will be split into two wings located in Holzdorf and Laupheim with the introduction of the new helicopter.

"We would like to establish up to two CSAR squadrons to have priority Personnel Recovery covered and also for training comparable with what we have now at Holzdorf: a mixed squadron, a training squadron and an operational squadron. There is a plan to deploy up to four flying squadrons at Laupheim, three with the heavy transport helicopters and one with the H145M and three flying squadrons with heavy transport helicopters at Holzdorf," Mayor opined.

"All personnel here are highly motivated with different backgrounds, which is good as it allows coming up with different and innovative ideas. I think this is an excellent Wing that is prepared for the future."

Text by Jeroen van Veenendaal

Former Dutch F-16s at Volkel AB for Chilean AF

'Project Disposal F-16' of the Dutch Air Force

F-16s have been serving the Dutch Air Force for decades now. Initially, they were deployed for defensive role but later on, they started using them for combat. The Dutch F-16 fleet was drastically reduced at the start of the year 2000 but after the closure of Twen the Air Base in 2004, it was decided for the first time, to sell a part of the F-16 Fighting Falcon fleet. To guide the successful sale of the fighter aircraft, Project Disposal F-16 (*Project Afstoting* F-16, PAF) was created. After evaluation, the Jordanian government decided that they would purchase F-16s to replace their outdated F-5 fleet. In 1996, the first agreement was signed with the US Government for the lease of 16 F-16 Fighting Falcons. These F-16s were of the type F-16A/B ADF (Air Defence Fighter). Delivery of the F-16s took place under the *Peace Falcon I* programme and these aircraft were flown to Jordan in a batch of six and two batches of five aircraft each in December 1997, January and February 1998. During the *Peace Falcon II* programme, another 17 F-16 ADFs from the United States were flown to Jordan in 2003. These aircraft were brought to the MLU (Mid Life Update) standard in Turkey in 2008 and 2009. Now that the country was accustomed to the F-16s MLU standard, it decided to purchase even more second-hand MLU F-16s. Eventually, a deal was concluded with Belgium for the delivery of sixteen ex-Belgian F-16s which the country wanted to sell. These F-16s were flown to Jordan during Operation *Peace Falcon III* in 2009.

It was in 2006 when for the first time Jordan bought F-16s from the Dutch Government. The second series of F-16s (after the first batch of 18 for Chile) was prepared for sale which took place in 2009. In total, the Jordanian government bought six F-16BMs from the Royal Netherlands Air Force. These aircraft left for Jordan on 28July 2009 from Leeuwarden Air Base and the same aircraft were flown to Jordan during Operation *Peace Falcon IV*. After this delivery, the Jordanians also received nine ex-Belgian F-16s in July 2011. These aircraft were delivered from Belgium during Operation *Peace Falcon V*. On 8 April 2011, the Minister of Defence announced budget cuts to the Dutch defence and the Council of Ministers agreed with this major austerity

Former Dutch F-16s at Volkel AB for Jordan AF

round. The withdrawal of the F-16s was already realised on 8 May 2011 and it was decided that out of the nineteen F-16s, the air force would sell fifteen. The buyer who responded for the sale was once again Jordan. The contract for the sale of these fifteen F-16s was signed in the summer of 2013 and their delivery was scheduled in 2014, but due to certain delays, aircraft were delivered only in 2017.

The F-16s were prepared for the ferry to Jordan at Volkel Air Base. Aircraft were equipped with Jordanian markings such as the distinctive Jordanian flag on the tail, the roundel on the fuselage and the registration number on the tail which was shown in Arabic. The test flights of the aircraft were flown under the Dutch flag and therefore, the F-16s were temporarily provided with Dutch markings in the form of stickers that were placed over the Jordanian markings. Once the fighters received approval from the Dutch personnel, the Jordanians made an acceptance flight from Volkel. After this flight, the acceptance was formally signed and the aircraft in question were formally handed over to the Jordanians. During the ferry, the aircraft made tank stops at Aviano in Italy and at Souda-Bay in Greece.

Joris van Boven and Alex van Noye

Air Vice Marshal Cecil Parker recollects...

Then: the HPT-32

Double century at the AFA

On 16 December 2017, No 200 PC (Pilots Course) graduated from the Air Force Academy (AFA) in Hyderabad. To commemorate this landmark figure, the AFA intends to bring out a commemorative publication and has requested inputs from air veterans.

I share a year of birth with the IAF (1932) and, with the passage of time, find myself today as the oldest living ex-commandant of the AFA. My own association with the AFA is threefold: as a flight cadet in 1951-52, as a QFI in 1955-57 and as the commandant in 1983-85.

The genesis of pilot training in our air force can be traced back to World War II (1939-45). It must be recalled that, for its first 15 years (1932-47), the IAF was a limb of the RAF and served Allied needs. It was the advent of the war that necessitated a rapid expansion of pilot training; commissions were offered to Indians in the RIAF/ IAFVR for the first time. 50 regular/ad hoc pilot training courses were conducted in UK/SA and at FTEs (Flying -Training Establishments) set up at some of the near – 200 emergency airfields constructed in undivided India. Our pioneering Indian pilots benefited greatly from the skills and knowledge gained in air operations both in India and overseas. This experience was vital in building up the IAF post Independence.

The process of indigenisation of Indian military air power can be said to have commenced with No. 51 PC which commenced their ground training at ITW (Initial Training Wing) Coimbatore in October 1947 and thereafter at EFTS (Elementary Flying Training School) at Jodhpur. This expanded into No 2 AFA which handled odd-numbered pilot courses while No 1 AFA at Ambala trained even-numbered pilot courses. I joined No 58 PC in early 1951 for our (then) 18–month flying training on Tiger Moth (Basic) and Harvard (Advanced) aircraft. In mid–1951, as part of the policy of relocating all non-operational training down south, No. 1

AFA moved to Begumpet where 30 of us were commissioned on 30 August 1952 by AVM Subroto Mukherjee, then DCAS. Thereafter, as and when needs of the air force expanded, additional FTEs were established at Bidar, Allahabad and flying clubs to augment output. In 1970-71, the present and permanent AFA Hyderabad was set up and all officer–branch training (other than technical training) was centralised under one roof commencing with No. 107 PC.

When I took over as commandant in 1983, our air force faced a major training problem. The HT-2 basic flying trainer had been phased out and the promised HPT-32 was still two years away. We had no choice but to carry out the IAF's first ever direct basic pilot training on jets (Kirans) of which we had no experience. In fact, in the 1960s, the RAF had experimented with direct basic jet flying training on Jet Provost aircraft but abandoned it as being ruinously expensive with a wastage rate of over 40%. To maintain strict flying standards, our own wastage rates for Nos. 132 to 134 PCs was a shade over 33% but the affected trainees had options for navigator training or the other two services if ex-NDA. The first prototype HPT-32 arrived at AFA on completion of my tenure in 1985.

It is now 32 years since I left the IAF but, being co-located with the AFA in retirement, I never fail to receive an invitation to the bi-annual GP (Graduation Parade) from the Academy which now conducts basic pilot training on Swiss Pilatus PC 7 trainers. In my 86th year, it is not always convenient to attend but when I do, I am happy to meet commandants who were pupil pilots/new flying instructors during my time and whose efforts collectively contribute to the double century at the AFA.

Now: the Pilatus PC-7 Mk. II of the IAF (photo: Angad Singh)

25 Years Back

From Vayu Aerospace Review, Issue II/1993

Case for MiG-21 replacement

The MiG-21 in its different variants forms the largest (and now the oldest component) of the IAF's inventory. While the MiG-27 and Jaguar are still being produced by HAL, the MiG-29s and Mirage 2000s are modern aircraft and can hold their own for the next ten years. It is the MiG-21 fleet that needs to be considered for immediate modernisation. If the MiG-21 programme can be tackled successfully, the next logical step would be to take on update projects for the MiG-27s and the Jaguars. The time factor will impose severe limitations on the type of updatement for the MiG-21 fleet, inevitable since much time has already been lost.

New airlines of India

Following the successful launch of private airlines and their operation on domestic trunk routes in India, two more 'majors' have appeared in recent weeks and will be flying Boeing 737s on scheduled services. The first amongst equals is *East-West Airlines* which, with a fleet of ten Boeing 737s, have achieved remarkable results in the first year of operations, followed by *CityLink Airways*, with Super One-Elevens and Fokker Friendships. *Damania Airways* have recently started services from Bombay to Goa and Bangalore while the newest is *Modiluft*, a new airline in technical partnership with Lufthansa.

Second ALH prototype

Second prototype of the Advanced Light Helicopter (ALH) was test flown at Bangalore on 8 April 1993, in the presence of COAS General SF Rodrigues and the SA to RM Dr APJ Abdul Kalam. Once plans are approved, the first production ALH would roll out from the assembly line in 18 months from the "go-ahead".

LCA roll out "in 1996"

On 1 April 1993, the Parliamentary Consultative Committee on Defence was informed on developmental status of the Light Combat Aircraft (LCA). Dr Abdul Kalam, SA to RM informed the Committee that the "first roll out" of the aircraft was expected in June 1996, "about six months ahead of schedule". However, the SA admitted, the LCA programme could be severely hit if restrictions were imposed on the funding.

DRDO missile developments

The DRDO continue to make progress in various missile developmental programmes, particularly the *Akash* surface-to-air missile, with a capability of intercepting multiple targets. The *Prithvi* tactical surface-to-surface missile is currently undergoing user trails and "good progress" has been made. The next launch of the *Agni* IRBM technology demonstrator will be in 1993, and so far two tests of the 1500-2000 km. range missile have been carried out.

First production Gripen flown

On 4 March JAS39 Gripen No.102 made its first flight from the Saab airfield in Linköping, flown by Saab test pilot Lars Redestrom. Batch one consists of 30 aircraft for delivery to the *Flygvapnet* between 1993 and 1996. Until the fall of 1995, when training of the first Gripen squadron starts at the F7 Wing in Satenas, the aircraft will be used for tactical clearance, instructor training and so forth.

Singapore requests F-16C/Ds

The Singapore Government is requesting the United States for supply of F-16C/D fighters. The Singapore air arm already operates eight F-16As and four F-16Bs and is due to receive another 11 A/Bs through the FMS route by 1996. Other ASEAN air arms that operate the F-16 are Indonesia and Thailand (both with the A/B) while South Korea has the more advanced C/Ds.

RAF/RN Civilian Flying Training

In the first award of its kind by the British Ministry of Defence to a commercial organisation, a contract to train student pilots for the RAF and Royal Navy has been won by Hunting Aircraft. The contract is for an initial five years with an option for a further five and potentially worth in excess of £20 million. It covers operation of a Joint Elementary Flying Training Squadron at RAF Topcliffe where student pilots will receive basic flying instruction on a fleet of British-manufactured Slingsby T-67M Firefly Mk.2s.

Pucaras for Sri Lanka

In their continuing effort to combat the LTTE in northern and eastern Sri Lanka, the Sri Lanka Air Force have diversified the procurement sources for new combat aircraft and weapons. The latest order is for four IA58 Pucara twin-turboprop counter-insurgency aircraft from Argentina. These will supplement the SLAF's half-dozen SiaiMarchetti SF-280 Warriors in COIN operations and follows the unsuccessful negotiations for armed Embraer EMB312 Tucanos and Pilatus PC-7s.

Modernisation of Palam and Santa Cruz airports

The Raytheon Company have formalised a $ 106 million order for the supply of equipment for modernisation of Palam and Santa Cruz airports. As per the contract, Raytheon will install state-of-the-art short-range and long-range surveillance radars as part of the Delhi and Bombay airport modernisation plans, aimed at facilitating the handling of upto 40 aircraft landings per hour (as against 10 at present).

Object Identified !

Now Rest in Peace !

In the *Tale Spin* of *Vayu's* Issue VI/2018, the tantalising photograph (re-produced) evoked the interest of multiple readers including that of our own venerable Prodyut Das who writes that "this was one of the most challenging spotter's quiz I have faced so far".

He continues: "My guess is that this is the tip tank of a Canberra B(I)58 photographed by the navigator whilst flying over the Taj sometime between 1966-1980 around 12 o'clock in the noon in the month of May-June. How the Taj Mahal came into the picture I am sure I don't know !

To explain: Turning over my mind and rejecting spinner of Avro 748/Antonov An-32/ Vampire NF.10, what twigged me on was the small projection on the nose of the object. The Canberra tip tank had such a projections, possibly an axial tie member to which the suspension lugs were somehow attached. Incidentally the tip tank was supposed to increase the theoretical aspect ratio by acting as a endplate-so typically Petter!

Canberra B(I) 58 because the navigator had a small window on the port side which matches the angle of the shot.In the Canberra B.2/ B.10 the window was so far back the Avon would get in the way!

1966-1980? Prior to 1965 the tank would have been painted silver. 1980? I guess from the sparsity of the habitat around the Taj.

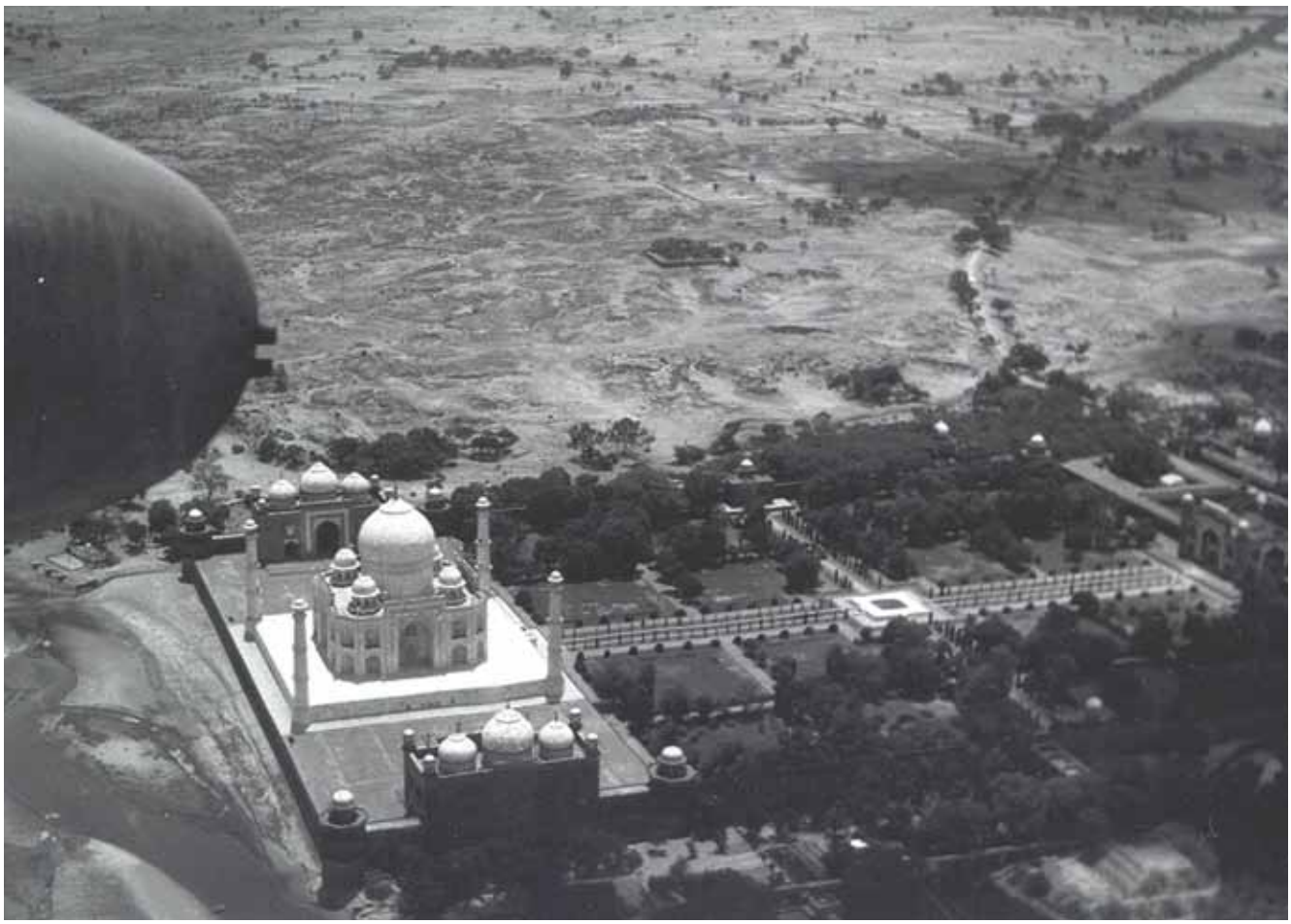
12 o'clock May-June from the fact of the shadows: the sun is almost vertical over the Taj as it would be in June and no damned tourist–the whole concourse is empty as a church's contribution plate.

Elementary my dear Holmes! (even that dumb Watson got it!) Great fun! Thanks!"

Thanks, Prodyut and one and all but perhaps this has not really been fair to *Vayu's* myriad of readers and air enthusiasts in India and the world. Thus to end the suspense, this is it:

The image is really of an USAAF B-25 Mitchell, aft end of starboard nacelle pictured over the Taj, photo taken from the starboard waist gun in 1944. The photographer recorded: "Just after take-off from Agra air base, the flight pattern goes over the Taj. This view is toward the southeast from a US Army Air Force B-25 that was taking us back to Calcutta after the Agra visit."

This image is part of a rich array of photographs taken in Calcutta during 1943-44 by Glenn S Hensley, a professional photographer participating in the surveillance of the Japanese in Burma for the US Army. During his off-duty time Hensley used his ethnographer's eye to capture daily life in a number of locations around India. The majority of the images are from Calcutta and its environs. Other locations in this collection are Madras, Kharagpur, Agra, and Burma. The photographs and notes were prepared by Hensley for his wife to use in teaching world history courses in Missouri during World War II.



Tale Spin

Double Dealing

The King of Jordan visited India in late February 2018 and received the now familiar hug from India's Prime Minister on arrival at Palam. A slew of agreements were later signed, including those on health, culture and customs but the one that raised eyebrows was on "defence cooperation". With India ? While there was no elaboration, Jordan certainly has long established defence ties with India's western neighbour which go back half a century when Royal Jordanian Air Force F-104s were 'lent' to the PAF and took part in operations, some of them being shot down by IAF MiG-21s. More lately, ex-Jordanian F-16s have been procured by the PAF and are now part of their order-of-battle.

Now, that's a big deal !

Made only in India

The dream of a commercial pilot to set up an aircraft manufacturing company is set to take wings with the Maharashtra government signing a pact to build aircraft in Palghar district. Thus reported PTI during the 'Magnetic Maharashtra,' global investors summit in February 2018. The enthusiast, a commercial pilot who had constructed a 6-seater aeroplane mockup on his rooftop in suburban Mumbai, now has plans to build a 19-seater "and three more similar planes", and then construct "1300 planes after that." However, professionals are querying as to how has the Maharashtra Government fallen for this when the nation's massive aerospace industry has barely produced some one hundred 19-seaters at Chakeri since the 1980s. *(For more, read, Anjuli Bhargava's editorial, 'Made only in India' in the Business Standard*).

Swadeshi moon shot

India's space programme is envy of the world, not the least because of the frugality with which the ISRO have achieved spectacular results at a fraction of what it would cost the western world. ISRO's Chairman has explained that the forthcoming 'Chandrayaan-2' mission to the Moon will cost less than it took Hollywood to produce their sci-fi movie 'Interstellar' or even 'Gravity' that earned a number of academy awards. 'Chandrayaan-2' involves a soft-landing on the moon's surface with its rover thereafter 'walking' the surface as part of ISRO's scientific mission.

Awards on earth for out-of-the-world achievements !

Car Struck

(Image from the internet)

Every man is a boy at heart when it comes to steam engines, aeroplanes and automobiles. Multi-billionaire Elon Musk has followed his heart when he underwrote the launch of his Tesla Roadster as payload on the US SpaceX's Falcon Heavy launch vehicle. Apart from this being unique in the space race, his car is now orbiting in space and although seen by some as 'space junk', the mannequin in the driver's seat is wearing the SpaceX spacesuit, the radio playing in endless loop and the glove compartment holding a copy of 'The Hitchhiker's Guide To The Galaxy'.

Honk, honk !

Afterburner

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