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Cover : IAF C-17 flanked by Su-30MKIs at Republic Day 2019 fly past
Photo courtesy : Major VK Singh, Photo Division, DPR Ministry of Defence

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38 "Speeding up LCA deliveries"



In an interview with the Vayu Aerospace Review, R Madhavan, CMD HAL has stated that the PSU has made preparations for production of LCAs (FOC-standard) after receiving the SOP. Meanwhile, HAL has produced 12 LCA Mk.I IOC standard fighters so far with the balance to be delivered within the current FY. The CMD also comments on other HAL programmes including the LCH, LUH, Ka-226T, IMRH and the futuristic IRTA.

46 In Defence of HAL



"HAL being removed from the IAF's Rafale acquisition programme at the last minute – and for reasons best known to the authorities – is astonishing to say the least" opines GS Jamadagni, former GM (Quality Assurance) Hindustan Aeronautics Ltd, who retired from HAL after 40 years of service. He urges that HAL should be considered for licence manufacture of the balance Rafales required by the IAF, should this decision be taken.

50 The Fighter for India's Future



Three well known commentators have given their views – and recommendations – on how to manage the "fighter gap" which the Indian Air Force is increasingly faced with. Mohan Guruswamy goes back to the beginning, to the original MMRCA tender for 126 aircraft which was scrapped, taking the IAF back to

square one. Ajai Shukla worries about an inability within the military and the MoD to anticipate equipment requirements and identify, evaluate, budget for and procure equipment to fill the gaps. Ravi Rikhye instead plumbs for a 50-combat squadron IAF to really get the odds right!

59 'God of the Seas'



The Indian Navy's long range maritime reconnaissance antisubmarine warfare (LRMRASW) force operates arguably the world's most advanced aircraft, the Boeing P-8I, the Indian variant of the US Navy's Poseidon, named after the Greek *God of the Seas*. Featuring various Indian-origin systems, the P-8Is of INAS 312 have truly given the Indian Navy's air arm an international stature.

65 The ShinMaywa US-2i and Indian Ocean Strategy



Bharat Karnad's new book *Staggering Forward*, an analysis of India's evolving social political and economic milieu, under Prime Minister Narendra Modi, is a critical perspective, both argumentative and thought provoking. The chapter on the manner in which bureaucratic turpitude has blocked the strategically important ShinMaywa US-2i amphibious aircraft for the Indian Navy is reproduced for readers of this Journal.

71 UAVs in India



The new dimension of unmanned aerial vehicles (UAVs) have been in the news for some time, especially with the US reportedly offering India an armed version of the Guardian drone.

Meanwhile, India's first private sector UAV manufacturing facility is being set up in Hyderabad, even as five UAV types are operated by the Indian Armed Forces, including those indigenously developed.

There are currently three UAV Squadrons operational with the Indian Navy, which are majorly contributing to Maritime Domain Awareness (MDA) in the IN's area of responsibility.

83 Triumph! The Game-changing S-400

Air Chief Marshal BS Dhanoa, CAS of the IAF has described the S-400 as "booster shot in the Indian Air Force's arm. No country is facing the kind of grave threat that India is confronted with. Intentions of our adversaries could change overnight. We need to match force levels of our adversaries." The S-400 is also described as a 'Game Changer' by India's adversary as well.

87 Aero India 2019 Section

With its logo inspired by the Tejas Light Combat Aircraft, Aero India 2019's tagline is *The Runway to a Billion Opportunities* with several events planned during the Show. This 12th Edition of the Aero India Show is, as before, being held at Air Force Station Yelahanka, 20-24 February 2019. As has been from the very first such event held at this venue north of Bangalore, the *Vayu Aerospace Review* is participating at the event and also is official media partner, publishing show dailies for the first three days of the event.

Also: "Gripen E is on Track"; India-Israel Defence Cooperation; the Tupolev Tu-160M.2; the MICA and METEOR for Rafale; Thales connected sensors for Rafale F4; Airbus in 2018; Boeing in 2018; CRUZEX 2018; USAF European Special Operations; Turkish CH-47F Chinooks; Hawgsmoke 2018; Readers Respond.

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Reform Defence Budgeting

Recent reports that Hindustan Aeronautics Ltd was forced to take a bank loan of Rs 781 crore to pay its employees' December salaries reflect the government's strange approach to defence budgeting and spending. The government currently owes HAL Rs 15,700 crore for products and services already delivered, of which Rs 7,000 crore is outstanding from the preceding year. With more bills likely to arise over the coming three months and no money to pay them, outstanding dues will swell to Rs 20,000 crore by the end of the financial year. HAL has asked the defence ministry to make some payments so that ongoing development projects, manufacture and the maintenance of the Indian Air Force's aircraft fleet are not severely impacted. But, given the government's financial pressure with an election looming, HAL does not expect relief in the revised budget estimates.

Nor is HAL the only defence public sector undertaking (DPSU) that finds itself in these straits. It is understood the military also owes Bharat Electronics Ltd thousands of crores in unpaid bills. It was one thing to and defer payments when HAL and BEL were wholly owned defence ministry enterprises. But, after their part-disinvestment, there are also interests of private shareholders, which will be adversely affected by non-payment of bills.

Things have come to this pass for a simple reason: the government has not allocated the capital budget needed for payments that were falling due this year. The navy projected to the defence ministry a capital requirement of Rs 30,358 crore, but was allocated only 19,083 crore, a shortfall of 37 per cent. The army asked for Rs 37,122 crore, but was given Rs 21,338 crore, short by 43 per cent. The IAF, with instalments due for the Rafale fighter and Apache and Chinook helicopters, asked for a whopping Rs 72,482 crore but was allocated Rs 33,100 crore, short by 54 per cent. Further, of the amount allocated for capital expenditure, about 90 per cent was pre-committed towards instalments on previous years' purchases. It was almost inevitable that the military would be left short of money.

Framing any budget is a competitive exercise in resource allocation. It is for the union cabinet to decide how much it can spare for defence from pressing competitive requirements like education and healthcare. This year, 16.6 per cent of central government expenditure went to defence. Next, this amount must be divided between the three services. Overseeing realistic budgeting is one task of the Defence Planning Committee (DPC), established in April with fanfare under the National Security Advisor. It is not clear how the DPC could fail to anticipate the current crisis in HAL.

Beyond allocation, there are other issues as well. In several previous years, including twice in the first three years of this government, thousands of crores of military capital budget allocation lapsed because it could not be spent in time. This needs to change, given the feast-or-famine nature of procurement spending, where one year could see little expenditure because of hitches in finalising some contracts, while the subsequent year sees a glut of contracts, with multiple payments falling due. Successive governments have promised to institute a "roll-on capital fund" to insulate against the lumpy nature of defence capital expenditure and smoothen the cash flows, but none has done so.

From *Business Standard*

Think Beyond PSUs

As the war of words continues over the Rafale jet fighter deal, Congress president Rahul Gandhi has now accused government of weakening defence PSU Hindustan Aeronautics Limited (HAL) to benefit Reliance Defence. To bolster this line of argument, Congress has pointed to recent reports that HAL for the first time had to borrow close to Rs 1,000 crore to pay salaries to its employees.

To be sure there are several valid questions that Congress has raised regarding the Rafale deal. These include why the original contract of 126 aircraft was changed to just 36 aircraft and why Reliance Defence – a recently incorporated company with no prior successes in defence manufacturing – was reported to have been made a major offsets beneficiary. But for opposition to bat for HAL and defence PSUs in general is a stretch. The track record of these government utilities is poor. Take for example the development trajectory of the indigenous Light Combat Aircraft Tejas. The Aeronautical Development Agency and HAL took more than three decades to produce an aircraft that met standards and has only now reached the induction phase. In contrast, China's defence PSUs have proved to be far more efficient and in recent years have been churning out advanced weapons platforms. A case in point is China's indigenous fifth-generation fighter J-20 developed by Chengdu Aerospace Corporation. Indian defence PSUs are nowhere near such capability, which is why India continues to be one of the largest defence importers in the world. This in turn puts further strain on the defence budget and comes in the way of India's defence preparedness.

The remedy lies in bringing more private companies into defence. Unlike defence PSUs, private players will be nimbler as they have a better work culture and won't be bogged down by India's notorious bureaucratic style of functioning. In fact, the government's aim ought to be to create an American-style military industrial complex comprising a web of defence research universities, domain experts and private companies that can quickly assess the country's strategic needs and translate this into modernisation and weapons platform development. Of course, private players need to be vetted properly and should not be trusted with big contracts from the word go. What's needed is a plan to build an indigenous private defence complex that will be vibrant within the next decade. That's what government and opposition should be discussing, rather than playing politics with defence.

From *The Times of India*

A Giant Leap

India has taken a giant leap forward in its space ambitions by announcing a Rs 10,000-crore programme to put three astronauts in space in an independent manned mission by 2022. The allure of space hasn't just been a medium for man's restless instinct for exploration. Space missions have done wonders in producing major scientific discoveries, particularly the realisation of how fragile our planet really is, its relative peanut-sized existence in the vastness of the universe. For a country of India's economic size, a little over \$1.40 billion is small enough to spend

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for this purpose. There's a far larger meaning in sending more Indians into space, not to enter a space race so much as to set off independent thinking to harnessing science for the national good. It's worth paying this price to develop both national pride and indigenous technological capabilities.

Manned missions are fundamentally risky, though we have come a long way in the 57 years since Russia and the United States set off on the space race, with the former ahead in putting Yuri Gagarin in orbit first and the US responding with manned flights to orbit the moon and landing Neil Armstrong and Edwin Aldrin on the lunar surface in 1969. Isro has gained global status as an efficient commercial launcher of satellites in the modern era, and doing it at a fraction of the cost of its key international competitors. In *Gaganyaan*, it will take on the challenge of ensuring the safe return of the those who will be cherry-picked by the Indian Air Force, from among whom the three luckiest ones will get to see our planet from space again — after Rakesh Sharma used the famous line “*Saare Jahan se Achcha*” in describing sighting India from way up there in 1984.

India will become only the fourth nation after Russia, the US and China to launch its own spacecraft while displaying mastery over rocketry and spacecraft re-entry. Exciting as the thought is, the fact to remember is that unmanned missions do more for exploring science than manned flights, including those on the shuttle to the International Space Station. Man is still light years away from colonising Mars, however much tech titans of today may nurse ambitions about furthering the cause of living in space and trying to preserve intelligent life. The far greater challenge will, of course, lie in saving the Earth from mankind's disastrous overuse of finite resources.

From *The Asian Age*

Number in the Sky

Can a cricket team be expected to win if it plays seven players instead of eleven? The Indian Air Force (IAF) faces a similar question—the number of its fighter squadrons has fallen to 30, and in another couple of years, it will be down to 26, an alarmingly low figure. In comparison, for instance, the Pakistan Air Force will have 25 squadrons of fighter aircraft by 2021 while China can potentially bring up to 42 squadrons upon India in case of a conflict. That this will happen if everything goes according to plan is an indicator of the crisis faced by the IAF, which is authorised 42 squadrons of fighter aircraft, the minimum needed to meet a two-front threat from China and Pakistan.

The IAF last had the full complement of 42 squadrons 17 years ago and the numbers have steadily fallen since. While many Soviet-era aircraft have been phased out, their modern replacements have not found their way into service. There are two major reasons for this: One, the indigenously developed and produced Light Combat Aircraft (LCA), Tejas, has been delayed by almost a decade; and, two, the plans for induction of imported fighter aircraft have not fructified, the major culprit being the 2007 tender for 126 Rafale aircraft in the UPA government which was cancelled by the BJP government in 2015.

The solutions are evident. The indigenously developed and produced LCA Tejas has to provide the bulk of the numbers – the IAF is committed to get six squadrons from HAL, four of them of Tejas Mark1A version. While HAL hopes to provide 18 aircraft per year, it has not been able to ramp up the capacity to even half that number so far. It is incumbent upon the government to ensure that the public sector HAL delivers the aircraft of appropriate quality and in adequate numbers. Till then, however, the only immediate option is to import more fighter aircraft. The IAF will get two squadrons of Rafale by 2023, and it has plans for six squadrons of another foreign fighter within a decade. But the latter is still a proposal on the planning board and a long way away from seeing the light of day. Considering this situation, the IAF is looking at a scenario where it will have to soon undertake emergency imports — perhaps at an exorbitant cost — to make up the numbers. It is a situation of the government's own making but if the lessons are learnt to avoid a repetition of these mistakes in the future, the impending crisis would have served its purpose.

From *The Indian Express*

China's Plan for the Indian Ocean

The Beijing state media has reported that China has begun constructing one of its advanced warships for export to Pakistan. One of China's most advanced guided missile frigates, the ship will be equipped with anti-ship, anti-submarine and air-defence capabilities. The *China Daily* report goes on to say that the ship will not just strengthen Pakistan Navy's capabilities but also help in maintaining the “balance of power” in the Indian Ocean region.

It is increasingly becoming clear that the frequency of Indian and Chinese navies brushing past each other in the Indian Ocean is set to rise. The contest over small atoll nations like the Maldives and Seychelles is part of this bigger story. If China's presence in Gwadar was already a worry, advanced frigates like the one under construction can throw a spanner in Indian plans to block Pakistan's maritime supply routes in case of a conflict across the line of control (LoC). This also comes on the heels of a detailed report by The New York Times on the militarisation of the China-Pakistan Economic Corridor (CPEC). The confidential CPEC plan involves, the Times revealed, cooperation on building military jets and other lethal weapons. Pakistan is also the only country that has been granted access to the military services of China's Beidou satellite navigation system. The revelations essentially unmasked China's real goals behind CPEC and, more broadly, its belt and road initiative (BRI).

China has always seen Pakistan as a balancer against India. Beijing has been generous with economic aid and military supplies (both conventional and nuclear) to Pakistan. Now as China's interest in the Indian Ocean is increasing, it sees Pakistani Navy as a helpful partner in tying down Indian resources in the Arabian sea — far away from the choke points in the eastern Indian Ocean region. India would do well to develop Andaman and Nicobar Islands as the strategic hub for its Indo-Pacific strategy. New Delhi has neglected the strategic potential of these islands for far too long. The domestic debates on balancing China often miss one crucial point: the latter has had no qualms in using Pakistan to balance India.

From *The Hindustan Times*

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We need to take a balanced view of Chinese President Xi Jinping's 'order' to the People's Liberation Army (PLA) to continue strengthening its combat capabilities and be always ready for battle. This is the kind of message that leaders all over the world are expected to give to their militaries, so it should not be taken to mean that the PLA is about to embark on a new wave of aggressive behaviour.

In his speech, Xi did emphasise that China faced unprecedented risks and challenges and so China's armed forces needed deeper "preparation for war and combat" to ensure an effective and efficient response "in times of emergency".

Though probably aimed elsewhere, there is a message there for the Indian military, which confronts China across a 4,000-km disputed border and is learning to cope with the PLA Navy movements across the Indian Ocean. Since the Doklam episode in 2017, the land border has been more active than ever; in the past year, there have been reports of the PLA upgrading its posture across the length.

Xi's remarks came two days after he raised the temperature on Taiwan by calling for 'peaceful reunification', while asserting that his government made "no promise to renounce the use of force" in relation to the issue. The 'Taiwan contingency' remains the premier focus of the PLA's deployments, followed by the South China Sea. On both accounts, it must contend with the fact that its premier adversary is the US, by far the much stronger power in the western Pacific.

Overall, the message seems to be that the PLA needs to double down on reform and restructuring that began in 2013. This is more so when Beijing is confronting an unprecedented political challenge from the US, which has now categorically designated China as a strategic challenger. Technology has emerged as a major area of this rivalry and the US is convinced that China has been systematically working to acquire western technology through acquisitions, forced transfers and thefts to gain strategic advantage.

The threat of an all-out war between, say, the US and China, or India and China is remote. But what is real is the jockeying for advantage in which both sides worry that emerging technologies could provide the other with some as yet



unknown battle-winning edge. However, as of now, the PLA is still in the midst of its restructuring and reform process that has led to considerable disruption through its reduction of numbers, as well as reorganisation into theatre commands.

For obvious reasons, the PLA is emphasising the reform of military education and training to accompany the acquisition of new equipment. The PLA's joint operations research and experimentation has revealed weakness in its military training institutes, joint proficiency of its officer cadre, joint training, doctrine and tactics and logistics, and command structures, all of which are being addressed in the current reform.

The key thrust of the reform process has been jointness. Over the years, the PLA has been moving from 'coordinated joint operations' to 'integrated joint operations'. It took a major step under the 2013 reforms, with the creation of theatre commands and the establishment of joint headquarters to create optimal joint operational capability.

The foundation of integrated joint operations lies in developing an effective system of systems capability. This, in essence, is the fusing of various components-weapons, equipment, units beyond their individual capacity to provide synergy. At the heart of this lies the development of integrated command, control, communications, computer intelligence, surveillance and reconnaissance (C4ISR) structure which will not just link the systems and forces, but also enhance their joint operational capacity.

The PLA's Strategic Support Force (PLASSF), set up on 31 December 2015, has sought to integrate capabilities in space, cyberspace and the electro-magnetic

spectrum into the PLA's combat arms. Its goal is to meet the PLA's military strategic guidelines of being ready to fight and win 'informationised' wars.

The SSF has been involved since 2016 in the PLA's key annual *Stride* exercises. But, say observers, it is still some way from developing its fifth generation of operational regulations (the previous set was issued in 1999) that will guide its operations in space and the cyber domains.

The shift of the PLA from being a continental force to one capable of integrated joint operations within China's borders and without could easily span a generation. Clearly, at present their capabilities remain far behind those of advanced countries like the US and Japan. In that sense, Xi's injunctions and those of the PLA Daily are by way of being exhortations to do better. Under Xi, the deadlines have been advanced. In the 19th Party Congress, Xi announced that modernisation of the PLA would be complete by 2035. Earlier, the third stage of the plan was for it to be completed by 2049. However as Xi himself noted, the PLA is not likely to become a world-class military till the mid-century. The US will remain the dominant global military power for the foreseeable future and can look after itself.

The big questions are for India, which has failed to push through any significant reform and reorganisation in its defence system. The political leadership seems to be uninterested in this. Meanwhile, its component force (Army, Navy, Air Force) leaders periodically boast about capabilities they don't have and so, we are simply not ready for the new generation of warfare. 🦋

Dr Manoj Joshi

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Sorting out the LAC



India's National Security Advisor, Ajit Doval and Chinese State Councillor and Foreign Minister Wang Yi, met for the 21st round of Special Representatives' (SR) talks at Dujiangyan near Chengdu in southwestern Sichuan province on 24 November 2018. In discussions that have been described as "constructive and forward looking", the two SRs resolved to "intensify" their efforts to achieve a "fair, reasonable and mutually acceptable" solution to the long-standing territorial and boundary dispute at an early date.

The truth is that resolution of the dispute is stuck in a groove entirely due to Chinese intransigence. In fact, despite prolonged negotiations, so far it has not been possible to accept a common alignment of the Line of Actual Control (LAC) and delineate it on the ground and on military maps. The two sides have failed to even exchange maps showing their perception of the LAC except in the least contentious Central Sector, that is, along the Uttarakhand and Himachal Pradesh borders with Tibet.

Stand-offs on the LAC

Much different from the disputed 4,056 km-long international boundary, the LAC implies *de facto* military control over respective areas and came into use after the 1962 border war. There are frequent incidents of transgression of the LAC both in Ladakh and Arunachal Pradesh. Both

sides habitually send patrols up to the point at which the LAC runs in their perception. These patrols leave "tell-tale" signs behind in the form of *burjis* (piles of stones), biscuit and cigarette packets and other similar markers in a sort of primitive ritual to lay stake to territory and assert their claim.

While no violent incident has taken place in the recent past, there have been many occasions when Indian and Chinese patrols have met face-to-face. Such face-offs have an element of tension built into them and, despite the best of military training, the possibility of a shooting match can never be ruled out. An armed clash that stretches

over several days and in which there are heavy casualties can lead to a larger border incident that may not remain localised. The un-delineated LAC is a destabilising factor as major incidents such as the Nathu La clash of 1967 and the Wang Dung stand-off of 1986 can recur.

Unimplemented Agreements

The two sides have signed a number of agreements and agreed on many confidence building measures to maintain peace on tranquility of the border. These include the Agreement on *Maintaining Peace and Tranquillity Along the Line of Actual Control*

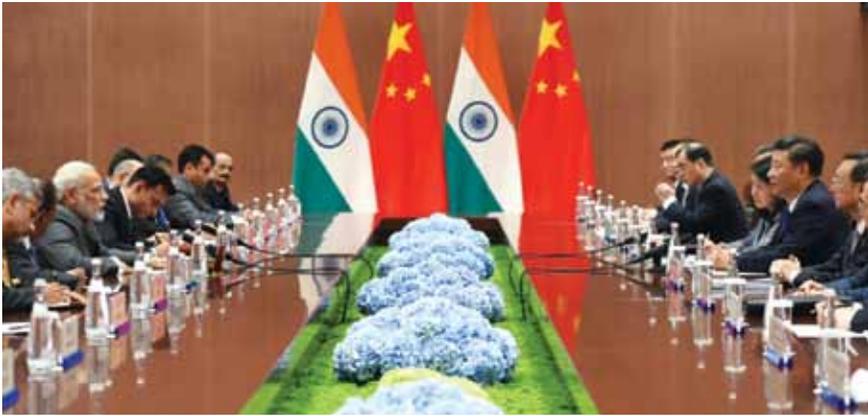




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in the India-China Border Areas, 7, September 1993; the *Agreement on Confidence Building Measures (CBMs) in the Military Field along the Line of Actual Control in the India-China Border Areas*, November 29, 1996; the *Agreement on Political Parameters and Guiding Principles for the Settlement of the India-China Boundary Question*, April 11, 2005 the *Protocol on Modalities for the Implementation of Confidence Building Measures in the Military Field Along the Line of Actual Control in India-China Border Areas*, April 11, 2005 and the *Agreement on Establishment of a Working Mechanism for Consultation and Coordination on India-China Border Affairs*, January 17, 2012.

The most recent such agreement is the *Border Defence Cooperation Agreement (BDCA)*, which was signed in October 2013. The BDCA commits the two sides to “periodic meetings” of military and civilian officers and to exchange information – including information about military exercises, aircraft movements, demolition operations and unmarked mines. It emphasises that border patrols must not “tail” each other and recommends that the two sides “may consider” establishing a hot-line between military headquarters in both countries.

Close examination of the BDCA reveals that it falls substantially short of removing the anomalies and impracticalities of similar agreements that have not worked well in the past. Unsurprisingly, major transgressions of the LAC by the PLA have continued unabated. One year after the BDCA was signed, the PLA violated the LAC at Demchok and Chumar in Ladakh. The tense, 73-day long stand-off at the Doklam plateau south of the Chumbi Valley, close to the India-Bhutan-Tibet tri-junction, in the summer of 2017 was defused with great

difficulty. The political leadership had to intervene at the highest level to get the two armies to disengage at Doklam.

Lofty Rhetoric

According to the Indian statement issued after the 21st round of border talks, the two sides “underlined the importance of approaching the boundary question from the strategic perspective of India-China relations and agreed that an early settlement of the boundary question serves the fundamental interests of both countries.” The Chinese statement released by the Chinese approvingly quoted the Indian NSA as having said that “a mutually acceptable solution to the boundary issue will send a positive signal to the outside world that the two ancient civilisations of India and China have the wisdom and

capability to peacefully resolve problems through dialogue and consultation”.

Similar statements have been made after various summit meetings between the Chinese president and the Indian prime minister. At the Wuhan summit in April 2018, the first after the Doklam stand-off, the two leaders “underscored the importance of maintaining peace and tranquillity in all areas of the India-China border region...” To this end, they... “directed their militaries to earnestly implement various confidence building measures agreed upon between the two sides”. Notably, the lofty rhetoric has not translated into significant forward movement towards dispute resolution.

It is in India’s interest to seek early resolution of the territorial dispute with China as India will be left with only one military adversary to contend with. Clearly, that does not suit the Chinese game plan as it will distort the current military equation between India and Pakistan. The Chinese wish to leave the dispute “for future generations to resolve”, as Deng Xiao Ping had famously told Rajiv Gandhi in 1988. China’s obvious negotiating strategy is to resolve the territorial dispute with India only when the Chinese are in a much stronger position in terms of comprehensive national strength so that they can dictate terms. Hence, though the probability of another India-China border war is low, it cannot ever be ruled out. 🇮🇳

Brig Gurmeet Kanwal (Retd)





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“Alive to emerging threats in the Indo-Pacific” : IAF Chief



Chief of the Air Staff, Air Chief Marshal BS Dhanoa has reiterated that the Indian Air Force is “very much alive” to emerging threats that could arise in the Indo-Pacific region, and asserted that his force was prepared to deal with any challenge to protect India’s national interests. The CAS also said there is cause for concern over the rate of modernisation and induction of new equipment in India’s neighbourhood, even as India faces challenges emanating from “unresolved territorial disputes” and “sponsored” non-state and transnational actors. The CAS also made an indirect reference to China’s rapid modernisation of its air force and also about the infrastructural development China has carried out in the Tibet Autonomous Region (TAR) bordering India.

He said that the IAF was adopting a holistic approach in harnessing all available resources at its disposal to deal with various security challenges “in a collaborative and cohesive manner.”

IAF to receive balance Su-30MKIs by 2021

During the recent Supreme Court hearing on the Rafale matter, and in response to questions of the Chief Justice of India, senior IAF officers informed the apex court that the Sukhoi Su-30MKI is the “latest combat aircraft to be inducted in India” and production continues by HAL at its Nasik plant. The final deliveries of this type will be in 2021, the IAF having ordered a total of 272 Su-30MKIs, both direct supply and 222 built under



licence by HAL. The type is reportedly now operational with 11 squadrons plus the TACDE, with another two squadrons to be stood up in the next two years.

Various reports however have it that the Government may order an additional batch of Su-30MKIs from HAL, numbers varying from 8 to 40.

Defending the Rafale Deal



In a recent interview, Indian Defence Minister Nirmala Sitharaman has strongly defended the deal for 36 Dassault Rafales, referring to the IAF’s continually reducing combat squadron strength and “its desperate need for new aircraft.” The NDA Government had increased direct purchase of the selected Rafale aircraft from 18 to 36, and “for the rest, we have already issued an RFI for them to be manufactured in India through a strategic partnership”. On the matter of “emergency purchases”, she referred to the Air Force’s requirement for “a maximum of two squadrons” as was in the past when Mirages were brought from France and Sukhois from Russia, “two squadrons each time”.

LCA given ‘limited’ FOC

On new year’s eve, 31 December 2018, the Tejas LCA Mk.1 was accorded a ‘limited’ final operational clearance (FOC) from the airworthiness certification agency CEMILAC. In a statement, HAL’s Chairman and Managing Director R Madhavan stated that “we have





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received drawings and documents related to this standard. We can now start activities such as planning, procurement of parts from vendors. We aim to deliver the first aircraft [in the cleared standard] in October or November 2019". HAL's Bangalore Complex has reportedly delivered 12 Tejas LCA Mk.1s (IOC-standard) to the Indian Air Force so far and is working towards supplying four more by end-March 2019, to complete unit establishment of the IAF's No.45 Squadron based at Sullur near Coimbatore.

However, the IAF's requirement for two-seat LCA Mk.1 operational conversion trainers will not be met for some time as ADA are working towards meeting various requirements including in-flight refueling of the Type. The IAF will meanwhile 'borrow' the prototype two-seater LCAs which however are not cleared for service.

HAL to deliver all IOC Tejas by March 2019



The two production facilities dedicated for Tejas LCA production at HAL's Bangalore Complex had, by late December 2018, delivered the 11th series production aircraft, which after flight testing was ferried to AFS Sullur, the base of No.45 Squadron. According to HAL sources LCAs SP-12 to SP-16, the last from the IOC Block are at the final equipping stage, SP-12, SP-14 and SP-16 with the LCA Division while SP-13 and SP-15 are being completed at the second production line at the Aircraft Division.

With (provisional) FOC being received on 31 December 2018, HAL has begun production preparations for this follow on batch with LCA aircraft SP-21, SP-22, SP-23 and SP-24 on the floor assembly. As per schedule, the first LCA (FOC) is to fly in October 2019 and all 16 aircraft of this standard "would be delivered during the FY 2019-20."

Tejas LCA to LIMA Show

Even as examples of the Tejas LCA would be much in evidence at the Aero India 2019 Show in Bangalore, the Tejas LCA will thereafter participate at the forthcoming Langkawi International Maritime and Aerospace Exhibition (LIMA) in Malaysia 26-30 March 2019. This will be the second international Air Show where the LCA is being showcased, the first having been at Bahrain in 2016. The LCA will reportedly be 'borrowed' from the IAF's No.45 Squadron at Sullur and demonstrated by test pilots from the NFTC at Bangalore. Apart from Malaysia, the LCA is reportedly of interest



to other air arms in the region including Sri Lanka and Vietnam. Its 'rival', the Sino-Pak JF-17 Thunder has recently been ordered by Myanmar, Nigeria and, reportedly, Azerbaijan.

IAF Jaguar re-engining plans stalled



The Indian Air Force's plans to extend the life in frontline service of its Jaguar fleet involves major upgradation of some 120 Jaguars, mostly HAL-built, with new engines, avionics, radars and weapon systems. The IAF order of battle currently includes six squadrons of the Jaguar, including one in the maritime role. The Indian Air Force had considered the procurement of Honeywell F-125IN engines from the USA, with some 275 engines to be imported for 120 Jaguars plus 35 engines as spare. However, with Rolls-Royce having withdrawn from the competition, this single tender bid got stalled even as some senior IAF officers still feel that "installation of a new engine requires major installation work, which has made the upgrade plan quite complicated. It appears that the upgrade plan has been made too ambitious, contributing to the delay in implementation."

Jaguar DARIN III programme

Meanwhile, progression of the Jaguar DARIN III programme has also been slow, with HAL just delivering six upgraded prototypes after obtaining initial operation clearance in November 2016 at a cost of \$6 million per unit. Under the new upgrade plan, HAL is also to integrate active electronically scanned array EL/M-2052 radar from Elta of Israel, which will provide capability to simultaneously track enemy fighters, guide missiles, jam enemy communications and radar. In addition, upgraded DARIN III Jaguar fighters would be wired to launch AGM-88 HARM missiles and CBU-105 sensor-fuzed weapons.

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Saab offers Gripen E, Lockheed Martin F-16 Block 70 to IAF



Although the process which follows release of the RFI by the Indian Air Force in April 2018 has yet to formally commence, it is well understood that the six companies in competition are continuing their efforts to keep the IAF briefed on status of their aircraft. In January 2019, Ola Rignell, Chairman of Saab India stated in an interview that “except the first 18 aircraft, we intend to manufacture everything in India, Saab will look to build an ecosystem of defence manufacturing inside the country”.



Meanwhile, Lockheed Martin’s Dr Vivek Lall has re-iterated that his company has offered to re-locate the entire F-16 production line from the United States to India and to make this country “the sole global production centre for the F-16 that would meet the requirements of the Indian Air Force but also overseas markets.... the current demand outside of India is for more than 200 aircraft. The value of those initial acquisition programmes would likely exceed \$20 billion”.

HAL LUH milestones

HAL’s Light Utility Helicopter (LUH) achieved an important milestone, reaching an altitude of 6 km, flown by Chief Test Pilot Wg Cdr. Unni K Pillai and Wing Cdr Anil Bhambhani, “the helicopter exhibiting satisfactory performance and handling qualities”. The flight was carried out under the envelope expansion tests and is a critical requirement towards certification of the LUH. The LUH is programmed to undertake high altitude cold weather trials in January 2019.



Meanwhile, third prototype (PT3) of the LUH made its maiden flight on 14 December 2018, flown by test pilots Wg Cdr Anil Bhambhani and Gp. Capt MR Anand. “The flight was flawless and PT3 will augment development flight testing in conjunction with the earlier two prototypes towards certification” (see picture below).



The 3-ton class new generation LUH has been designed and developed by HAL’s RWR&DC to replace the ageing Cheetah and Chetak helicopters. First flight of the LUH PT-1 was on 6 September, 2016 with the second prototype flying on 22 May, 2017. There is a stated requirement for 187 LUHs comprising 126 for the Indian Army and 61 for the IAF.

IAF conversion training on Boeing Apaches and Chinooks

Indian Air Force personnel have been imparted conversion training on both the Boeing AH-64E Apache and CH-47F Chinook at various locations in the USA, preparatory to induction of the new types with the Indian Air Force. On 8 October, IAF aircrew



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started their Chinook training at Boeing's facility in Ridley Park, Delaware, with four pilots and four flight engineers at the course. On 22 October, IAF personnel commenced Apache training at Fort Rucker, Alabama. The IAF is to receive 22 AH-64Es and 15 CH-47Fs with deliveries to begin in 2019, the Chinooks to be based at Chandigarh as part of No.126 HU while the Apaches will be based at Hindon, sharing this air base with other US-origin aircraft types such as the C-130J-30 Super Hercules and C-17 Globemaster III.

LCH completes weapon trials



On 17 January 2019, HAL's indigenously designed and developed Light Combat Helicopter (LCH) carried out air-to-air missile firing against on a moving aerial target. During the tests at the integrated test range at Chandipur, Odisha, the LCH flown by Wg Cdr Subash P John with Col Ranjit Chitale, as Flight Test Engineer, fired the MBDA Mistral-2ATAM "scoring a direct hit." The ATAM Mistral is also integrated with the HAL Rudra (weaponised Dhruv ALH).

The LCH is equipped with a 20mm turret gun plus 70 mm rocket pods, firing trials of which were completed last year. The DAC has accorded approval for procurement of an initial batch of 15 LCHs (10 for IAF and 5 for the Army).

HTT-40 progression

Two prototypes of the indigenous Hindustan Turbo Trainer-40 (HTT-40) basic training aircraft, being developed by HAL, are continuing test flights and have reportedly "exceeded" the IAF's demanding air staff requirement. The final qualification tests which includes stall and spin trials, are expected to be completed by mid-2019 with final certification received by end of the year. The



HTT-40 is being developed with internal HAL funds amounting to Rs 500 crores which includes preparations for series production, although the IAF has yet to formalise the order for 70 HTT-40s.

According to independent observers, the Indian Air Force which had earlier ordered 75 Pilatus PC-7 Mk.II trainers, and are currently operating at the Air Force Academy Dundigal is pressing for a follow on order involving another 38 PC-7s which could well impact on reducing the number of HTT-40s in the future. It is recalled that in October 2013 the then Air Chief had proposed that instead of pursuing the HTT-40 development, HAL should licence manufacture 106 PC-7 Mk.IIs under licence from Pilatus of Switzerland.

'Exercise Bahubali'



In an effort to evaluate its 'Rapid Airlift Capability' and to enhance crew efficiency in this role, the IAF's Western Air Command, airlifted a record 463 tonnes of load from its airbase at Chandigarh to airfields and drop zones in the Ladakh region, in a single wave under 'Exercise Bahubali' on 19 December 2018.



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The effort was accomplished by a fleet of 16 fixed wing transport aircraft comprising Boeing C-17 Globemaster IIIs, Ilyushin-II-76s and Antonov An-32s. All aircraft were loaded and took off from Chandigarh airbase at dawn, the entire wave carried out in little less than 6 hours. The airlift of some 500 tonnes, in the achieved time frame “in a single wave” confirmed the Commands’ capability towards rapid and heavy airlift. WAC is entrusted with air maintenance of the entire northern region of the country and under normal operating circumstances, airlifts close to 3000 tonnes of load per month.

Hardened aircraft shelters for IAF



The IAF is to construct 108 Next Generation Hardened Aircraft Shelters (NGHAS) (‘blast pens’) at its fighter bases in northern and north-eastern India, the Government having recently allotted some Rs 5,500 crore for the project. This comes in wake of increased activity by the PLAAF, which has carried out several exercises in the Tibet Autonomous Region. While most IAF air bases in north, west and south western India have hardened aircraft shelters, they are not able to accommodate the large Su-30MKIs and the new shelters will suitably be enlarged for the purpose (*stock photo above*).

Blended bio-jet fuel powers IAF An-32

On 17 December 2018, an Antonov An-32 of the IAF carried out its flight using blended bio-jet fuel, the project being a combined effort of the IAF, DRDO, DGAQA and CSIR-Indian



Institute of Petroleum. The aircraft was flown by aircrew from the ASTE. The Indian Air Force had earlier carried out extensive engine tests on the ground, followed by flight trials using 10% bio-jet blended ATF, this fuel made from Jatropha oil sourced from Chattisgarh Biodiesel Development Authority (CBDA) and then processed at CSIR-IIP, Dehra Dun. The IAF also flew this An-32 during the Republic Day flypast in January 2019.

Ex-‘Shinyuu Maitri’ 2018 with JASDF



The *Koku-Jieitai* (Japanese Air Self Defence Force) carried out bilateral air exercises with the Indian Air Force over 3-7 December 2018 at AF Station Agra, aim of the exercise being joint Mobility/Humanitarian Assistance & Disaster Relief (HADR), using various transport aircraft types. The JASDF deployed an C-2 tactical transport aircraft (*above*) along with aircrew/observers which was the first air exercise between the two Air Forces. The IAF deployed their An-32s and C-17s.

Combined Guided Weapon Firing Exercise



Air Chief Marshal Birender Singh Dhanoa, Chief of the Air Staff, IAF visited Air Force Station Suryalanka on 7 December 2018 to witness combined guided weapons firing exercises. This first-of- its-kind Exercise involved the launch of four different kinds of surface-to-air missiles in inventory of the IAF, being the *Akash*, *Spyder*, *Osa-Ak-M* and *Igla*, this being carried out during both day and night in an integrated networked environment.



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NAeL delivers ALH structures

HAL's Helicopter Division in Bengaluru has received the first batch of helicopter structures and sub-assemblies for the Dhruv ALH manufactured by HAL's subsidiary Naini Aerospace Limited (NAeL) at Prayagraj. The *Certificate of Conformity* of sub-assemblies and bottom structure assembly was formally handed over at a function in Naini. VM Chamola, Director (HR) HAL and Chairman (NAeL) lauded the efforts of NAeL employees "in acquiring skills in the difficult domain of manufacturing of aero-structures".

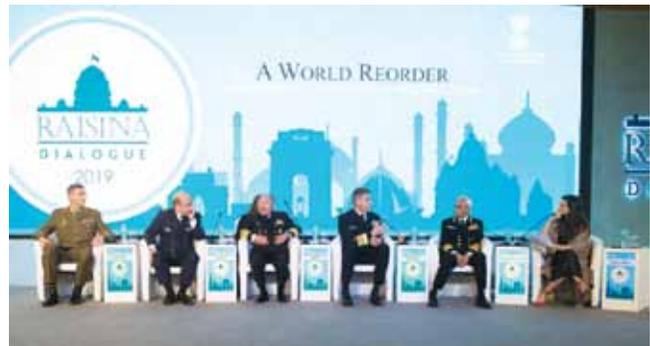
Adani-Elbit UAV unit inaugurated



On 14 December 2018, Adani Defence and Aerospace (ADA) inaugurated their Unmanned Aerial Vehicles (UAV) facility in Hyderabad, set up in partnership with Israel's Elbit Systems. "The UAV complex, which has a staff count of 110, will roll out four complete carbon aero-structures for the Hermes 900 in 2019 and 18 aero-structures in 2020. The first of the aero-structures is expected to roll out in March 2019... The structures would then be sent to Israel for final assembly for the global market," stated ADA head Ashish Rajvansi. Should the company receive orders for 150 UAVs expected from the Indian MoD, the Hermes 900 Medium Altitude Long Endurance UAV would be built entirely in India and the complex upgraded. "Other than the UAV complex, the 20 acre Aerospace Park will also house a helicopter unit and a training and R&D facility. Of which, the helicopter gear complex – a joint venture with Rave Gears – is expected to come up by September next year."

"China's conduct in Indian Ocean is a concern"

With China having added 80 new warships in the last five years to bolster its naval capability, the Chinese Navy is a force which is "here to stay" stated Admiral Sunil Lanba the CNS. Speaking at the recent Raisina Dialogue in New Delhi in early January 2019 he voiced concerns over China's growing assertiveness in the Indo-Pacific region. At any given time, there are six to eight Chinese Navy ships in the northern part of the Indian ocean, the CNS observed. "Also, two years ago they commissioned their first overseas facility or base in Djibouti. The stated aim of



this deployment is to protect their trade which is flowing through this area from piracy. They have deployed submarines for anti-piracy operations which is the most unlikely platform to be used for this role".

Also speaking at the Session were Admiral Philip S Davidson, Commander, US Indo-Pacific Command, French Navy Chief Admiral Christophe Prazuck and Admiral Katsutoshi Kawano, Chief of Staff, Joint Staff, Japan Self Defence Forces, the latter clearly stating that "Japan has serious conflicts with China in the East China Sea, especially the Senkaku Islands". General Angus Campbell, Chief of Defense Forces of Australia, also acknowledged that there is uncertainty about China's growth, expanding capabilities and presence in the waters. "Australia prefers to work with coalitions of nations to create a better security order. Building an Indo-Pacific community is a multi-faceted effort," he said.

Russian warships visit Visakhapatnam for exercises



Russian Federation Navy (RuFN) Ships *Varyag*, *Admiral Panteleyev* and *Boris Butoma* of the Pacific Fleet based at Vladivostok sailed to Visakhapatnam to participate in *INDRA NAVY*, this bilateral maritime exercise conducted off Visakhapatnam 9-16 December 2018. The primary aim of the exercise was "to increase inter-operability amongst the two navies, develop common understanding and procedures for maritime security operations".

The Sea Phase was conducted in the Bay of Bengal, thrust of the exercises being anti submarine warfare (ASW), air defence, surface firings, visit board search and seizure (VBSS) operations and tactical procedures. The Indian Navy was represented by the guided missile destroyer INS *Ranvir*, indigenous frigate INS *Satpura*, indigenous missile corvettes INS *Kadmatt*, *Kuthar* and *Khanjar* and fleet tanker INS *Jyoti*. In addition, one *Sindhughosh*-class submarine, Dornier 228 MPAs, Hawks and various helicopters took part in the exercise.



Naval Exercise Konkan 2018

The Royal Navy's HMS *Dragon*, a Type 45-Class destroyer with Wildcat helicopter embarked visited Goa for the joint India and Britain Maritime Exercise *Konkan* 2018 from 28 November to 6 December 2018. The Indian Navy participated with its guided missile destroyer INS *Kolkata*, embarking a Seaking ASW helicopter. Also participating were IN Dornier 228 MPAs, aim of the exercise being on Anti-Submarine Warfare and Area Air Defence.

INLCU L55 commissioned at Port Blair



On 20 December 2018, the VCNS Vice Admiral Ajit Kumar P commissioned IN LCU L55 at Port Blair, an amphibious ship capable of transporting and deploying main battle tanks, armoured Vehicles, troops and equipment from ship to shore. Beaching operations, search and rescue, disaster relief operations, supply and replenishment and evacuation from distant islands are other roles performed by this vessel, displacing 830 tonnes.

The ship has been indigenously designed and built by Garden Reach Shipbuilders and Engineers (GRSE), Kolkata. The remaining three ships of the same class are at advanced stages of construction at Kolkata and scheduled to be inducted over the next year and a half.

Defence Minister inaugurates IFC-IOR



On 22 December 2018, Defence Minister Nirmala Sitharaman inaugurated the *Information Fusion Centre – Indian Ocean Region* (IFC-IOR), at the Information Management and Analysis Centre (IMAC) in Gurugram (NCR). In his address, the CNS said that the IFC-IOR “shall be a collaborative construct that will work with partners, countries as well as international agencies to enhance maritime security and safety. It would also aim to work closely with the multi-national constructs and other information fusion centres” The information exchange at the IFC-IOR would initially be undertaken by virtual means, using telephone calls, faxes, emails and video conferencing over the internet. Subsequently, to enable better interaction, quicker analysis of information and provide timely inputs, the IFC-IOR would host liaison officers from partner countries. “Additionally, towards enhancing capability building, the IFC-IOR would undertake conduct of exercises and training capsules in maritime information collation and sharing.”

INS 'Kohassa' commissioned

The Indian Navy's newest Naval Air Station at Shibpur in the north Andaman Islands was commissioned as INS *Kohassa* on 24 January 2019 by Admiral Sunil Lanba, Chief of the Naval Staff.



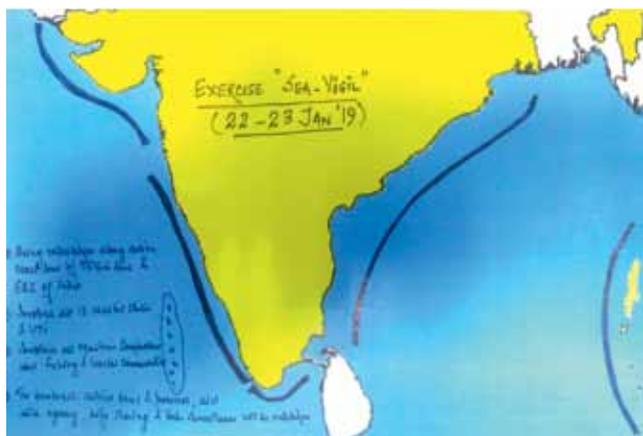
Kohassa is a white-bellied sea eagle, endemic to the Andaman and Nicobar Islands. Located in the northern most part of the A&N Islands, NAS Shibpur was established in 2001 as a Strategic Forward Operating Air Base (FOAB) with a runway of 1000 metres, suitable for operation by Dornier 228s and engaged in surveillance over the Andaman Sea. The runway is to be extended to a length of 3,000 metres, allowing for operation of larger aircraft as also fighters.

Basing of an independent naval unit with the requisite facilities and manpower will enhance overall operational capabilities of the ANC, with permanent basing of aircraft at the Naval Air Station. INS *Kohassa* is the third Naval Air Base in the Andamans, following INS *Utkrosh* at Port Blair and INS *Baaz* at Campbell Bay in the extreme south.

Exercise Sea Vigil : 'Nigrani, Nireekshan and Nakabandi'



A comprehensive, and first of its kind coastal defence *Exercise Sea Vigil*, was carried out by the Indian Navy and Coast Guard in coordination with State Governments and Union Territories in the fourth week of January 2019. The exercise had participation of more than 100 ships, aircraft and patrol boats manned and operated by various security agencies. During two distinct phases, simulated attacks were carried out on vital installations and assets in Kerala and the Lakshadweep Islands, the security agencies thwarting attempts to infiltrate using commandeered fishing boats. "Phases of the exercise were constantly reviewed by Vice Admiral Anil Kumar Chawla, FOC-in-C, Southern Naval Command."



Three new IN Dornier Squadrons



In mid-January 2019, the Government of India formally cleared establishment of three additional Naval Air Squadrons equipped with HAL-Dornier 228s, to be based in Gujarat and Tamil Nadu. In addition the Government has sanctioned additional manpower for the manning of increased number of Dornier 228 squadrons in Kerala and the Andaman Islands. Dornier 228s presently equip four Indian Naval squadrons including 310, 311, 318 and 550. The contract for procurement of 12 additional Dornier 228s was formalised with HAL Kanpur on 29 December 2016 with deliveries commencing in January 2019. These Dornier 228s are equipped with improved 'state of the art' sensors and systems and include a glass cockpit, advanced surveillance radar, ELINT, Optical sensors and various networking features.

Japan moots 2+2 dialogue "as early as possible"



According to a Japanese spokesperson, Japan is focused on boosting defence and security ties with India and would like the first 2+2 dialogue between the defence and foreign ministers of the two sides to be held "as early as possible". Bilateral economic cooperation has been the driving force for the past decade and defence and security cooperation was catching up, said Natsuko Sakata, a spokesperson of Japan's foreign ministry. The two sides had agreed on holding a 2+2 dialogue during Prime Minister



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Narendra Modi's visit to Japan last October and Tokyo would like the inaugural round to be held "as early as possible".

Japan is also keen on beginning negotiations for the proposed Acquisition and Cross-Servicing Agreement (ACSA), which is aimed at logistics and cross-servicing arrangements between the Indian Armed Forces and Japan's Self Defense Force. It was also acknowledged that the progress has been slow on the forward movement on plans for the Indian Navy to receive the Japanese ShinMaywa US2i amphibian aircraft although this remains on the agenda.

Development of an Indian Regional Airliner



In his address at the *Global Aviation Summit 2019* in Mumbai on 15 January 2019, Civil Aviation Minister Suresh Prabhu announced that an indigenous regional airliner would be developed in the country and that the Government was preparing 'a blue print' for the purpose. According to the government document 'Vision 2040', with an estimated 1.1 billion passengers flying to, from and within the country, India will need some 200 airports and an investment of \$40-50 billion to support the same. "This is over six times the 187 million traffic recorded in FY 2018," Mr Prabhu said and that the document will "chart out" a roadmap to achieve the objectives in making India a "global hub" for the aviation sector we are losing out resources to outsiders" according to the document: "if India starts manufacturing aircraft domestically, it will not only reduce the price of the airliner but will also generate enormous job opportunities as well".

Revival plans for Air India

The government has prepared a revival plan for Air India which provides for a comprehensive financial package, differentiated strategies for each of the airline's core businesses and robust organisational reforms, according to Minister of State for Civil Aviation Jayant Sinha. Various initiatives to turnaround the national carrier, "which is still airborne thanks to a bailout package extended by the previous government, including monetisation of real estate assets, are progressing". Mr Sinha informed the Lok



Sabha that the comprehensive financial package includes transfer of non-core debt and assets to a *Special Purpose Vehicle*, implementation of robust organisational and governance reforms by the board and differentiated business strategies for each of the core businesses of Air India. "Higher levels of operational efficiency by strengthening management and implementing best business processes," are among the major elements of the plan.

Jet to return 8 Boeing 737s

Jet Airways are returning eight Boeing 737 aircraft to its lessors and delaying induction of new airliners "owing to financial constraints," the airline already having reduced its network to contain losses. Jet Airways have 123 aircraft in their fleet including Airbus and Boeing variants as also ATRs. It is understood that Jet had come to a settlement with GE Capital Aviation Services (GECAS) to return the eight 737s before the end of lease period.



However, the airline had introduced 65 additional weekly frequencies on its domestic and international routes, especially on the Mumbai-Delhi sector and scale of its deployed capacity would remain unaffected, even as the airline is in discussion with all its partners, including lessors, providing them updates on the various efforts being undertaken to improve liquidity.

Vistara increases frequency



Vistara, the joint venture of Tata Sons and Singapore Airlines, are planning to raise frequency of flights on existing domestic routes, besides adding some more destinations, according to Chief Executive Leslie Thng. The airline currently has 22 aircraft but would add ten Airbus' A320neos in 2019 with a total of 56 aircraft on order : 50 Airbus A320s and A321neos and six Boeing 787-9s. The latter will be inducted from the first quarter of 2020 and pilot conversion training has begun. Mr Thng observed that "we have done reasonably well in building brand loyalty. We have seen our average fare increase on a year on year basis... occupancy is improving, too, in the business and premium economy cabins".

IndiGo plans flights to Georgia, Azerbaijan and Yunnan



The Indian low cost carrier IndiGo are planning a slew of new international flights from India to Tbilisi in Georgia and Baku in Azerbaijan. According to reports from Tbilisi, IndiGo would be operating scheduled services from Delhi with an ever expanding fleet of Airbus A320neo and A321neos. The airline is also considering operating flights to Kunming and Chengdu in China even as direct flights now operate from Delhi to the popular tourist resort of Phuket in Thailand.

Saab and AAI MoU on pan-Indian ATM

Saab and the Airports Authority of India (AAI) have signed a Memorandum of Understanding (MoU) to research a pan-Indian Air Traffic Management Automation System for airports under the UDAN Regional Connectivity Scheme. They will jointly explore potential avenues for co-operation for Air Traffic Management (ATM) solutions in India. The MoU was signed by Vineet Gulati, Member (ANS) from AAI and Peter Engberg, Head of Traffic Management, Saab Business Area Industrial Products and Services.

This MoU with Saab will support AAI's need for ATM solutions and training of its personnel in ATM services and highlights the efforts of AAI to build infrastructure for the Indian government's UDAN-RCS regional airport development and regional connectivity plan, "helping to make air travel more affordable and widespread." Saab ATM systems are now operational at Ahmedabad, Amritsar, Guwahati, Jaipur, Lucknow, Chennai, Kolkata, Mumbai, New Delhi, Cochin and Bhuvaneshwar, all of which airports have Saab's A-SMGCS software and a combination of other products such as SR-3 and the Multilateration (MLATS).

SCOOT to Coimbatore, Trivandrum and Visakhapatnam



Continuing with its massive expansion plans, Scoot, the low-cost arm of the Singapore Airlines Group, plan to fly to an additional three new cities in India being Coimbatore, Trivandrum and Visakhapatnam. The new routes are due to be transferred over from sister airline SilkAir and Scoot will be the only airline operating direct non-stop flights from Trivandrum and Visakhapatnam to Singapore. Flights from Trivandrum to Singapore will commence from May 2019, and flights from Coimbatore and Visakhapatnam will start later in October 2019, all subject to regulatory approvals. In India, Scoot already operates on seven existing routes from Amritsar, Bengaluru, Chennai, Hyderabad, Kochi, Lucknow and Tiruchirappalli.

Turkish Airlines and IndiGo in codeshare

Turkish Airlines, and IndiGo have announced a codeshare and mutual cooperation agreement which will enable both carriers to provide “more flexibility of choice to their respective customers to fly on sectors between India, Istanbul and beyond”. This reciprocal arrangement will allow ‘TK’ and ‘6E’ to provide seamless connections to their passengers, besides enabling them to use through check-in and many other facilities. IndiGo will place its code ‘6E’ on 20 points beyond Istanbul operated by Turkish Airlines.

Boeing’s forecast : 2,300 new airliners for India



Boeing has issued its long-term forecast for commercial airliners for India even “as unprecedented domestic passenger traffic and rapidly expanding low-cost carriers (LCCs) drive the need for 2,300 new jetliners – valued at \$320 billion – over the next 20 years”. In 2018, more than 10 million passengers, on average, travelled within India each month. “To meet this increased domestic air traffic growth, we see the vast majority of available airplane seats coming from LCCs,” stated Dinesh Keskar, senior vice president of Sales for Asia Pacific and India, Boeing Commercial Airplanes. According to Boeing’s Commercial Market Outlook (CMO), India’s commercial aviation industry has achieved 51 consecutive months of double-digit growth, matching in other sectors of the country’s economy.

Wipro supplies to Boeing

Wipro Infrastructure Engineering (WIN) have commenced shipments of parts to Boeing from its plant in Bangalore (Devanahalli). Boeing had earlier contracted Wipro Aerospace to manufacture strut assemblies for the 737MAX and Next-Generation 737 airliners. WIN and Boeing have partnered over the last few years, providing various aerostructures and components for the B-737, B-767 and B-787 Dreamliner programmes through its facility in Israel.

Drone Policy 2.0 unveiled

Minister of State for Civil Aviation Jayant Sinha, while unveiling the updated *Drone Policy 2.0* at the Global Aviation Summit, said that the country requires to have a policy road map and regulations that will support the growth of the drone ecosystem. “Commercial UAS (unmanned aerial system) operations will foster various new forms of air freight capabilities, such as creation of supply chain relay networks for delivery of payload, transport of temperature-sensitive commodities like bodily organs, emergency or just-in-time deliveries of life-saving medicines or safe blood for transfusions and collection of patient specimens for delivery to laboratory for time-sensitive testing,” as per the policy document.

IndiGo receives A321neo



At the year end, IndiGo received its first longer-range Airbus A321neo (new engine option), arriving at Delhi from the Airbus facility at Hamburg in Germany and was accorded the traditional water cannon salute on its arrival. Induction of the A321neo, of 150 on order, will enable IndiGo to plan services to medium-haul international destinations. IndiGo now has 204 airliners in its fleet, including one A321neo, 65 A320neos, 126 A320ceos (current engine option), plus 12 ATRs.

Amritsar airport “grew fastest in 2018”

During 2018, Amritsar, Bagdogra and Patna became the fastest growing Indian airports in terms of passenger traffic. Amritsar

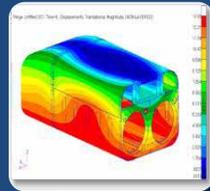


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recorded the highest passenger growth with 48.1% increase in flyer numbers over 2017 while Bagdogra and Patna were at 48% and 47.3% growth, respectively. Although the overall passenger numbers for 2018 are yet to be issued by the DGCA, a spokesman said that, “we have collected data for the 21 airports (AAI-run but not the JV ones at Delhi, Mumbai, Bangalore, Hyderabad and Kochi) that handled over 20 lakh passengers last year. The growth has been phenomenal”. Of the 10 fastest growing airports, only Patna’s growth came entirely from domestic flyers as the airport does not have international flights. Two of these airports—Bhubaneswar and Indore—saw their international traffic grow by 218% and 147%, respectively. According to DGCA data, there were 126 million domestic flyers during January–November 2018, up 19.2% from 106 million in same period in previous year.

Record 1,004 flights from Santa Cruz on single day



On 10 December 2018, including the charter flights to transport guests for the Ambani-Piramal wedding celebrations in Udaipur, Santa Cruz airport at Mumbai witnessed a record 1,004 flights on one day. Although Santa Cruz has two intersecting runways, only one of them is in operation at a time. The airport’s main runway has a declared capacity of 46 movements per hour, with flights schedules and slots approved on that basis. Flight movements on a given day can be higher because of non scheduled or charter movements and thus on an average the airport records 46-48 movements per hour during its peak hours. In contrast London’s Gatwick airport handles around 55 aircraft movements per hour but is closed from mid-night till 5 am owing to social factors.

4th international airport in Kerala

On 10 December 2018, Kerala’s fourth international airport was inaugurated by Union Civil Aviation Minister Suresh Prabhu and Chief Minister Pinarayi Vijayan. “It is a historic moment for, north Kerala. No doubt the new airport will fuel growth in the Malabar area,” said Vijayan. Prabhu said “Kannur has scripted another chapter in country’s aviation industry which will pave the way for overall development of the state.” A semi-corporate airport, 67.14% shares in the Kannur International Airport Ltd are



owned by individuals (mostly NRIs) and corporate entities while the state government holds 32.86% in return for land and other development undertaken in the area. Kerala, which has a sizeable expatriate population, already has three international airports at Kochi, Thiruvananthapuram and Kozhikode. Kannur airport is expected to cater to one million passengers annually.

Regional connectivity routes: UDAN 3.0



The Government of India has announced new regional air connectivity plans under UDAN 3, which is focused on tourism routes as well as ‘water aerodromes’, with Rs 4,500 crore sanctioned for a revival of a number of airports. Amongst these are routes from and to Port Blair, capital of the Andaman & Nicobar Islands, air linking Car Nicobar, Campbell Bay (southernmost tip of India and close to Sumatra in Indonesia), Shibpur (northernmost Andaman and close to Myanmar), to be served by the startup Andaman Airways.

Air links within the northeast are also included, involving Dimapur, Imphal, Lilabari, Jorhat Shillong, and the Umrangso Reservoir, to be served by Spicejet, IndiGo and Alliance Air. There are several other (unusual) city pairs, including flights from Goa to Jamnagar, Ambala to Srinagar, Bhubaneswar to Kalaikunda, Adampur to Mumbai, Saharanpur to Lucknow, Durgapur to Chennai and Kalaikunda to Vizakatnam.

Integrated Battle Groups (IBGs) to be war-gamed



Indian Army Chief General Bipin Rawat has stated that the Indian Army will war game its new structures, geared towards sudden and swift offensives into enemy territory with ‘integrated battle groups’ (IBGs) in the next months and then carry out exercises on ground in May 2019. The proposed IBGs are the essence of an offensive doctrine or ‘Cold Start’, which involves launching an offensive rapidly, on multiple independent thrust lines. Such a Cold Start doctrine has long been denied until General Rawat publicly endorsed this on his first Army Day speech in January 2017.

“We will carry out war games in February/March, and in May we will exercise the IBGs. Hopefully, after that, we will go to the government and take their sanction [to restructure traditional Divisions into permanent IBGs]. According to observers, the first IBGs will be established in the plains of Jammu, Punjab and Rajasthan, and one of the army’s three Strike Corps restructured into a rapid reaction *Sabre Corps*, capable of immediate launch.

Upgraded Arjun tank on trials

An upgraded version of the Arjun main battle tank, the Mark1A is presently undergoing validation trials, being the first official confirmation on the variant which is additional to the Arjun



Mark.2, which is somewhat lighter in weight. The Defence Research and Development Organisation and the Indian Army had, in the first half of 2018, accepted this new version of which the Army has a requirement for 118 numbers. Some 93 modifications have been carried out since the Arjun Mark 1 which was first inducted in 2010-11, with 124 numbers ordered.

Orders on Defence PSUs reduced by 33%

According to reports, the quantum of contracts awarded to Defence Public Sector Undertakings (DPSUs) has fallen by some 33 per cent over the past three years. The value of capital given to DPSUs in 2015-16 was Rs15,617 crore, which came down to Rs12,374 crore in 2016-17 and further fell to Rs10,475 crore in 2017-18. Nine DPSUs function under the Department of Defence Production which manufacture weapons, ammunition, armoured vehicles, heavy vehicles, aircraft, helicopters, warships, submarines, missiles, electronic equipment, earth moving equipment and special alloys.

Significantly, the Government has increased orders on the private sector, with “the government pursuing initiatives to achieve higher levels of indigenisation and self-reliance in the defence sector. This is sought to be achieved by harnessing the capabilities of both public and private sector industries in the country”. Towards this end, the number of items requiring an industrial licence has been reduced. A total of 394 licenses have been issued to 239 Indian companies for manufacture of defence items since 2001.

Integrated arms at Army Day Parade 2019

Indian Army celebrated its 71st Army Day on 15 January 2019 when General Bipin Rawat, COAS reviewed troops at the Cariappa Parade Ground, Delhi Cantonment. The march past included contingents of infantry preceding which were columns of T-90 MBTs, BMP IIs, M 777 ultra light howitzers, K-9 Vajra SP guns, Akash, SAM systems even as Army Aviation helicopters carried out combat manoeuvres including simulated insertion of special forces behind enemy lines.



Agni-5 ballistic missile test-fired



An Agni-5 ballistic missile with range of 5,000 kms was successfully test-launched on 10 December 2018, being the seventh trial of this indigenously-developed three stage missile. Carrying a load of 1.5 tonnes, including nuclear warheads, Agni-5 was launched by personnel of the Strategic Forces Command alongside DRDO scientists. Flight performance of the missile was tracked and monitored by radars, tracking instruments and observation stations, including ships located at mid-range, “the missile impacting accurately on the designated target”.

PSLV-C43 launches HysIS and 30 foreign satellites

ISRO’s Polar Satellite Launch Vehicle (PSLV-C43) launched 31 satellites from *Satish Dhawan Space Centre* (SDSC) at Sriharikota on 29 November 2018. The PSLV-C43 injected India’s Hyper-Spectral Imaging Satellite (HysIS) into the 645 km sun-synchronous polar orbit, 17 minutes 19 seconds after lift-off. Shortly thereafter, 30 foreign satellites were injected into their intended orbit after restarting the vehicle’s fourth stage engines twice. Following separation, the two solar arrays of HysIS were automatically



deployed and the ISRO Telemetry Tracking and Command Network at Bengaluru gained control of the satellite. HysIS is an earth observation satellite built around ISRO’s Mini Satellite-2 (IMS-2) bus weighing about 380kg, the primary aim of HysIS being to study the earth’s surface in both the visible, near infrared and shortwave infrared regions of the electromagnetic spectrum. Alongside in the payload were one micro and 29 nano-satellites from eight countries, including Australia, Canada, Columbia, Finland, Malaysia, Netherlands, Spain and USA.

GSAT-11 launched from French Guiana



ISRO’s heaviest and most-advanced high throughput communication satellite GSAT-11 was launched from the Spaceport in French Guiana on 5 December 2018. The launch vehicle Ariane 5 (VA-246) lifted off from Kourou Launch Base, French Guiana carrying India’s GSAT-11 and South Korea’s GEO-KOMPSAT-2A satellites. After 30 minutes, GSAT-11 separated from the Ariane 5 upper stage in an elliptical Geosynchronous Transfer Orbit, the achieved orbit very close to the intended one. The 5854-kg GSAT-11 will provide high data rate connectivity to users of Indian mainland and islands through 32 user beams in Ku-band and 8 hub beams in Ka-band.

GSLV-F11 launches GSAT-7A



On 19 December 2018, ISRO's Geosynchronous Satellite Launch Vehicle (GSLV-F11) successfully launched the communication satellite GSAT-7A from the Satish Dhawan Space Centre (SDSC) in Sriharikota. Soon after the separation of the satellite, ISRO's Master Control Facility (MCF) at Hassan in Karnataka took over command and control of GSAT-7A. The satellite's health parameters are normal. Dr K Sivan, Chairman of ISRO stated "in the last 35 days, ISRO has successfully launched three missions from SDSC starting with GSLV MkIII-D2 on November 14, PSLV-C43 on 29 November and finally GSLV-F11. GSLV has successfully injected GSAT-7A into a super synchronous transfer orbit".

The IAF's 'Angry Bird' satellite



The GSAT-7A, communications satellite has been dubbed the 'Angry Bird' and dedicated for exclusive use by the Indian Air Force. The GSAT-7A will instantly connect IAF aircraft, AEW&C platforms and UAVs as also ground stations, thus achieving a network centric warfare capability. According to ISRO, this advanced communication satellite has a mission life of eight years, providing communication in Ku-band over the Indian region.

Defence Budget presented for 2019-20



In his presentation of the 'Interim Budget for 2019-20' in Parliament on 1 February 2019, acting Finance Minister Piyush Goyal announced a total outlay of Rs 3.05 lakh crore for the defence budget in this FY, a hike of some Rs 10,000 crore from Rs 2.95 lakh crore last fiscal. Over and above the defence budget, an amount of Rs 1,12,079.57 crore has been allocated for defence pensions, which has exceeded the allocation of Rs 1,08,248.80 crore made for capital expenditure.

The Minister qualified the presentation in saying "our defence budget will be crossing Rs 3 lakh crore for the first time in 2019-20. For securing our borders and to maintain preparedness of the highest order, if necessary, additional funds would be provided". Defence analysts however opined that India's defence spending continued to slide measured against its gross domestic product (GDP)... this year it is a mere 1.51% of the GDP, the lowest in decades. It is argued that considering the security environment, India should be spending some 3% of its GDP to enhance military capabilities.

Major space missions in 2019

During 2019, ISRO plans 32 space missions, so doubling the number from 2018, including 14 vehicle launches and 18 spacecraft missions. Primary among these will be launch of *Chandrayaan-2*, India's second moon mission, with the objective to land a rover on the moon and expected for launch in September or October 2019. As ISRO Chairman K Sivan said "We have put everything in place. *Gaganyaan* has the highest priority for 2019. We are planning to have first unmanned mission in December 2020 and second for July 2021. Once we complete this the manned mission will happen in December 2021. The entire team is geared up to achieve this target". The Government has recently cleared the Rs. 9,023 crore programme he confirmed.



3 Indians in Space by 2021

The Indian Space Research Organization (ISRO) has announced plans to send Indian astronauts to space in December 2021, under the flagship human space mission programme *Gaganyaan*, at a cost of Rs 1000 crores or US \$ 1.4 billion. The crew of three, possibly test pilots of the Indian Air Force, will orbit in space for about a week. ISRO chairman K Sivan announced that in preparation, a *Human Spaceflight Centre* will be established in Bengaluru for space flight training. "This is a major turning point for ISRO... this programme will not end with just sending humans to space, but continue with sending humans to a space station and then, to the moon," he stated. The Centre will be headed by S Unnikrishnan Nair and the *Gaganyaan* programme led by R Hutton.

Major upgradation of A&N Command

Plans for major upgradation of infrastructure in the Andaman & Nicobar Command have reportedly been finalised. This will be spread over 10 years and involve expansion of existing airfields, further berthing facilities for warships, plus stationing of additional troops of the army. The initial plan which was for around Rs 10,000 crore has a 'force accretion' of the three services in phases by 2027. This will include stationing of additional infantry troops plus new air defence, signals, engineer, supply and other support units in the 572 island archipelago.

MoD clears Project 75-I for six submarines

On 31 January 2019, the Defence Acquisition Council (DAC) chaired by Ms Nirmala Sitharaman, cleared the procurement of six advanced submarines for the Indian Navy under project 75-India, at the cost of some Rs 40,000 crore. The six submarines

will have 'air independent propulsion' (AIP) which gives them extended under water endurance for upto 14 days. In 2017, the Navy had sent out RFIs to a number of global OEMs, soliciting interest in Project 75-I, and these sent to Thyssen Krupp Marine Systems from Germany, Kockums from Sweden, Naval Group from France and Rosobronexport from Russia.

According to the MoD, "this is the second project under the MoD's ambitious Strategic Partnership (SP) model that ... envisages indigenous manufacturing of major defence platforms by an Indian SP who will collaborate with a foreign OEM to establish production facilities in the country". The other project under the SP model was that for 111 naval utility helicopters (NUH) which was approved in August 2018.

Appointments

Vice Admiral G Ashok Kumar takes over as Vice Chief of the Naval Staff



Vice Admiral G Ashok Kumar assumed charge as Vice Chief of the Naval Staff on 30 January 2019, having held various Staff and Command assignments during his naval career spanning more than three decades. He commanded INS *Kulish*, a *Kora*-class corvette, and the guided missile destroyer INS *Ranvir*. Among his shore tenures, he was Staff Officer Indian Naval Work-up team, Head of Training Team (Navy) at Defence Services Staff College, Wellington, Defence Advisor at the High Commission of India in Singapore and Chief Staff Officer (Operations) of Western Naval Command. He was later Commandant National Defence Academy and Deputy Chief of Naval Staff.

Vice Admiral G Ashok Kumar's predecessor Vice Admiral Ajit Kumar P has been appointed Flag Officer Commanding-in-Chief of Western Naval Command at Mumbai.

Vice Admiral MS Pawar appointed DCNS



Vice Admiral MS Pawar assumed charge as Deputy Chief of the Naval Staff on 30 January 2019. Amongst other important assignments earlier in his career, he has commanded INS *Nashak*, INS *Kuthar* and INS *Talwar* as also the Mauritius National Coast Guard Ship 'Vigilant'. Earlier he was Deputy Assistant Chief of Integrated Staff (Maritime) at HQIDS. As Vice Admiral he has been Director General Project *Seabird* and Chief of Staff, Eastern Naval Command.

Exercise AVIAINDRA



Officers of the IAF and RFASF at Jodhpur during AVIAINDRA 2018. In the background are Russian-origin aircraft of the IAF including an An-32, Su-30MKI and Mi-17



Air Chief Marshal BS Dhanoa, CAS IAF with visiting officer of the RFASF

with the members of the participating contingents and spoke about the long standing military partnership between the RFASF and the IAF and the commonality of equipment operated by both the nations. He complimented the efficiency of the Russian equipment in “having played a pivotal role during various IAF air campaigns”.

AVIAINDRA is a unique exercise wherein the foreign participants do not bring their own assets and is seen as “testimony of the Indo-Russian military relationship, mutual co-operation and understanding between the IAF and the RFASF”.

Exercise AVIAINDRA involving the Indian Air Force and the Russian Federation Aerospace Force (RFASF) was conducted at Air Force Station, Jodhpur from 10 to 21 December 2018. This was the second edition, the first having been held at Lipetsk in Russia 17 to 28 September 2018.

Objective of this exercise was to “expose” RFASF and IAF pilots to single and multi aircraft missions in a counter terrorism scenario “within a predefined scope and understanding of each other’s concept of operations”. The 30-member RFASF contingent comprised fighter, transport and helicopter pilots, led by Lt General Lurii Sushkov.

Air Chief Marshal BS Dhanoa, Chief of the Air Staff IAF, met and interacted



Russian and Indian fighter pilots seen with MiG-29UB at Lipetsk in Russia

Exercise Cope India 18



General CQ Brown Jr of the USAF in Mirage 2000D of the IAF



Air Chief Marshal BS Dhanoa with USAF officers at Kalaikunda

Described as testimony of a growing Indo-US military relationship, *Exercise Cope India 18*, the fourth edition in the series of bilateral joint exercises between the Indian Air Force and the US Air Force, was held from 3 to 14 December 2018 at two fighter airbases, Kalaikunda and Panagarh, both in West Bengal.

While the IAF contingent fielded 10 Sukhoi Su-30MK1s, 6 Jaguars and 5 Mirage 2000s, the US Air Force brought 12 F-15 Eagles from Kadena Air Base, Japan, which also houses the 67th Fighter Squadron 'Fighting Cocks', plus 3 C-130 Hercules tactical transport aircraft, from the Illinois Air National Guard.

On his visit to Kalaikunda on 5 December 2018 to witness the exercise, Air Chief Marshal BS Dhanoa, Chief of the Air Staff, emphasised the importance of joint exercises as "they create an

environment of camaraderie and provide an opportunity to learn from each other's best practices and operational synergy."

General CQ Brown, Jr, Commander Pacific Air Forces, USAF also visited Kalaikunda and stated, "These exercise scenarios challenge us to be agile in execution, innovative in our approach and integrated in our command and control... enhancing the readiness and lethality of our airmen and our allies and partners."

Earlier, Air Commodore JS Mann, Exercise Director, said that the aim was to give an exposure to IAF fighter pilots and ground crew on USAF practices, having four objectives : to hone the technical use of air power, imbibe best practices, and prepare for future operations wherein "we learn to exercise intra capability so that we can fight together ... understand each other's limitations and capabilities and complement each other".



USAF F-15 Eagle at Kalaikunda, from the USAF's 18th Operations Group at Kadena Air Base, Japan. (US Air Force photo by Staff Sgt. Hailey Haux)

nimo

Indian-Chinese Army in 'Hand-in-Hand' Military exercises



Continuing exercises between the Indian and Chinese Armies was *Hand-in-Hand 2018* which took place in Chengdu in China's south western province of Sichuan for two weeks from 10 December 2018. Representing the Indian Army was a



Company of 11 Sikh Light Infantry who were flown to Chengdu by an Ilyushin Il-76, the validation exercise on 22 December being reviewed by Major General Sanjiv Rai, GOC 3 Mountain Division.

The Indian and Chinese troops were in integrated live firing and carried out counter-terrorism exercises in urban and jungle terrain which “provided an opportunity to both the forces for a greater understanding and strengthening mutual trust and cooperation”. 🇮🇳

“Speeding up LCA deliveries”



VAYU Interview with

R Madhavan, CMD HAL

VAYU : *There are reports about HAL receiving ‘Limited’ clearance from CEMILAC for production of LCAs in FOC standard, you having been quoted on receiving the documents and drawings. What will be the schedule for their deliveries?*

HAL : The Aeronautical Development Agency (ADA) handed over the Drawing Applicability List and Equipment Standard of Preparation (SOP) documents to HAL on 31 December 2018, duly cleared by the Centre of Military Airworthiness & Certification (CEMILAC) to go ahead with the production of FOC standard aircraft. HAL has established a manufacturing facility for production of eight aircraft per annum. Currently, HAL is producing LCA IOC standard aircraft for which IOC was received from ADA in December 2013. To date, HAL has produced 12 LCA Mk.I

IOC-standard fighters. The balance four IOC-standard LCAs are under production and will progressively be delivered in the current financial year.

HAL has also made preparations for the production of LCA (FOC) standard aircraft after receiving the SOP and has planned to deliver all 16 FOC-standard LCAs progressively. For the eight trainer aircraft (four each in IOC and FOC standard), the SOP is yet to be released for their production.

So as to speed up production of LCAs, an investment of Rs 1381 crores has been sanctioned by the Government for establishment of facilities for ramping up production rate from 8 to 16 aircraft per year. Additionally, a parallel production line has also been established at Aircraft Division Bengaluru to support an increased rate of production. In addition, major assembly modules have been outsourced to private partners like DTL, Bengaluru (front fuselage), Alpha Tocol, Bengaluru (rear fuselage), VEM Technologies, Hyderabad (center fuselage) and L&T, Coimbatore (wings) to enhance the production rate.

VAYU : *The Light Combat Helicopter (LCH) programme is making rapid progress with armament and other on-going trials. What is status of the programme? When are deliveries to commence ? What is the order book position?*

HAL : After successful completion of flight testing of the LCH basic performance, rocket firing trials and turret gun firing trials have been carried out. The helicopter participated in IAF’s ‘Iron Fist 2016’ exercise in March 2016 and displayed rocket firing capabilities in its



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The HAL Light Combat Helicopter (LCH)

weaponised configuration. The IOC for LCH was accorded on 26 August 2017 in presence of the Defence Minister and production activities have been launched, awaiting firm order.

The LCH has achieved another milestone, successfully carrying out air-to-air missile firing on a moving aerial target on 11 January 2019, the tests conducted at the integrated test range at Chandipur, Odisha. It was a flawless mission that achieved direct hit on the aerial target. With this, the LCH has successfully completed all weapon integration tests and is ready for operational induction.

HAL has submitted its quotation against the RFP for supply of 15 limited series production (LSP) helicopters which is presently under consideration.

VAYU : *The Light Utility Helicopter (LUH) is also achieving several milestones like the GTV - endurance run, shake tests etc. Kindly indicate status of this project and future plans.*

HAL : The LUH is a single-engine, three-ton weight class helicopter with Glass Cockpit and Multi-Function Displays. The LUH will be employed for the Reconnaissance and Surveillance

role, the helicopter capable of flying at 220 kmph, with service ceiling of 6.5 km and a range of 350 km having 500 kg payload. The LUH has also recently achieved an important milestone, flying upto 6 km altitude in Bengaluru on 7 December, 2018, as part of envelope expansion tests. Maiden flight of third prototype (PT3) of the LUH took place on 14 December 2018.

As part of LUH development activities, HAL has built three prototypes, one Ground Test Vehicle (GTV) and one Break Away Fuselage (BAF). The three prototypes have cumulatively logged more than 170 flights, extensive flight testing being carried out to establish helicopter performance parameters. Sea level and hot weather trials have been completed as part of the development flight process. System level flight testing is under progress presently which will be followed by cold weather, hot weather, and high altitude trials.

Series manufacture is planned at the 'greenfield' Helicopter Manufacturing Facility coming up at Tumakuru for which the foundation stone was laid by the Prime Minister on 3 January 2016, with further activities in progression. HAL flew the LUH from the facility at Tumakuru on 29 December 2018 and also successfully met the timeline of 2018.

VAYU : *HAL has been chosen as manufacturing partner by the Russians for execution of orders received by them on the Ka-226T programme. Kindly share some details on the way forward in this programme.*

HAL : The IGA signed on 25 December 2015 between the Governments of India and Russian Federation envisages supply of 200 Kamov Ka-226T helicopters to the Indian defence services (Army & IAF) through a Joint Venture (JV) company in India. Accordingly, a joint venture company *Indo-Russian Helicopter Limited (IRHL)* was incorporated on 2 May 2017 with the following stakeholding : HAL 50.5 % ; Russian Helicopters 42 % ; Rosoboronexport 7.5 %. Following the RFI of 9 May 2017,



The HAL Light Utility Helicopter (LUH)

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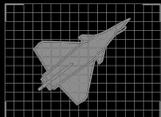
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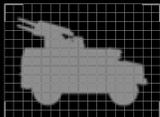
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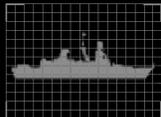
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HAL's Hawk i at Aero India 2017

the joint venture IRHL has submitted the techno-commercial proposal for the supply of 200 Kamov Ka-226T helicopters and allied equipment. The proposal is under evaluation by the Technical Evaluation Committee (TEC), with the JV committed to commence deliveries as per the delivery schedule in the RFP.

VAYU: HAL launched two engine development programmes during its Platinum Jubilee year, a 25 kN engine for trainer aircraft and a 1200 kW turbo shaft engine for helicopters. The Defence Minister commissioned trial runs of one of the engines, to demonstrate progress. How are these twin projects doing? What is the future for them?



The Kamov Ka-226

HAL : HAL has taken up the design and development of the following aero engines: the 25 kN turbofan engine is expected to meet requirement for basic advanced military trainers, small business jets and also for large UAV applications. The core engine has been built and the engine run commenced in December 2015 with 100% rpm achieved. The core 2 engine run was successfully carried out in January 2018. Both the core engines are under testing and so far over 300 engine runs have been successfully completed. Development of this engine will enable the country to achieve self-reliance in design of this class of engines and its technologies, such experience further leveraged to design and develop higher thrust engines for modern fighter aircraft.

HAL is also working on design and development of the 1200 kW turboshaft engine to be used as power plant for three to six-ton category helicopters. The HTSE-1200 engine technology demonstrator was assembled and inaugural test run successfully carried out on 12 February 2018 with 76% rpm achieved. The engine was actually tested at sea level at the DefExpo 2018 site for light up, acceleration and stable running at idle speed. The engine is currently under testing with over 240 successful engine runs completed so far.

VAYU: HAL has undertaken upgradation of the Hawk AJT and has developed a Technology Demonstrator, referred to as Hawk i, first displayed at Aero India 2017 and also dedicated to the Nation by the former Defence Minister. Has HAL marketed this aircraft to the IAF and for export? What are the plans to promote this aircraft?

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HAL : HAL has presented the Hawk Mk.132 avionics upgrade capabilities to the IAF and the Indian Navy. During Aero India 2017, a BAES test pilot flew the aircraft and the Namibian Air Force was given demonstrations. Subsequently, delegations from Sri Lanka and the UAE during their visits to HAL, showed interest in Hawk i's features including the Mission Computer with Digital Map Generation, Embedded Virtual Training Facility, EW systems and new weapons, in addition to other indigenous systems. The feedback received is encouraging.

The new capabilities and continuous developments are being demonstrated regularly to all prospective customers and the aircraft is also planned to be showcased during Aero India 2019.

VAYU : *A full-scale mockup of the Indian Multi-Role Helicopter (IMRH) was unveiled during Aero India 2017, as main attraction at the HAL display, which also received favourable reviews. What is status of the project and plans for its development?*



The IMRM mockup at Aero India 2017

HAL : Preliminary design studies of the Indian Multi-Role Helicopter (IMRH) have been completed taking into account requirements of the Indian Armed Services, the IMRH being proposed as an indigenous development project with government funding. Discussions have been held with several Indian Private Industries and various HAL Divisions to maximise indigenous content. Internal studies have been completed and review by the Preliminary Design Review (PDR) committee which includes members from the three Services, CEMILAC and DGAQA have been initiated. This review is to fully understand operational requirements, maintenance, logistics support and upgradation of the helicopters during service life. HAL is looking forward to the next phase of the project after the configuration freeze.

VAYU : *The proposed Indian Regional Transport Aircraft (IRTA) is a much talked about subject and Aero India 2009 is an excellent opportunity to review its status. There seems to be hope for the Project with the setting up of a Consortium of HAL, NAL and ADA. A Special Purpose Vehicle (SPV) will take this project forward. Kindly share some details on this project.*

HAL : The Ministry of Civil Aviation has proposed development of the Indian Regional Transport Aircraft (70 to 90 seat) to meet requirements, forming a Special Purpose Vehicle (SPV) with participation of stakeholders, being HAL, NAL and ADA. In



Artist's depiction of the IRTA

pursuance of recommendations of the Committee of Secretaries, Ministry of Civil Aviation (MoCA) has constituted a Committee with these stakeholders for creation of such a SPV for development of the IRTA. The committee has proposed initiation of the Project Definition Phase (PDP) by CSIR-NAL, HAL and DRDO-ADA with CSIR-NAL as the lead agency, and parallel setting up of the SPV. The SPV will be a government-funded entity with special administrative and financial powers, which will facilitate execution of the project within the stipulated time frame. The in-principle approval for formation of SPV and development of RTA project will be pursued by the MoCA for submission to the Ministry of Finance (MoF).

VAYU : *HAL is considering re-engining of the Avro transport aircraft and also incorporate improvements to extend its service life. Please elaborate on this project.*

HAL : The project is under preliminary discussion phase. The upgrade will consist of avionics and engine upgradation.

VAYU : *The 'Make in India' initiative has encouraged many large and medium sized private industries to consider moving into the aerospace domain. The concept of SP (Strategic Partners) as also the indirect patronage of the Government could erode the market share of HAL. Recent RFPs for acquisitions have excluded HAL from participating! What is HAL's reaction and strategy to address this situation in maintaining its pre-eminent position in the field of Aeronautics, which it has enjoyed for close to eight decades ?*

HAL : In line with the Government's vision of developing the ecosystem for aerospace and defence (A&D) industry in the country, HAL is committed to develop vendors and suppliers, and also to strengthen the supply chain for the industry. For the past 78 years, the organisation has been supporting the Indian Defence Forces, building trainers, fighters and military transport aircraft, helicopters of various categories and upgrading the fleets. HAL has also supported Indian defence forces in maintaining, repairing and overhauling aircraft built over the decades.

The entry of private players under the 'Strategic Partnership' model and related Government policies will make the industry competitive. HAL believes that healthy competition will be in favour of the industry, to develop vendors and suppliers, build defence capabilities and make the country a defence manufacturing hub. There is always scope of constructive collaboration for mutual benefits ! 🦋



The people we all rely on
to make the world go round,
they rely on Thales



HAL Jaguar 2-seater

In Defence of HAL

“HAL being knocked out of the the IAF’s Rafale acquisition programme at the last minute – and for reasons best known to the authorities – is astonishing to say the least” opines GS Jamadagni, former GM (Quality Assurance) Hindustan Aeronautics Ltd. who retired from HAL after 40 years of service.

Hindustan Aeronautics Ltd (HAL) turned 78 in 2018 and has always been regarded as ‘backbone’ of the Indian Air Force. Two-thirds of the IAF’s combat aircraft inventory are from HAL, which currently manufactures the Tejas 4th generation light combat aircraft, incorporating advanced avionics and weapons as also the heavier Sukhoi Su-30 MKI fighter aircraft of Russian-origin, currently from raw materials, with major upgradation of the Jaguar strike fighter and Mirage 2000 air superiority fighter underway.

In the area of design & development, HAL has to its credit many indigenous programmes ranging from gliders, basic piston-engine trainers (HT-2, HPT-32), jet trainers (HJT-16 Kiran Mk I and Mk II), supersonic fighter (HF-24 Marut), agricultural aircraft (Basant) and has also

to its credit a number of aircraft upgrade programmes. Aircraft types manufactured over the decades began with the Vampire, then the Gnat, Jaguar, MiG-21 variants and

MiG-27, and all these have served long, in peace and war with the Indian Air Force.

As a nation we have to be proud of these accomplishments. Unfortunately, in the



Tejas LCA



HAL-Sukhoi Su-30MKI

recent past, HAL has been unduly blamed and - it seems - systematically tarnished on the basis of myths, wrong notions and false charges.

Design, production and technological capabilities of HAL should have been factored before the PSU was “knocked out” from the MMRCA programme, being tarnished in the process as being an industry “not capable of producing the Rafale.” The government is instead buying 36 Rafales in flyaway condition from its original equipment manufacturers Dassault Aviation. The fact that two thirds of the aircraft in IAF are from HAL’s factories is surely testimony enough to HAL’s manufacturing capability.

All these years, HAL was the major partner in the IAF’s induction of new aircraft and weapon platforms. The government seems to have ignored HAL’s track record and its contributions to the nation’s defence by preventing what is its own Company from participating in the national programme to acquire French-origin Rafale fighters for the Indian Air Force.

Rafale sans HAL

HAL being removed from the IAF’s Rafale acquisition programme at the last minute and for reasons best known to the powers-that-be, was astonishing! Rafales being built abroad and supported in India without HAL’s involvement and support are akin to a chariot without a horse. Any start-up Indian company

certainly cannot replicate HAL’s capability which has been built over eight decades.

Political battles apart, this decision is a matter of serious concern in the larger interests of the nation. In an article that appeared in *The Indian Express* ‘Don’t ground the Rafale’ written by former CAS Air Chief Marshal S Krishnaswamy, various reasons were given: the first one was refusal of Dassault Aviation to take responsibility for the output of HAL and, secondly, insistence of the IAF for the manufacturer to provide guarantees because of what was said to be “the unsatisfactory performance of HAL in the past.” Finally, that the estimated man-hours required to produce aircraft at HAL would be three times the man hours taken at Dassault Aviation.

While the first insinuation is a myth, the second one is based on incorrect notions, and the third is a matter of industrial reality. The actual situation is contrary to what has been perpetuated as one will see from the following facts.

While the negotiated price per aircraft is closely guarded under the “secrecy clause” of the contract, “poor performance” has been unfairly alluded to HAL, which is unfortunate and has become a subject of open debate, which has harmed its global image and seriously damaged the Indian aviation industry in its entirety. The image and credibility of India’s public sector undertaking, including its “jewel in the crown” HAL, has become suspect in the

global aviation sphere. This is a matter of serious concern and warrants immediate and corrective measures to be instituted.

Now let us also consider impact of the outright purchase of Rafales without any local manufacturing or product support. The programme will entail enormous life cycle costs which will surely drain the defence exchequer. Apart from the national imperative of keeping HAL’s extensive facilities engaged, as also the strategic aim for achieving self-reliance being promoted in the ‘Make in India’ drive, HAL as a major partner of the Rafale programme would have benefitted from transfer of technology, apart from providing spares support over the Rafale’s life cycle of 35-40 years.

Track Record

Since its foundation in December 1940, HAL has grown from strength to strength and is now a world-recognised entity with 11 research and development centres, 20 production units and a work force of 29,300, HAL being ranked as 34th amongst the top 100 global aerospace industries. HAL has produced or overhauled over 3500 aircraft, both indigenous and under licence and some 5,015 aero engines. The turnover of the company during 2017-2018 was Rs.18,284 crore. In the last five years HAL’s contribution to the exchequer has been Rs.30,429 crores (dividend including taxes paid to the Central and state governments) and the PSU has made a (cumulative) profit of Rs.16,884 crores.

The real causes

But back to the present situation. It has been repeated again and again that the IAF had insisted on a “guarantee” from HAL because of what it said, was “unsatisfactory performance” in the past. This is a myth being perpetuated by an unfortunate mindset that ‘*videshi is achha and swadeshi is kachha*’. Unless that mindset is uprooted, self-reliance in defence aviation will forever remain a dream.

An important flashback: In 1993, the government had constituted a committee on fighter aircraft accidents (COFAA) headed by Dr APJ Abdul Kalam, then Secretary Defence R&D. The committee was to recommend remedial measures to reduce such aircraft accidents. Data of the Technical Defect (TD) accidents presented in the report clearly brought out that the rate of TD accidents (number of accidents per 10,000 hours of flying) on fighters, trainers, helicopters and transport aircraft of HAL origin was half that rate of accidents involving aircraft of non-HAL origin, of comparable technology and vintage, as is tabulated in the following paragraph,

Accident rate by aircraft type :

HAL MiG-27 : 0.50
RAC MiG-23 : 0.95
HAL Jaguar : 0.30
RAC MiG-29 : 0.62
HAL Kiran : 0.17
PZL Iskara : 0.42
HAL Cheetah / Chetak : 0.05
MIL Mi-8 : 0.18

Thus firmly established was that accident rate of HAL-made aircraft was far lower than those imported. I rest my case !

Unraveling more myths

Apart from such statistical data culled from the COFAA report, more examples are recalled from the writer’s experience to bust the unfair blame on HAL.

Ground flame-out of R-11 engines : Over a span of just one month there were 12 incidents of ground flame outs. HAL was blamed for poor quality in the process of engine overhaul. *It was established that actually maintenance lapses resulted in fuel contamination.*

Inability of Type 77 aircraft to recover from nosedive position : There were two such accidents in quick succession where pilots were unable to move the stabiliser servo booster from the nosedive position – but they ejected safely. Quality of the overhaul at Nasik Division was subjected to vigorous

scrutiny. *It was established that these accidents were because of maintenance lapses at the air force station where there were omissions in routine checks on inlet filters.*

Failure of 4th stage compressor disc of R-29 engine of MiG-27 : Bursting of 4th stage compressor disc on ground was yet another case where shadows were cast on the quality of discs manufactured at HAL. *Russian experts while giving ‘clean chit’ to the quality of discs manufactured at HAL, established that the failure was because of skipping of an operational drill during taxing. The problem was eliminated after pilots followed the prescribed SOP.*

Fatal accident of its Avro aircraft: There was fatal accident of an aircraft where the entire crew and IAF musicians band of 28 were killed. There were indications of ‘Fire



HAL -Avro 748



HAL Chetak

Warning’ and ‘Auto feathering of propeller’ prior to the accident and the IAF laid blame on quality of the engine overhaul. HAL was not in agreement as post-accident investigations were contrary to this theory. HAL then referred the case to BAE Systems for their independent opinion with a brief narrative of the sequence of accident and findings of the court of inquiry. *The conclusion was that this tragic accident had not happened in manner narrated by the COI but was due to maintenance and operational lapses.*

Jaguar accident/incident due to failure of hydraulic system: There were two identical failures of the Jaguar hydraulic system in quick succession when pilots could not lower the undercarriage and consequently had to abandon aircraft. The

IAF pronounced that it was because of quality lapses during aircraft overhaul. BAE Systems after investigating the second incident pronounced that it was due to IAF's operational and maintenance lapses which resulted in these failures. Independent investigations then continued by HAL established that the component failure was due to 'Low cycle-High load' fatigue. After initial reservation, BAE Systems eventually accepted that the cause was because of design deficiencies in the brake body of the combat slat motor. Eventually the OEM was held responsible which was finally accepted.

Summing up, in all the five cases cited above, maintenance, operational lapses and poor quality of the components supplied by the OEM were cause for the unfortunate situation and not HAL's quality as was made out by the IAF. There are many more such examples.

Incorrect calculation of man hours

HAL has also been blamed for 'high' man-hours (thrice that of the OEM) required to produce an aircraft. However, comparisons cannot be between 'oranges and apples'. If self-reliance is the nation's primary objective, a critical should be the acquisition of 'technology' while costs should not be the main criteria. In any major programme of the type and complexity of the Rafale, transfer of technology is of paramount importance. Decisions based on comparing just man-hours/cost will take us off on a tangent without appreciating the strategic intent.

Comparison of man hours of the OEM and the licensed manufacturer is not fair. In France, Dassault Aviation would surely have outsourced a large percentage of the work content and therefore its own man-hours would become relatively less. It is also an accepted fact that industrial productivity in tropical countries, including India is lower than in their Western counterparts.

Anyway, since HAL is required to give fixed price quotations for each batch of aircraft on order, the IAF gets the benefit



Hawk AJTs under production at HAL, Bangalore Complex.

of ever reducing man-hours owing to the learning curve phenomenon even as the production proceeds.

However, more important than productivity is the life cycle cost. The OEM's cost of spares support over the product life cycle for 30-40 years will inevitably soak up the IAF's allocated finances. HAL's pricing would certainly be more cost-effective over the Rafales' life in service.

In this package procurement of 36 Rafales, Dassault Aviation has promised 75% serviceability of the fleet but this should be looked at holistically. Serviceability of the fleet is not only joint responsibility of the operator (IAF) and the OEM but role of the operator is vital in ensuring expected level of serviceability, which in fact is much more than that of the OEM. If lower serviceability is attributed to operational and maintenance lapses, the OEM would certainly disown their commitments. This aspect needs careful analysis.

Carry out damage control – now !

The original RFP in 2007 for procuring 126 MMRCAs had a condition that the OEM take responsibility for HAL's share of work but further, the IAF insisted on such a guarantee from the OEM because of "unsatisfactory performance of HAL in the past". Such a condition, based on prejudices and misconceptions, has caused

serious damage to HAL's credibility and is completely against the essential objective of India's self-reliance in defence aviation.

Inclusion of such a condition in an international contract and further insistence of the OEM's guarantee is a serious slur on HAL, jointly committed by the IAF, senior MoD bureaucrats and perhaps politicians of that time. Need of the hour today is to institute a damage control exercise and giving HAL its rightful place. The Company's intrinsic capabilities and its potential contribution cannot be ignored. Non-inclusion of HAL at the initial stage has created a situation where the IAF will continually have to go back to direct purchases to meet its future requirements.

Damage control will have to be initiated sooner rather than later, with the Government initiating action at the highest priority and enter into another inter-governmental agreement to have future Rafales, if any, required by the IAF manufactured by HAL under license. The process of ToT has to start at the earliest to ensure continuity in deliveries of future Rafales.

The Government of India must take serious relook at ways to protect the interests of HAL. If all the wrongs committed on HAL are not corrected in time, all expertise built in-country over eight decades will be wasted away for lack of continuity even while the nation faces challenging tasks. ✈️

Looking for a Fighter for India's future



Dassault Rafale

Going back to the beginning

In April 2018, the Indian Air Force released an RFI (request for information) for 114 fighters, not very much after the present government scrapped the MMRCA deal for 126 fighters to buy 18 ready for combat Rafale fighters and 108 to be built in India. The French Rafale (*picture above*) was chosen as the fighter for the future after an almost decade-long process of contemplation, examination, evaluation and a competition that came to be called the “shoot-out”. We still haven’t got to know why it was really scrapped?

The IAF was hoping for a minimum of four squadrons of Rafale fighters, but this government has kept the initial order down to 36 fighters in a flyaway condition.

Commenting on this, the Air Officer who was part of the intensive selection process that led to the choice of the Rafale, Air Marshal (retd.) M Matheswaran observed that “the original MMRCA tender was cleared for \$10.5 billion for 126 aircraft,” suggesting that delay in deciding is also a factor that is costing the country dear.

The Rafale is a twin engine, canard delta wing, multi-role fighter designed and built by Dassault Avions to replace a multitude of specialised platforms such as the Jaguar, Mirage F.1, Mirage 2000 and Super Etendard in French service. To that extent it is truly a multi-role aircraft, but is still very different from what it was initially intended to originally replace : the Mirage 2000.

The single engine Mirage 2000 was designed as a competitor to the USA’s F-16 and made an impressive debut at the Farnborough air show in 1978. In 1985, in response to Pakistan’s acquisition of F-16 fighters, the Rajiv Gandhi government decided to induct over 100 Mirage 2000 fighters into the IAF. The first 49 aircraft had been imported from France and the rest were to be manufactured by HAL. But the second part of the programme was not implemented despite HAL having intensively prepared for the production of Mirage 2000s at its Bangalore Complex.

But there is another mystery implicit in how a bid by the IAF to buy more single-engine Mirage 2000 fighters became a bid for the heavy MMRCA. The MoD turned



Depiction of Lockheed Martin F-16 Block 70 in IAF colours

this IAF request down opining that the Mirage 2000-5 variant being offered by Dassault was a different aircraft because it was not the Mirage 2000. The dash 5 suffix was enough for the mandarins to decide it was a different aircraft and hence a fresh bid should be called for ! This is how the requirement for a lighter fighter became a competition between heavier fighters.

Now we are back at square one. The IAF still wants light fighters to replace its large and obsolete fleet of single engine light fighters like the MiG-21 (*which was the raison d'etre for the LCA programme in the very first place : Ed*).

The arguments over the pros and cons of single and twin-engine fighters are old. One perennial argument is that two

engines make the aircraft less vulnerable, give it more range and weapons load. Fighter pilots who know say that single engine fighters being smaller are better optimised aerodynamically improving their survivability in a dogfight. They argue, “having one engine means that mass is distributed closer to the central axis which reduces roll inertia and improves roll onset



Indian Air Force Mirage 2000s

rate". Their smaller size also means that they are more difficult to acquire by hostile radar or visually. These experts also argue that single engine fighters tend to have superior fuel fractions, which is the weight of the fuel divided by the gross takeoff weight of the aircraft. A lower fuel fraction means a comparable or longer range. Besides all modern fighters, light or heavy, are now equipped for aerial refueling.

The generally believed superior survivability of a twin-engine fighter is also questioned. Most modern twin-engine fighters have their engines next to each other and the loss of one in combat or due to fire often means the other also doesn't make it. These experts also cite numbers to bolster their claim. Their data shows that the USAF loses more twin jet F-15s to engine fires than the single engine F-16. Also the F-18 Hornet's crash rate is 3.6 per 100,000 hours, while the Gripen's is 2.46. Others challenge the survivability argument citing Gulf War data analysis showing the F-16 had a loss rate of 0.22 per 1,000 sorties while the F-15s had a loss rate of 0.91 and F-18's a loss rate of 0.66.

The proponents of twin-engine fighters usually weigh in with the IAF's experience with the MiG-21. The MiG-21 was designed in 1954 and has some basic design flaws such a cockpit visibility and high landing speed (360 kmph). Almost half

the MiG-21 crashes were due to pilot error due to inadequate training facilities such as AJT's and simulators. To compound problems the quality of manufacture and spares by HAL has been very suspect. In any case, the MiG-21 series are well past their use till age. The IAF literally flies them held together with wire and soap. That's why they should be retired to parks and playgrounds as soon as possible.

Finally there is the cost factor. According to open sources a JAS 39 Gripen can cost anywhere between \$30-60 million each depending on configuration. By contrast a Rafale starts at \$80 million and is well over \$100 million including add-ons.

According to the website www.airforce.com, the Gripen can out compete current European twin-engined fighters on costs and in a number of key areas such as better range, higher speed, less weight and lower operating costs. A former Air Chief estimates a price difference of anywhere between Rs.250-350 crores each between the 4th generation single and twin-engine fighters.

The IAF has been shouting itself hoarse over the rapidly depleting fleet. The MoD's insistence on a completely new process, like the almost decade long MMRCA one is seen as another ploy by the bureaucrats to delay the process. It makes even less sense when the IAF and MoD have the information needed to make an enlightened and perhaps

even honest decision. But the question still remains; why not restrict this bid to single-engine fighters, particularly since the total costs will be much less? Besides the only two single-engined fighters to choose from now are the Saab Gripen E and the Lockheed F-16V Viper which have already been evaluated in the course of the MMRCA shoot out. Both manufacturers have expressed their willingness to break ground in India and build factories to aggregate the aircraft here.

The promise of the Tejas LCA has so far remained just that : Even if the LCA Mk.II is finally cleared for series production, HAL cannot produce them in the numbers and time frame the IAF requires. Clearly we need two production lines of single engine light fighters, one of who must almost certainly be the Tejas. In the years to come, as India's economy grows and as regional geo-politics will inevitably change, India will have to consider a bigger air force and hence cost will become a more important factor. Unlike the HF-24 Marut, the Tejas should become the building block for a truly indigenous fighter aircraft design and production capacity. That's why, apart from the huge economic benefits, 'Make in India' becomes so important. Without it we are just like another Saudi Arabia splurging on military hardware. 🦋

Mohan Guruswamy

The Saab Gripen E is proposed for the IAF



Managing the “fighter gap”



MiG-21s still equip seven squadrons of the IAF, over five decades after the first variants were inducted

A further fall in squadron numbers with the Indian Air Force now seems inevitable. The IAF should already have retired the remaining seven squadrons of obsolete MiG-21s and this cannot be put off longer than the next couple of years. To replace them, Hindustan Aeronautics Ltd (HAL) is building the last two squadrons of Sukhoi Su-30MKIs at Nasik and two squadrons of LCA Mk.I fighters in Bengaluru. Then there are the two squadrons of Rafale fighters that must be inducted by mid-2022. That adds up to just six incoming squadrons against the outgoing seven, whittling down the IAF’s combat strength to 29 fighter squadrons, of which the three Mirage 2000 squadrons operate fewer fighters than their authorised

unit establishment. The IAF, therefore, faces a “fighter gap” of 13 squadrons, more than 30 per cent of its authorised strength.

If 42 squadrons are the inescapable minimum needed to defend India, the IAF would be caught seriously short in a two-front war – the worst-case planning contingency in which China and Pakistan target India simultaneously. Some have argued that India’s defence no longer requires 42 squadrons, given that contemporary multi-role fighters carry more weapons and are far more capable than yesterday’s aircraft and those capabilities are further enhanced by force multipliers such as mid-air refuelling aircraft and airborne warning and control systems (AWACS). The previous NDA defence minister,

Manohar Parrikar, had indicated that the IAF could get by with fewer squadrons. In January 2015, he had said that “if 35 (fighter) squadrons can be brought to a proper shape, that would give us more time to increase the strength.” And on 13 April, 2015, three days after Prime Minister Narendra Modi announced in Paris that he had asked French President Francois Hollande to sell the IAF 36 Rafale fighters, Mr Parrikar stated on *Doordarshan*: “Forty-two squadrons is the strength approved. We should have at least 37-38 very active squadrons.” Yet, even with these scaled-down numbers, there will be a “fighter gap” of eight to nine squadrons after 2022. For enemy planners, this provides a predictable window of opportunity.



Seen together at an Aero India Show are a pair of French Rafales with a trio of Swedish Gripens



The Tejas LCA Mk.1

Towards bridging this shortfall the government had initiated in April 2018 the procurement of 114 new fighter aircraft – or for six new squadrons. Even if these contracts are processed with unprecedented speed, the fighter gap will remain. That is because the 114-fighter proposal envisages the first squadron being delivered, fully built, only after another five years, or by end-2024. The next five squadrons, which are to be built in India, will come on stream over the next 5 to 12 years from contract

signing, that is between 2024 and 2032. And this assumes that such a contract is signed by end-2019.

Nor is the proposed LCA Mk.1A likely to enter service fast enough to bridge the fighter gap. In December 2017, the defence ministry sanctioned Rs 33,000 crore (Rs 330 billion) for building 83 LCA Mk.1As – or four squadrons of fighters – starting from 2020-21, with HAL’s production line churning out 16 fighters, or almost one squadron every

year. But, typically, the LCA Mk.1A is already being delayed by uncertainty. Initially, the Mark.1A was to have four capability enhancements to the current LCA Mk.I, including active electronically scanned array radar, an electronic warfare suite, a self-protection jammer, mid-air refuelling capability and easier repair and maintenance. Then, the IAF additionally demanded “smart multi-function cockpit displays”, a “combined interrogator and transponder” to differentiate between friendly and hostile aircraft, a digital map generator and an improved radio altimeter. Integrating these systems onto the LCA Mk. 1A requires comprehensively redesigning its mission computer – another delay of three-four years.

Such amateurish planning stems from a worrying inability within the military and the defence ministry to anticipate equipment retirements and to identify, evaluate, budget for and procure the equipment needed to fill those gaps. Instead of launching a new competitive procurement initiative for 114 fighters on exactly the same lines as the failed procurement of 126 Rafale fighters, there is a need to step back and examine our procurement record.



Saab Gripen at Aero India



SU-30MKI

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Historically, India has been successful in only three categories of procurement. First, in the purely indigenous development of strategic weapons systems like ballistic missiles, where watertight international sanctions forced Indian technologists to indigenise practically every dimension of these systems. With no option available for import, the Defence R&D Organisation (DRDO) conceived the Integrated Guided Missile Development Programme (IGMDP) and translated it into four successful missile systems – the Agni and Prithvi ballistic missiles, the Akash air defence missile and the Nag anti-tank missile.

The second successful procurement model has involved the DRDO working with foreign technology partners and India's private sector, with the latter two compensating for gaps in the DRDO's own capability and capacity. Examples of such successes are the Indo-Russian BrahMos and Indo-Israeli Long Range Surface to Air Missile (LR-SAM), the Pinaka rocket launcher, Advanced Towed Artillery Gun System (ATAGS) and the *Arihant*-class nuclear submarine.

The third successful procurement model has involved government-to-government deals, such as the T-90S tank, C-17 Globemaster III aircraft and a myriad of combat aircraft, such as the Sukhoi



Boeing C-17 Globemaster III departs on a mission

Su-30MKI, Mirage 2000 and numerous MiG-series fighters. In these procurements, the government jettisoned ambitious multi-vendor contests and instead consulted the relevant service to identify suitable weapon equipment. Trials were conducted where necessary and the deal then concluded with the vendor country, for either an off-the-shelf purchase or for building the equipment in India with transferred technology.

With the first model irrelevant and the second model already adopted for the LCA Mk.1A, an expeditious purchase of 114 fighters could best be executed through the government-to-government model. There is little time for cumbersome technical and trial evaluations of multiple fighters on offer,

which, in any case, ignores broader factors such as the simultaneous procurement of 57 naval multi-role combat aircraft for India's aircraft carriers. Bunching these two procurements together would provide a better deal, something that has been ignored so far. Additionally, aspects of strategic and technological partnership must feed into this multi-billion dollar decision.

To a government already burned by the Rafale allegations, this may seem fraught with peril. But all it requires is intensive consultations with the military, rather than the political unilateralism that has proved damaging to the government in buying new fighters. 🦋

Ajai Shukla



Tejas LCA deploys parachute-brake on landing



Why not 50 ?

Pair of IAF Mirage 2000s

Ravi Rikhye plumbs for a 50 combat squadron Indian Air Force to really get the odds right !

Explaining irrationality is difficult. The Indian Air Force has yearned for a 42 fighter squadron force. However, after the two Rafale squadrons are operational, probably by 2022, and the long overdue phase-out of the MiG-21 completed, the IAF will have just 29 squadrons: 13 Su-30, 6 Jaguar, 3 Mirage 2000, 3 MiG-29, 2 Tejas, and 2 Rafale. The Air Force is modernising some of its existing aircraft, which is wise, but only if the Government of India understands that we are well below expected strength and modernisation serves only as a stop-gap while waiting for new aircraft.

First, let's look at the magical pixie dust figure of 42 squadrons. That was formulated decades ago, when the Chinese Air Force was limited in its capabilities on our northern frontiers. That figure is meaningless now, as China continues relentless modernisation of its air force and its Tibet-basing capability.



Pair of PAF JF-17 Thunders

Moreover, for many years the Chinese have shaped their military forces to operate on an all-China basis, instead of the regional model they have earlier been built on. Today the Chinese Air Force has 1700 combat aircraft of which perhaps 500 are 4th Gen. Meanwhile, Pakistan has grown to 20 squadrons including its elite Combat Commander's School. China is modernising at the approximate rate of 100 new aircraft every year and Pakistan at some 20 every year. And we are actually phasing out at least 40 aircraft every year.

No one is saying that the Chinese Air Force is 3-metres tall. It surely has some problems with its newer designs, and its 5th Gen aircraft have a very long way to go despite Chinese tom-tomming otherwise.

Nonetheless, China has a GDP of \$14-trillion, a massive aviation R&D base, a propensity for hard work – and the determination to overtake the US in military power. A back of the envelope calculation suggests that India should actually be aiming for 50 combat squadrons, not 42. Thus the IAF is actually woefully short.

We Indians inhabit two realities simultaneously. One of the “ideal” the other as “real”. In an ideal world, the IAF should have nine Rafale squadrons plus nine of the Tejas, and as first of the six new fighter squadrons start standing up, say by 2023, this would-permit 50 combat squadrons, even after six of the older existing squadrons are phased out.

But in the real world, instead of formalising a 6+3 squadron Rafale deal in 2012, this was reduced to two squadrons in 2015, and that from without provision for maintenance reserve/strike-off wastage (MR/SOW) of 6 aircraft, plus 8 more for the TACDE. The LCA Tejas production remains stuck in some black hole; the LCA Mk.II, which is the IAF's dream version, will not fly till 2023 – at the earliest. Meanwhile, the Government has sent out an RFI for 114 new fighters even though more Rafales make most sense from the viewpoint of continuity and standardisation.

What has really been happening? In 1962, India spent 1.9% of GDP on defence (excluding pensions). After the 1962 China-border war, this stayed around 3-3.5% until 1989, when the financial crisis forced a temporary decline. When the economy recovered, the GOI decided to keep money to spend on “vote-buying schemes” and aside from an occasional bump up, this



Pair of Dassault Rafales



Tejas light combat aircraft

came down to 1.65% in 2018. Because salaries keep going up, such reduction has really been on new equipment, so the result is that India's armed forces have a 30-year modernisation pileup.

The size and structure of India's armed forces, however, requires a minimum of 3.5% spending, which means another \$50-billion year on year for equipment from now onwards. Will the GOI spend this, even as we in 2019 become the world's fifth largest economy after the US, China, Japan, and Germany? As without funds, there can no modernisation. Indeed, the way it is going, India could well have to downsize its forces by half, say to 20 Divisions, 18 fighter squadrons, and 50 first class warships.

We could live with this, but all that requires a major and fundamental policy

change and could well mean compromising on Kashmir, giving up the Aksai Chin and Arunachal to the Chinese. Accepting the Chinese offer of withdrawing its Arunachal claims for India with a counter offer of acknowledging that Aksai Chin is part of China will work only for a short time because Beijing is taking an increasingly expansive view of its “lost” territories.

If this is what the Government (and the people of India) want, so be it. But we cannot give up our independent status. Now, if the \$50-billion missing from the defence budget were being spent productively, that would be one thing. Instead it is going in subsidies which encourage inefficiency. This is a lose-lose situation: neither guns nor butter with the money saved by cutting the defence budget in half. 🦋

'God of the Seas'



The Indian Navy's LRMRASW force

Named by the US Navy, as *Poseidon* ('God of the Seas' as per Greek mythology) the Boeing P-8 was selected by the Government of India to fulfill the Navy's long range maritime reconnaissance and anti-submarine warfare aircraft (LRMRASW) requirement. The Indian Navy had for several years till then been operating large, Russian-origin Tupolev Tu-142M (NATO *Bear-Foxtrof*) and Ilyushin Il-38SD Sea Dragons in this role but clearly with mounting serviceability issues, their urgent replacement was sought. The 'acceptance of necessity' (AON) was accorded by the Defence Acquisition Council (DAC) in September 2005 and requests for proposal were issued in December 2005 to a number of OEMs. Responses were received from five companies in April 2006 and thereafter evaluated by a technical evaluation committee. Both the Boeing P-8 (based on the commercial Boeing 737 airliner) and EADS-CASA derivative of the

Airbus A319 airliner were down selected and the Boeing variant finally chosen in December 2006.

As per the official statement "the Government of India has selected Boeing IDS to provide eight P-8I long-range maritime reconnaissance and anti-submarine warfare aircraft to the Indian Navy. The P-8I is a variant of the P-8A Poseidon that Boeing is developing for the US Navy and India is the first international customer for the P-8. Boeing will deliver the first P-8I within 48 months of the contract signing, the remaining seven by 2015".

The President of Boeing Integrated Defence Systems (IDS) reinforced that decision: "This aircraft will provide outstanding capabilities tailored to India's unique maritime-patrol requirements.... the aircraft will bring the Indian Navy advanced technology that is unmatched in maritime reconnaissance aircraft, and the reach and capability it needs to defend India's maritime

interests." The P-8I was described as being "a true multi-mission maritime patrol aircraft (MPA) that features greater flexibility and a broader range of capabilities than aircraft currently in service...can operate effectively over land or water while performing anti-submarine warfare missions; search and rescue; maritime interdiction; long-range intelligence, surveillance, target acquisition and reconnaissance".

Following detailed and comprehensive negotiations, on 1 January 2009 the Government of India formalised the contract for eight Boeing P-8I aircraft with the Company as also approved infrastructural augmentation at their intended base, INS *Rajali*, at Arakonam in Tamilnadu. Indian Naval teams were thereafter seconded to Boeing facilities at Seattle on the north western Pacific coast of the United States for contract management, even as the Navy selected personnel, both pilots and observers for operational conversion training.



The first Indian Navy Boeing P-8I seen over the Seattle area

Five batches, each comprising two pilots, five observers and two technical sailors, making a total of 35 Indian Naval personnel, were given operational training on the Boeing P-8I at Seattle beginning from late 2012 till October 2013, with time on type-simulators plus 20 hours in-flight. The squadron commander designate was Captain HS Jhaji, the other pilots being Cdr VS Ranganathan, Cdr Savio Rodrigues, Cdr VS Barve, Cdr Vivek Chandahas, Cdr Amit Mohapatra, Lt Cdr AK Singh, Lt Cdr Ajay Kanwar, Lt Cdr Shobhit Mittal and Lt Cdr Kashyap Srinivasan. The pilots were from varied flying backgrounds, having flown Tupolev Tu-142Ms, Ilyushin Il-38SDs and Dornier 228s.

The 25 Observers included Commanders V Ramraj, Sudeep N, Ravi Kumar and Ravikant Pandey and there were 3 lady officers including Lieutenant Ambica Hooda, Lieutenant Seema Rani Sharma and Lieutenant Aruna Bhardawaj, the last batch completing their training in August 2013.

Meanwhile, the Indian Navy's P-8Is, resplendent in their new colours and sporting the initials 'ARK' (for Arakkonam) on their tails, had completed 'shake down flights' in the Seattle area of north western United States and began their ferry flights to India, the first aircraft arriving in Arakkonam in May 2013, with the eighth and last landing in October 2015. The P-8Is were to share this sprawling Naval Air Station with the Tupolev Tu-142Ms of INAS 312 'Albatross', themselves being formed into INAS 312A ('312-Alpha') although INS *Rajali* still had limited infrastructure for the P-8s with most of the planned improvement still underway.



Welcome to Rajali !



The first CO of INAS 312A was Captain HS Jhaji, seen here being greeted by the FOC-in-C as the first aircraft arrived at INS Rajali



Strange bedfellows ! Indian Navy P-8I taxis past Indian Navy Tu-142Ms at INS Rajali [Photo by Angad Singh]

Plans had called for all eight aircraft to be housed in dedicated hangars, a concept new to the base since the eight Tupolevs of INAS 312 had spent the entirety of their service lives parked out in the open. There were delays on infrastructure development at Arakkonam perhaps because of its somewhat remote location, far from urban centres and therefore from competent engineering and construction resources.

However, the key advantage inherent to the Boeing P-8I was that it was based on the highly successful, massively-produced Boeing 737 commercial airliner, endowing it with high reliability and an extremely small logistical footprint, particularly in contrast to the Soviet-era aircraft that it was replacing. Compared to the Tu-142M, the P-8I has a slightly reduced endurance of around 9-10 hours, but managed this with a mere 32 tonnes of fuel as against the gargantuan 85 tonnes required by the Tupolevs for the same mission.

The P-8I is in fact a heavily modified 737-800, and could easily be mistaken for its civilian cousin from a distance. Upon closer examination, however, the differences are more readily apparent. The 737-800 fuselage is strengthened and mated to wings derived from the 737-900, these

wings featuring two key modifications : sleek raked wingtips instead of the winglets typically seen on commercial 737 variants, and hardpoints for AGM-84 Harpoon anti-ship missiles, two under each wing, just outboard of the engines. The powerplants themselves are relatively unchanged, but the increased electrical power requirements for onboard systems required the CFM 56-7B turbofans to be encased in redesigned

nacelles with bulges to accommodate larger 180kVA generators.

A combined weather/search radar, Raytheon's AN/APY-10(I), is housed in the nose of the aircraft, and complemented by a Telephonics APS-143C(V)3 multimode radar (MMR) housed under the fuselage just aft of the landing gear. The AN/APY-10(I) is a variant made specifically for the P-8I and incorporates an air-to-air



Harpoon missiles seen under wing of an IN P-8I



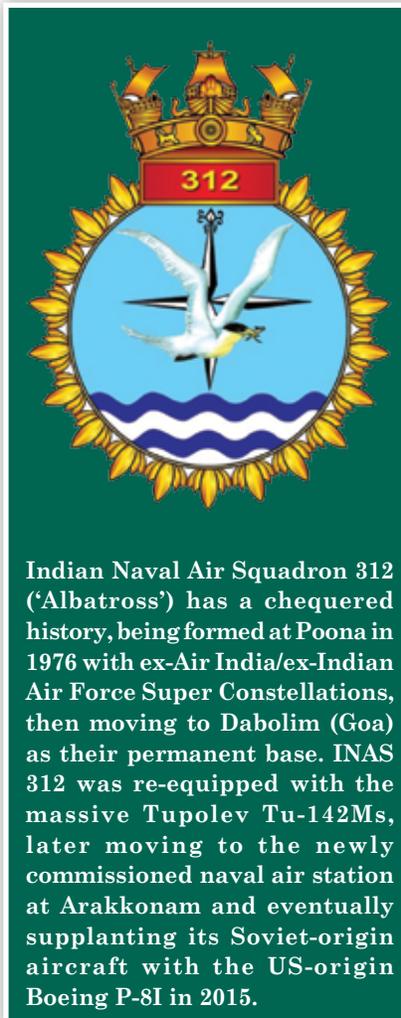
Various Indian-origin systems are integrated on the Indian Navy P-8I

mode, allowing detection of threats in the air as well as at sea. It also includes an interleaved weather and surface search capability to provide the flight deck with accurate weather avoidance information while allowing sensor operators in the cabin to perform surveillance tasks. The APS-143C(V)3 is more mission-specific to the LRMR role, featuring a multitude of modes geared toward maritime operations.

In addition to the radar, the aircraft has a retractable L3 Wescam MX-20HD electro-optical/infra-red (EO/IR) turret installed forward of the wing, along with a magnetic anomaly detector in a short boom near the APU exhaust. A full ESM/ELINT suite is incorporated, as are a number of Indian-developed systems such as a BEL-developed datalink and IFF interrogator, weapons bay doors and tailcones from HAL, as also APU door fairings and radomes from Tatas.

Personnel requirements were similar to the Tu-142, with a typical mission involving 9-10 crew members, but some archaic posts such as the flight signaller and navigator were dispensed with, providing the P-8I with more mission operators to focus on the sensors. There are only two flight technicians, whose primary role is loading the internal rotary sonobuoy launchers.

Crew training was initially conducted in the USA, but as more experience was gained, this moved entirely to India and



conducted in manner similar to the other maritime reconnaissance squadrons.

The first batch of ten pilots selected for P-8I conversion comprised four former 11-38 pilots, four from the Tu-142M fleet, and two Dornier 228 pilots. Similarly, all mission operators had prior experience in their role before conducting their conversion. There were no simulators in-country and while the terms of the contract with Boeing did not cover simulator construction in India, the Navy was exploring options for flying training of P-8I crews that would either see it build and operate a simulator at INS *Rajali* itself, or utilise commercial simulators to take advantage of the P-8I's commonality with the Boeing 737 airliner.

On board the aircraft, once again in stark contrast to the Tu-142Ms, the P-8I provides an unparalleled level of comfort to its crew. There are extra seats to accommodate additional crewmembers, reducing individual workloads if necessary, and toilet and galley facilities similar to those found on commercial airliners, which makes them a world apart from the rather simian amenities offered by the two Russian MR aircraft types operated by the Indian Navy. The ability of the P-8I to attack underwater targets on ASW missions remains relatively unchanged when compared to the Tu-142M, though the Boeing aircraft carries two more torpedoes than the Tupolev. The true 'game changer' certainly is the AGM-84 Harpoon with



Dispensing flares during an exercise over the Bay of Bengal

ability of the P-8I to autonomously detect, track and prosecute surface targets. While this capability also exists for the upgraded Il-38SD aircraft based at Goa, induction of the P-8I marked the first time that any of the Arakkonam-based aircraft had an organic ASuW ability.

These formidable aircraft of '312-Alpha' were quickly off the mark, operating all over the seas surrounding the Peninsula and well beyond, in the Indian Ocean Region, tracking surface vessels and submarines across the IOR. Before the Squadron was even formally commissioned, they had conducted deployments away from their home base, operating from Port Blair as well as Malaysia during the MH370 search efforts. In fact, a P-8I was ready in place at a base in Malaysia within 24 hours of India's commitment to this international operation. Regardless of the type's fledgling status in the Navy, this deeply impressed crews and commanders alike, and there is nothing but heady optimism for the future of the P-8I in service with the Indian Navy.

INAS 312A was formally commissioned by then Defence Minister Manohar Parrikar in October 2015, the Minister having flown to INS *Rajali* onboard an Indian Navy P-8I from Port Blair. The dedication ceremony at INS *Rajali*, home base of Indian Naval Air Squadron (INAS) 312A now under the command of Commander Venkateshwaran Ranganathan, was held in presence of the then Chief of the Naval Staff Admiral RK Dhowan and then FOC-in-C, Eastern Naval Command Vice Admiral Satish Soni.

With final phase out of the Tupolev Tu-142s, INAS 312 became a purely P-8I

squadron and with increasing operations achieved 10,000 flight hours by mid-2017, also receiving the Chief of Naval Staff's unit citation for "outstanding operational performance". The P-8I has endowed the Indian Navy with very long (sea) legs and for the first time in its history, flew the IN's flag far and wide. In October 2017, for instance an Indian Navy P-8I was deployed to the Philippines, carrying out search and rescue of missing sailors, many Indian, from the MV *Emerald Star* which had sunk northeast off the coast of the Philippines. Operating from Villamor Air Base of the Philippine Air Force in Manila, the aircraft (IN 323) dropped SAR kits which contained inflatable dinghies.

In July 2016, the Cabinet Committee on Security (CCS), chaired by PM Narendra Modi, approved the purchase of four additional Boeing P-8I aircraft at a cost of \$1 billion (Rs 6,700 crore), the first of which are to be received in late 2019. It is expected that these aircraft will be based at INS *Hansa*, Goa and possibly given the nomenclature INAS 315A, as expected to supplant the Ilyushin Il-38SDs which presently equip INAS 315 *Winged Stallions* at Dabolim. Future plans could well include doubling of the P-8I inventory and this is very much part of the Navy's long term perspective plan.

In 2017, Boeing was contracted for 3 additional years in support continuation of the Indian Navy's fleet of P-8Is. Beyond field and logistics service, the contract included engineering, support and planning, robust material support, including a 737-based component services programme, to be executed in conjunction with Boeing Commercial Aviation Services' Fleet Services division.

The Indian Navy's P-8Is have also operated alongside P-8As of the United States Navy from their patrol squadron (VP 47), based at Pearl Harbour (Hickam) most recently in August 2018 during *Rim of the Pacific* (RIMPAC) exercises. In October 2018 a US-Navy P-8A participated with the Indian Navy in anti-submarine warfare exercises from INS *Hansa*, in Goa on the Arabian Sea.

The P-8I has now truly given the Indian Navy's air arm an international stature. 🦋



The Indian Navy has 8 Boeing P-8Is in service and expects to receive four additional aircraft in the next two years [Photo by Angad Singh]

Much more than a Book Review

BRIS and the Mod Quad

Bharat Karnad's analysis of India's evolving social, political and economic milieu, under Prime Minister Narendra Modi, is a critical perspective, both argumentative and thought provoking. Ajai Shukla's review of the book 'Staggering Forward' extracted below, first appeared in the 'Business Standard' and pertinent parts are reproduced along with with the chapter on ShinMaywa which would be of special interest to readers of the *Vayu Aerospace & Defence Review*.

Many of the themes in Bharat Karnad's latest offering were earlier fleshed out in his 2015 book, *Why India is Not a Great Power (Yet)* and have since been amplified in his prolific writings, blog posts and speaking appearances. Mr Karnad, who styles himself in his blog as "India's foremost conservative strategist", certainly has robust views. He believes that if India wants to be treated like a Great Power, it must start thinking like one. New Delhi's defence and security focus should be on China, without wasting effort on minnows like Pakistan. To ward off China, India must abandon its pusillanimous "No-First-Use" nuclear doctrine and be ready to go first with nuclear weapons to halt a Chinese conventional attack. To persuade Beijing from responding in kind, Mr Karnad wants India to develop, test and deploy thermonuclear weapons, which he regards as the final arbiters of power. Washington, he believes, constrains, not benefits, India. The relationship with Moscow must be nurtured more carefully. Karnad also wants India to outflank China and Pakistan through military bases in Central Asia and the Gulf.

In this book, Mr Karnad looks inwards at the trajectory Indian politics and policymaking has followed since Prime Minister Narendra Modi came to power in 2014. Given the author's unapologetic, nationalistic, India-first approach to security policy, many would logically expect him to endorse the Bharatiya Janata Party's (BJP's) policies and achievements. But the hawkish Karnad of foreign and security policy reveals himself as slightly leftist liberal on domestic policy. This revealing sentence sums up his book: "This book is in the

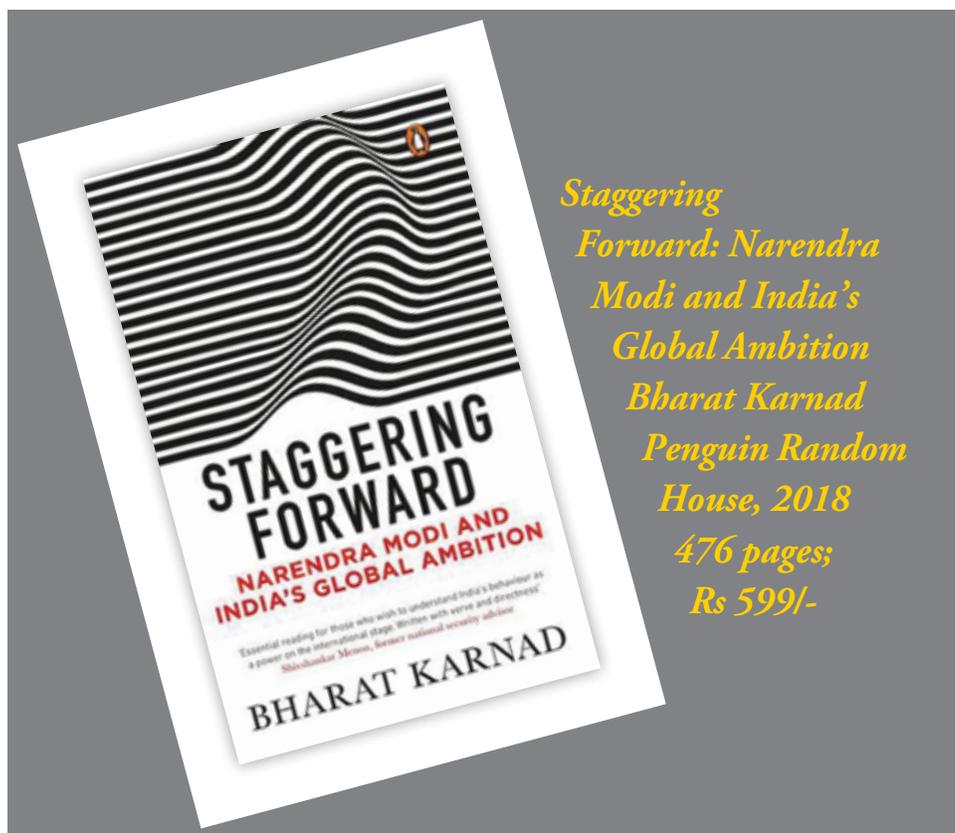
main a critique of Modi's foreign and national security policies – an audit if you will... If readers find the analysis suffused with disappointment, they will not be wrong."

In the book's most original strategic construct, the author suggests New Delhi could obtain genuine strategic autonomy and counter the "proto-hegemons" – the US and China – through two new security coalitions. The first is BRIS – named after *Brazil, Russia, India and South Africa* – which is BRICS with China removed. Mr Karnad, however, does not clarify who will expel China, or how.

The other coalition India should join is the catchily named *Mod Quad*, short for *Modified Quadrilateral*. This weaponised grouping cuts out America from the

current Quadrilateral (India, US, Japan and Australia), replacing it with a rash of South East Asian countries. Myanmar and Vietnam book-end the landward side, while Indonesia and the Philippines anchor the sea-end, with other countries like Singapore, Thailand, Brunei and Malaysia in the middle. Given the difficulties these very countries face in presenting a united front in the Association of Southeast Asian Nations (ASEAN), Karnad should have clarified how they would manage with the additional contradictions of the Quadrilateral.

Notwithstanding several contradictions, Mr Karnad presents an interesting evaluation of Mr Modi's strategic and economic performance, which will probably be widely read in an election year (*see below*).



*Staggering
Forward: Narendra
Modi and India's
Global Ambition
Bharat Karnad
Penguin Random
House, 2018
476 pages;
Rs 599/-*

Extracted from Bharat Karnad's book 'Staggering Forward'

The ShinMaywa US-2i and Indian Ocean Strategy



India and Japan are intent on a concert of like-minded states in the Indo-Pacific to block China. Prime Ministers Modi and Shinzo Abe get along well and aspire to mesh Indian manpower with Japanese financial resources to construct a chain of seaports and related infrastructure in island nations and along the East African, Gulf, South Asian and South East Asian littorals to facilitate intra Indian Ocean Region trade and commerce (the Asia–Africa Growth Corridor) as a rival to China's BRI. It conceives of economic triangles of cities and manufacturing hubs connecting regions with the promised infusion of \$200 billion in this region. And yet the flagship project, other than the Shinkansen high-speed railway linking Mumbai with Ahmedabad, of setting up a production plant in India with transferred technology of the ShinMaywa US-2 amphibious aircraft, a project Tokyo lays much importance by, has not taken off, owing to the obdurate defence ministry bureaucrats in Delhi and, surprisingly, Modi's inaction in pushing this project over the hump.

The Indian bureaucracy is justly famous for being a wrecker of dreams, for gutting the best-laid plans of Indian leaders, but only because the prime ministers have not held the bureaucrats accountable, and otherwise failed ruthlessly and fearlessly

to rewrite rules of business and eradicate what a senior diplomat called 'atomised' bureaucratic decision-making in the Indian government. Absent is the possibility of being kicked out of service, courtesy *Article 311* of the Constitution guaranteeing lifetime job security, the default option of the lowest civil servants is to do nothing or as little as possible to get by unless top-driven to produce time-bound results or in crisis situations when non-performance can have costs. Some examples of the MEA's egregious inaction have already been retailed. Even so, a couple more stand out.

In 2013, in the lead-up to the annual India-Russia summit, Manmohan Singh's PMO succeeded in convincing the Russian President Putin, who was pressing the Indian government to buy four *Grigoryevich*-class frigates, that because India was as keen to strengthen its own warship-building industry as Russia was in building and selling its frigates, the two sides could compromise by constructing all these ships in India and sharing equally in equity and effort. Putin was persuaded and agreed to this scheme. That's where the deal still stands with not an inch of movement by the Indian side on this project, because the defence ministry bureaucrats cannot seem to agree on which public sector shipyard to assign the work to and what

the role of private-sector shipyards should be. Moscow, meanwhile, has fretted and fumed. Modi hasn't instructed the ministry to get going and, therefore, nothing has happened.

Stunning Example

A more stunning example of Indian bureaucratic turpitude is the ShinMaywa US-2 programme that Prime Minister Modi and Abe had agreed on but this is twisting slowly in the Indian bureaucratic wind with no push from the PMO, or the MoD, and thereby hangs a tale that is as much farce as national tragedy.

India's immense maritime domain—1208 islands, most of them bunched in the Andaman Sea, and an EEZ of 2.2 million square miles in the Indian Ocean—cries out for a fleet of amphibious surveillance aircraft to patrol this vast area, a role that the land-based Dornier aircraft with the Navy and the Coast Guard can only inadequately perform. In late 2010, discussions formally began on acquiring an amphibious aircraft and decision made that the navy would be the lead agency for procurement purposes because it would operate it, and because seaplanes defined under UNCLOS regulations have to comply with numerous nautical guidelines that the navy is familiar with.

So a request for proposal (RFP) was issued in January 2011, to which seven or eight international companies responded, ranging from the smallest carrying four people to the largest able to carry 200. There were many concerns with range, speed, sea-keeping ability, the amount of cargo that would go through and the kind of specialised roles it would need to perform. A series of discussions within the MoD with the Navy, Coast Guard, Air Force and the Headquarters Integrated Defence Staff followed. After examining all the proposals, it was concluded that there was only one aircraft type that met the mission-role: the US-2 aircraft produced by the Japanese ShinMaywa Corporation.

This aircraft has several unique features which are not found in any other seaplane. First is its ability to operate in 'sea-state 5' which means 3-metre wave heights which many Indian naval ships find difficult to handle. The second is its short take-off and landing capability-it can take off in 7 seconds inside of 300 metres versus 40 seconds of its nearest competitor. It needs very short runways and can align to whichever direction the wind is blowing and become airborne. The third factor is that it has very low draft-it can go very close to the beach, lower the undercarriage and taxi up the beach as long as it is a hard beach. It also has a glass cockpit and search and rescue

(SAR) systems, all very high-technology: No other aircraft in the world has all these features and it is the only military-certified amphibious plane of its kind.

While these discussions were on, India-Japan relations were developing fast with an agreement to ratchet up the 'special relationship' to a higher level. There were also things happening within Japan at the time. The South China Sea issue was on the boil and Tokyo was looking to find allies and partners to hold its own against North Korea and China, and India was its preferred potential partner. There were staff level talks, 2x2 meetings of defence and foreign ministers, defence and foreign secretary-level talks and a large number of interactions of the Track 1.5 and Track 2 variety between think tanks—the *United Service Institution, National Maritime Foundation* and the *Institute of Defence Studies and Analyses* on the Indian side, and the *Japan Institute of International Affairs* and the *National Institute for Defence Studies* on the Japanese side. These dialogues tackled maritime issues as that was the easiest thing to do because of the common maritime interests—securing sea lines of communication, accessing markets and resources, maintaining sovereignty at sea and freedom of navigation and of air space.

At this time the Pentagon, particularly the US Navy, was wrestling with

China's anti-access, area denial (A2AD) wherewithal and strategy while keeping an eye cocked towards defence budget sequestration, and President Obama's 'Pivot to Asia'. Except that the cuts in the US defence spend led to America spending neither on anti-A2AD technology nor on enlarging the contingent of deployable forces. Questions were raised in US circles about whether there was enough funding to field twelve aircraft carriers and how many could be spared for the Indo-Pacific. It was in this context that the issue of Indo-Japanese defence collaboration first came up. It was preceded by Abe's speech in 2007 about the 'confluence of the two seas' and the full-blown emergence of the China threat.

Simultaneously, the Japanese government realised that they couldn't have complete confidence in the US security umbrella because, in a confrontation with China, there were doubts about whether Washington would enter the fray. That's when the Japanese armed forces started reorganising themselves. For the first time, they created seven theatre commands with the lead service, the navy, looking after it and a CDS system was installed with all the necessary resources assigned. This process of reorganisation and change was finished inside of a year—something India has been only debating since 1997 and



The ShinMaywa US-2's unique features are not found in any other seaplane extant



Japan's newest helicopter-carrying warship JS Kaga, seen recently in Indonesian waters during Naval Exercises with the USN

responded tartly that a fighter aircraft carries only one passenger—the pilot—and cost in excess of Rs 300 crore each and, therefore, was worth nothing either ! “This ignorant and uninformed joint secretary was a complete disaster and really damaged the country,” reflected a former MoD official.

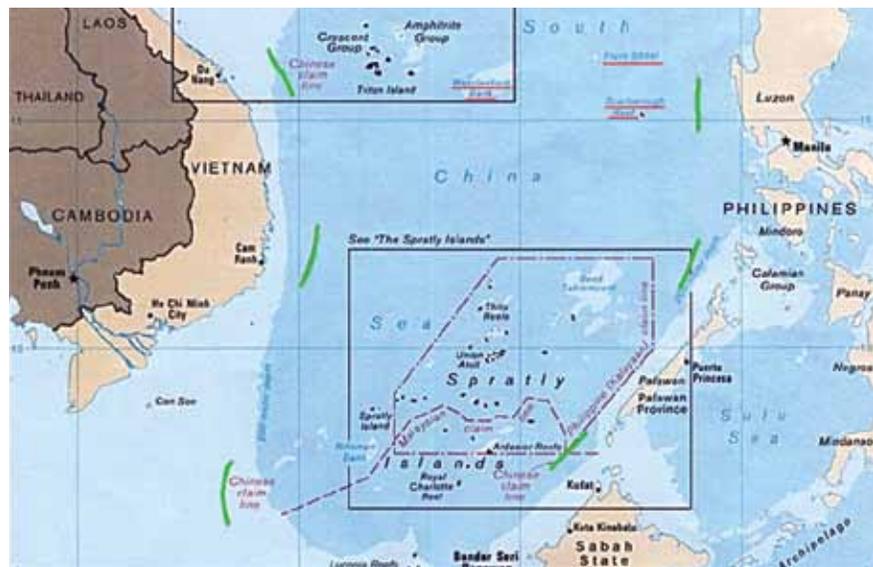
But now the institutional egos were engaged. The defence secretary, on account of his junior colleague being slighted and because this deal of “national importance”, was handed over by the PMO to Amitabh Kant, then secretary, Department of Industrial Policy and Promotion, to oversee, decided to take his ministry out of the decision-making loop altogether without taking it out of the procurement process. The crafting of the deal for this “national project” assigned to Kant, presently CEO of NITI

was imposed on the Japanese military by a political directive, so the services could like it or lump it. Around the same time, the disputed Senkaku/Diaoyu Island dispute started to heat up.

Just then, Beijing came up with its expansive *Nine Dash Line* claim in the South China Sea, exacerbating Japan's anxiety. It resulted in the Japanese defence forces shifting their focus away from Russia and the Kurile Islands with its naval activity centred on the Hokkaido island base to keep Russian submarines out. This was also the time when the Japanese industry started moving as well on the India front. As a prelude to this development Tokyo had relaxed the rules on arms sales and created a new strategy, with an entirely new department established in the Japanese Ministry of Defence to push military sales, which they had never done before owing to the strictures in the Peace Constitution. Offshore patrol vessels (OPVs) were leased or sold to the Philippines, Indonesia and other countries, and aircraft to Manila. That's when the Indian RFP for the amphibious aircraft was issued and the US-2 shortlisted.

Politico–Military Significance

Manmohan Singh's PMO decided that, given its politico-military significance, this was a programme of national importance and should not merely be an MoD project. The concept that was envisioned was that of ‘a chariot with two wheels’: one was the US-2 aircraft, the other the commercial aspects of the deal about making India part of the global supply chain of Japanese



The Nine Dash Line in South China Sea

From the Internet

companies, which produced components for Boeing and Airbus aircraft, some of which work the Japanese hoped to pass on to Indian firms involved in the US-2 work. A joint working group (JWG) was formed to advance this objective with NSA Shivshankar Menon, who saw the potential in this opportunity, leading the initiative.

This is where things began going wrong. The MoD adopted dilatory tactics, claiming the Defence Procurement Policy (DPP) procedures were not followed. A joint secretary in the defence ministry reportedly played a “bad role”. On the basis of hearsay, she charged that such a deal would hurt relations with China and, more farcically, that the US-2 aircraft was worth nothing because it carried no weapons ! The navy

Aayog, was aimed at building the aerospace business capability and infrastructure in India with a network of micro, small and medium enterprises (MSMEs), with the JWG constituted between the Indian and Japanese governments to explore technical collaboration. Three visits were made by Indian members of the JWG, with the MoD representative instructed to be on a “listening brief” only, and to say nothing. The rest of the Indians in the group did an independent appraisal and came back very satisfied with what the Japanese were offering.

What Japan was offering—and this was before *Make in India*—was, firstly, a parts manufacturing project not just for the US-2 but for Boeing and Airbus aircraft.

The plan was for this capacity to become the source base for eventually exporting wholly manufactured Indian US-2s to third countries. Secondly, Tokyo offered that ShinMaywa would do the final assembly and integration of the entire aircraft in India after Indian manpower achieved a certain level of expertise and competence. The time-frame for this stage was to be three years. Thirdly, Indian-built US-2s would thereafter be exported to meet the requirement of third countries, with an order of thirty-eight aircraft already in the company's order book. Fourthly, ShinMaywa undertook to create an entire maintenance, repair, overhaul (MRO) facility for this aircraft in India. It was, and remains, a transformational offer. As far as price is concerned the Japanese attitude, according to an industry source,

was: "This is the listed price, but we are prepared to negotiate it." In addition, the Japanese government and defence ministry said they were willing to look at the additional official development assistance (ODA)-driven offsets in the deal to build up air fields, seaports, navigational aids and other infrastructure around India's peninsular coastline to serve this aircraft, and allotted \$200 million of the total offsets commitment of some \$750 million to this task. The business model was that the Indian government would incur an expenditure of \$2 billion but the revenue the country would earn from worldwide sales would exceed \$6 billion.

A bureaucracy scorned can be a dangerous thing. With its institutional bureaucratic ego on the line, the MoD prevented this programme from going

through—even though the fully articulated proposal went to the Defence Acquisition Council (DAC) twice. In both instances, the defence secretary asserted that because the PMO had initiated this project, the decision was for the prime minister to make and that the DAC had no *locus standi* in the matter. The anomalies in the 'rules of business' are such that the prime minister cannot order the MoD to do anything; he can only send an advisory. Despite the serious interest in obtaining the US-2 by all the end-users and support organisations—the Navy, Air Force, Coast Guard, Army and even elements in the defence ministry—it hasn't taken off.

For once, all the armed services were on the same page. The IAF was interested because they knew its flying characteristics, the army because of its utility to the Special Forces, including operations in the north-



The US-2i is proposed to be built in India, not only to meet national requirements but also for the export market



The far reach of the US-2i can be appreciated by drawing 470 km. arcs from anywhere along coastal India as being within its domain

west against China in the Pangong Lake area, and in the north-east, because the aircraft can land on the Brahmaputra river, as it requires just one and-a-half metres of water depth to operate from. Because of its ability to land on any body of water anywhere, it would be a huge strategic asset. Further, the US-2 can carry 32 fully armed troops, 2 tonnes of cargo and can get the Special Forces troops fast to wherever they have to be, with a flying speed of 470 km per hour. This aircraft would eliminate the need for parachuting of commandos, which is a more onerous job. It can airlift a battalion-sized force with just ten sorties.

Besides the maritime dimension, there is island support for operations off Sri Lanka, Lakshadweep, the Maldives, Mauritius and Seychelles. For a perspective on the potential of the US-2, consider the much-lauded evacuation of 4748 Indians and 1962 foreign nationals from Yemen in 2015 (*Operation Raahat*). It involved two warships, two passenger ships, several Ilyushin Il-76s of the IAF and a couple of Air India jumbo jets, and took a month. The US-2 on its own could have fetched up at the Sa'ana airport, four-and-a-half-hours

flying time from Mumbai, and, in SAR configuration, run like point-to-point buses, packed in the evacuees and completed the entire airlift mission in five days. Ten US-2s, each able to transport 80 people or 3 tonnes sortie, would have brought in 800 people at a time. In military operations, it can lift twenty troops and a full combat load.

Operational range-wise, the US-2 can be in the Red Sea in four and a half hours, and in the same time reach Port Blair in the Andamans or the Maldives in one and a half hours. "Indeed, one can draw 470 km arcs from anywhere in coastal India as the aircraft's reach. The awful thing is that this joke of a joint secretary, incidentally, a woman, who had originally stiffed the deal, then returned to the ministry!" said the source. Thus, when the navy put up the proposal again, the MoD reacted with the same objection about the prime minister needing to approve the US-2 deal on his own. Whereupon the navy once again very strongly pitched for this aircraft. This time the MoD put a different spin on the issue. It asked the navy to prioritise between its various needs: US-2s, helicopters, carrier aircraft, etc. "This is standard stuff from

the MoD," said the source. "You can't say you have dal or roti, you have to have both. You need both and there has to be some balance."

Understanding the importance

The Navy understands the importance of the US-2, because it combines response and surveillance. Experts explained the plane's utility to the Navy thus. "Take an example of apprehending a dhow sailing in from the Gulf with smuggled goods or terrorists. The operation can take over twenty hours and involve a Dornier aircraft to spot it, whence a warship is dispatched to the site by when the whole operation is already compromised: after watching the Dornier circling overhead, the smugglers will simply throw all incriminating goods and papers overboard. A US-2 could land with a Marine commando team next to the dhow and finish that operation inside of an hour and capture the smugglers or terrorists with evidence on them. Just one such demonstration of capability will end all such activity because everybody would come to know that such clandestine forays are not worth the risk.

Then there's the problem with floating derelict ships that get beached' (like the ship that ran aground on Mumbai's Juhu beach in 2011).

The Navy looked at all these roles: long-range SAR, fleet deployments, operational defects at sea and their rectification that can be carried out by US-2 transporting equipment, spares to the stricken ship mid-sea, and crew rotation. It will save money and time. It takes three months to ferry naval crews manning facilities for seaward surveillance from land-based radarsweeps and surveillance patrols in the Maldives, Mauritius and Seychelles. With US-2 the crew rotation can be completed in ten days. Then there are the issues of sovereignty at sea and force projection. A US-2 can put a battalion-sized force in the Maldives in next to no time, obviating the need for paratroops. "The flexibility US-2 offers is tremendous."

According to inside sources, the US-2 team briefed the prime minister with a presentation which was restricted to five slides as advised by the PMO. The slides explained all that this aircraft can do, the diverse missions it can perform including rescuing carrier aircraft pilots flying the MiG-29K off *Vikramaditya* who ditch at sea, which capability the navy does not currently possess. They showed the aircraft's 'footprint' covering compass points on the Red Sea in the west, the South China Sea in the east and even talked of the competitive Chinese amphibian aircraft the Chinese displayed at the Zhuhai Air Show based on a stolen US-2 design but scaled up in size, which will allow the Chinese forces to go anywhere in the Indian Ocean. It was explained to Modi that the underlying aim of the US-2 deal was to create a world-class aircraft industry, rapidly develop skills by setting up a world-class aero-structures design and engineering centre at IIT, Roorkee. This centre was estimated to cost \$30 million, with India and ShinMaywa sharing this cost.

And the prime minister was told of the setting up of an MRO for the US-2 aircraft, and the programmes for its Dowty propellers and Rolls-Royce engines for capacity building for high technology, technology integration and for the full manufacture in India, as also about the scheme to export the Indian-built US-2s to numerous countries, and how all these various streams would lead to designing

The Indo-Japanese ACSA



Visiting Japan in late October 2018, Indian Prime Minister Narendra Modi met with his Japanese counterpart Shinzo Abe to ratify an *Acquisition and Cross Servicing Agreement (ACSA)* between the two Defence forces. Japan's ambassador to India, Kenji Hiramatsu, said it was only natural for the two militaries to have a logistics-sharing agreement because of the large number of exercises they were carrying out each

year. "We hope to start formal negotiations with regard to signing of the ACSA. It is high time we had mutual logistics support," he urged.

Under such a pact, Japanese ships would get access to fuel and servicing at major Indian naval bases including the Andaman and Nicobar islands, which lie near the Malacca Straits through which a large amount of Japan's but also China's trade and fuel supplies are shipped. India's Navy, which is increasingly sending ships further east as a way to counter China's expanding presence in the Indian Ocean, would get access to Japanese facilities for maintenance support.

and developing a nineteen-seater aircraft in India for the global market that the Japanese would be very keen to help India develop –and to market.

The time-frame for the first Indian-built aircraft is four years with the production reaching the planned rate of one aircraft every nine months. The total project cost is \$3 billion with offsets of \$900 million.

The obstinate attitude of the bureaucracy is because, as a senior civil servant noted, bureaucrats see themselves as 'landlords' who have to look after the assets and permanent interests of the state, and

political leaders are seen as "often unruly tenants who are here today, gone tomorrow" who have by whatever means to be reined in. Juxtaposed against Japanese Prime Minister Abe's get-go attitude and removal of corporate and procedural obstructions at the Tokyo end, Modi's inability to get the Indian defence ministry to play ball is a sad commentary as much on his limitations as mover and shaker as the dysfunctional Indian bureaucracy. So, the country is stuck with a seemingly unalterable reality: Its leaders are all affirmative but the bureaucracy is all inaction. 🛩️



"The obstinate attitude of the bureaucracy has stalled the US-2i programme"

The New Dimension



UAVs IN INDIA

GA-ASI's SkyGuardian RPA

As has been in the news for sometime, the United States has reportedly offered India an armed version of the Guardian drone that were originally authorised for sale unarmed, only for surveillance purposes. According to a senior US official, if the deal comes to fruition, this would be the first time Washington has sold such armed drones to a country outside the NATO alliance and would certainly be the first high-tech unmanned aircraft in this region.

In April 2018, President Donald Trump's administration had announced a long-awaited overhaul of US arms export policy aimed at expanding sales to allies, in that "it would bolster the American defence industry and create jobs at home". The plan included a new drone export policy that allowed lethal drones that could fire missiles, and surveillance drones of all sizes, to be more widely available to allies. Last June, General Atomics said the US government had approved sale of a naval variant of the drone: India has been in discussions to buy 22 of the unarmed surveillance aircraft, MQ-9B SeaGuardian, worth more than \$2 billion. Besides potentially including the armed version of the drone, the sources said the number of aircraft had also changed.

An Indian defence source said that the military wanted a drone not just for surveillance but also to be able to eliminate targets at land and sea, arguing that otherwise "such acquisition was not justified" in buying an unarmed drone. However, the cost and integration of the weapons system are still open issues, as well as Indian assent to the *Communications Compatibility and Security Agreement* (COMCASA) which Washington insists on as a condition for operating such advanced defence systems.

US drone manufacturers, facing growing competition, especially from Chinese and Israeli rivals "which have a more relaxed approach" have lobbied hard for the changes in US export rules. Among these will be a more lenient application by the US government of an arms export principle known as "presumption of denial." This has impeded many drone deals by automatically denying approval unless a compelling security reason is given together with strict buyer agreements to use the weapons in accordance with international law.

The MTCR – a 1987 missile-control pact signed by the United States and 34 other countries – will still require strict

export controls on Predator-type drones, which it classifies as Category 1, those with a payload of over 500 kg. However, the Trump administration is seeking to renegotiate the MTCR accord to eventually make it easier to export the larger armed drones.

Meanwhile, India's first private sector Unmanned Aerial Vehicles (UAV) manufacturing facility has been inaugurated at Hyderabad, the facility set up by Adani Defence & Aerospace with Elbit Systems of Israel and inaugurated by Telangana Home Minister Mohammad Mahmood Ali on 14 December 2018. The 50,000 square feet facility is also the first outside Israel to manufacture Hermes 900 Medium Altitude Long Endurance (MALE) UAVs. As Adani Group Chairman Gautam Adani stated, "Our foray into defence and aerospace has a deep personal significance for me. I want us to be able to look back and reflect that Adani Group did its bit to help build a more self-reliant India, a nation that is second to none in its defence manufacturing capabilities." The factory will be engaged in manufacturing complete carbon composite aerostructures for the Hermes 900, followed by Hermes 450, aiming at the global market and will be further ramped up for

the assembly and integration of complete UAVs. Apart from the UAV Complex, the Adani Aerospace Park was also inaugurated at Hyderabad.

As Elbit Systems CEO and president Bezhaleh Machilis stated, “This facility where the Hermes 900 (MALE) and the Hermes 450—the most advanced UAV systems in the world will be manufactured, is in line with Indian government’s strategic plan and enables us to share our extensive experience in defence systems and benefit from the dedicated Indian workforce as well”.

Interestingly also, the Indian Army has selected the SpyLite mini unmanned



SpyLite mini unmanned air vehicle



IAI Harpy

air vehicle offered by Cyient Solutions & Systems – a joint venture between local company Cyient and Israel’s BlueBird Aero Systems – for a high-altitude surveillance requirement. On 4 September 2018, the company announced that “the SpyLite was the only candidate to have met the army’s need to perform real-time surveillance and target acquisition tasks during trials performed from 18,000ft above sea level, including in extreme weather conditions”.

This UAV has demonstrated quick operational readiness, from autonomous launch to precision recovery by parachute, during the trials. The activity included supplying real-time video footage by day and night, automatic return and recovery in a “no communication” situation, and the ability for an operator to control the system from a moving ground vehicle. BlueBird chief executive Ronen Nadir says the Indian army requires a highly reliable, low-cost and field-proven UAV with high performance, diverse capabilities and ease of use.

Currently, five Unmanned Aerial Vehicles are operated by the Indian Armed Forces. There is the indigenous *Nishant* for the Indian Army which UAV, developed by DRDO’s Aeronautical Development

Establishment, requires a launching system with catapult technology. This does not have self-propelling ability and recovers with the help of a parachute. The Indian Army has however cancelled further orders of this UAV and there is a decision in fact to phase out the *Nishant*.

There are three UAVs from Israel Aerospace Industries (IAI), the first of these being the *Heron*. This is a Medium Altitude Long Endurance (MALE) UAV,

developed by Israel, has a flight time of upto 52 hours, but actual time of flight depends on the payload and flight profile. This has some advanced features for artillery observation and surveillance plus can carry out intelligence tasks. The *Harpy* from IAI is also employed by the Indian armed forces, and carries a warhead, homing in to destroy radar systems after loitering. This can also carry out suppression of enemy air defences, including surface to air missile sites and anti-aircraft installations. The *Harpy* has a maximum speed of 185 km/hr and 500 km range of flight.

The third is IAI’s *Searcher* UAV which has a speed of 200km/hour and can fly up to 18 hours. Both the Indian Navy and Air Force deploy there for extended reconnaissance (see article).

Then there is the *Rustom II*, an unmanned combat air vehicle under development by the DRDO and the definitive *Rustom II* could be manufactured by a yet-to-be-selected private company.



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Ahead of Time



UAVs in the Indian Navy

At the turn of the new millennium, Indian Naval Aviation took a major step towards the future with the induction of unmanned aircraft into maritime operations. Two types of Israeli Unmanned Aerial Vehicles (UAVs) were procured, the IAI Malat Searcher Mk.II and the larger and more capable Heron, serving as sensor platforms to undertake a wide range of tasks including maritime surveillance, search and track, over-the-horizon targeting, SAR assistance and others.

Initial training of operators and maintainers was imparted at IAI Malat's facilities in Israel, where 16 Internal Pilots, 11 Observers, 8 External Pilots, 6 Technical Officers and 75 technical and non-technical sailors attended theory classes back in 2002. An Intensive Flying and Trials Unit (IFTU) was then established on 31 August 2002 at INS *Garuda*, tasked with aircraft acceptance,

operator and technical crew training, evaluation and trials of aircraft and sensors, formulation of doctrines, operating and maintenance procedures. Flying training commenced in January 2003, initially with OEM support. Israeli personnel began withdrawing gradually as unit personnel began gaining expertise.

Routine and training flying gave way to operational exploitation and the unit started regularly participating in exercises off both coasts from ships and from various military and non-military airfields. Training of technical officers and sailors was also taken up by the OJT cell to pass on the freshly acquired expertise to successive generations of maintainers.

On 6 January 2006, Admiral Arun Prakash, then Chief of Naval Staff, formally commissioned IFTU as an operational squadron, INAS 342, with Cdr Rajesh Kawatra assuming command. The unit was

christened 'Flying Sentinels' and was the first of three IN UAV squadrons that would be commissioned in the following decade. The next unit was INAS 343 'Frontier Formidables,' raised on 17 January 2011 at Porbandar in Gujarat, followed by INAS 344 'Spirited Showers' on 11 April 2012 at INS *Parundu* in Tamil Nadu.

Since their induction, a series of upgrades have been executed, most important being Automatic Take-Off and Landing (ATOL) capability for both the Searcher and Heron. Enabled by ultra-precise Differential GPS (DGPS) and a backup airfield laser landing system, ATOL functionality obviated need for a dedicated External Pilot to launch and recover the aircraft, thereby streamlining training and squadron staffing. Typical Heron mission crews today comprise two pilots, an observer dedicated to manning the optical and radar displays, and a sailor monitoring the COMINT and ELINT



payloads. Crews rotate every four hours, normally requiring between two and three sets of crew per mission, although the Navy has flown some missions longer than 16 hours when necessary.

The Navy's UAV squadrons have majorly contributed to Maritime Domain Awareness (MDA) in the IN's area of responsibility, in some cases flying more hours in a year than their manned counterparts. The UAVs are limited only by inclement weather, with rainwater ingress a serious concern. At stations like Porbandar, for example, where manned flying is limited by the operating hours of the civilian ATC, the Dornier 228s of INAS 310 'Cobras' usually fly during daylight hours when ATC is active, while the Herons and Searchers of INAS 343 maintain surveillance for the remainder of the day. Since the UAVs, Herons in particular, are equipped with virtually the same sensors as the Navy's Dornier 228s, the quality and nature of reconnaissance data generated is much the same, allowing for nearly seamless handoffs between manned and unmanned missions.

The UAVs are typically controlled from a Ground Control Station at the home airfield, the same station functioning as a pilot/observer training aid when not in operational use. The directional datalink is limited only by line of sight, and can operate even if there are clouds or other weather phenomena between the aircraft and ground station. As a backup, all UAVs have automatic provisions that allow them to autonomously return to base in the event of a failure of any of the onboard flight

critical systems or the datalink. In addition, the operating range of the UAVs can be extended by using a specially configured sister aircraft as an Airborne Aata Relay (ADR), adding up to 85 nautical miles of reach. UAV control can also be handed off to ships at sea, provided they are suitably manned and equipped either with a containerised Advanced Ship Control Station (ASCS) or have an Integrated Ship Control Station (ISCS) built in. At present few IN ships are thus equipped, but as shore-based UAVs integrate more closely with the fleet, ship control is likely to become more common. Ship based control, with higher transmit and receive performance than ADR-configured UAVs, essentially doubles the range of the shore-based platforms.

Planned upgrades to the entire Indian military UAV fleet will further enhance the utility of the unmanned platforms in service with the Navy, bringing Automatic Identification System (AIS) for improved maritime awareness, Traffic Collision Avoidance System (TCAS), and SATCOM datalink for true long range operations.

Training & Maintenance

With unmanned operations in the Indian Navy now approaching 20 years, maintenance activities are well understood and streamlined, principally carried out by the Navy, with involvement of the platform OEM, as well as local partners such as HAL and BEL. First Line maintenance is conducted at the squadron level by Naval personnel, while subsequent scheduled and unscheduled servicing is carried out by the

OEM or local partners, such as HAL and BEL, which are nominated to carry out a great deal of structural, mechanical and electronics upkeep. Engine overhauls and MOSP maintenance and repair are now all completed in-country by HAL, for instance. In general, the UAVs are described by the Navy as relatively easy to keep serviceable, which is reflected in their annual flying hour totals, some units crossing 1,000 hours per year.

Similarly, operator training has been straightforward, with each squadron being equipped with simulators for flying and payload training. Personnel selected for flying or sensor operation attend a combined tri-service Technical Type Training (TETTRA) course conducted by the Indian Air Force before being assigned to their respective squadrons. Once with the squadron, operational training begins. Pilots train for approximately 6 months, carrying out intensive simulator flying as well as about 15 hours piloting the actual aircraft. Unlike other observers in Naval Aviation, UAV payload operators do *not* attend the Observer School at INS *Garuda*, their training being conducted entirely at the squadron level. Sensor operators have a similar mix of synthetic and actual in-flight training as UAV pilots, but their syllabus is typically completed in 4-5 months, involving fewer total hours in simulators and flying. Once pilots and sensor operators are deemed fit for purpose, they are included in the regular flying operations of the squadron.

With contributions from Angad Singh

The World of UAVs

GA-ASI Certification of new MQ-9B SkyGuardian

General Atomics has received a Special Airworthiness Certification in the Experimental Category from the FAA for its second MQ-9B SkyGuardian aircraft. The company-owned Remotely Piloted Aircraft (RPA) joins the first SkyGuardian in support of the MQ-9B development programme. MQ-9B is the result of a five-year, company-funded effort to deliver an unmanned aircraft that can fly in non-segregated airspace, while meeting the stringent airworthiness type-certification requirements of NATO STANAG 4671. The RPA features endurance of more than 40 hours, rapid integration of new payloads with nine hardpoints, all-weather, short-field, self-deployment through SATCOM controlled Automatic Takeoff and Landing Capability, Lynx Multi-mode Radar and a Detect and Avoid (DAA) system.



Germany extends contracts for IAI Heron 1



Germany has extended operational contracts of the Heron 1 drones by Airbus DS Airborne Solutions GmbH, until mid 2020. Extension for contracts signed with the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support end December 2018, means continuation of one of the most successful cooperations between the Bundeswehr and Airbus Defence and Space. The contract comprises provision of all assets and manpower to support the Israeli Heron 1 systems of deployment.

The German Air Force has been using the Heron 1 system in Afghanistan since 2010 and in Mali since 2016. With its operational range of up to 800 kilometers this significantly expands the possibilities of airborne reconnaissance of the German contingent. Until today, in total and over both countries, more than 46,000 operational flying hours have been successfully flown.

Airbus Helicopters VSR700 demonstrated



The Airbus Helicopters VSR700 demonstrator made an unmanned autonomous flight at Istres in the south of France, to establish compliance with demanding regulatory and safety systems necessary for future unmanned flight in France. During the exercise the demonstrator performed a 30 minute flight executing a variety of flight patterns before landing in an autonomous mode, the unmanned air vehicle piloted and monitored from the ground station. The VSR700 is a light military tactical unmanned aerial system able to carry multiple payloads, with an endurance of around 8 hours at 100 nm. The system will initially offer extended surveillance capabilities for navies, allowing them to preserve manned helicopter flights for critical missions. Of an ideal size, this is designed to complement manned helicopters, without replacing them, on ships ranging from small corvettes to major warships.



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Leading The Situational Awareness Revolution

IAI Elta Next Gen Drone Guard C-UAS



Elta Systems, a division and subsidiary of Israel Aerospace Industries (IAI), has unveiled a new and enhanced configuration of its Drone Guard system which “detects, identifies and disrupts the operation of UAS and small drones.” With hundreds of units operational across the world, the new modular configuration has added a Communication Intelligence (COMINT) system for more precise detection, classification and identification based on broadcast frequency and unique communication protocol analysis and verification for neutralising threats. Furthermore, the Drone Guard’s 3D Radars, Electro-Optical (EO), and Jammer systems have been upgraded with increased capabilities. In addition to the current radar, EO and jamming capabilities a hostile threat can now also be detected, classified, identified by means of the enhanced COMINT system. The system effectively jams or disrupts the drone’s control channel and navigation, by supporting an array of communication protocols that can ‘fend off’ a single drone or even a swarm of drones from the protected premises.

IAI Malat and Airbus Maritime Heron RPAS for FRONTEX



Israel Aerospace Industries (IAI) in partnership with Airbus DS Airborne Solutions, a subsidiary of Airbus DS successfully completed 200 flight hours with the maritime Heron Remotely Piloted Aircraft Systems as part of marine patrol and coastal guard missions at Crete in Greece, flying in European civilian airspace under a civilian code. Operating for FRONTEX, the European Border and Coast Guard Agency, the maritime Heron performed a series of flights equipped with an electro-optical payload for day and night vision, a maritime radar made by IAI and an automatic identification receiver. Each mission was for 14 hours on average. The surveillance platform Heron 1 used a direct link when flying within Line of Sight (LOS), switching seamlessly to a satellite link when flying Beyond Line of Sight (BLOS) to transmit real time information to multiple users in real time.

IAI and Airbus were selected by FRONTEX in a contract that includes operating the RPAS on daily security and coastal guard missions, maintenance and more. IAI and Airbus will provide the service for pre-planned assignments as well as for emergency situation.

European MALE RPAS progresses

Another major milestone in the *European Medium Altitude Long Endurance Remotely Piloted Aircraft System* (MALE ARPAS) programme was attained with the recent System Preliminary Design Review. This significant accomplishment follows the European Organisation for Joint Armament Co-operation (OCCAR) inviting Airbus Defence and Space in late 2017 to submit a proposal for the Development, Production and initial in Service Support phase of the European MALE RPAS Programme. This milestone will allow developing the System with firm requirements and a clear picture of the overall system design. As designated future prime contractor, Airbus Defence and Space will coordinate the industrial response to the Invitation to Tender (ITT) with the involvement of major Sub-Contractors: Airbus Defence & Space, Dassault Aviation SA and Leonardo. It is projected that by middle of the next decade, the MALE RPAS will be operated worldwide to perform Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) missions.

GA-ASI MQ-9B selected by Belgium

The Government of Belgium will begin negotiations with the US Government to acquire the GA-ASI MQ-9B SkyGuardian Unmanned Aircraft System (UAS). MQ-9B is the latest generation of GA-ASI's multi-mission Predator B fleet. MQ-9B is the result of a five-year company-funded effort to deliver an unmanned aircraft system to operate in non-segregated, civil airspace, which meets the stringent airworthiness type-certification requirements of NATO STANAG 4671.



Elbit to provide Maritime UAS to EMSA



Elbit has been awarded a framework contract to provide maritime Unmanned Aircraft System (UAS) patrol services to the European Maritime Safety Agency (EMSA) for countries in the European Union. The contract, to be executed in cooperation with CEiiA, is for a two-year base period with two single year option periods. The total contract value is €59 million (approximately \$68 million), under which and in cooperation with CEiiA, a leading engineering company in Portugal, Elbit Systems will lease and operate its Hermes 900 Maritime Patrol and its Ground Control Station. This long-endurance, long-range unmanned maritime surveillance system tailored for littoral and blue water operations, the Hermes 900 Maritime Patrol will feature maritime radar, an Electro Optic payload, Satellite Communication and an Automatic Identification System (AIS) receiver.

The SeaGuardian for



Persistent Maritime ISR

The SeaGuardian is maritime version of the MQ-9B SkyGuardian from General Atomics Aeronautical Systems, and is slated to become the world's most advanced RPA when the first variant is delivered to the Royal Air Force as the *Protector RG Mk1* in the early 2020s. "Protector will be a step change for us in terms of capability," stated RAF Group Captain Lyndon Jones, "the new aircraft will offer greater range and endurance, and will be certified to fly in UK airspace."

On 11 July, 2018 the MQ-9B became the first Medium-altitude, Long-endurance (MALE) RPA system to complete a trans-Atlantic flight when it landed at the Royal Air Force airfield at Fairford in Gloucestershire, the flight having originated from GA-ASI's Flight Test and Training Centre in Grand Forks, North Dakota, USA.

As the RAF awaits its first delivery, demand from other parts of the world continues to increase. In addition to the UK and the United States, countries such as Italy and France have GA-ASI MQ-9A systems in their inventory, and the United Arab Emirates operates the Predator RPA, while Spain and the Netherlands have

MQ-9 systems on order. In November, the Government of Belgium announced its selection of MQ-9B SkyGuardian to meet this RPA requirements and the Australian Government has announced GA-ASI to provide the Armed RPA system under Project Air 7003. Discussions are ongoing with several other countries.

A mature system

The MQ-9B leverages the mature system architecture of the legacy MQ-9A, with more than two million flight hours, while incorporating enhancements that support mission capability, global industrial expertise, and its goal of achieving unfettered access to national and international airspace. Nine external hard points on the MQ-9B offer great configurability to meet diverse mission requirements. In the basic Intelligence, Surveillance, and Reconnaissance (ISR) configuration, the standard SeaGuardian is equipped with a high-definition Electro-optical/Infrared (EO/IR) sensor and a high-performance 360° multi-mode maritime radar to support maritime patrol and surveillance missions.

In contrast to the MQ-9A, the MQ-9B's wings have been extended by four metres to

a total length of 24m to accommodate additional fuel capacity, while also providing greater lift and endurance. The wing extension adds two hard points for a total of nine that can accommodate a maximum external payload of 2,155 kg.

The SeaGuardian has a range of 6,000-plus nautical miles with an endurance of more than 40 hours. GA-ASI flew an MQ-9B for 48.2 hours on 2,721 kg of fuel in May 2017, thus "providing greater endurance at lower operating cost, the SeaGuardian being ideally suited to complement manned maritime patrol aircraft in performing wide area maritime surveillance."

Endurance and Persistent Maritime ISR

In addition to its exceptional endurance, the SeaGuardian's state-of-the-art sensors offer "unparalleled ISR capabilities for a wide range of operational and threat environments". Capable of operating at Beyond Line of Sight (BLOS) ranges at altitudes over 40,000 feet and in inclement weather conditions, the MQ-9B can also provide EO/IR Full Motion Video (FMV), Synthetic Aperture Radar (SAR) imagery, and Ground Moving Target Indicator



In October 2017, GA-ASI demonstrated remote detection and tracking of submerged contacts. The MQ-9A used sonobuoys to gather acoustic data and track underwater targets. The demonstration successfully paired sonobuoy receiver and data processing technology onboard the MQ-9A.

(GMTI) data about potential threats to military commanders in real-time from stand-off ranges without harm to the aircrew.

The platform can also be equipped with a multi-mode maritime search radar, an Inverse Synthetic Aperture Radar (ISAR) capability, and an Automatic Identification System (AIS) detection capability that provides a true Maritime Wide Area Search (MWAS) and allows for the identification and interdiction of maritime targets. These maritime capabilities, for long in use by the United States, are critical to confront maritime threats before they reach population centres.

ATLC and All-Weather Performance

SATCOM Auto Takeoff and Landing Capability (ATLC) is part of the SeaGuardian package, designed to help minimise the aircraft's launch and recovery footprint, and reduce manning and equipment requirements at a Forward Operating Base (FOB). This capability allows aircrew on a Main Operating Base (MOB) to land, taxi and launch the aircraft from a separate FOB, requiring only a small team equipped with a ruggedised laptop at the FOB.

Both SeaGuardian and the MQ-9B SkyGuardian are capable of all-weather day/night operations, their cold weather engine start capability allows ground operations down to -41°C. It also has an Electro-expulsive De-icing system (EEDS) for wing leading edges, anti-ice heated engine inlet, heated pitot tube and static ports, and lightning protection.

As the MQ-9B is a ground-up redesign of earlier variants, which was done to earn certification for flying in non-segregated airspace and integrate seamlessly with manned aircraft, GA-ASI expects MQ-9B to achieve certification in the early 2020s. The aircraft will initially meet NATO STANAG-4671 airworthiness standards, and subsequently will meet commercial



The GA-ASI-developed Detect and Avoid (DAA) system is made up of an Air-to-Air Radar, TCAS II, ADS-B IN/OUT, and a Conflict Prediction and Display System. The DAA system provides pilots with real time situational awareness about proximate traffic and real time guidance to 'remain well clear'.

airworthiness certification standards in cooperation with the U.S. Federal Aviation Administration (FAA).

The Detect and Avoid (DAA) system that GA-ASI has developed for the aircraft consist of the radar, Traffic Collision Avoidance System [TCAS], Automatic Dependent Surveillance-Broadcast [ADS-B], with the ability to blend that surveillance onboard in support of alerting and maneuvering guidance to the pilot in the Ground Control Station (GCS). This enables the RPA to detect other platforms and safely remain well clear in coordination with air traffic control.

Numerous technologies and design attributes have been incorporated into production of the MQ-9B to meet certification standards. To comply with STANAG airworthiness requirements for airframe fatigue and integrity, all MQ-9B aircraft are constructed with certified composite materials using riveting and bonding processes that yield a service life of 40,000 flight hours, which is double the service life of the MQ-9A aircraft.

For MQ-9B to be able to “file and fly,” it needs to be controlled by a GCS that is

also certified. That effort has brought with it a number of key features designed to enhance safety and situational awareness for the remote pilot, including the Launch and Recovery Element (LRE), Mission Control Element (MCE), dual control Pilot/Sensor Operator (PSO) stations, full automation or manual “pilot-in-the-loop” operations, and design standards to meet the FAA’s DO-178/DO-254 airborne systems and equipment certification.

ASW Capability

GA-ASI is also developing an Anti-submarine Warfare (ASW) capability and in October 2017 demonstrated remote detection and tracking of submerged contacts using an MQ-9A RPA. The MQ-9A used sonobuoys to gather acoustic data and track underwater targets, the data transmitted to the MQ-9A, processed onboard, and then relayed to the aircraft’s GCS. This demonstration successfully paired sonobuoy receiver and data processing technology onboard the MQ-9A.

Future developments are planned that include SeaGuardian’s ability to carry and dispense sonobuoys and to transmit the

acoustic data via BLOS SATCOM, which continuing development offers yet another cost-efficient capability to complement manned maritime patrol aircraft in the prosecution of submerged vessels.

Operating worldwide, “every second of every day”

GA-ASI has delivered over 850 aircraft, more than 300 GCS and its aircraft operate worldwide, every second of every day, close to 70 of GA-ASI RPA being airborne. Till now, GA-ASI aircraft have accumulated over five million flight hours, with 90 percent of these flight hours achieved during deployed operations.

Developed to fly in civil airspace, SeaGuardian provides persistent situational awareness across vast maritime domains, does without putting aircrew at risk and more cost effectively than do manned aircraft. Interoperable with NATO, its multi-mission capability makes it a valued asset in a variety of scenarios – from environmental protection and maritime domain awareness to search and rescue and military surveillance. 🦋

Courtesy:

General Atomics Aeronautical Systems



GA-ASI’s Certifiable Ground Control Station (CGCS) is used to fly the MQ-9B. In October 2018, the CGCS completed its first operation

Triumph!



The Game-changing S-400

Air Chief Marshal BS Dhanoa, CAS of the IAF has described the S-400 as “booster shot in the Indian Air Force’s arm. No country is facing the kind of grave threat that India is confronted with. Intentions of our adversaries could change overnight. We need to match force levels of our adversaries,” he stressed.

Despite threats of US sanctions, the Government of India has formally contracted for five advanced S-400 Triumph air defence missile systems with Russia, the S-400 deal being centre stage of Russia’s President Vladimir Putin’s visit to India in October 2018. The S-400 has been described by Western observers as “one of the best air-defence systems extant and considered way ahead of the American THAAD (Terminal High Altitude Area Defence) equivalent.”

Termed as “a game changer”, this strategic air defence missile system has

mesmerised many professionals. Over three years back, on 13 April 2015, chief executive of the Russian state-run arms company Rosoboronexport also confirmed that China had contracted for purchase of these systems, initially reported to consist of six units. “China would now significantly improve its ability to defend its air space and serve as an effective stand-off weapon against air attacks”, according to the spokesperson.

In late 2017, the President of Turkey and Russian officials signed an agreement for delivery of \$ 2.5 billion worth of S-400 units. India would be the third nation to

operate the Triumph, and there are reports that more countries including Iraq and Qatar have initiated talks with Russia to acquire this advanced missile system.

Describing the S-400

The S-400 Triumph is an air defence missile system developed by the Almaz Central Design Bureau of Russia, replacing the S-300P and S-200 in service with the Russian armed forces. The S-400 was developed as an upgrade of the S-300 series of surface-to-air missile systems which entered service in April 2007, the

first S-400 deployed in combat in August 2007. Russia itself has four S-400 units defending national airspace in the Moscow region, the Baltic exclave of Kaliningrad and the Eastern Military District. The missile system integrates a multifunction radar, autonomous detection and targeting systems, anti-aircraft missile systems, launchers and command and control centre for providing a layered defence, being capable of firing three types of missiles. Each unit will have up to 32 missiles on launchers at any time. It is expected that two units will defend India's National Capital Region with another two to cover the Mumbai-Baroda Industrial complex and one in the strategic Dooars corridor linking Bengal with Assam .

The S-400 Triumph air defence system integrates multifunction radar, autonomous detection and targeting systems, anti-aircraft missile systems, launchers, command and control centre. There are four different missile types: the very-long-range 40N6 (400 km), the long-range 48N6 (250 km), the medium-range 9M96E2 (120 km) and the short-range 9M96E (40 km). The system can engage various types of aerial targets simultaneously, some 36 targets including aircraft, unmanned aerial vehicles (UAV) as also ballistic and cruise missiles within



the range of 400km and upto an altitude of up to 30 km.

The 55K6E command and control system of the S-400 Triumph is based on the Ural-532301 mobile command post vehicle, equipped with LCD consoles to process air space surveillance data of

the individual batteries. It controls and monitors long-range surveillance radar, tracks airborne threats, prioritises the threats and coordinates with other batteries. The system is also capable of exchanging data with other defence systems such as the SA-12, SA-23 and S-300.



“S-400 is a Game Changer”

Pakistan’s concerns ... as expressed by a senior retired officer *

With the Indian military set to induct five units of the S-400 air defence system into service by the early 2020s, a number of the new weapons systems are likely to be deployed on India’s north-western borders where the bulk of India’s forces are currently stationed. The S-400, widely considered as the most advanced long range surface to air missile system in the world, is set to become a game changer in the balance of power between India and Pakistan,

with its deployment seriously undermining Pakistani security. The weapon’s 400km range when deploying highly precise 40N6 hypersonic missiles in particular, poses a considerable threat to Pakistani aircraft deep inside the country’s home space. The S-400 will provide India with coverage over almost entire northern and western Pakistan and would allow the Indian forces to shoot down Pakistani fighters at will. Should India choose to deploy the system as far west as Amritsar, the S-400 would be able to threaten Pakistani aircraft even over Peshawar. Pakistan’s territory is long, but not deep, and this plays into Indian hands.

With the S-400 capable of engaging up to 36 targets simultaneously, including a combination of aircraft and both ballistic and cruise missiles, the weapons system poses a considerable threat to Pakistani forces in the event of a shooting war. With the S-400 designed to shoot down some of the fastest, highest flying, stealthiest and most manoeuvrable fighters in the world including the US Air Force’s F-22 Raptor air superiority fighter, Pakistan’s older, lighter and unstealthy aircraft should provide the system with little challenge—and the PAF could well suffer heavy losses in the opening hours of a conflict should they be deployed within range of the S-400. With just two units of the S-400 able to cover more than half of Pakistan’s territory, this poses a considerable threat. Even the Pakistani fifth generation light fighter jets currently under development under *Project Azm* are unlikely



to fare well against the S-400. Pakistani support aircraft including Il-78 aerial tankers, Y-8 AWACS platforms, and Falcon 20 electronic warfare aircraft, large and unmanoeuvrable as they are, would also be denied access within most of the country’s own airspace and are highly vulnerable even at extreme ranges.

Compounding this threat, the Pakistani ballistic missile arsenal which has heavily relied upon as an asymmetric measure to neutralise larger Indian forces, which includes advanced platforms such as the *Ghauri*, *Ababeel* and *Shaheen 3*, would also be vulnerable to the S-400, with each Indian air defence unit well able to intercept and destroy dozens of these missiles at a time. The result would not only be an inability of the Pakistan Air Force to protect its own skies, let alone engage Indian forces on an offensive, but also the blunting of the country’s retaliator capabilities. The implications of the S-400 therefore are truly severe for Pakistan’s security.

However, there are a number of measures that the Pakistani military can take to strengthen its defences with the S-400 in mind. While Pakistani aircraft will be unable to effectively respond to incursions by India’s fighters because of the S-400’s presence, the country’s own air defences will remain unaffected. While operating without air support will put an immense strain on Pakistan’s surface-to-air missile platforms, a strengthening of the country’s air defence network could

go a long way towards denying Indian fighters control of the skies. Fortifying air defence sites and radar installations, possibly in underground bunkers as per the approach taken by North Korea, remains a highly viable option. Acquiring more advanced air defence systems, possibly the Chinese HQ-9C or even the S-400 itself, would also be a viable strategy, which would effectively create a ‘no fly zone’ for the air forces of both countries and thus nullify any Indian advantage.

Pakistan could also move to deploy long-range artillery such as its *Nasr* missile systems closer to the border, which would be capable of targeting S-400 sites deep inside Indian territory - thus forcing India to deploy its systems even further away east thus reducing the area coverage of Pakistani territory. To keep its missile forces viable, Pakistan could also invest in both submarine-launched ballistic missiles to target India from its southern coast, an undefended area which will likely not be covered by the S-400, as also developing more advanced ballistic missiles capable of reaching higher speeds and manoeuvring in flight, all to serve in improving viability of the country’s missile forces against the S-400.

While the upcoming S-500 has been designed as the first air defence platform capable of intercepting hypersonic missiles, the S-400 cannot do this. Indeed, more advanced missiles could well be used to launch precision strikes on Indian S-400 batteries in the early stages of a conflict and thus largely neutralise the threat to Pakistani aircraft - while also allowing Pakistan to bring its older missiles into play.

Ultimately, while the S-400 is set to become a considerable game changer, all is not lost for Pakistani forces which can take a number of measures to better handle the threat. With both countries now under the Shanghai Cooperation Organisation and unlikely to resort to a major open conflict to resolve disputes in future, the prospects for the S-400 being actively employed against Pakistani forces remain somewhat slim.

*Posted on the Internet

India's National Air Defence

In his analysis, Colonel Ajai Shukla writes that “experts regard India’s current air defence set-up as weak, with numerous gaps that a skilled adversary would exploit. Besides the shortage of fighter aircraft, India’s radar network – which should ideally detect PAF fighters as soon as they take off from their bases – has insufficient range and gaps in coverage”.

The IAF’s Soviet-era and Russian-origin SAMs, such as the Pechora SAM-3 and the OSA-AK SAM-8, have inadequate ranges of under 35 kilometres. By 2021, when the S-400 enters service, India’s air defence will be improving. The IAF will by then have its full complement of 272 Sukhoi-30MKIs,



and the first Rafale squadron and two Tejas squadrons would have entered service.

Simultaneously, the capable Indo-Israeli medium range SAM (MR-SAM) – with a detection range of 150 kilometres, a strike range of 70 kilometres and a far higher hit probability than current missiles – would be getting inducted in significant numbers. The IAF, which funded 90 per cent of the MR-SAM’s development cost of Rs 10,075 crore has ordered 18 such units.

Meanwhile the Akash SAM, developed by the Defence R&D Organisation and built by Bharat Electronics Ltd (BEL) is also being inducted into service in numbers. The Akash has a range of just 25 kilometres, but there is a project to upgrade that.

National air defence includes multiple layers of surveillance sensors and strike capabilities – both defensive and offensive.

The most offensive air defence option, and one to which the IAF would allocate most aircraft at the start of a campaign, is to knock out enemy fighters on the ground. This requires IAF strike aircraft to penetrate deep into enemy territory after jamming enemy radars, drop cluster bombs to destroy enemy aircraft and immobilise runways with deep penetration bombs.

The Israeli Air Force had knocked out almost the entire Egyptian, Syrian and Jordanian air forces on Day One of the 1967 Six-Day War, but this is unlikely in the India-Pakistan context. Therefore, the IAF’s air defence plan must also cater for retaliatory strikes by PAF fighters.

Multiple layers of sensors detect incoming fighter strikes. Amongst the most reliable, surprisingly, is a chain of “mobile observation posts” (MOPs) all along the

border – each one a single human with a radio set, trained to identify and report enemy aircraft flying across the border.

Behind the MOPs, a chain of surveillance radars looks into enemy airspace to detect aircraft activity. Looking even deeper are Airborne Early Warning Command and Control (AEWC&C) systems, like the IAF’s three Phalcon systems, mounted on Russian Il-76 transport aircraft (photo above). From on high, where the earth’s curvature does not obscure visibility, they detect even low-flying aircraft at ranges of 400 kilometres and direct IAF fighters precisely onto them.

All these air defence elements are networked through data and voice communication channels to an autonomous “integrated air command and control system” (IACCS), which also links with civilian air traffic control radars. 

Quarter century of Aero India Shows!

The *Vayu Aerospace Review* has been intrinsically part of Aero India Shows since the very first over a quarter century back. In fact, the very first Air Show in India was *AVIA India*, which took place during 15-18 December 1993 at AFS Yelahanka, north of Bangalore and which has now become synonymous with the event. *Vayu Aerospace Review* was official publication partner for this India's first airshow and has remained so, with Special Issues and Show Dailies marking the events over the next quarter century, Aero India 2019 included.

At the very first effort in 1993, some 21 nations and 138 exhibitors participated, including those from the USA, UK, France, Germany, CIS, Israel, Italy, Singapore and Japan. On static display were 30 aircraft, including the prototype MiG-21-93 (precursor to the MiG-21bison) with the legendary General Designer Academician Rostislav A Belyakov personally on hand.

Aero India 1996 : Obviously, after witnessing such positive response, the Ministry of Defence got enthused into organising an air show by themselves, but by the time all glitches were ironed out, three years were to elapse and the first *Aero India* show was held in December 1996, also at Yelahanka. Then Prime Minister HD Devegowda inaugurated the event where some 22 countries took part and 62 aircraft were displayed.

Aero India 1998 : Two years on, during 8-12 December 1998, there were 25 aircraft on static display and then Defence Minister George Fernandes with Minister for Civil Aviation Ananth Kumar jointly inaugurated the event. However, most leading companies from America did not participate following the sanctions imposed by the US Government on India following the nuclear tests in May 1998 at Pokharan.

Aero India 2001 : With excessive rains during *Aero India* 1996 and 1998, which played spoilsport and following advice of the Indian Air Force, third edition of *Aero India* was shifted to the month of February. Defence Minister George Fernandes inaugurated the five-day event on 7 February, 2001 with over 150 international companies from 17 countries participating at the Show.

Aero India 2003 : Took place over 5-9 February and was again inaugurated by Defence Minister George Fernandes, with 176 international companies from 22 countries showcasing their products and services, as also 75 Indian companies. Of the 62 aircraft on display, 46 were from Indian Air Force.

Aero India 2005 : This event was inaugurated by then Defence Minister Pranab Mukherjee on 9 February, with 136 Indian and 236 international companies participating. There was a feast of flying displays including that by the Russian MiG-29K, Su-30MKI and Il-78 tanker; the American F-15E, C-130J Super Hercules and P-3C Orion aircraft; the French Mirage 2000 and Falcon 2000; the British Hawk 100, Jaguar and Sea Harrier and the Swedish Saab JAS 39 Gripen, apart from HAL's Dhruv ALH and HJT-36 Intermediate Jet Trainer (IJT).

Aero India 2007 : Held on 7-11 February, this edition had some 70 aircraft on static display with 30 carrying out flight demonstrations. This Show also marked Platinum Jubilee of the Indian Air Force, with a specially painted Su-30MKI highlighting the occasion. Saab sent three Gripens to participate while other attractions were the Lockheed-Martin F-16 and the Boeing F/A-18E/F Super Hornet, all contenders to meet the Indian Air Force's 126 aircraft MMRCA requirement.

Aero India 2009 : Took place over 11-15 February and provided a platform for 289 Indian and 303 international companies from 25 countries to display their products. There were 70 aircraft

on static display while 30 aircraft took part in the flying display, the Eurofighter Typhoon making its flying debut in India. Aero India 2009 also witnessed the biggest US participation till date, the contingent including the F-16 Fighting Falcon the F/A-18 Hornet, the C-17 Globemaster III, the C-130J Hercules and the KC-135 Stratotanker.

Aero India 2011 : From 9 to 13 February, this witnessed perhaps the largest number of aircraft participating, including virtually all the contenders for the IAF's gigantic MMRCA tender. These comprised the Boeing F/A-18E/F Super Hornet, Dassault Rafale, Eurofighter Typhoon, Lockheed Martin F-16 Falcon, Mikoyan MiG-35 and Saab JAS 39 Gripen, all at Yelahanka, perhaps together at the same venue for the last time.

Aero India 2013 : This Show from 6 to 10 February provided an extended platform for 352 international and 255 national companies to showcase their products and services. During the event, an armed ALH Mk.IV Rudra was handed over by HAL to the Indian Army. The Russian aerobatic team, *Russian Knights* with Su-27s performed for the first time in India.

Aero India 2015 : This 10th edition which took place 18 to 22 February was inaugurated by Prime Minister Narendra Modi, with the 'Make in India' initiative as theme. There was participation of some 33 countries with 623 companies (295 Indian and 328 International, with 72 aircraft and an increased space of 27,678 sqm. With the French aircraft now declared as the MMRCA 'of choice', Rafale International, the consortium consisting of Dassault, Thales and Snecma (a Safran subsidiary), showcased three Rafale fighters, including a single-seat Rafale C and two twin-seater Rafale Bs.

Aero India 2017 : The unique flypast which heralded start of this Show on 14 February was the *Might Formation* consisting of five indigenously-built aircraft : Tejas LCA, HAL-Dornier 228, HTT-40, HAL-Hawk-i, and Su-30MKI. There were 270 Indian and 279 international companies participating and during the Show, DRDO handed over the first of three indigenously designed airborne early warning on control (AEW&C) platforms to the Indian Air Force.

Aero India 2019: And so the Show goes on!! 



2019

AERO INDIA

AERO INDIA SPECIAL

“Gripen E is on Track”

Delivery of first series production

aircraft in 2019



VAYU Interview with

Ola Rignell

**Chairman and Managing
Director, Saab India**



VAYU : Saab is one of the global companies shortlisted to meet the Indian Air Force's requirement for future fighters, with the Gripen E as a strong contender. Kindly update our readers on status of this programme and as to when the first aircraft are being delivered to the Swedish Air Force.

Ola Rignell : Gripen E/F is part of the Gripen E-series and a new fighter aircraft system. The second Gripen E test aircraft, designated 39-9 has also made its maiden flight on 26 November 2018. Gripen E has successfully fired the IRIS-T air-to-air missile and completed the first tests to verify the ability to release external payloads by



jettisoning one external fuel drop tank. The aircraft has also completed the first flight armed with the MBDA Meteor beyond visual range air-to-air missile (BVRAAM). Saab remains on track to deliver the first series production units of its Gripen E by the end of the current year.

VAYU : *The Brazilian Air Force are to also receive their first Gripen Es in the near future even as preparations are ongoing for production of this aircraft type in Brazil. Meanwhile, what is the timeline for development of the two-seater Gripen F?*

Ola Rignell : The development of the two-seat Gripen was closely connected with the Brazilian industry, with Embraer leading the development. A cumulative effort by Embraer, Saab and other companies that are benefitting from the technology transfer project, are developing the two-seat fighter with Sweden. The two-seat version of the Gripen NG is being developed at the Gripen Design and Development Network (GDDN), which was inaugurated in November 2016, in the state of São Paulo. In 2024 the last jet fighter will be delivered to the Brazilian Air Force, but the partnership between Saab and Brazil is expected to go on for a long time through a wide-ranging technology transfer that will enable Brazil to develop, produce and maintain supersonic jet fighters.

VAYU : *As part of the 'Make in India' initiative, Saab has identified a number of Indian companies for collaboration in various areas including software development. Kindly enumerate on these.*

Ola Rignell : Saab is looking at the Indian Industry as our potential partner in product development for the world market. We believe that the Indian Industry has the necessary capability and can absorb the state of the art technology for manufacturing world class products.

Our plans in India are based not just on selling products but on creating a defence eco-system which would involve hundreds of Tier 1, 2 and 3 partners, vendors and suppliers. Saab would incubate partnerships between its global supply chain and Indian suppliers. Saab would also foster R&D partnerships for next-generation platform, system and sub-system design and development across the industry.

Saab is also working with many suppliers in India, including CIM Tools,

Tata Advanced Material Limited and Aequus (former QUEST Global Manufacturing). These companies play a very valuable role in helping Saab develop, industrialise and manufacture complex airframe assemblies for Airbus and Boeing. Our joint venture with Aequus manufactures and supplies assemblies for the global commercial aero structures market.

VAYU : *Is Saab's Deployable Aircraft Maintenance (DAM) Facility designed specifically for the Gripen or can this be adopted for other combat aircraft as well?*

Ola Rignell : Saab Deployable Aircraft Maintenance Facility combines a First Line Maintenance Hangar for storage, protection and maintenance of the aircraft, Maintenance Containers furnished as workshops and storage facilities and integrated Barracuda multispectral camouflage protection. It is rapidly deployed, enabling flexibility and mobility. The rigid design and compliance with NATO environmental standards facilitates operation in the toughest of climates. The Deployable Aircraft Maintenance (DAM) can be adopted by any combat aircraft.

VAYU : *The Swordfish MPA has been getting very encouraging responses from various countries. The Indian Navy too has an identified requirement for such advance systems : are detailed presentations planned on the system in the near future?*

Ola Rignell : There is no ongoing conversation on Maritime Patrol Aircraft with Indian Navy.

VAYU : *Saab have been engaged in supply of electronic warfare (EW) self-protection system for the HAL Dhruv ALH and the same could be integrated with the new light combat helicopter (LCH). Which fixed-wing aircraft types could also be considered for the IDAS?*

Ola Rignell : Saab is providing the Integrated Defence Aid Suite (IDAS) for both the Indian Air Force and Army Aviation Corps variants of the Advanced Light Helicopter (ALH), designed and manufactured by Hindustan Aeronautics Limited (HAL). IDAS is a fully integrated multi spectral warning system designed for self-protection of airborne platforms. IDAS combines radar-,laser-and missile approach warning functionality integrated with a countermeasure dispensing (CMD) capability for the deployment of chaff and flare decoys.

On the ALH, IDAS is integrated with an Indian-designed and manufactured CMD system. IDAS is supported by a dedicated mission planning tool known as the Threat Library Management System (TLMS). The supply of IDAS equipment for ALH is currently in full series production. Saab is also providing a comprehensive transfer of technology (ToT) to HAL for in-country maintenance and repair of the IDAS system in India, with the scope of expanding into full production in the near future.

We will reply to request from the Indian Air Force on a case to case basis for fixed wing aircraft but in general our system could be fitted to almost any fixed wing aircraft available today.



VAYU : *The Carl-Gustaf antitank rocket system is in widespread use with the Indian Army; is the latest M4 version being offered for supply and manufacture in India ?*

Ola Rignell : The Indian Armed Forces are one of the biggest and most experienced users of the Carl-Gustaf weapon system, and today they are operating the Carl-Gustaf M3 version. Through FFV Ordnance, part of the Saab Group, the Indian Armed Forces has been offered the Carl-Gustaf M4.

Today's dismounted infantry face a broader range of battlefield challenges than ever before. Having a single weapon for all situations increases their tactical flexibility and reduces the amount of equipment that they carry. The new Carl-Gustaf M4 version has all the effectiveness and versatility of the Carl-Gustaf M3 system but its improved, lightweight design (weighing less than 7 kg) offers significant mobility improvements to the soldier. Capabilities much needed for soldiers operating in

challenging environments. The M4 enables soldiers to deal with any tactical situation – from neutralising armoured tanks or enemy troops in defilade, to clearing obstacles and engaging enemies in buildings. We have showcased the M4 version to the Indian Army as well and you will be able to see it in our stand during Aero India.

VAYU : *What is the interest in India of Saab's Digital Air Traffic Solutions especially for remote airfields which is very pertinent in context light of India's expanding regional air services under the UDAN Scheme.*

Ola Rignell : Saab and the Airports Authority of India (AAI) have signed a Memorandum of Understanding (MoU) to research a pan-Indian Air Traffic Management Automation System for airports to be included in India's UDAN Regional Connectivity Scheme. The MoU with Saab will support AAI's need for ATM solutions and training of its personnel in ATM services. In addition, Saab is offering its Remote Tower for providing Air Traffic Management Solutions in far flung areas. The Remote Tower product suite includes high-definition cameras and pan-tilt-zoom cameras, surveillance and meteorological sensors, microphones, signal light guns and other devices for deployment at the airport.

VAYU : *Kindly give us a preview of Saab's displays at Aero India 2019 and the message the company would like to convey.*

Ola Rignell : At the Saab stand, there are dedicated displays and augmented reality exhibits showcasing our key products and systems. We are exhibiting our cutting-edge technologies and capabilities in aviation systems, ground combat systems, electronic warfare and naval systems - solutions that demonstrate our long and successful track record in developing ground-breaking technologies and pioneering innovations. Some of the products on display include Gripen E and Weapons System, Gripen Maritime, Integrated Defence Aids Suite (IDAS), Digital Tower Management Solutions, Ground Combat System, Land Electronic Defence System (LEDS) 50Mk2, Next Generation Radar Systems, including GaN based (Gallium Nitride) Saab AESA Fighter Radar and the truly multi-role Globaleye AEW &C aircraft with ERIEYE-ER radar, GIRAFFE 1X and Saab's portfolio of Signature Management Systems. 



VAYU Interview with Mr. Eli Alfassi, Executive VP Marketing, IAI



Heron TP (photo: IDF Spokesperson Unit)

VAYU : We last interacted on the eve of Defexpo 2018 when you stressed “True partnership paves the way for IAI in India”. Can you tell us about the continuing progress of IAI in India?

EA : Successful teamwork is a critical aspect of a strategic endeavour and IAI has proved its partnership and support through decades of cooperation in India: in joint research, development, integration, testing to technology and work sharing.

IAI is engaged here with many local companies and works with various defence agencies, the Navy, Air Force, Army and the Coast Guard.

We expect to expand our collaborations with local leading companies in order to integrate strategic state-of-the-art systems for India’s Ministry of Defence in various fields, and in accordance with the ‘Make in India’ policy.

VAYU : What are some of the current projects that IAI is involved with in India?

EA : IAI has been working with India’s defence industries and the armed forces for the past 25 years, as part of strategic collaboration in a variety of fields.

The company is engaged with many local companies and works with various defence services, including the Coast Guard, Navy, Air Force and Army. Our joint-development projects include the MRSAM air defence system, both maritime and land-based versions, various radar systems and UAVs. All collaboration agreements include transfer of technology for the benefit of local production as part of the Indian government’s *Make in India* policy.

VAYU : Kindly elaborate on the MRSAM programme and co-operation with DRDO, BDL and BEL?

EA : MRSAM is an advanced air and missile defence system, a unique joint development by IAI and DRDO and various Indian companies including Bharat Electronics Limited (BEL), Larsen and Toubro, Bharat Dynamics (BDL) and several private Indian companies.

The MRSAM air and missile defence system is operational with the Indian Air Force, Indian Navy and Israel Defence Forces and in the near future with the Indian Army.

Recent contracts signed and to be executed with the Indian Navy, will be carried out with BEL Bharat Electronics Limited, which are the main contractor in these projects.

VAYU : Are IAI pushing for more advanced UAVs to the Indian Armed Forces? Currently India uses various IAI UAVs such as the Searcher, Heron and Harpy : any upgrades on the existing airframes?

EA : IAI is a global leader in the design, development, and manufacture of UAVs.

The Heron family, with over 40 years’ of experience and more than 1,600,000 operational flight hours, perform intelligence gathering and targeting missions in support of key military operations around the world.

Our UAVs and loitering munitions systems are combat proven with more than 20 customers worldwide. IAI will continue to support existing customers worldwide, introducing additional state-of-the-art sensors and technologies.



VAYU : What is the main theme of IAI at Aero India 2019?

EA : A leading global defence company, IAI addresses the unique challenges of national defence and homeland security with technologically advanced and operationally proven solutions.

An Aero India 2019, IAI will present some of its latest and most advanced aerospace and defense solutions, featuring the latest technologies in military aviation, air defence and missiles systems, unmanned systems, special mission aircraft, radars and cyber technology.

Among the systems on display are the operationally proven air defence systems MRSAM, special mission aircraft, the Heron TP, the largest platform in IAI’s family of advanced unmanned aerial systems (UAS). Satellites, radars, loitering munitions systems, EO surveillance systems, Strategic, HPR and tactical radars, advanced mission systems for helicopters. These are only some of the highlights of IAI’s display at Aero India 2019. 🦋

Lt. Gen. Kamal Davar on

India-Israel defence cooperation

“A blossoming partnership”



Ariel Sharon

became the first Israeli PM to visit India, opening up diverse vistas for cooperation between the two nations including in defence.

because of its energy dependence and the massive inflow of foreign exchange being sent to back India by its citizens working in the Arab world. Still, in 1950, India had recognised the State of Israel, but did not accord formal recognition to the latter apart from permitting Israel to open a consulate in Bombay, primarily to cater for the large number of Jews who inhabit India's commercial capital.

India did not maintain any diplomatic relationship with Israel and these remained informal till the early 1990s. However, in both the 1965 and 1971 India-Pakistan wars and even later, Israel did provide some light weaponry, ammunition, and intelligence. Reportedly, former Indian PM Indira Gandhi had directed her RAW chief, RN Kao, to establish links with the Israeli intelligence agency Mossad while India's own external intelligence agency was raising. What is not very well known is that prior to the 1971 war, PM Indira Gandhi had requested Israeli PM Golda Meir for supplying India with some weapons and ammunition which the former diverted from its exports to Iran to India (till the fall of Shah of Iran's regime, Israel and Iran had maintained cordial relations).

Despite India's diplomatic and economic outreach to the Arab world, it was only in 1992, under PM Narasimha Rao, that India formally established diplomatic relations with Israel. In 1997, President Ezer Weizman became the first senior Israeli politician to visit India. It was in 2000 that the first senior minister from India, Deputy PM LK Advani visited Israel to establish joint counter terror mechanisms with Israel, then followed by the visit of India's Foreign Minister Jaswant Singh. In 2003,

The last few years, especially in the NDA regime, saw a marked upsurge in visits to each other by the senior political hierarchy of both the nations. In November 2014, Indian Home Minister Rajnath Singh visited Israel to discuss “border management” while in October 2015, President Pranab Mukherjee became the first Indian head of state ever to visit Israel. Later, PM Narendra Modi made a landmark visit to Israel in July 2017 as the first Indian prime minister to visit the Jewish state. This was reciprocated by an equally high profile visit of Israeli PM Netanyahu to India in January 2018 who brought a 130 member delegation to India to discuss and sign various agreements in diverse fields.

Defence Cooperation

Currently, India is the largest buyer of military equipment from Israel and the latter is the third largest defence equipment supplier to India, after Russia and the USA. As is well known, India, ofcourse, has the unflattering distinction of being the world's largest importer of defence equipment in the world—fact not lost on the technologically advanced nations of the world to tap India's huge arms market. From a meagre 1 million US dollars of military equipment imports from Israel in the mid-nineties, by 2009 military imports from Israel had touched a whopping 9 billion US dollars. Defence cooperation has also encompassed intelligence sharing and joint military training.

Apart from a variety of munitions and communication equipment, in relatively small numbers from Israel in the last 40 years or so after our independence, it was only in 1996 that a major deal was signed between the two nations. Many security analysts term 1996 as a watershed in India-Israeli defence cooperation. 32 Searcher UAVs and laser-guided bombs, manufactured by the Israeli

Defence Cooperation among nations, beyond the seller-buyer relationship, is generally an upshot of fraternal ties between each and emerging from common strategic goals, ideological affinities and, importantly, a shared regional or global overview in today's troubled times. Located in different and disturbed regions of the world and now with full-fledged diplomatic relations, the growth in military cooperation, between two nearly disparate nations—India and Israel—is nothing short of astounding! In particular, over the last three decades, both nations have established cooperation that spans high technology, agriculture, tourism and space but most striking and unquestionably, in the field of defence. That this cooperation has enormous potential is emphasising the obvious.

Diplomatic Background

In 1948, the UN had mandated the partition of Palestine into Israel and an Arab state which was then opposed by India, more to retain its relationship with the emerging oil-rich Arab world. India continued with its pro-Arab policies right throughout the first half century after independence, essentially



giant company, Israeli Aerospace Industries Ltd (IAI) were contracted. In addition, Israeli expertise was also utilised to upgrade India's large but aging MiG-21 fleet. In 1997, the Barak-1 SAM (surface to air missile) was inducted into the Indian Navy. Barak-1 has the ability to intercept anti-ship missiles such as the Harpoon sea-skimming missiles, which the Pakistanis had acquired along with Lockheed P-3 Orion maritime surveillance aircraft, from an indulgent USA. It is also pertinent to note that, like Russia and France, Israel did not criticise India after the 1998 Pokhran 2 nuclear tests. Israel also supplied, at short notice, some essential munitions during the 1999 Kargil operations against Pakistan. In addition, a variety of UAVs were also procured later for the Indian Army and the Indian Navy. These 'eyes in the sky' with their powerful Synthetic Aperture Radar (SAR) and Forward Looking Infrared cameras (FLIR) have proven to be an effective surveillance and intelligence gathering mechanism.

The turn of the century witnessed a growing upsurge in India buying state-of-the-art weaponry and platforms from Israel. Apart from frequency-hopping radio sets like the Tadiran and night vision equipment for its armoured formations, three Phalcon AWACS fitted with IAI radar mounted on Russian Il-76s were inducted into the Indian

Air Force in 2003 at a cost of 1 billion US dollars. In a significant move, India also signed a 2.5 billion US dollars deal with Israel in 2007 for the design, development and production of anti-aircraft systems and missiles, namely the Medium Range Surface to Air Missile (MR-SAM). The MR-SAM has a range of 70 kms and an indigenous content of 80 percent. The MR-SAM has been gradually inducted and is considered to be a leading air defence system for the three services. Plans are advanced to jointly manufacture a shorter range SAM too for India's Navy.

In 2008, the Israeli military satellite TecSAR was launched by the Indian Space and Research Organisation (ISRO). In earlier years, media reports had also suggested Israeli satellites providing vital information to the Indian government.

Current Initiatives

In the past couple of years, many joint forums have been set up to provide a fillip to defence cooperation between the two nations. The India-Israel Industrial Research and Development and Technology Innovation Fund (14F), Indo-Israel CEO Forum, the India-Israel Innovation Bridge, an online platform to encourage and facilitate collaboration between various Israeli companies and Indian 'start-ups' have

also been established. MOUs between ISRO and the Israel Space Agency (ISA) have also been signed.

The Government of India has been encouraging Israeli companies to sign MOUs with Indian companies to give a momentum to the 'Make in India' and 'Make with India' initiatives of PM Narendra Modi. Eli Alfassi of Israel's leading aerospace and defence conglomerate, recently stated that the "IAI has led many joint programmes evolving with India providing aerial refueling capabilities, unmanned aerial systems (UAS), airborne early warning aircraft, various radars and many other defence systems and capabilities." He added that their systems and platforms were in service with the three Indian services and other government agencies and "were all working together for mutual benefit while leveraging this partnership for further expansion." Significantly, Eli Alfassi also expressed that "aligned with the evolving Indian policies, as part of the offset obligations, we have been buying Indian subsystems and services worth nearly \$ 800 million from 80 Indian suppliers. We intend to increase our work here, adding more Indian suppliers in the future."

Further, IAI, Dynamics Technologies Ltd and the Sun Group are to establish a JV

for UAVs, striving for joint development and production to make futuristic UAVs. Another planned JV with Mahindra will be in the realm of defence electronics, radars and communications. With Bharat Forge Ltd, IAI will be working towards smart munitions. The Israeli Golan Industries Division also signed a MOU with Taneja Aerospace and Aviation for the manufacture and marketing of aircraft seats for civil and military aircraft while Wipro and IAI have forged a strategic alliance for the manufacture of composite aero structure parts and assemblies. Elbit (ISTAR Division) of Israel and India's Adani Group also have a JV to manufacture UAVs in India. Cooperation between the two nations is, in short, rapidly diversifying and growing in the fields of defence and security.

The Landmark Visit

Since his tenure as Gujarat CM and after taking over as the Indian PM, Narendra Modi has displayed a marked inclination to upgrade Israel-Indian relations and a revision of India's unqualified traditional support for Palestine. However, as the *Indian Express* then pointed out that "after originally signaling this pro-Israel shift, Modi embarked on a course correction by mid-2015 and effectively resumed the policy of multi-engagement of all relevant West Asian actors. Before traveling to Israel, Modi had visited the UAE, Saudi Arabia, Qatar and Iran" and also hosted the Palestine President Mahmoud Abbas in New Delhi in mid-2017. Nevertheless, India-Israel relations are unmistakably on the upswing especially in the defence sector, notwithstanding India's traditional fraternal ties with the Arab world and Iran. During PM Modi's visit to Israel in 2015 ties between the two nations were upgraded to a "strategic partnership."

PM Netanyahu's visit to India in January 2018 was after a long break by any Israeli PM (PM Sharon had visited India in 2003). This highly publicised visit saw the signing of nine agreements and many MOUs in the fields of space cooperation, oil and gas, agriculture, cyberspace, counter-terrorism and homeland security. The Israeli PM also stated that "Indians and Israelis know the pain of terrorist attacks. We remember the horrific savagery in Mumbai" and called for synergy among the two nations to combat terror. On defence cooperation both the prime ministers issued directions to their

establishments for developing more joint business models and partnerships for JVs and joint manufacturing including transfer of technology, research and development in the defence and security fields. They both desired, according to reports published in the Israeli newspaper, *Jerusalem Post*, "viable, sustainable and long term cooperation in the defence industry."

However, some differences

Though, unquestionably, India-Israeli ties are on the upswing in diverse fields, yet a few differences in opinion exist in mutual diplomatic ties and also in defence aspects. However, both these remain publicly understated and have not affected the cordiality between the two nations. India has not wavered from its traditional stance for support to the establishment of an independent Palestinian state. The existence of Palestine remains an anathema to the Israelis and, somewhere, India could play a major role in bringing these two warring people reduce their political differences. In addition, Iran, an arch enemy of Israel, is building its south eastern port of Chahbahar with Indian investment and assistance, which irks Israel. Nevertheless, India's energy dependence on Iran, its strategic interests in the region and the consequent development of Chahbahar Port for conferring much needed connectivity to India towards Afghanistan and the Central Asian Republics is also a strategic imperative for India, which the Israelis do acknowledge.

As regards China, since decades Israel has maintained excellent trade and defence relations with the former. China has been a buyer, in substantial quantities of modern defence equipment from Israel, reverse-engineered many of Israeli cutting edge technologies and is utilizing the same for its alarmingly growing arsenal. China-Israeli defence ties, though primarily commercial in nature, do impact on India's defence preparedness and it will be prudent on India's part to impress upon Israel to not sell everything and anything to the financially powerful and geo-politically assertive Chinese.

Untapped Frontiers

Faced with the common scourge of Islamic extremist terrorism and the need for developing strategic military and commercial, mutually beneficial ties with each other, India and Israel have made more than a promising start. As Israel endeavours to tap India's gigantic arms market, it will be prudent for India to reach out to the technologically highly advanced Israeli industry, imbibe their cutting edge technologies and jointly develop, manufacture and market modern weaponry for themselves and to friendly foreign countries. In India's march towards acquiring a globally powerful profile, Israel will have a major role to play. Hopefully, both nations will synergise their human resource availability, technological abilities, innovative genius, diverse resources and financial muscle to jointly move forward to newer vistas and untapped frontiers. 🦋



Shalom, Shalom ! Netanyahu and Modi in New Delhi

Successes of Israel's defence industry

IAI and Aero partnership on F/A-259 Striker

Czech aircraft manufacturer Aero in partnership with Israel Aerospace Industries (IAI) has launched a new version of the L-159 light-attack trainer aircraft, the F/A-259 Striker. New avionics and a wet-wing capability have been introduced and this is being pitched for the US Air Force's OA-X light-attack aircraft competition. Even though the USAF had already invited Textron Aviation and Sierra Nevada/Embraer to take part in an evaluation exercise with their Beechcraft AT-6 and A-29 Super Tucano respectively, Giuseppe Giordo, President and CEO of Aero, believes the USAF "cannot afford the risk of flying with turboprops." "We do believe that US pilots need to have the best assets in close air support missions. This is not a developmental airplane. It has been used in a operational war environment and can perform many roles."

The F/A-259 Striker combines the "robustness and effectiveness" of its successful predecessor, the L-159 Alca, with the latest advances in avionics and aircraft systems technology. With benefits of a wet wing, F/A-259 Striker provides 'superior' performance, 'great' maneuverability and long range. IAI Lahav Division general manager Benjamin Cohen states, "Our cooperation with Aero Vodochody offers the USAF impressive proven performance of the F/A-259 with new innovative IAI systems to provide customers with aircraft that meet their OA-X requirements."

IAI's ASW capabilities for RPAs



Israel Aerospace Industries (IAI) is upgrading its involvement in the maritime arena with anti-submarine capabilities for its marine Remotely Piloted Air Systems (RPAS). The new capabilities respond to the need arising from discontinuation of the "Shahaf" manned Sea Scan maritime jet by the Israeli Navy and the growing use of IAI Heron RPAS for maritime patrol missions, which created a need in anti-submarine capabilities with the RPA. The maritime RPA, which carries a range of dedicated payloads, now has two new payloads for submarine detection: the Sonobuoy (acoustic detector) and the MAD (Magnetic Detector).

Elbit EW suites for Israeli Navy

Elbit has been awarded a \$85 million contract from the Israeli Ministry of Defence (IMOD) to supply Electronic Warfare (EW) suites for the Israeli Navy Sa'ar 6-class corvettes that will be tasked with the protection of Israel's Economic Exclusion Zone.

The EW systems to be supplied are combat proven and include digital receivers, signal processing technologies and analysis tools that are all of an open system architecture, thus enabling effective operational capabilities and flexibility to cope with both current and future threats. The latest configurations of those technologies were developed in close cooperation with the IMOD's Administration for the Development of Weapons and Technological Infrastructure and with the Israeli Navy, and have been recently declared fully operational after successfully completing intensive sea trials.

Elbit Hermes 900 StarLiner



Elbit has commenced global marketing of the Hermes 900 StarLiner, a Medium Altitude Long Endurance (MALE) Unmanned Aircraft System (UAS) that features adverse weather capabilities and is fully compliant with NATO's Standardisation Agreement (STANAG) 4671, qualifying it to be safely integrated into civilian airspace and fly in the same environment with manned aircraft. Concluding an extensive year-long flying schedule, the Hermes 900 StarLiner has been performing Civil Aviation Authority-certified flights in Masada National Park, Israel. A series of the Hermes 900 StarLiner (known as Hermes 900 HFE in the Swiss programme) is currently being assembled for the Swiss Armed Forces and is scheduled to be delivered and integrated into Switzerland NAS during 2019.

RADA Radar orders

RADA Electronic Industries Ltd. has announced an order of \$4 million for the company's software-defined radars which will be



used in “today’s most advanced defence applications.” These include active protection systems (APS) for armoured vehicles, counter rocket artillery and mortar (C-RAM), counter UAV and short range air defence (SHORAD).

Rafael and Lockheed Martin MoU on SPICE

Lockheed Martin and Israel’s Rafael Advanced Defense Systems have signed a Memorandum of Understanding (MOU) to evaluate potential markets and customer requirements for Rafael’s Smart, Precise Impact and Cost-Effective (SPICE) missile guidance kits. “SPICE is a leading air-to-surface weapon system offering US and international air forces operating Lockheed Martin’s platforms, as well as strategic bomber aircraft, an important complement to their existing operational capabilities,” stated Yuval Miller, Executive Vice President, Head of Rafael’s Air & C4ISR Division. “SPICE’s unique features greatly enhance the ability to operate in contested environments. We are excited to engage in cooperation with Lockheed Martin to make SPICE available as a US-made system, adapted to fully meet US standards.”



The MOU covers the SPICE 1000 (453 kilogramme/1,000 pound weight class) and SPICE 2000 (907 kilogramme/2,000 pound weight class) precision guided missile kit variants.

RADA MHR for UK

RADA’s Multi-Mission Hemispheric Radars (MHR), which are embedded in the Rafael Advanced Defense Systems Drone Dome



counter-drone solution, will be delivered to the British Army “to protect from airborne drones some sensitive facilities and sites on which British armed forces are deployed.” Signal intelligence system along with electro-optical sensors, provide additional layers of threat classification and identification, while RF jamming provides the soft-kill layer of this solution.

Rafael’s SPIKE LR2 for Australia



Australia has selected the Rafael Advanced Defence System’s Spike LR2 as Anti-Tank Guided Weapon (ATGW) for the Australian Defence Force’s (ADF) Boxer Combat Reconnaissance Vehicle (CRV). The Spike LR2 will be delivered by Varley Rafael Australia (VRA Systems), a joint venture between Rafael and the Varley Group. In addition to the Spike LR2, VRA will deliver a range of Rafael products for the Australian market including the Trophy Active Protection System (APS) for armoured vehicles; the Tamir Counter-Rocket, Artillery & Missile (CRAM) interceptor for short-range Ground Based Air Defence (GBAD); and the Torbuster Torpedo Counter-Measure (TCM) for submarines.

Controp partners with eCastle

Controp Precision Technologies Ltd. has partnered with eCastle Australia for the marketing of its EO/IR defence and homeland security solutions. According to Mr. Ra’anah Shelach, Controp’s VP Marketing, “Controp sees eCastle as a strong and committed partner in establishing our position in the country, marketing our products, and developing the Australian EO/IR market. Controp’s extensive experience and operationally-proven products,



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together with eCastle's SME position as a Command & Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) integrator will help position our products as part of wider C4ISR solutions for protection of defence bases, Home Affairs and Australia's borders and key infrastructure."

Elbit's Naval Weapon Stations



Elbit has been awarded a contract to provide Naval Remote Controlled Weapon Stations (RCWS) to the Navy and Coast Guard of "an Asia-Pacific country." The contract will be performed over a five-year period. Under the contract, Elbit Systems will provide lightweight, fully stabilised dual-axis Naval RCWS to be installed onboard a wide range of vessels. The Naval RCWS feature a 12.7mm machine gun and ammunition, Elbit Systems' advanced fire control system and the Company's modular electro-optic suite.

Aeronautics latest UAS

Four months after Aeronautics Group completed acquisition of Chassis Plans, the synergy of the two companies was seen at the AUSA exhibition in Washington DC where Aeronautics group presented its most advanced Small Tactical UAS with long endurance and long distance abilities. Chassis Plans develops, manufactures and integrates operating stations for unmanned systems and computer equipment for military and industrial applications. Among its customers are US defence industry complexes, including Boeing, Lockheed Martin and General Dynamics.



Aeronautics manufactures a range of Small Tactical UAS including the Orbiter 4 that offers high transportability without the need for a runway. The Orbiter 4 UAS features advanced technological capabilities including: the ability to carry and operate 2 payloads simultaneously, with endurance of up to 24 hours, use

of satellite communication, launch versatility Maritime Patrol Radar (MPR), 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.

CONTROP launches Tornado-ER

CONTROP has launched the Tornado-ER, an Electro-Optical panoramic scanning and automatic maritime target detection system, for coastal surveillance and protection and maritime traffic control, particularly in dense waters. The system provides a 360 panoramic IR image up to the horizon of all maritime views. The Tornado-ER includes two Thermal Imaging InfraRed (IR) cameras that provide a real-time, panoramic image from short to long distances up to the horizon.



New orders for RADA

RADA Electronic Industries have received new radar orders for software-defined radars for counter rocket artillery and mortar (C-RAM) and counter UAV and short range air defence (SHORAD). All orders were from "new and strategic customers." RADA offers Pulse-Doppler, multi-mission, AESA radars for tactical applications, these Software Defined radars introducing hemispheric spatial coverage with 'excellent performance-to-price ratio'.

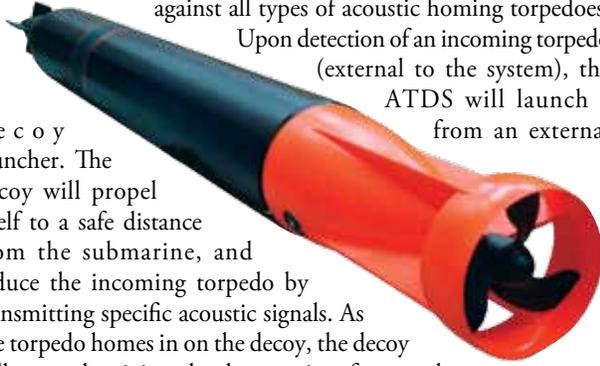


Rafael unveils Torbuster ATDS

Rafael has unveiled its new ATDS Active Advanced Torpedo Defense-capability for surface vessels, a “unique, innovative capability for surface ships, providing detection capabilities, locator sensors and neutralisation capabilities for naval forces.” Based on Rafael’s unique Torbuster underwater active decoy, ATDS provides defence against all types of acoustic homing torpedoes.

Upon detection of an incoming torpedo (external to the system), the ATDS will launch a decoy from an external

launcher. The decoy will propel itself to a safe distance from the submarine, and seduce the incoming torpedo by transmitting specific acoustic signals. As the torpedo homes in on the decoy, the decoy will sense when it is at the closest point of approach and self-explode, inflicting sufficient damage to the torpedo and so neutralise it.



CONTROP’s iSea-30HD EO/IR for Latvia

Controp is to provide the Latvian Navy its iSea-30HD system to enhance maritime surveillance capabilities. The system was designed for various maritime vessels and is already in operational use by the Latvian Navy as well as other navies worldwide. The iSea-30HD features a stabilisation system that enables a stable, continuous and uninterrupted line-of-sight (LOS) ensuring a very clear picture even in the roughest of seas. Offering a full solution for naval maritime operations, the iSea-30HD interfaces with other onboard systems, including the vessel’s radar system providing slew-to-cue functionality. The system comprises the payload electronics box, a Control Unit (CU), a display, DVR and UPS.



Rafael’s 360° multi-layered Suite



Rafael Advanced Defense Systems has unveiled its unique 360° multi-layered suite of maritime defense solutions to provide naval forces defence superiority against all modern naval threats, including for naval area defence, swarm attack defence, and torpedo defence, “based upon years of experience and operational lessons in various naval arenas and scenarios, and integrating the company’s combat-proven technologies in all domains.”

IAI’s Air Defence System upgrades

Israel Aerospace Industries (IAI) has been awarded a contract worth \$ 550 million by an Asian country to provide its *Sky Capture* Air Defence system. This command and control system for anti-aircraft systems, transforms the customer’s legacy air defence systems into highly accurate and effective systems with advanced command and control capabilities as well as information fusion based on multiple sensors, including advanced fire control and detection radars, electro-optical sensors made by IAI and ELTA systems. This command and control system provides accurate target data for the interceptors and manages the threat and firing detection in an optimal manner according to the target type. This system developed by IAI provides short-range aerial defence for army forces, headquarters, bases and strategic assets against a broad range of air-borne threats.



IAI Barak 8 LRSAMs for Indian Navy

Israel Aerospace Industries (IAI) has been awarded an additional, \$777-million contract for supply of LRSAM Air and Missile Defence systems (marine version of the Barak 8) AMD system for seven ships of the Indian Navy. The contract was entered with Bharat Electronics Limited (BEL) which serves as main contractor in the project. The LRSAM system, part of the Barak 8 Family, is an operational AMD system to provide broad Aerial and point defence against a wide range of threats to the marine arena from the air, sea or land. The Barak-8 AMD system was developed by IAI in collaboration with Israel's MOD, India's DRDO (Defense Research and Development Organization), the navies of both countries, IAI's ELTA Group, RAFAEL and local industries in India and Israel.

IAI's advanced AMD system wins another contract

Israel Aerospace Industries (IAI) will provide Barak-8 advanced defence systems to Israel Navy's *Sa'ar-6* corvettes. The contract was led by the Navy, Directorate of Defence Research and Development (DDR&D) and the procurement administration of Israel's Ministry of Defence.

IAI and KSU to operate TaxiBot

Israel Aerospace Industries (IAI) has an agreement with KSU of India for operating TaxiBot vehicles at New Delhi and Mumbai airports. In the first phase, TaxiBot vehicles will be delivered to the airports for controlled trials until end 2018, the second phase involving the delivery of 38 additional vehicles over four years. TaxiBot is a semi-robotic vehicle which connects to the aircraft and is controlled by the pilot to taxi from the airport's bridge to the runway without employment of aircraft engines. "The Indian government regards the TaxiBot as a significant means for addressing air pollution issues at airports, which are exacerbating."

RADA in Iron Fist APS for Bradley AFV

General Dynamics' subsidiary, General Dynamics Ordnance and Tactical Systems, together with Israel Military Industries (IMI), which was recently acquired by Elbit Systems. RADA is the provider of the radars to the Elbit/IMI IFL system.

The IFL system is a lightweight APS, providing enhanced survivability for armored and tactical platforms. RADA's software defined radars identify and precisely track incoming threats, from any direction, in real time. The system then intercepts the threat by launching a small warhead and activating it at a safe distance from the protected platform at a precisely calculated moment, defeating the threat through a shock-wave effect.

Elbit/ Leonardo torpedos for Seagull USV

Augmenting the Seagull Unmanned Surface Vessels' (USV) capability to mount and launch light weight torpedoes, Elbit Systems ISTAR division has teamed with Leonardo to develop and demonstrate Leonardo's lightweight and mini torpedoes launching capabilities from the USV. Operational with the Israeli Navy, Elbit Systems' Seagull USV "performed superbly" at the Belgian Defence Ministry 2017 North Sea trials and has been participating regularly in international naval exercises involving Mine Counter Measures and Anti-Submarine Warfare missions.

Elbit Systems acquires IMI Systems

Elbit has completed acquisition of IMI Systems Ltd. for approximately \$495 million, with an additional payment of \$27 million contingent upon IMI meeting agreed performance goals.

Elbit Seagull USV tests with KATFISH Sonar



Elbit Systems Seagull multi-mission Unmanned Surface Vessel (USV) has completed a series of rigorous sea tests operating the Kraken Robotic Systems KATFISH Synthetic Aperture Sonar (SAS) towed system. These tests are an addition to a successful series of Mine Counter Measures (MCM) tests and exercises conducted by the Seagull over the past two years, including trials and exercises in participation with Western and other Navies. Actively controlled, KATFISH is an intelligent towfish platform that was specifically designed for high-speed hunting of naval mines and underwater improvised explosive devices. 



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Rafael unveils the Spike ER2

Rafael Advanced Defense Systems has revealed its Spike ER2 Fifth Generation Extended Range missile, “to enable Joint 5th generation tactical overmatch for ground manoeuvre, rotary dominance and naval deterrence.” The new missile features a number of new capabilities, and a combination of greater standoff range of up to 10 km for surface launch, and 16 km when fired from a helicopter, NLOS engagement capabilities (launch to grid coordinate), “while retaining the Spike legacy of relatively light weight (less than 34kg) and high lethality.” These constitute significant factors for precision-guided missiles.

The Spike ER2 has evolved from the wider Spike Missile family, which is “one of the ‘most combat-proven missiles’”, integrated on more than 45 platforms, in use by 30 nations, with over 30,000 missiles already supplied and 5000 missiles fired. The Spike ER (Extended Range) variant, now upgraded to Spike ER2, is the mid-range member of the family, with a range of 8 km, and has a vast platform portfolio, including on the Spanish Army Aviation Tiger helicopter, the Colombian Air Force Blackhawk, the Italian AW129 Mangusta, the Romanian Super Puma

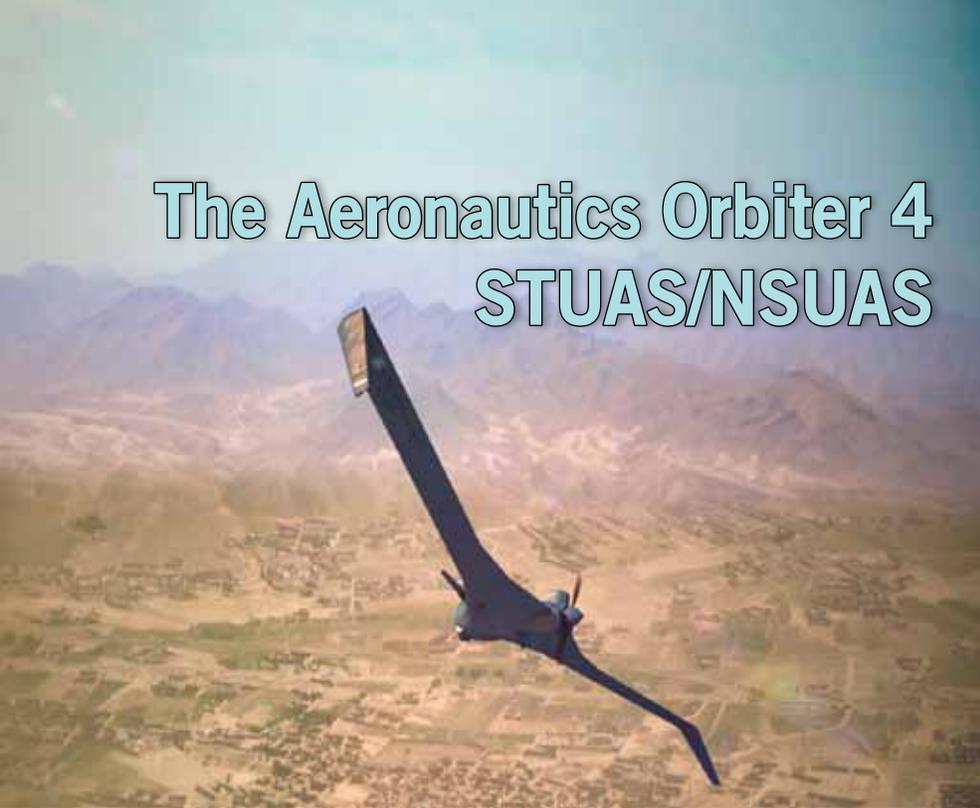
helicopter, the Super Cobra, and various types of ground vehicles and naval vessels.

The missile includes a new RF datalink variant to maximise the missile’s energetic range for enhanced stand-off launch from rotary platforms, having a 16 km range. It also integrity a modern advanced seeker with high resolution IR and day sensors for extended range target acquisition, and a multispectral target tracker, enabling sensory data fusion - an important feature in the smoky environment of today’s battlefields. The missile also has a special

maritime target tracker which can sustain target lock-on in the maritime environment. The Spike ER2 seeker was designed for the modern battle arena enabling ‘hotswap’ capabilities of sensory swap between IR to day midflight (important for detection of camouflaged targets). In addition, it has network connectivity and Non-Line-Of-Sight (NLOS) engagement capabilities, including an embedded IMU (Inertial Measurement Unit) for third party target allocation, allowing firing of the missile on NLOS grid target coordinates. 🦅



The Aeronautics Orbiter 4 STUAS/NSUAS



Most advanced UAV of its kind

Having an endurance of more than 24 hours with a maritime version, Aeronautics newest UAS is the Orbiter 4 STUAS/NSUAS, an advanced multi-mission platform with ability to simultaneously carry and operate two different payloads. Orbiter 4 continues evolution of the Orbiter family and the Small Tactical UAS, and delivers “top mission performance with the lightest, most versatile, and is the most advanced covert platform available today ideal for both land and maritime operations”.

Based on the aerodynamic structure and properties of the Orbiter 3 STUAS, performance of the Orbiter 4 gives maximum endurance of more than 24 hours, with maximum takeoff weight of 50 kg, maximum flight attitude of 18,000 feet and the ability to operate two different payloads simultaneously.

With its Advanced Image Processing Capabilities, automatic takeoff and recovery system and ability to navigate with, and without GPS and datalink, the Orbiter 4 delivers similar capabilities as other tactical

platforms operational today, but with better endurance, serviceability, operational flexibility and cost-effectiveness. Operated by 3 personnel, the Orbiter 4 is easy to use and maintain, and carries a low logistical footprint.

According to Amos Mathan, CEO Aeronautics, “the Aeronautics Group provides comprehensive aerial solutions consisting of several integrated platforms. These ‘system of systems’ solutions are ideal for the most advanced Defense Para-military and HLS missions. With our latest development, the Orbiter 4 STUAS, Aeronautics group is – as always - one step ahead”.

Aeronautics Ltd is an Israel-based defence solution provider and a world leading developer and manufacturer of Unmanned Aerial Systems focusses on the Mini, Tactical, and MALE UAS categories. Since its establishment in 1997, the Company’s products have been delivered and successfully deployed by over 50 defence, military and homeland security forces on five continents.

Aeronautics Ltd, are a leader in the development, manufacture, and marketing of state-of-the-art unmanned systems for land, sea and air, integrating surveillance equipment with network information. As a specialist in the field of unmanned Intelligence, Surveillance, and Target Acquisition and Reconnaissance (ISTAR), Aeronautics in-house vertical integration capabilities facilitate rapid delivery of tailored turnkey solutions to its customers.

With its subsidiaries, Comtact, Zanzottera, Controp, RT, PoziDrone and CP Tech, the Aeronautics Group offers a ‘one-stop shop’ for cost-effective solutions for defence and HLS missions.

Courtesy: Aeronautics



IAI follow-up agreements on MRSAM

Israel Aerospace Industries (IAI) has entered agreements worth \$93 million for provision of naval MRSAM (Medium Range Surface-to-Air Missile) systems. The contracts were entered with the Indian Navy and Cochin Shipyard Limited (CSL). Under the contracts, IAI will provide complementary systems for the air defence system (ADS), and involve follow up orders for a range of maintenance and other services for various sub-systems of IAI's advanced MRSAM ADS. Recently, the Indian Navy, in collaboration with IAI, held an interception test aboard INS *Chennai*, which assessed for the first time potential collaboration between ships. The interception scenario, which was executed successfully, demonstrated how the operational force of the defence system can be enhanced.

As Boaz Levi, Executive Vice President and General Manager of Systems, Missiles & Space Group stated, "The follow-up orders provide additional evidence of the satisfaction and trust of our Indian partners in respect to the MRSAM family. The test demonstrated the advanced technological capabilities of the air defence system as well as our collaboration between IAI, its partners in India's Navy, the local Indian industry and our colleagues at IAI's ELTA and Rafael. This is a badge of honour for the entire Israeli industry".

The MRSAM family is an operational air-defence system used by Israel's navy as well as by India's naval, air and ground forces. It has been uniquely developed by IAI in collaboration with Israel's Ministry of Defence, India's Defence Research and Development Organisation (DRDO), Rafael, IAI's Elta and additional industries in India and Israel. To date, MRSAM has achieved over \$6 billion in sales. It provides broad as well as topical defence against a range of air assault, marine and ground threats. MRSAM comprises several key state-of-the-art systems, including a digital radar, command and control, launchers, and interceptors with advanced homing seekers.

IAI Ltd. is Israel's largest aerospace and defence company and a globally recognised technology and innovation leader, specialising in developing and manufacturing advanced, state-of-the-art systems for air, space, sea, land, cyber and homeland security. Since 1953, the company has provided advanced technology solutions to government and commercial customers worldwide including satellites, missiles, weapon systems and munitions, unmanned and robotic systems, radars, C4ISR and more. IAI also designs and manufactures business jets and aerostructures, performs overhaul and maintenance on commercial aircraft and converts passenger aircraft to refueling and cargo configurations.



MRSAM air defence system

Controp at Aero India

At Aero India 2019 CONTROP is presenting the SIGHT-HD, a specialised targeting EO/IR payload for Remote Weapons Stations (RWSs) and Armoured Fighting Vehicles (AFVs). The SIGHT-HD is a gyro-stabilised payload that was developed especially to withstand extreme environmental conditions, facilitating mid-to-long range target acquisition, day and night, for mobile and stationary applications. When installed on AFVs, it is ideal for a wide range of applications, such as border surveillance, perimeter protection of sensitive installations, force protection, route clearance and more. At just 13kg, the low-weight payload is easily installed on any type of vehicle or weapon station.

The SIGHT-HD includes a high-performance Thermal Imaging (TI) camera using a 3-5 μ Cooled IR detector with a continuous zoom lens; High Definition (HD) Color Day camera with a continuous zoom lens; and an Eyesafe Laser Range Finder (ELRF), all integrated into an all-in-one Line Replacement Unit (LRU). The advanced image processing features include local AGC on the TI and Day cameras; Video Enhancement; Automatic Video Tracker and Picture-in-Picture (PIP). A Laser Pointer, Control Unit (CU) and Digital Video Recorder (DVR) are also available as optional add-ons.

Another product is the iSky-50HD “which was uniquely developed for the challenging and often turbulent aerial



Controp's new SIGHT-HD payload



Controp iSky-50HD

environment to provide solutions for most medium and long-range aerial surveillance platforms.” Features include a continuous optical zoom lens in the day (or high definition-HD) and thermal imaging (SD/HD) cameras, gyro-stabilised gimbals and multi sensor options including Eyesafe Laser Range Finder (ELRF) and/or Laser Pointer, all of which provide outstanding capabilities. The iSky systems can be installed on helicopters, fixed wing aircraft and unmanned aerial systems (UAS), and may be

integrated with the platforms’ systems. The payload system includes three (3) channels: a continuous zoom HD day channel, a continuous zoom HD thermal channel, and a SWIR spotter. Additional optional features include an Eyesafe Laser Range Finder (ELRF) and/or Laser Pointer. The systems include superb gyro-stabilisation, real-time image enhancement features, built-in INS, and automatic video tracker. All of the CONTROP iSky day/night camera payloads have an easy interface to radar and



Sight-HD for AFVs and RWSs



An intriguing option!

The Tupolev Tu-160M2

The Indian Navy had acquired a strategic manned airborne dimension with the induction of Tupolev Tu-142M Long Range Maritime Patrol/Anti-Submarine Warfare (LRMP/ASW) platforms in 1988. Powered by four KKBK Kuznetsov NK-12MV turboprops (each rated at 11,033 KW or 14,795 shp), with eight-blade contra-rotating reversible-pitch Type AV-60N propellers, the Tu-142M boasted a “near-conventional jet speed” of around 500 knots while encompassing the major swaths of Indian Ocean region from bases in South and Central India (INS *Rajali* and INS *Hansa* being more prominent) on internal fuel alone. An Air-to-Air Refuelling (AAR) probe was fitted above the nose and could summon the Agra-based Indian Air Force (IAF) Ilyushin Il-78MKI tankers of No.78 Squadron if situations required.

While as primary sensors, the Tupolev Tu-142M platforms were fitted with the *Korshun-K* (Black Kite) automatic search and sighting system and MMS-106 Ladoga magnetometre to detect ‘stealthy’ nuclear-powered submarines, the Indian Navy’s Tupolev Tu-142M made news headlines for its ‘Wet Eye’ search and attack radar. The Australian Government in fact once had strong reservations about the Tupolev Tu-142M’s intended role in Indian Navy

service, which to the Australian Government represented “an Indian naval effort to expand its sphere of influence at the cost of Australia’s own.” Matters did not help as rumours spread (later confirmed) that the Indian Navy Tupolev Tu-142M fleet, which in addition to LRMP/ASW gear and role, retained sufficient ability to carry out a secondary heavy-bombing role. However, with a top speed of around 500 knots it only had marginal effectiveness in penetration of well defended airspace yet the prospect of integration of state-of-the-art Anti-Ship Cruise Missiles (ASCM) or Land Attack Cruise Missiles (LACM) could well have transformed the *Bear-Foxtrot* into being a formidable attack platform and decimate targets at will from stand-off distances.

Tupolev to Tupolev

Although various plans once existed for upgrading the Tupolev Tu-142M fleet to becoming even more formidable LRMP/ASW platforms with Electronic Intelligence (ELINT) attributes, the Indian Navy was also “looking beyond” LRMP/ASW platforms for effective operations in its sphere of influence and this was somewhat confirmed at the turn of millennium by persistent yet intermittent reports of the lease of Tupolev Tu-22M3 (*Backfire-C*) multi-mission strike platforms, capable of

performing low-level nuclear strike and conventional attack role both over land and sea alongside strategic reconnaissance missions. In absence of official confirmation and shielded in misinformation or secrecy, the proposed airborne package as per media reports, included leasing of three Tupolev Tu-22M3 strategic bombing/maritime strike platforms, plus one Tupolev Tu-22MR reconnaissance oriented platform with a giant Side Looking Airborne Radar (SLAR) in what was previously the internal bomb bay to enable aerial reconnaissance from great slant distances. Also, the package reportedly included one Tupolev Tu-134UBL, with each of the mentioned types to be provided from the Russian Air Force inventory.

During height of the Cold War, the Tupolev Tu-22M remained one of the most controversial airborne platforms and contributed considerably to breakdown of Strategic Arms Limitation Talks (SALT) II owing to arguments as to whether to classify this as a strategic platform or not. Two Kuznetsov NK-25 turbofan engines provided the Tupolev Tu-22M a range of some 7,000 km-plus at high altitude on internal fuel alone, with further extension possible with AAR. To complicate matters further, the maximum speed was reported to be 2,300 km/h at high altitude with 12





The Tu-160 over Moscow (photo: Alex Beltyukov)

tonnes of strike ordnance or an alternative load of a single air launched cruise missile carried in semi-recessed form to reduce drag. Thus, it was logically deduced by the United States Administration that if air bases were made available in certain South or Central American nations, the Tupolev Tu-22M acquired the “strategic dimension” by conducting “one-way over Arctic” missions against the United States homeland and thus be regarded as a strategic platform. This logic was outright rejected by the Soviets for few practical reasons but ultimately leading to breakdown of SALT II.

However, in Soviet *Dalnaya Aviatsiya* or Long-Range Aviation and AV-MF or Naval Aviation service, the Tupolev Tu-22M represented a formidable strike platform with the radar speculated to be of the missile guidance ‘Down Beat’ family in conjunction with formidable contemporary avionics and electronic warfare suites and so were feared and respected by the North Atlantic Treaty Organisation (NATO) adversaries. Most of the electronic warfare suites were ‘flush mounted’ so as not to hamper aerodynamic performance. During height of the Cold War, the Tupolev Tu-22M ‘Backfire’ achieved further notoriety from NATO’s perspective for repeated simulated launch of cruise missiles against the NATO

Aircraft-Carrier Battle Groups (CVBG) and also penetrating the formidable Japanese air-defence network at will. These were bound to be carefully planned ELINT/ferret missions and tactics to test and record NATO Strike Fleet and Japanese air defence tactics and procedures. Operating from forward bases in the European Landmass, the Soviet Tupolev Tu-22Ms were active over North Atlantic as far as the Azores, encompassing the whole European landmass and were considered a significant threat to NATO surface ASW barriers in key areas such as Greenland-Iceland-UK (GIUK)

gaps. However, slab-sided fuselage and engine intakes presented prominent Radar Cross Section (RCS), and the positioning of engine intakes occupied significant fuselage space reducing internal fuel loads and thus reducing potential range.

In this context, perhaps, another Tupolev optimally suitable maritime strike platform for the Indian Navy resided in the Russian upgraded Tupolev Tu-160M2 *Blackjack* supersonic strategic bomber, the basic design being true successor of Tupolev Tu-95/142 and pride of the Russian *Dalnaya Aviatsiya* (Long Range



Air-to-air refuelling of Tu-160 by Il-78

Aviation). Tupolev Tu-160s equip the 121st Guards Heavy Bomber Regiment based at Engels Air Force Base at Saratov region. As confirmed by Col. Gen. Viktor Bondarev, commander of the Russian Federation Air Force (RFAF), Russia's new Tupolev Tu-160M2 Blackjack supersonic strategic bomber is expected to enter full-rate production by 2021.

The Tupolev Tu-160, in contrast to the Tupolev Tu-22M represents a formidable state-of-the-art platform with its 10,500 km inter-continental range, having considerable weapons load estimated on a mission profile of subsonic high altitude cruise, followed by transonic or supersonic penetration at low altitude on internal fuel alone with aerial refuelling option available for further enhancement of range. Russian Air Force Tupolev Tu-160s repeatedly displayed their capability to operate over the Indian Ocean during *Indo-Russian Naval Exercises (INDRA)* from the Russian homeland and CIS bases striking notional targets with cruise missiles and combat tested over Syria. In operational terms, the Tupolev Tu-160 functions as a rapid response cruise missile platform, swiftly moving into the optimum position to launch long-range cruise missiles from stand-off distances.

At a conceptual level, if operated from Indian bases, the Indian Ocean "will fall under its scanner in totality" along with adjoining territories of West Asia and Far East.

In the Tupolev Tu-160 design, sufficient emphasis is given on reduction of RCS with the wing and fuselage gradually integrated into a single-piece configuration. The four NK-32 augmented turbofan engines (candidates for further upgradation), each providing a maximum thrust of 25,000 kg, are installed in two pods under shoulders of the wing with engine-intakes well shielded under fuselage to be screened from look-down radars. Measures were also applied to reduce signature of the engines to infra-red and radar detectors. The Tupolev Tu-160's avionics system consisting of navigation and attack radar and electronic countermeasures system will represent the latest in Russian technology after proposed upgrades and KRET claims that the system ranks "among the most advanced in the world," capable of shielding the Tu-160M2 from Surface-to-Air Missiles (SAMs). In addition, the aircraft will carry a platform-less inertial navigation system, which will determine



the coordinates, route and speed using laser gyroscopes and quartz accelerometers. Even a limited export/joint production order for Indian Navy may evoke considerable interest as this is bound to "streamline" the re-opened production line to subsequently cater for future needs.

Besides carrying the full assortment of Russian Air-to-Surface Missiles (ASM) and added Precision Guided Munitions (PGM) capability, the Tupolev Tu-160M2 in Indian Navy service could well be the perfect carrier of the projected air-launched variant of supersonic (Mach 2.8) Indo-Russian PJ-10 BrahMos Anti-Ship Cruise Missile (ASCM) with smaller booster and additional tail fins for stability during launch, accommodating six of them on multi-station launchers in each of the two internal weapons bays. The BrahMos ASCM is a joint venture between Indian DRDO and Russian NPO Mashinostroyeniya (NPO Mash) and inherits from its predecessor, the Russian

Yakhont ASCM, low RCS with an active radar homing seeker to facilitate fire-and-forget launch. Varieties of flight trajectories including sea-skimming or terminal pop-up followed by a deadly dive, would complicate the task of the adversary. This supersonic bomber in principle could act as the loitering first stage of the supersonic missile shadowing enemy CVBG and Surface Action Groups (SAG) from stand-off distances and providing target coordinates of capital warships within the group once the missiles are launched. Interestingly, subject to tripartite negotiations between India, Russia and Israel, the Tupolev Tu-160M2 represents a suitable candidate for adaptation to a reconnaissance and Ballistic Missile Defence (BMD) role if armed with advanced reconnaissance gear and air launched variant (still a closely guarded issue) of 150 km ranged Barak-8ER, reportedly capable of neutralising hostile ballistic missiles at their boost phase. ✈

Sayan Majumdar

Rosoboronexport : record levels in 2018

On 4 November 2018, Rosoboronexport, part of the Rostec State Corporation, celebrated its 18th anniversary. The Company was established in 2000 by decree of President of the Russian Federation. “Over the past 18 years, Rosoboronexport has become a world leader in the supply of weapons and military equipment and has reached record levels. Today, Russia ranks second in the world in scope of military-technical cooperation. The Company’s order book is well above \$50 billion, while the total value of deliveries has exceeded \$150 billion over the years. We continuously improve and offer customers more new models of military equipment, often the best in the world in performance and competitive in terms of price and quality. More than 200 Rosoboronexport employees have been awarded state and departmental awards for their great contribution to the development of military-technical cooperation with foreign countries,” stated Rostec’s Director General Sergey Chemezov.

In 2018, the Company was actively engaged in efforts to promote new products. Rosoboronexport took part in

22 international exhibitions and forums. The Eurasian Air Show in Antalya, Turkey, the International Far Eastern Maritime Show in Vladivostok and ADAS 2018 in the Philippines were debut exhibitions for the Company. “Despite unprecedented competition, Rosoboronexport continues to strengthen its position in the global market. Just recently, we signed the biggest-ever contract in the company’s history to supply India with the S-400 Triumph anti-aircraft missile systems. In 2018, we delivered weapons and military equipment to more than 40 countries. At the same time, over 1,100 contract documents worth about \$19 billion were signed. These statistics suggest that the quality of Russian weapons and their proven performance are a determining factor for our partners,” stated Rosoboronexport’s Director General Alexander Mikheev.

Rosoboronexport continues to expand its range of military products over the years and is actively promoting a number of new military hardware in the world arms market, including the Buk-M3 Viking and Tor-E2 SAM systems, the Sprut-SDM1 light amphibious tank, the ships *Karakurt*



and *Sarsar*, Il-78MK-90A aerial tanker and the Il-76MD-90A(E) military transport aircraft.

“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.” A subsidiary of the Rostec Corporation, it was founded on 4 November 2000 and now Rosoboronexport has become one of the leading world arms exporters in the international market. Its share in Russia’s military exports exceeds 85 percent. Rosoboronexport cooperates with more than 700 enterprises and organisations throughout the Russian defence industrial complex. ✈

“Contract for S-400: biggest-ever deal in company history”

On 5 October 2018, at New Delhi, Rosoboronexport signed a contract to supply India with the S-400 Triumph long-range air defence missile system (ADMS). “The S-400

supply agreement with India is a new landmark in the history of military-technical cooperation between our countries. The deal demonstrates the highest level of trust and understanding between India and Russia. I am sure that this agreement will also be a new impulse for strengthening and deepening our cooperation in the industry,” stated the Head of Rostec State Corporation Sergey Chemezov.



“The main advantage of the S-400 is in its versatility. The system is able to engage all types of aerodynamic targets and ballistic missiles, including intermediate-range ballistic missiles. The Triumph is far superior to its foreign counterparts in maximum engagement range and minimum engagement altitude, emplacement/displacement time, as well as in a number of other key characteristics. The contract for supply of the S-400 Triumph air defence missile systems to India is the biggest for the entire history of military-technical cooperation between Russia and India and the largest in history of Rosoboronexport. We have now begun to execute it,” stated the Head of Rosoboronexport, Alexander Mikheev.

UAC: “More Than 43,600 New Civil Aircraft Will be Sold Until 2037”



UAC has presented its annual Market Outlook for the next 20 years. According to the forecast, it is estimated that the total demand for new passenger aircraft beyond 30 seats in 2018-2037 will exceed 43,600 aircraft “worth over US\$6 trillion”.

The market outlook is a comprehensive marketing analysis devoted to the world’s civil aircraft segment that analyses tendencies and

trends in the development of commercial air transportation in the world. Most attention is devoted to the passenger transportation segment both in terms of value and delivery numbers. This segment is very important to UAC as, according to the Corporation’s long-term development strategy, UAC’s revenue from sales of commercial aircraft should reach 45% of total sales, outgrowing other revenue segments.

UAC President Yury Slyusar has stated that “The innovative development of this industrial model, increasing production rates of narrow- and wide- body aircraft are paving the way to new market segmentation. The changing competition conditions are leading to further fleet optimisation, adjustment of air transportation models, and demand for new civil aircraft in general”.

According to the outlook, annual passenger turnover rates during 2018-2037 will grow by 4.6% per year. Narrow body aircraft with 110 plus seats will be the most demanded by airlines, being 68% of the market in quantity and 56% by value. The total demand for wide body aircraft will amount to almost 8,000 aircraft, 40% by value of the total market at 2018 prices. Demand for new jet airliners with 30-110 seats will amount to about 4,000 aircraft – with only 3.1% of the total market value. The demand for turboprop aircraft is estimated at 22,000 aircraft. ✈

Aeroflot and UAC in agreement for 100 Superjet 100s

Aeroflot and United Aircraft Corporation have signed an agreement for 100 Superjet 100 (SSJ100) aircraft. The document was signed by Aeroflot CEO Vitaly Saveliev and UAC President Yury Slyusar during the Eastern Economic Forum in the presence of President of the Russian Federation Vladimir Putin. Under the agreement, UAC will deliver 100 SSJ100 aircraft to Aeroflot between 2019 and 2026, the aircraft configured with 12 seats in business class and 75 seats in economy class. The final contract documents will be signed after the parties agree on material terms of the transaction and obtain necessary corporate approvals.

As Yury Slyusar, President of PJSC UAC said, “We have worked with Aeroflot for many years. As the first and largest operator of



SSJ100 aircraft, Aeroflot has significantly helped the development of Russia’s aircraft industry. The signing of the new agreement marks the next stage of our cooperation and joint contribution to the

development of the aircraft industry and the expansion of regional and international air connections. We are happy to continue working with Russia’s leading airline.”

UAC: Improved Il-78 tanker flight tested

The improved United Aircraft (UAC) Ilyushin Il-78M-90A tanker has commenced flight testing with its maiden sortie conducted from the Aviastar SP production site in Ulyanovsk. Key changes on the updated model include a new wing with increased fuel capacity and Perm PS-90A-76 engines, in common with the -90A version of the Il-76 heavy transport.

Besides its enhanced tanker performance, the new model can also be used as a transport vehicle by removing its additional on-board fuel tanks. The -90A also has new navigation systems that will enable it to be operated in international airspace in accordance with civilian requirements.



Testing of Su-57 Avionics 'Complex' completed

The communications, navigation and surveillance systems of the Su-57 are described as an integrated avionics 'complex', featuring network centric architecture with a unique approach to embedded computer processing and data transmission. The Su-57 will eventually replace Russia's multi-purpose fourth generation Su-27 fighter force.

"From the perspective of electronics engineers, modern fighters have already reached a level where sharp growth of their capabilities is no longer possible. However, we know that modernisation of their airframes, and engines could lead to a 20–30 percent advantage over their predecessors. At the same time, design of new 'brains' (or avionics) could result in an increase of their efficiency and combat capabilities by several times," stated the Deputy Director General for Research and Development of Radioelectronic Technologies Concern.

The new "complex" is based on Russian multi-core chips and an operating system, which works within a real-time mode in close communications with other fighters, military transport aircraft and ground forces. This not only allows exchange of information with other fighters, but also performs a lead role, setting priorities during the Russian.

Prior to each Su-57 flight, a specific flight programme is loaded onto the flight management computer. This comprises intelligence data, information on weapon systems of the target, coordinates and other vital data, all this can also be adjusted during a combat mission, at any time. Sukhoi Design Bureau engineers describe the Su-57 avionics as "featuring a central computer which controls all aircraft systems, including weapons and is information for the pilot.



The computer is simultaneously "an electronic pilot, an electronic navigator and an electronic flight engineer", automatically recognising and determining adversaries and targets.

The Su-57's onboard systems use fibre-optic channels. This transition from copper to optical fibre has allowed designers to significantly increase speed and volume of data transmission, while reducing weight of the cable, as also improving noise immunity.

Steadily ahead: Irkut's third MC-21-300

Irkut Corporation (a UAC member) has completed assembly of the third MC-21-300, which is now preparing for flight tests. On 25 December 2018, the aircraft was transferred from the final assembly shop to the flight test unit of Irkutsk aviation plant. Test results of the first MC-21-300 aircraft passing certification tests were taken into account in the production of the new aircraft. The fourth flight test aircraft is presently being assembled at the Irkutsk Aviation Plant.



Ready for flight

Currently, two MC-21-300 aircraft are taking part in flight certification tests at the Flight Test Institute airfield named after M.M. Gromov. Static testing is being done at the Central Aerohydrodynamic Institute (TsAGI). As President of UAC and Irkut Corporation Yuri Slusar stated, "In 2018 flight and ground certification tests of prototype aircraft confirmed the main design and UAC enterprises have begun to manufacture parts and units of MC-21-300 aircraft intended for customer delivery. Joining the flight tests of new aircraft and production intensification of mass-produced airplanes are the main tasks for 2019."



Final assembly

Since the beginning of flight tests in late May 2017, the aircraft has carried out more than 30 flights. In October 2017, MC-21-300 made a non-stop flight from Irkutsk Aviation Plant (IAP) to the airfield of the Flight Research Institute, located near Moscow, a modern test base has been constructed from where certification flight tests will take place. Test flights have taken place at an altitude up to 12,000 meters and speeds up to 860 km/h. The maximum flight duration has exceeded 6 hours with a range of 4500 km.

To obtain certification of the type, it is necessary that the experimental MC-21-300s perform about 1000 flights. Applications for aircraft certification have been submitted to Russian certification authorities and EASA. According to current plans, the Russian type certificate for MC-21-300 will be obtained in 2019, with a similar EASA document in 2020.



MC-21 assembly at Irkutsk Aviation Plant

An unprecedented number of certification and qualification tests are being conducted, considering the extensive use of composite materials in construction of the MC-21 aircraft including the wing caissons and tail fins of the aircraft. In December 2017, the composite wing caisson successfully passed static tests, demonstrating a significant margin of safety as per the design loads.

For the first test aircraft, a Pratt & Whitney PW-1400G-JM engine, certified by FAA and EASA, was installed. Customers of MC-21-300 are provided with the option to choose an alternative engine the, Russian PD-14, which is being tested in a flying laboratory. The wide use of composites and other innovative solutions are intended to provide the MC-21 family with superiority in performance and economy over present narrow-bodied aircraft. The composite high aspect-ratio wing greatly improves aerodynamics, while innovations will give reduction of operating costs by 5-7% compared with the latest variants of popular narrow-bodied airliners of similar capacity.

Another distinct difference between the MC-21 family aircraft and its competitors is that the fuselage is of an increased diameter, which provides increased comfort for passengers and reduces working hours at airports. "The order book of 175 MC-21s will ensure the production for many years ahead." ✈️



MC-21 airliner in flight

BrahMos: India's ultimate force multiplier



extent. This 'universal' missile has been designed to neutralise high-value ground or sea-based targets with its high speed, great accuracy and devastating warhead. Multiple target strike capabilities of the BrahMos have been validated with numerous successful test firings conducted from the ground, sea, sub-sea and now, air platforms.

While the land-attack BrahMos is now integral with the Indian Army and numerous Indian Navy warships are equipped with this 'prime strike' missile, the Indian Air Force has recently integrated the BrahMos on its Sukhoi Su-30MKI. Test firing trials of the BrahMos air-launched cruise missile (ALCM), launched from an IAF Sukhoi Su-30MKI against a sea target, took place on 22 November, 2017. This 2.5-ton missile, an improved variant of the original anti-ship BrahMos, features a lighter propulsion system, improved nose cone and enhanced aerodynamic structure.

Advent of this advanced air-launched missile is a true "game changer" for the Indian Air Force, being a powerful tactical asset, especially as regional power plays are establishing strategic supremacy. BrahMos Aerospace, the India-Russia JV entity which designs develops and manufactures the BrahMos, has established its leadership position, carrying out a complex programme of integrating and flight testing of this unique, precision strike weapon from the air. The Su-30MKI, equipped with the BrahMos, will become India's ultimate 'trump card'.

"The BrahMos is a very heavy missile and such a class of weapon has never been deployed on a frontline air combat platform

in the world. The BrahMos ALCM has enormously widened the Indian Air Force's stand-off air attack capability and given it distinct strategic edge over adversaries," says Dr Sudhir K Mishra, CEO & MD of BrahMos Aerospace. "As the heaviest – and deadliest – weapon launched from long standoff distances, the BrahMos-A would annihilate any kind of sea and ground-based targets".



India is the only country extant having in its inventory such a powerful supersonic cruise missile, launched from land, sea/sub-sea and air platforms. With the Indian Air Force now receiving the BrahMos-A in large numbers fir integration with Sukhoi Su-30MKI, the Indian armed forces have acquired "unprecedented capability to engage critical enemy assets across the spectrum of warfare, thus decisively influencing the course of conflict in the future".

India's military prowess has undergone steady transformation over the past few years and the country is now regarded as one of the major powers of Asia where the rapidly changing geostrategic situation has created new power equations.

Amongst the many modern, highly advanced military assets with India's armed forces today is the BrahMos supersonic cruise missile system, which has metamorphosed the Indian Armed Forces into becoming a most formidable force.

Induction of the BrahMos, the precision strike weapon with stealth, versatility and multi-role capability, has arguably revolutionised modern warfare to a great



Dr. Sudhir K Mishra, CEO & MD of BrahMos Aerospace



The Indian Air Force and MBDA: “A lasting successful partnership”

MBDA has been delivering battle-winning capabilities to the Indian Air Force and collaborating with Indian industry for over 50 years. Throughout this history, there have been two guiding principles: to provide the very best technologies to the Indian Air Force, and to work in true partnership in support of the Indian Defence Industry. Fitting perfectly with our long-term strategy is the ‘Make in India’ programme, to which we are fully committed.

The Indian Air Force is receiving the ramjet powered and network-enabled Meteor beyond visual range air-to-air missile from MBDA. This next generation missile is widely recognised as a game changer for air combat, and will provide the Indian Air Force with an unrivalled air dominance capability. 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 more than three times greater than any other existing or planned BVR weapons.

Other examples of technological edge equipping the Indian Air Force include the MICA and ASRAAM within visual range (or dogfighting) missiles. 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. Its ability to fly out to BVR in passive mode before the seeker locks on in

the final stages of the end game has earned it the nickname “silent killer” as the target has little time to react or to deploy effective countermeasures. Possessing both infrared and radar-guided versions also makes MICA highly countermeasure resistant and therefore highly effective

ASRAAM is providing the IAF’s Jaguar fleet with a step-change in air combat performance. 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. MBDA’s ASRAAM missiles are significantly enhancing the battle capability India’s Jaguar bombers, giving them unrivalled self-protection ability and enhanced ability to penetrate hostile airspace. These and other technologies make the Indian Armed Forces a proud equal to any modern force in the world.

Industrial partnership is of equal importance though, given the importance of sovereign industrial defence capability. MBDA has been assisting the development of sovereign Indian missile industry, both public and private, for over 50 years. Partnerships MBDA has formed with Indian industry have seen over 40,000 missiles of the MILAN family produced in India – a noteworthy and on-going success. Indian industry is now supplying key components for both MICA and ASRAAM missiles. MBDA continues to deepen its relationship with Indian industry, as seen by the recent formation of a joint

venture with long-standing partner Larsen & Toubro to deliver a series of important missile programmes under the *Make in India* category.

The Mistral ATAM system has been successfully integrated on the Advanced Light Helicopter (ALH) and final integration is being done on the Light Combat Helicopter (LCH). Utilisation of the Mistral missile on India’s helicopter platforms also provides a bridge to their use in a ground based VSHORAD role, where the missile is fully compliant with India’s requirements and outperforms the capabilities of its rivals.



Loïc Piedevache, Country Head, India, MBDA Group



The MICA and METEOR are the Rafale's

“Spears for aerial dominance”



MICA RF being loaded on a Rafale

Having significant strike potential, the Dassault Rafale (Squall) multi-role strike fighter is also a formidable air superiority fighter. An excellent weapons platform for multi-dimensional warfare, Rafale's avionics and electronics are integrated through four Mil STD-1553B data buses and two Mil STD-1760 data buses operating in the ADA language.

The Rafale's highly sophisticated Beyond Visual Range Air-to-Air Missiles (BVRAAM) will immeasurably enhance combat potential of the Indian Air Force over skies of the subcontinent. To decimate hostile airborne platforms, BVRAAM missiles load usually include six MBDA MICA RF/IR for air defence oriented missions. The *Missile d'Interception, de Combat et d'Autodéfense* (MICA) BVRAAM forms the standard armament of the Dassault Rafale and also presently selected for upgraded package of IAF Mirage 2000I/IH fighters. 3.1-metre long, 112-kg weight, the MICA was originally designed as a 'multi-aircraft' missile that could easily be

integrated onto any modern fighter aircraft, without significantly reducing the aircraft speed or negatively affecting its aerodynamic characteristics. MICA is capable of both BVR (60km+) and close range interception thanks to its dual active radar (as in MICA RF) and Imaging Infra-Red (as in MICA IR) seeker and Lock On Before Launch (LOBL) as well as Lock On After Launch (LOAL) capability. Minimum range is said to be in the region of 500 metres.

Carried under the aircraft's fuselage or under wings, and fired by ejection or by rail, MICA is 'permitted' to be ejected from the airframe up to 4g while wings pylons can release MICA up to 9g. Products of research and development during the 1990s, both MICA RF and MICA IR have a range in excess of 60 km as the MICA IR version receives mid-course update commands from the radar to compare target location with the location of its seeker's track for LOAL engagements. In the case of MICA RF, after the target has been designated by the host aircraft's radar, this then makes first phase of its fight in inertial guidance mode, and

then homes onto the target in flight in fire-and-forget mode, using its '4A' active-radar homing head. The MICA is well reputed for its general level of sophistication and reliability in terms of 'kill percentage' even in adverse European meteorological conditions in dense electronic warfare environment infested with saturation jamming as the missiles in turn sport a formidable Electronic Counter Counter Measures (ECCM) system to burn through hostile jamming. The seeker is cooled by an onboard closed-cycle system, which is electrically powered and can be operated for long periods. Complex algorithms have been developed to provide the IR seeker with an ability to track at longer range and to reject flare decoys. When fitted to aircraft with track-while-scan radars the MICA weapon system is capable of attacking several targets simultaneously with individual missiles.

Its excellent manoeuvrability is aided by combination of long chord wings, efficient tail control surfaces while at short range, thrust vector control (TVC)



Meteor on Rafale

facilitates high off-boresight angle (HOBA) engagements. Interestingly, seeker of the MICA IR may also be utilised for discrete optronics monitoring prior to launch. Again, the MICA IR with its angular resolution will be able to mount stealthy strikes on unsuspecting opponents especially if the launch platform gets well pre-positioned by friendly AEW&C platforms, the lethal 12 kg high-explosive blast fragmentation warhead being triggered by a Doppler radar proximity fuse. Surprise has always been the key to successful execution in air combat, with as much as 50-percent of shot down pilots totally unaware of the fact that they were under attack in the first place!

Meanwhile the French armament directorate (DGA) has launched a development programme that will modernise the MICA BVRAAM and Surface-to-Air Missile (SAM), introducing a new generation of the weapon (MICA NG). Maintaining the size, weight and electronic interfaces of the present missile, MICA NG will be a most effective successor to the baseline MICA. With an improved seeker and new propulsion, it will have the agility and performance to cope with modern threats and countermeasures, which includes targets with reduced infrared and electromagnetic signatures, atypical targets (Unmanned Aerial Vehicles and small aircraft), in addition to the threats normally countered by air-to-air missiles (combat aircraft and helicopters).

Maintaining the same MICA RF and MICA IR versions, among enhancements to the MICA NG are the addition of a new infrared seeker that uses a matrix sensor providing greater sensitivity. The radio

frequency seeker will use an AESA (Active Electronically Scanned Array) antenna, giving smart detection abilities. The reduced volume of electronic components within MICA NG will allow it to carry a larger quantity of propellant, thereby significantly extending range of the missile.

Outer Air Battles

Rafale's air combat capability will increase substantially with service entry of the European MBDA Meteor active-radar homing BVRAAM with its 80+ nautical miles range to provide an ultra-long range interception capability against fighter sized targets critical in attaining 'first look-first shoot-first kill' ability alongside fulfilling the BVR role for 'outer-air battles', obligatory for IAF in response to proliferation of BVRAAMs in its neighbourhood including United States AIM-120C-5 variant of AMRAAM in Pakistan Air Force (PAF) service. A 3.65 metre long, stealthy, low drag, lightweight (185 kg) BVRAAM design from MBDA, the 80+ nautical miles range Meteor with a more linear velocity profile is in demonstration phase. Born from the multi-national Project S225X examining the future BVRAAM technologies and designed for a network-centric warfare (NCW) environment, the Meteor has a data-link capability, guided not only by the launching aircraft but also by another fighter or even by AEW&C platforms. The extended range is ensured by Meteor's solid Boron fuelled Variable-Flow Ducted Ram-rocket (VFDR) propulsion system, also referred to as Throttle-able Ducted Rocket (TDR), along with a speed of more than

Mach 4 and high terminal velocity. Thus even when launched from extreme stand-off ranges, the missile will retain the energy at the end game to defeat fast, manoeuvring targets. The control system consists of four small moving tail surfaces but at inherent high speed, sufficient to perform sharp manoeuvres. The engine's two air intakes, positioned on the both sides of the lower part of missile's body, are shaped to reduce the missile's radar cross-section.

Meteor is capable of engaging a wide range of airborne targets autonomously, including cruise missiles with less than 1 metre square Radar Cross Section (RCS). For mid-course navigation guidance Meteor utilises Inertial Navigation System (INS) combined with update commands provided by the launch, or any friendly aircraft via the two way secure microwave data-link, to adequately offset Identification Friend or Foe (IFF) complexities or challenges at long ranges. During terminal phase the Ku-band (NATO: X band) active-radar homing seeker (advanced version of the MICA RF '4A') employs advanced proportional based navigation software. Also rumours persist that the system can operate passively in the K-band given the consortiums previous research interests.

As the Meteor is designed for a NCW environment, it is compatible for the futuristic concept of "Cooperative Fighter Operations" or Mixed Fighter Force Concept (MFFC) that is essential for future BVR engagements and optimum performance and results. Conceptually, in IAF service, pairs of Rafale will be data-linked as one illuminates the other launches the missiles against the targets. In such engagements the 'striker' fighter will be able to impart the greatest kinetic energy to the Meteor BVRAAM by accelerating up to Mach 2 and then manoeuvring out of the engagement. The illuminator, with the powerful radar capable of performing like a mini Airborne Early Warning & Control (AEW&C) platform will remain subsonic, keeping a decent distance from the target, providing command-guidance updates alongside illuminating the target.

For 'eyeball to eyeball' confrontation, the Rafale is also equipped with a single 30 mm GIAT 791B cannon mounted on the right engine duct with a rate of fire of 2,500 rounds per minute and carrying 125 rounds of ammunition. 🦅

Sayan Majumdar

The Elettronica Group

Advanced electronic and cyber warfare solutions



Elettronica Group have been at the cutting edge of electronic warfare for more than 60 years, supplying armed forces and governments of 30 countries with more than 3000 high technology systems. Privately controlled by Benigni's family, with Leonardo and Thales in the shareholders structure, the Group is composed of three industrial assets: Elettronica S.p.A, the headquarters, based in Rome, leader in EW capabilities; CY4GATE, a joint venture with Expert System, specialising in Cyber EW, Cyber Security and Intelligence, and Elettronica GmbH, the German subsidiary specialising in EW signal processing design and production and Homeland Security solutions.

Elettronica's systems are deployed for a variety of key operational missions, from strategic surveillance, to self protection, SIGINT, electronic attack and operational support for airborne, naval and ground applications. The Elettronica Group boasts a strong record of successful domestic and international collaborations on all the key modern military platforms such as the Italian PPA, the fighter Eurofighter Typhoon, the NFH-90 helicopter, the Italian and French warships *Horizon* and FREMM, and a wide range of projects in the Gulf, Middle East and Asia.

In a recent collaboration, Elettronica has tied up with Indra of Spain for the first next-generation, fully European self-protection infra-red solution, to defend any type of airborne platforms, from helicopters to transport/tankers to jets fighters, from heat-guided missiles (MANPAD). The solution, named EuroDIRQM (Direct InfraRed

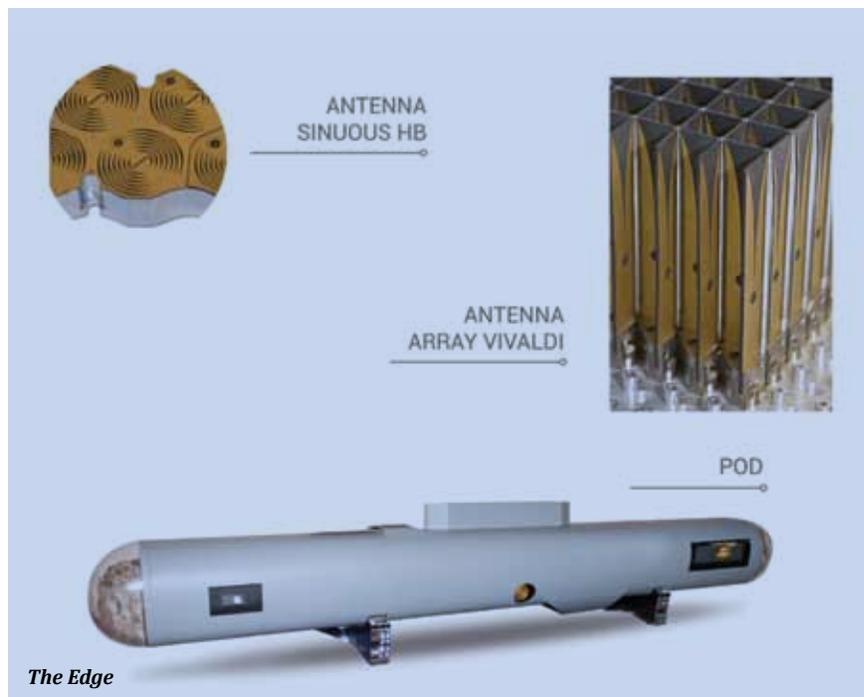
Countermeasure) reflects its European roots and the use of a new technology -the Quantum Cascade Laser (QCL), is the latest development in laser technology that represents a step forward from conventional semiconductor lasers. The EuroDIRQM solution will bring together about 30 years of combined

experience in the DIRCM field by the two companies. MANPADS are today the main cause for military aircraft losses in conflict scenarios representing an international threat and a global concern due to their proliferation and their use by terrorist groups.

In addition to MANPADS, new military and security challenges are arising globally in the form of new and lethal threats, and one of them is the massive growth in the use of drones. ADRIAN (Anti-Drone Interception Acquisition and Neutralisation) is an advanced anti-drone system dedicated to the protection of critical infrastructures and

public areas during open events and civil airspace from hostile mini and micro drone threats. The company is already working with the Italian Air and Land Forces for the supply of this anti-drone system and with a country in the Middle East.

The company also offers the EDGE, the new Escort Jamming solution for airborne applications based on a high level of electronic and mechanical innovation. An autonomous pod configuration designed to increase the survivability and success of attacking airborne forces with unique performances and installation capabilities. EDGE's functions are designed to create a safe corridor for multiple mission aircraft. It's embedded ELINT features and networking capabilities enhance situational awareness, intelligence collection and advanced jamming countermeasure against new 3-D radars. Elettronica is the co-design authority of the PRAETORIAN self-protection system in wing-tip-pod configuration on board of the Eurofighter Typhoon platform, that allows the aircraft to dominate the electromagnetic scenario by automatically responding to air-to-air and surface-to-air threats. 🦋



NAMMO's 'Nucleus' in first launch



On 27 September 2018, Nammo successfully carried out the first launch of *Nucleus*, a sounding rocket powered by its new hybrid rocket motor. *Nucleus* was launched from the Andøya Space Centre in Northern Norway, and reached an altitude of 107.4 km. That made it not only the first rocket powered by a Norwegian motor design to cross the Karman line, the commonly recognised border to space, but also the first European hybrid rocket motor to do so in more than 50 years.

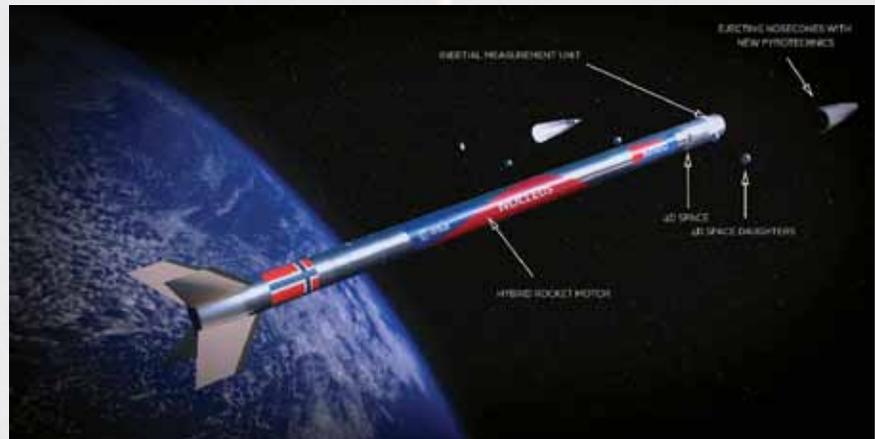
The Hybrid Rocket Motor powering the *Nucleus* has been developed by Nammo at Raufoss in Norway, and could potentially power a whole new generation of smaller European launch vehicles.

Nucleus is a sounding rocket, designed to lift scientific instruments into the upper layers of the atmosphere. The hybrid rocket motor propelling it, however, can be scaled up to lift a wide range of payloads, including small satellites into low earth orbit. "For this specific flight, *Nucleus* carried 3 technical experiments aloft. The most important one was the ASC/UiO 4D-SPACE module loaded with its 6 'daughter' payloads. During flight, the 'daughters' were released 2 at a time when the rocket passed 60 km altitude. They measured small-scale plasma structures and transmitted data back to the main 4D-Space module. In addition, we also tested a newly ASC developed pyrotechnical system and an inertial unit (IMU) from Sensoror AS", said Kolbjørn Blix, Director of Space Systems at Andøya Space Centre.

Nammo is hoping that the new propulsion technology demonstrated with *Nucleus* will be able to power future launch vehicles for small satellites. "Over the next few years, there are plans to launch thousands of small satellites." The benefit of our new hybrid rocket motor is they can lift them into orbit with the accuracy of a liquid fueled engine, but without the associated complexity and costs, making it ideal for smaller European launch sites," stated Onno Verberne, Nammo's VP of Business Development for space.

Presently, just a select few nations – Russia, India, China, USA, France and Japan – have the capacity to build launch vehicles for satellites and send them into space from home bases. If the technology demonstrated in the *Nucleus* is successful, Norway has the potential to join them.

The *Nucleus* rocket is 9 metres long with a total weight of around 800 kg. The motor gives a thrust of 30 KN (3 tons) but planned future version of the engine would give 75-100 KN of thrust. 🦋



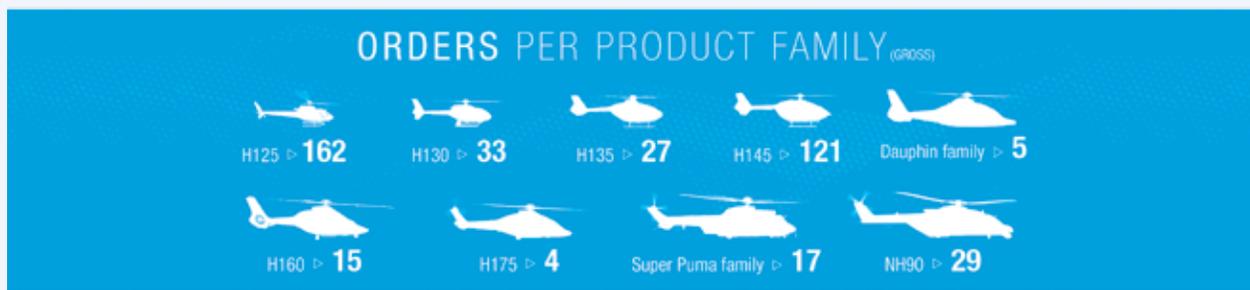
Norwegian Prime Minister in India



Prime Minister of Norway Erna Solberg was in New Delhi on a three day state visit to India in early January 2019. Talks were held with Prime Minister Narendra Modi on a host of issues so as to expand the multi-faceted bilateral partnership. The Norwegian Prime Minister also delivered the inaugural address at the Raisina Dialogue and addressed India-Norway Business Summit during her stay at New Delhi.

Maintaining their lead Airbus Helicopters sales in 2018

AIRBUS HELICOPTERS RESULTS 2018



AIRBUS

Airbus Helicopters delivered 356 rotorcraft and recorded gross orders for 413 helicopters (net: 381) in 2018 (up from 350 gross orders in 2017), maintaining their lead in the civil and parapublic market while reinforcing its position in the military market, having notched key successes in international campaigns. The company also booked 148 orders for light twin-engine helicopters of the H135/H145 family and secured 15 orders for the next-generation H160. At the end of 2018, the overall delivery backlog increased to 717 helicopters.

“Our commercial performance in 2018 demonstrates the resilience we have developed as a company to help us navigate what remains a challenging environment,” said Bruno Even, CEO Airbus Helicopters. “Even though the civil and parapublic market remains at a low level worldwide,

we have maintained our global leadership, thanks to our wide and modern portfolio of products and services and our international footprint. Meanwhile, we have increased our market share in the military sector by securing major contracts with leading armed forces worldwide, with best-in-class solutions. These positive trends give us the means to prepare the future and continue our transformation, with innovation at our core and customer loyalty at heart.”

In 2018, Airbus Helicopters delivered the first of 100 H135s for China at Qingdao, where a dedicated final assembly line will serve the growing demand of the Chinese market for civil and parapublic helicopters. Meanwhile, the Hong Kong Government Flying Service took delivery of the first H175s in public services configuration.

The year 2018 also saw successes for the Super Puma family which demonstrated its versatility by being selected in key military campaigns, while attracting new civil and parapublic customers with re-configured H225s previously operated on the oil and gas market. Likewise, 2018 proved to be a very positive year for the NH90, which attracted orders for 28 units in Qatar while being selected by Spain for a follow-on order for 23 units.

Various programme milestones were achieved in 2018, including the power-on and ground testing of the CityAirbus electric vertical take-off and landing (eVTOL) technology demonstrator, with its maiden flight expected in early 2019. The first H160 in serial configuration entered flight trials in 2018, while the VSR700 unmanned aerial system demonstrator carried out its first unmanned flights at the end of the year. 🦁



Dassault's Rafale F4 standard launched

Eric Trappier, Chairman and CEO of Dassault Aviation, received the F4-standard development contract for the Rafale combat aircraft on 14 January 2019 during the visit to Dassault Aviation Mérignac plant by Florence Parly, French Minister of the Armed Forces.

The F4 standard is part of the process to continuously improve the Rafale in line with technological progress and operational experience. The F4 standard comes in the wake of standards F1 (specific to the first aircraft of the French Navy), F2 (air-to-ground and air-to-air capabilities), F3 and F3R (extended versatility).

Eric Trappier said that “In our role as industrial architect, we will be responsible for implementing innovative connectivity solutions to optimise the effectiveness of our aircraft in networked combat (new satellite and intra-patrol links, communication server, software defined radio). New functions will also be developed to improve the aircraft’s capabilities (upgrades to the radar sensors and front sector optronics, helmet-mounted display capabilities), and new weapons will be integrated (Mica NG air-to-air missile and 1,000-kg AASM Air-to-Ground Modular Weapon). Lastly, with regard to availability, we are working under a through-life support contract which will become more *top-down* under the authority of the aircraft manufacturer.

Validation of the F4 standard is planned for 2024, with some functions becoming available in 2022.

An ‘omnirole’ aircraft, able to operate from land bases or an aircraft carrier, capable of carrying 1.5 times its weight in weapons and fuel, the Rafale has been designed to perform the full spectrum of combat aircraft missions: Interception and air-to-air combat using, Mica IR/EM missiles and

Meteor missiles; close air support using a 30-mm gun, GBU laser-guided bombs and AASM GPS-guided bombs; deep strike using Scalp-Storm Shadow cruise missiles; maritime strike using the Exocet AM39 Block 2 missile and other air-to-surface weapons; real-time tactical and strategic reconnaissance using the Areos pod; buddy-buddy in-flight refueling and Nuclear deterrence using the ASMP-A missile. ✈

Dassault Aviation renews agreement to support SMEs

Eric Trappier, Chairman and CEO of Dassault Aviation, and Florence Parly, French Minister of the Armed Forces, have also signed the renewed agreement between Dassault Aviation and the Ministry of the Armed Forces for support to Defence SMEs. Dassault Aviation had first signed this agreement in January 2014 and in signing this renewal, “Dassault Aviation confirms its long-standing policy of supporting the hundreds of SMEs which partner it on military programmes.”

The French industrial network of which Dassault Aviation is part has been growing for decades, gaining and sharing knowledge, ways of working, business rules and design and production tools that are invaluable and must absolutely be protected. “These competences, which stem from the production of various generations of aircraft since 1945, are synonymous with technological sovereignty, as few countries have them. They are also synonymous with growth: as an example, more than 150 French SMEs have been offered development opportunities in connection with the Rafale contract in India.”

Rolls-Royce: “Speeding up indigenisation, Partnering for progress”



Foreign original equipment manufacturers (OEMs) have already begun leveraging these benefits and are encouraging Indian industry to adopt best practices for global quality standards in their manufacturing processes so as to nurture a world-class supply chain and defence manufacturing ecosystem in India.

The government is already investing in this area, but the pace of development needs to pick up considerably to not miss opportunities, and public-private participation can go a long way in hastening this process.

Additionally, a strong supply chain is critical for a defence manufacturer. Steadily a handful of Indian small—and medium-sized enterprises (SMEs) are playing a key role in the global supply chain of OEMs. With the government’s offset policies, procurement policies and regulatory incentives spurring the growth of a domestic defence industry, the SMEs need to play a more active role.

Importantly, to be ready for opportunities of the future, industry needs to develop and retain talent through specific training to address growing needs of the market. In addition, academia and industry, backed by government policies, need to forge partnerships to encourage research and technological advancements and create a talent pool that is industry-ready.

With defence being within the government’s high-priority focus area, India should emerge as a preferred partner for co-development and co-creation of an indigenous and self-sufficient defence manufacturing ecosystem. ✈️

2019 has begun to a splendid landscape in showcasing India’s burgeoning aerospace and defence capabilities: the 12th edition of Aero India show. The tagline for Aero India 2019 “The Runway to a Billion Opportunities”, is apt in conveying India’s growing value proposition to global investors and domestic manufacturers.

India is at the cusp of metamorphosing from an important regional player to one with global presence. As India’s geo-political and economic ambitions grow, it needs to develop robust indigenous manufacturing capabilities and an ecosystem to achieve self-reliance in the aerospace and defence industry.

Currently, the country is one of the largest importers of conventional defence equipment and spends almost one-third of its total defence budget on capital acquisitions. About 60 percent of its defence requirements are met through imports.

Owing to its dynamic security environment, India’s defence requirements are likely to increase in the foreseeable future, making indigenous development of modern defence hardware and technology as top priority for the government.

Sea of opportunity

With the government pledging \$250 billion to modernise the country’s military equipment — from fighters to guns and submarines — India is uniquely positioned to create a vibrant defence manufacturing ecosystem that can help achieve self-reliance. It offers tremendous opportunities in engineering, services, supply chain sourcing and associated maintenance, repair and overhaul-related activities. Although the government is taking numerous measures to bolster defence manufacturing, the pace of modernisation must be balanced with both short and long-term initiatives.

Hastening indigenisation

At Rolls-Royce, we believe that co-development and co-manufacturing is the way forward to achieve the vision of turning India into a global high-value manufacturing destination, not just for the home market but also for export.

Rolls Royce at Aero India 2019

Aero India is a key event for the aerospace sector, offering an excellent opportunity to meet with many customers and partners. At this year’s show, Rolls-Royce is showcasing its technological prowess along with its local partners at the Show in Bengaluru.

*Kishore Jayaraman,
President, Rolls-Royce, India & South Asia*



Thales: Supporting India's big ambitions

As one of the fastest growing economies in the world, India provides extraordinary opportunities across sectors to build business partnerships. There has been resurgence in a push towards growth and self-reliance, very evident in India's growing defence sector. Being one of the world's largest defence spenders with an estimated spend of some two per cent share of its GDP, India is increasing efforts to boost indigenous research, development and manufacturing along with facilitating global defence players to invest in country, so as to enable India emerge as a global platform for the defence sector in the research, manufacturing and supply chain ecosystems.

The "Make in India" initiative is a step in the right direction for the defence industry, the policy expected to boost Indian industry across sectors including defence, thereby positioning India as a global manufacturing hub. This will not only help Indian industries become globally competitive but also allow companies like Thales to further support the country's modernisation needs. As an active contributor towards development of the Indian defence sector since 1953, Thales remains fully committed to the country.

Helping India master decisive moments

Since 1953, Thales has been assisting India achieve its big ambitions. As a long-standing partner, the organisation takes pride in having contributed towards nation building and solidifying its foundations by sharing its niche technologies and expertise in defence, transport, aerospace and digital security markets.

Thales has built up a reputation of being a trusted partner to all three branches of the Indian armed forces, providing them with flagship solutions ranging from combat aircraft, air defence systems, sensors (ground, ship-borne and airborne), tactical



Mr Emmanuel de Roquefeuil, VP & Country Director, Thales in India

communication and military avionics, electronic warfare, among others.

Thales has enhanced the technical-operational capabilities of the IAF's Mirage 2000 fleet. In July 2011, Thales and Dassault Aviation signed a contract for the upgrade of this fleet. Another game-changer is selection of the Rafale by the IAF with Thales providing a number of state-of-the-art equipment and systems on-board this omnirole combat aircraft.

The company has also formed several other local partnerships from transfer of technology and supply chain perspectives. We have been working closely with Hindustan Aeronautics Limited (HAL) for over five decades. We also have a strong working relationship with Bharat Electronics Limited (BEL) with whom we have formed a joint venture (JV) BEL-Thales Systems Limited (BTSL) dedicated to civilian and select ground-based military radars. With

BTSL, Thales is jointly developing the PHAROS fire control radar for gun and missile systems that will support both domestic Indian and international markets. BTSL will also be undertaking the production of the LBREC – Low Band Receiver of the self-protection suite of the Rafale. Thales also has JVs with Samtel, L&T Technology Services and Reliance Aerostructure.

By sharing its technological expertise with indigenous partners, Thales touches the lives of billions of Indians each day. The organisation's local partnerships and JVs reinforce the company's commitment to the country.

Focus on creating jobs

Our objective is to make in India as well as export from India, a strong workforce of over 1,500 people working both directly with as well as indirectly through the supply chain partnerships built with Indian companies. Our plan is to triple this number in the next two-three years as we are looking forward to developing capabilities for local engineering, procurement from India and strengthening our local partnerships.

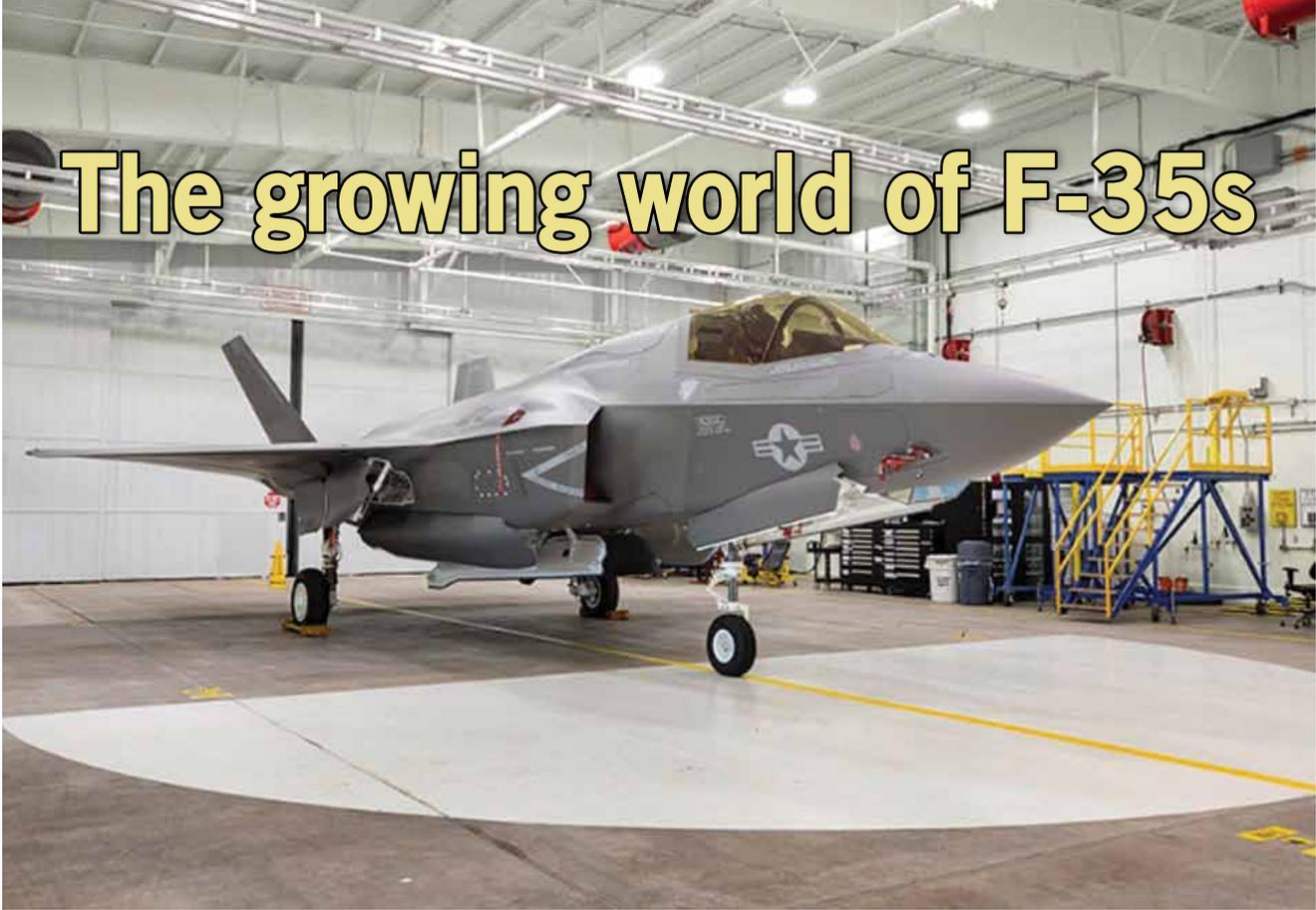
As we are setting up a state-of-the-art Engineering Competence Centre in Bengaluru, we seek to hire over 2000 engineers in the next three-five years for this centre alone, a first-of-its kind engineering centre in India that will focus on software and hardware capabilities in the areas of civil as well as defence businesses, serving Thales' global needs.

India is rich in engineering, human talents and certainly a source of competitiveness for our Group to grow. We further plan to invest in the country by partnering with customers, universities, commercial and technology partners, and to hire and train local talent to be as local as possible.

We look forward to participating in Aero India 2019.



The growing world of F-35s



Lockheed Martin meets 2018 F-35 Production Targets

Lockheed Martin delivered its 91st F-35 aircraft in 2018, meeting the joint government and industry delivery target for the year and “demonstrating the F-35 enterprise’s ability to ramp to full rate production.” The 91 deliveries in 2018 represent nearly a 40 percent increase from 2017 and about a 100 percent production increase compared to 2016.

In 2019, Lockheed Martin is set to deliver more than 130 F-35s, representing yet another 40 percent increase in production. The 91st aircraft is a US Marine Corps F-35B, delivered to Marine Corps Air Station Beaufort, South Carolina. In 2018, deliveries included 54 F-35s for the United States, 21 for international partner nations and 16 for Foreign Military Sales customers. By end 2018, more than 355 F-35s had been delivered and are now operating from 16 bases worldwide. More than 730 pilots and over 6,700 technicians were trained and the F-35 fleet has surpassed more than 175,000 cumulative flight hours. Ten nations are flying the F-35, seven countries have F-35s operating from a base on their home soil, four services have declared Initial Operating Capability, and two services have confirmed that their F-35s have been employed in combat operations. ✈️

UK to double its F-35 inventory



The UK is set to double the number of F-35 stealth fighters after ordering 17 more aircraft. Defence Secretary Gavin Williamson announced that 17 new F-35B aircraft will be delivered between 2020 and 2022 and will complement the 16 British aircraft currently based at RAF Marham and in the US, as well as two additional aircraft which are already on order. Overall, the UK has committed to procure 138 F-35s over life of the programme. The 17 new aircraft being ordered are part of a \$6 billion contract for 255 aircraft being built for the global F-35 enterprise.

The announcement also affects the economy, as British companies are building approximately 15% by value of all 3,000-plus F-35s planned for production. It is projected that around £35 billion will be contributed to the UK economy through the F-35 programme, with around 25,000 British jobs also involved.



“Unmatched & Undefeated”: The F/A-18 Super Hornet

Pilots swear by it, ground crews love working on it and commanders consider it one of the most capable assets at their disposal. Fitting multiple mission roles and embodying the true meaning of ‘anywhere, anytime’ capability; the F/A-18 Super Hornet has cemented a position for itself amongst the most legendary and game-changing fighters the world has ever seen.

The F/A-18 Super Hornet has lived up to its reputation. Faster, more capable and lethal than its predecessor, the Super Hornet has time and again proven its supremacy in pitched aerial battles and a myriad of other strike and support missions. Equally at ease on carrier decks and forward air bases, the Super Hornet has continued to enhance itself and prove itself adept at handling every mission assigned to it. In fact, the multi-role and fully capable Super Hornet has seamlessly taken on the mantle of aircraft such as the F-14 Tomcat, A-6 Intruder, Lockheed S-3 Viking, and KA-6D aircraft. An electronic warfare variant, the EA-18G Growler, replaces the EA-6B Prowler.

The first operational F/A-18 E/F Super Hornet squadron was formed in June 2001 and deployed in combat aboard the USS *Abraham Lincoln* (CVN 72) in July 2002. In

April 2005, Boeing delivered the first Block II Super Hornet, complete with the world’s first tactical multi-mode AESA radar, and it became fully operational by 2007.

Apart from the US Navy, the Royal Australian Air Force also places immense trust on the Super Hornet as a multi-role, frontline fighter of choice. All 24 of the Australian Super Hornets were delivered by Boeing to the customer, ahead of schedule in October 2011. Further proof of the continued edge this fighter brings to armed forces globally can be gauged from the order recently placed by Kuwait for 22 F/A-18 Super Hornets.

Constant Evolution for Continued Relevance

A robust roadmap has been laid out to ensure that the F/A-18 Super Hornet is capable of dealing with future threats. The US Navy’s continued investment is proof of the fact that this aircraft will continue to have the technologies needed to outpace threats for decades to come. Boeing and the US Navy have laid out and maintained a robust spiral development approach to the Super Hornet that provides updates to the aircraft’s subsystems and software every two years.

The Super Hornet is the most advanced aircraft of its kind in operation today, with designed-in stealth, an AESA radar and many other advanced technologies. The Super Hornet not only has a low acquisition cost, but it costs less per flight hour to operate than any other tactical aircraft in US forces inventory. Part of its affordability is because the Super Hornet is designed to need far less maintenance, which translates into the high mission availability it is known for.

Boeing and its industry partners have built more than 700 Super Hornets and Growlers, all on cost and on schedule. Boeing is confident that it will see F/A-18 production well into the mid 2020s, based on the US Navy’s need for more aircraft and near-term international opportunities.

“Perfect Fit” for the Indian Armed Forces

The Super Hornet brings the latest generation of technologies to the warfighter. The AESA radar in particular, is an exponential leap in technology that will be needed for current and future missions. The Advanced Targeting Forward Looking Infrared system, Joint Helmet Mounted Cueing System, Multifunctional Information Distribution

System, advanced high capacity computer system, and state-of-the-art cockpit provides the warfighter with intuitive situational awareness and capability now and far into the future.

The fighter is highly capable across the full mission spectrum and is a true multi-role aircraft, able to perform virtually every mission in the tactical spectrum, including air superiority, day/night strike with precision guided weapons, fighter escort, close air support, suppression of enemy air defenses, maritime strike, reconnaissance, forward air control and tanker missions. It has the right level of stealth, the right sensors and the right number of missiles for the Indian Air Force's missions.

Boeing has also completed extensive analysis and testing on the F/A-18 Super Hornet's compatibility with Indian aircraft carriers. Results show that the Super Hornet is capable of launching off a ski-jump carrier and could be operated from Indian carriers with a meaningful fuel and weapons load.

One Fighter, Many Benefits

Boeing has had a presence in India for more than seven decades and is committed to expanding its partnership by producing Super Hornets in India and thereby further developing India's aerospace ecosystem. Boeing is proposing a world class advanced manufacturing facility in India with the very latest technologies in place.

With designed-in stealth and robust capability growth plan, the Super Hornet is the best aircraft to launch India's Advanced Medium Combat Aircraft (AMCA) programme. Boeing will work closely with the Indian industry to ensure they have latest technologies and apply lessons learned from the current Super Hornet production line.

Working towards this goal, in 2018, Boeing announced a partnership with Hindustan Aeronautics Limited (HAL) and Mahindra Defence Systems (MDS) for manufacturing the Super Hornet

in India for its armed forces, and pursuing the joint development of future technologies.

Boeing's partnership with HAL and Mahindra will enable it to optimise the full potential of India's public and private sector to deliver next-generation F/A-18 fighter capabilities. Boeing envisions that this partnership can deliver an affordable, combat-proven fighter platform for India, while adding growth momentum to the Indian aerospace ecosystem with manufacturing, skill development, innovation and engineering. The partnership will transform India's aerospace and defense ecosystem, further building on its 'Make in India' success.

Future production of the Super Hornet in India, with Indian partners, will involve maximising indigenous content and producing the F/A-18 in India for its armed forces thereby creating a 21st century aerospace ecosystem. 

Courtesy: Boeing



A Pilot's View

Boeing test pilot Steve 'Bull' Schmidt is a calm, cool and collected man, traits that serve him well on the job. Several times per month he flies fighter jets, just off the production line, to determine if the new aircraft can safely do what they were designed to before the military customer takes delivery.

"Flying the F/A-18 Super Hornet is the culmination of a lot of work that happens beforehand," Schmidt said. "The engineers and mechanics on the floor are the ones who put it all together, so the high quality is really a reflection of their efforts and the team overall."

Schmidt has made more than 400 production first flights in his career, including the T-45, F-15, T-X and F/A-18. The next jet to be added to Schmidt's extensive aviation resume? The Block III Super Hornet! I'm really excited to see what the next-generation Super Hornet can do," he said. "As a pilot, I'm most looking forward to seeing how the conformal fuel tanks and advanced cockpit system operate in the skies. Those two capabilities are game-changers for US Navy pilots."

The Block III configuration adds capability upgrades that include enhanced network capability, longer range, reduced radar signature, an advanced cockpit system and an enhanced communication system. The fighter's life also will be extended from 6,000 hours to 10,000 hours.

Schmidt began flying the F-14 in 1984 for the US Navy. He retired from the Navy after 20 years, which included completion of the Naval Test Pilot School and Naval Fighter Weapons School, or *Top Gun*. Between the military and Boeing, Schmidt says he's been flying continuously for 30 years, but still relishes his profession.

‘Protecting our Protectors’

DCM Shriram venture into Defence

Making their debut at the DefExpo 18 in April 2018, where the Group announced their new venture into Defence equipment manufacturing, DCM SHRIRAM had Admiral Sunil Lanba, Chief of the Naval Staff and Chairman and Chief of Staff Committee formally inaugurating the ZEBU light bullet proof vehicle, in presence of Mr Alok Shriram Vice Chairman of the Company.

For DCM Shriram Industries Limited (DSIL), this new venture was inspired by the Defence Procurement Procedure (DPP 2016). With the DCM brand being a ceaseless part of India’s growth for decades, they took a conscious decision to bring that skill and experience to a new field. The beginning was made with the design and testing and production of the ZEBU light bullet proof vehicle for the Indian Defence and Para-Military Forces and its futuristic export.

As Mr Tilak Dhar, Chairman and Managing Director said, “Our group, under the guidance of our founder Lala Shriram

and later Lala Bansi Dhar, has consistently been a part of the nation building endeavours for over 125 years. We have been manufacturing original, India-made products since 1890 and have consistently worked towards aiding growth and development. We firmly believe that this project will create jobs not only within our company but in numerous automotive ancillary units and allied services, bringing further prosperity to the nation and greatly enhancing our Armed Forces’ access to critical resources and thus their capabilities.”

The ZEBU is a world class armoured bullet-proof vehicle which meets all the requirements and various service conditions that India’s armed personnel face and function in, including various types of terrain and climatic conditions, be it the heat of the desert, the glacial conditions in the high Himalayas or the rainy jungles of India’s North East.

Mr Alok B Shriram, Vice Chairman and Deputy Managing Director added, “In addition to manufacturing and providing vehicles within India, our aim is to eventually export them to other nations and peace-keeping forces. Featuring excellent all-terrain and off-road capabilities, a 360° rotating turret and several other features, this new LBPV is a promising new entrant to the indigenous defence sector in India, the team firmly believe that the ZEBU is the first step towards achieving their target as well as fulfilling the desired goals of Indian Government and the Indian Armed Forces going forward.

Over the year, the Group have gone ‘airborne’, diversifying to include the ‘Flyeye’ Mini UAV which is hand launched after achieving readiness in less than 10 minutes. The system has the surveillance payload with two cameras (Daylight & IR) under the fuselage which ensures better range of observation and quickly switching of the video imaging.





Aequs: Ecosystem Advantage in the Aerospace Sector

The Aerospace and Defence industry is recording significant advancements over the past few years, driven by multiple factors such as high demand from consumers in addition to technological disruption. According to a report by Deloitte, backlog on commercial aircraft orders is at its peak at more than 14,000 aircraft, with about 38,000 aircraft expected to be produced globally over the next 20 years. While original equipment manufacturers (OEMs) expect the suppliers to reduce costs and increase the production rate this in turn is putting pressure on the suppliers. This process will continue as the OEMs focus on expanding their margins. Reports also estimate that by 2025, India is expected to become the “third largest” aviation market with some 478 million passengers flying by 2036. It follows that there could be a demand for more than 2000 new aircraft in India over the next two decades, dominated by single-aisle aircraft.

In line with this, there is a dire need for a new paradigm of manufacturing which can

be versatile and flexible so as to increase the intensity and pace of manufacturing. Also, with diversification of the customer base and manufacturing facilities, there is need for a robust supply chain to meet these significant demands. To deal with these challenges, manufacturers should focus on ways to strengthen supply chain management, increasing the efficiency and productivity by implementing latest technologies in their facilities.

Supply chain: resourcefulness is critical

The success of any manufacturing supply chain lies in its resourcefulness. Innovative approaches can reduce the manufacturing costs, use available human resources efficiently, and accelerate timely delivery to effectively meet customer requirements. Manufacturing components in isolated facilities in multiple locations has been a tradition in the sector despite the challenges that comes with it, be it higher costs, time consuming processes, coupled with huge

waste generation in each of the facilities. This is also a high maintenance business.

There is need to integrate all the facilities in one location and have a strong and progressive ecosystem. This process of amalgamating multiple isolated facilities in manufacturing, eases the communication and efficiency among the parties involved - original equipment manufacturers (OEMs), their suppliers and customers.

The objective of such a system is to create a holistic and integrated aerospace ecosystem which enables customers to meet all their requirements at one place to save time, costs and logistics involved in sourcing from multiple locations. To be specific, this helps in cutting down the huge waste generation, speeding up time to market in the process. This vertical integration also helps in building a better network among the stakeholders involved which, in turn, results in better performance and meeting the customer demands.

While sole-sourcing of suppliers involves risk but is a traditional model,



multiple-sourcing minimises the occurrence of supply disruption as there are alternate suppliers to source in case of crisis. Sales and operations unit is implemented in various companies to have better connectivity within the supply chain for better-timed decisions and effectiveness. With inclusion of suppliers from lower-cost countries with reasonable technological capabilities, digital disruptions and adoption of newer technologies are leading to a major change in the supply chain management in the sector, driving the adoption of an integrated manufacturing ecosystem.

The way forward

With changes across the sector, there also comes a need to constantly upgrade the workforce with required technical skills and digital knowledge. As more facilities are incorporated to create a modular ecosystem with all the components and their benefits at hand, the challenges are being addressed with the adoption of newer technologies. We foresee the industry moving towards embracing the integrated manufacturing ecosystem model, quickly adopting to newer technological changes to stay agile. This will lead to a quantum jump in efficiency and productivity.

The aerospace industry is entering an era of boundless possibilities and the

outlook is positive for all stakeholders involved. As OEMs and the suppliers work to reduce costs and move closer to customers, emerging markets can leverage the same to bring in investments, create quality employment opportunities and meet the needs of their domestic aviation and defence sectors. India's emerging aerospace industry is witnessing the advantages of an integrated ecosystem in states like Karnataka and Telangana, setting an example for other

players in the market to identify and adopt this trend. Favorable geopolitical situation and policy amendments are key to the growth of such agile ecosystems and the country has already set its course in that direction.

The bold moves made by private players, together with the government's support to encourage such moves and provide timely access to funds and resources, are taking this sector to new heights in India.



Aravind Melligeri, Chairman & CEO, Aequs which is one of the fastest growing global aerospace manufacturing ecosystem, headquartered in the Aequs Special Economic Zone in Belagavi (Belgaum) in Karnataka state



The Javelin's Versatility

First deployed in 1996, Javelin is the world's most versatile and lethal one-man-portable and platform-employed anti-tank and multi-target precision weapon system, and more than 45,000 missiles and 12,000 Command Launch Units (CLUs) have been produced. The Javelin weapon system has experienced numerous technology insertions since its initial fielding to stay ahead of advancing threats. The Javelin, which is produced by a joint venture between Raytheon and Lockheed Martin, has been used extensively and to great advantage in combat operations in both Afghanistan and Iraq with over 5,000 engagements conducted by US and coalition forces.

The Javelin continues to evolve as the world's most versatile and lethal close-combat weapon system, thus shoulder-fired anti-tank missile advancing to become platform mounted capabilities, offering the warfighter a highly mobile, combat-proven weapon.

Platform deployment applies to a wide variety of ground, air and maritime platforms, for this use, the standard (unmodified) configuration round is integrated onto a Remote Weapons Station (RWS) or manned/unmanned turret using a modest integration kit. The kit consists of an electronics interface

unit, cables and mechanical fixturing. Standard RWS and vehicle/platform sensors, displays, controls and power sources are used for system support.

The Javelin has been integrated onto numerous platforms and vehicles for demonstration/testing and is in service on several platforms and tactical ground vehicles with US and allied forces. Vehicle use includes the U.S. Army Stryker Brigades.

The Javelin will remain in the US Government inventory until 2050 and is currently undergoing spiral upgrades to reduce weight and cost while improving performance. Javelin's field ready capability has been well documented and demonstrated over many years of combat operations. Javelin has maintained an extremely high operational readiness rate and engagement success rate over a wide variety of operational environments, which include operations at high and low altitude, as well as extreme adverse weather conditions.

Selection of Javelin will provide the Indian Armed Forces with a highly versatile and capable anti-tank weapon system that is interoperable with US and 18 allied forces even as the Javelin will continue to be upgraded over its remaining service life to remain relevant against emerging threats.



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The demands of military aviation in the 21st century leave no room for compromise – or outdated solutions. With cutting-edge technology and unrivalled build quality, the EJ200 has proven time and again to be the best engine in its class. The EJ200's inherent capacity for growth can deliver even more technological advances that can be realised in a joint partnership approach. To find out how our market-leading design and unique maintenance concept ensures that your air force will be able to fulfil its operational requirements and achieve the most value long-term, visit us at www.eurojet.de

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AvioHeliTronics in defence manufacturing

“The Next Big Thing”

With the increasing participation of OEMs across the globe and manufacturing complexes lately opening up under the ‘Make In India’ initiative as well as ‘Manufacture in India’, AvioHeliTronics are prepared for rapid growth in its manufacturing vertical.

With experience of over a decade, with meticulously designed infrastructure having highly skilled experts, AvioHeliTronics are carrying out focused research and translating that into successful development of advanced capabilities which include design-to-manufacture of aero structures. AvioHeliTronics offers these services in capacity of an IOP (*Indian Offset Partner*) to several aerospace majors, extending to the domain of civil aviation, and as service provider to several OEMs plus Tier-1s in the Design & Development of Embedded-Software (Avionics/Railways), AeroStructures-Design/Analysis/Prototyping and Technical-Documentation.

Manufacturing has been AvioHeliTronics strong forte, with its modern facilities spread over a 25,000 square-foot area, equipped to work around-the-clock. AvioHeliTronics

current manufacturing unit has an array of high-technology equipment, operated by very skilled experts. AvioHeliTronics is in a promising position with an added advantage of Certifications including AS9100 D, CMMI Level 3(Svc. & Dev.), ISO 27001:15, CEMILAC, R&D Unit, recognised by DSIR and Defence Industrial Licenses (D-IL).

With AvioHeliTronics focussing on R&D, this has resulted in mature designs, further checked for inconsistencies and errors by well-placed pre-manufacture checks. Manufacturing processes are continuously optimised at AvioHeliTronics, with insightful inputs from R&D teams working in the domain. In fact, such work on optimisation of design and manufacturing in seamless manner ensures optimisation in multi-dimensions. Equipped with in-house capabilities to deal with manufacturing from the ab-initio stage, AvioHeliTronics have the advantage of giving highly efficient solutions, optimising the manufacturing life-cycle in many innovative ways.

Over the years, AvioHeliTronics have demonstrated their ability to meet the exacting demands of various aerospace

companies, both national and international. Their national customers include aerospace majors, particularly Hindustan Aeronautics Limited (HAL), Indian Space Research Organisation (ISRO), Brahmos Aerospace.

“The growing needs and demand for manufacturing in global and domestic markets have urged us to expand in multiple dimensions in the field of aerospace manufacturing. Senior executives of AIS have been following long-term growth strategies which are not just focused on scale, but on growth in technology, quality and expertise. These strategies have shaped our upcoming venture, the state-of-the-art manufacturing facility at the Aerospace SEZ Park in Devanahalli, Bengaluru,” stated Deepika Ramesh, COO & Sr. VP.

This facility will be equipped with new and advanced manufacturing machinery that include 5-axis CNC Machines, Milling Centres and CNC Turning Centres amongst others. Additionally, inspection facilities such as Coordinate Measurement Machines (CMM), Profile Projectors, Video Measuring System (VMS) are being installed to ensure precision requirements associated with defence projects and aerospace.

Apart from its expertise in manufacturing, AvioHeliTronics has an established customer base for various domains of business:

Embedded Electronics & Software (Avionics)

- ◆ Design, Development, Coding(C / C++ / Ada, QT, Open GL ES, Lab windows) as per DO 178B/254
- ◆ IV&V (DO 178B – Level: A, B,C& D)
- ◆ Solutions: RADAR control Software; Mission Payload Software; DMM /IHH; Navigation System Software; Railway system control Software

Structural Engineering

- ◆ Digitisation of drawings; 3D Modelling
- ◆ Reverse Engineering and Prototyping
- ◆ Design Dossier Checks (Airbus and Bombardier Standards)
- ◆ Jigs and fixture Design & Aero structure analysis (CFT, Stress, F&DT, CAE)

Technical Documentation

- ◆ Illustration and Authoring Activities
- ◆ Interactive Electronic Technical Manuals (IETM)
- ◆ Engine Manuals, CMM, IPC, Technical Translations



Visit AvioHeliTronics at HALL C, STALL C2.12

Japan orders more F-35s for its upgraded carriers



In a paradigm move, the Japanese Government has directed that its Navy's two existing helicopter carriers JS *Izumo* and JS *Kaga* be extensively upgraded for operation of fixed wing fighters, notably the next generation Lockheed F-35. This is regarded as direct response to China's continuing push for dominance in the Pacific and South China Sea.

Japanese Prime Minister Shinzo Abe approved a major five-year defence budget for \$240 billion that includes these aircraft carriers for the JMSDF, the country's first such since the Second World War along with purchase some 105 F-35A and F-35B stealth fighters. The JASDF had ordered the F-35A in 2011 and the new order includes some 42 F-35B variants, designed for VTOL operations and suitable for smaller aircraft carriers.

Belgium selects F-35A Lightning II

Belgium has selected the Lockheed Martin F-35A to replace its F-16s, with the country's Council of Ministers choosing the fighter instead of the Eurofighter Typhoon or Dassault Rafale. As well as 34 F-35A Block 4 jets, the council approved acquisition of two MQ-9B SkyGuardian unmanned aerial vehicles. Defence minister Steven Vandeput has said the F-35 was "the best choice for our country in financial, operational, and industrial terms".



Belgium will pay €3.8bn for the 34 F-35As, plus two flight simulation centres, equipment and information and communications technology for operational and technical support, plus pilot helmets. The contract will also cover training of pilots and technicians and technological developments until 2030. The first aircraft are expected to be delivered by 2023.

Canada's new fighter quest

The Government of Canada's protracted effort to select a replacement for its CF-188 Hornets has progressed with release of a draft request for proposals (RFP) to Airbus Defence and Space, Boeing, Dassault Aviation, Lockheed Martin and Saab. The chosen company must ensure investments in Canada equal to the value of the contract, an estimated US\$12 billion. In 2009 Canada's earlier Conservative government stated that it would procure F-35s before the nation's Liberal party was elected in 2015 which moved towards scrapping the Lightning II purchase and instead looking at cheaper options to buy 88 new fighters. The Canadian Government is expected to finalise the contract in 2021-22, with the first aircraft delivered in 2025 with initial operational capability to be achieved the following year.

More Rafales delivered to Egypt

Three twin-seat Rafales joined the Arab Republic of Egypt Air Force in September 2018. This brings total deliveries to 17 (nine 'DMs and eight 'EMs), leaving seven 'DMs to be delivered to complete the order for 24, which are all expected to be in service by 2020.



Pakistan provides 'guarantee' for Nigerian JF-17 contract

As reported in *Vayu* Issue VI/2018, the Government of Pakistan has approved a \$183 million sovereign guarantee for the sale of three JF-17 Thunder fighters to Nigeria. The guarantee was approved by the Pakistani Economic Coordination Committee and is the first official confirmation of the contract with Nigeria from the Pakistani



side. Nigeria has made several payments towards the acquisition of three JF-17s, with \$47 million approved in the 2018 budget, after earlier allocations of \$33 million and \$25 million. It is assumed that Nigeria will order more than three aircraft to replace or supplement its F-7Ni fleet, a third of which have been lost in accidents. Nigeria has also bought Super Mushshak trainers from Pakistan's PAC.

PLAAF J-10s exercise with Gripens in Thailand

During Exercise *Falcon Strike 2018*, which took place at Udon Thani Air Base, Thailand, in September, five PLAAF J-10As from the 130th Air Brigade at Mengzi, along with a J-10S in 131st



Air Brigade markings were deployed with support provided by three PLAAF Il-76 transports. They exercised jointly with resident Gripens of the Royal Thai Air Force's 23 Wing. The exercise was "to deepen co-operation and exchanges between the two air forces, test combat tactics and methods, promote equipment development and improve the combat training level of the two sides".

Taiwan's F-16V upgrade



Taiwan's Ministry of National Defence will increase the budget for upgrading the Republic of China Air Force's (ROCAF's) F-16A/B fleet. A high-ranking defence official said that additional funding was for an increase in the number and types of air-to-air missiles to be carried. These upgrades are alongside a package of enhancements being applied to all 141 of the ROCAF's surviving F-16A/B Block 20s to bring them up to F-16V (Block 70/72) standard, Lockheed Martin having been awarded a contract for the F-16V upgrade on 1 October 2012.

Iran's 'Kowsar' fighter into production



Iran has started production of its locally-designed fighter aircraft, to be known as 'Kowsar' (Thunderbolt), Defence Minister Amir Hatami said at an unveiling ceremony. The Kowsar, which was unveiled recently is claimed to be '100% indigenously made' but images reveal this to be much like the two-seat F-5 Freedom Fighter which has equipped the country's air arm for decades.

MiG-31Ks for 712th GvIAP at Kansk



The Russian 712th Guards Fighter Aviation Regiment (GvIAP) at Kansk is to receive MiG-31Ks, with the parent 21st Mixed Aviation Division comprising two regiments of MiG-31s and one of Su-34s, the MiG-31 regiments based at Kansk and Perm, while the Su-34 regiment is at Shagol. The MiG-31Ks will be armed with the new Kh-47M2 *Kinzhal* (dagger) hypersonic missile, primarily tasked with covering the airspace of southern and southeast Russia. In related news, photos have been released of a Russian Aerospace Forces MiG-31BM carrying a mock-up of a new anti-satellite (ASAT) weapon. The aircraft is understood to have been developed under the Mikoyan OKB's *izdeliye* (article) 06 programme, calling for an anti-satellite weapon or space launch system. The new missile has folding rear fins and is probably a two-stage system with a powered kill vehicle for anti-satellite missions.

Six JF-17 Thunders delivered to Myanmar

An initial six Chengdu JF-17Ms have reportedly been delivered to the Myanmar Air Force, these to operate from Patheingyi (formerly Bassein) air base. The aircraft which were shipped in CKD condition, were ordered under a contract in November 2016.



More Su-35S to Western Military District

Another three Su-35S fighters have been delivered to Besovets-Petrozavodsk air base in the Western Military District of Russia, to serve with the 159th Fighter Aviation Regiment. Meanwhile, another two Su-34s have been handed over to the VKS's Central Military District. They will be used to convert pilots onto the Su-34, after which both aircraft will transfer to their permanent unit, the 2nd Guards Bomber Aviation Regiment (2nd GvBAP), at Chelyabinsk-Shagol air base.

Philippine Air Force revives Basa AB

One of the Philippine Air Force's Oldest Fighter Wings (the 5th) has been reformed at the country's earliest air bases (Basa) in Pampanga. Flying F-51 Mustangs from this base till the late 1950s, the 5th Fighter Wing will now operate 12 FA-50PHs with the 7th Tactical Fighter Squadron 'Bulldogs', which had previously been operating from Clark AB while awaiting completion of new infrastructure at Basa. The 5th FW also includes the three surviving S.211s of the 105th Combat Crew Training Squadron (CCTS).



E-2Ds for JASDF



It is reported that an additional nine Northrop Grumman E-2D Advanced Hawkeye Airborne Early Warning aircraft will be acquired for the Japan Air Self Defence Force (JASDF). Japan had ordered an original batch of four E-2Ds in 2015, with one aircraft ordered in November 2015 and the second in August 2016. The E-2D is replacing 11 earlier E-2C Hawkeyes that entered service with the JASDF in 1982 and are based at Misawa and Naha Air Bases, operating under the *Keikai Kokutai* (AEW Group).

Boeing E-7 AEW&C aircraft for RAF ?



UK Under-Secretary of State for Defence Procurement Stewart Andrew has stated that discussions are ongoing with Boeing for potential procurement of its E-7 Wedgetail Airborne Early Warning and Control aircraft. “Since the 2015 Strategic Defence and Security Review, the MoD has undertaken significant work to understand the best way to invest in and improve the RAF’s airborne warning and control capability... the E-7 Wedgetail, which has been proven in operations and is already in use by the Royal Australian Air Force, is likely to be the best option to provide ‘eyes in the sky’ surveillance for UK forces”.

F-35’s IOT&E delayed



Operational testing of the US Navy’s F-35C has begun on-board the aircraft carrier USS *Abraham Lincoln* (CVN 72) in the Atlantic, using six aircraft from Strike Fighter Squadron 101 (VFDA-101) ‘Grim Reapers’ at Eglin Air Force Base, Florida and VFA-125 at Naval Air Station Lemoore, California. This is precursor to the Department of Defence initial operational testing and evaluation (IOT&E) process, the start of which was delayed from September to November 2018 allowing the aircraft to be updated with latest of the F-35’s Block 3F software. The IOT&E is scheduled for completion in summer 2019, ahead of the planned October 2019 decision on the F-35’s transition to full rate production.

A330-200 MRTT *Phénix* inducted into service



The first Airbus A330–200MRTT *Phénix* for the French Armée de l’Air was delivered to BA125 Istres-Le Tubé on 27 September where it will serve with *Groupe de Ravitaillement en Vol 2/91* ‘Bretagne’. The aircraft was later officially inducted into service on 19 October at a ceremony attended by Armed Forces Minister Florence Parly and General Lavigne, Chief of Staff of the *Armée de l’Air*.

France orders three more A330 MRTT tankers



Airbus Defence and Space has received a firm order from the French Defence Procurement Agency (DGA) for a further three A330 MRTT Multi-Role Tanker Transport aircraft. Known as *Phénix* in French service, these constitute the third and final tranche of the multi-year contract for 12 A330 MRTTs signed by the French Ministry of Defence in 2014. In French service, the A330 MRTT will be powered by Rolls-Royce Trent 700 engines and equipped with a combination of the Airbus Refuelling Boom System and underwing hose-and-drogue refuelling pods. The aircraft can be configured in a variety of layouts carrying up to 272 passengers as well as medevac arrangements including the French MORPHEE intensive care module carrying up to ten patients as well as 88 passengers.

First South Korean A330 MRTT



The first Airbus A330 Multi Role Tanker Transport (MRTT) aircraft for the Republic of Korea Air Force (ROKAF) is now at Gimhae Air Base in Busan, South Korea for acceptance tests. The ROKAF will be supported by a team from Airbus, which will be based in South Korea for the duration of the tests.

Airbus and Lockheed Martin in aerial refuelling MoA



Airbus and Lockheed Martin have an agreement to jointly explore opportunities to meet the growing demand for aerial refuelling for US defence forces. The companies will seek to provide aerial-refuelling services to address any identified capacity shortfall and to meet requirements for the next generation of tankers. “Reliable and modernised aerial refuelling is an essential capability for our customers to maintain their global reach and strategic advantage,” said Lockheed Martin, President and CEO Marilyn Hewson. “By combining the innovation and expertise of Airbus and Lockheed Martin, we will be well positioned to provide the United States Air Force and allies around the world with the advanced refuelling solutions needed to meet 21st century security challenges.”

Hungary orders 16 H225M helicopters



Hungary has ordered 16 H225M multi-purpose helicopters equipped with the HForce weapon management system. Together with the helicopters, Airbus will also provide an extensive training and support package “to ensure the highest level of operational availability”. The H225Ms will be equipped with state-of-the-art communication capabilities and will be used for transport, combat search and rescue, and special operations missions.

USAF accepts KC-46A



On 10 January 2019, the USAF accepted its first KC-46A Pegasus tanker from Boeing Company, a major milestone for the next generation tanker and which now begins operational testing and flight training.

Bases selected for B-21 Raiders

With development of the Northrop Grumman B-21 Raider moving apace at Melbourne, Florida, the USAF has selected Tinker Air Force Base at Oklahoma to coordinate maintenance and sustainment of this futuristic programme with Edwards AFB, California, for lead testing and evaluation of this next generation



strike bomber. The B-21 is being developed as a long-range and highly-survivable aircraft capable of penetrating air defences and conducting a range of critical missions. First deliveries will be in the mid-2020s.

A.50 AEW&C aircraft upgraded



Upgradation of the A.50 AEW&C aircraft has been carried out by Vega Radio Engineering Corporation of the Ruselectronics holding company (part of Rostec) and the Beriev Aircraft Company. With the use of modern electronic systems, the new variant A.50U is capable of tracking more targets with precision and with increased detection range. High performance of the radar has been achieved by implementing an end-to-end channel of digital radar data processing and upgradation of the receiver and transmitter.

Canada orders ISR King Air 350ER

The US State Department has approved foreign military sale of three Beechcraft 350ER aircraft to Canada for intelligence, surveillance and reconnaissance (ISR) operations. Under the \$350 million deal, the aircraft will be fitted with customer-unique ISR equipment including the Wescam MX-15D multi-spectral imaging sensor, Northrop Grumman AAR-47B(v)2 infrared-guided



missile, laser-guided/laser-aided threat warning and unguided munitions warning system and BAE Systems' ALE-47 airborne countermeasures dispenser systems. The aircraft are being proposed for Canada's manned airborne ISR programme, which will support the country's Special Forces.

Leuchars reactivated while Poseidons move to Kinloss



The RAF's initial P-8A Poseidon maritime patrol aircraft will be delivered to Kinloss in Scotland rather than the type's main operating base at nearby RAF Lossiemouth, this decision taken to avoid disruption caused by major refurbishment at Lossiemouth. As part of the £400m construction effort, the resident RAF Typhoons will also temporarily relocate to Leuchars in Fife. The work at Lossiemouth is required to accommodate both the Poseidon and an additional Typhoon unit, the IX (Bomber) Squadron. During the summer of 2019, routine Typhoon flying will briefly operate out of Kinloss and the *Quick Reaction Alert North* function will temporarily relocate to Leuchars. The first two P-8A Maritime Patrol Aircraft, that are due to arrive in the UK in February 2020, will be temporarily based at Kinloss before moving to their permanent home at RAF Lossiemouth once the main runway has been refurbished.

T-50s for Iraq



A third batch of six T-50IQ Golden Eagles has been delivered from South Korea to Iraq. The second batch consisting of four aircraft arrived in May and followed the first delivery of six in February 2018. A total of twenty-four T-50IQs were ordered in 2013.

Franco-Belgian Advanced Jet Training School closed



Formal closure of the Franco-Belgian Advanced Jet Training School (AJeTS) at Base Aérienne 120 Cazaux in France took place in October. The joint unit, flying Alpha Jets, had trained Belgian and French pilots since 2004. The 25 Belgian Alpha Jets which have gone through a mid-life update, including new head-up display and GPS navigation, will continue at Cazaux, but are now being put up for sale, along with engines, other equipment and a simulator.

Special mission P-8As for USN

The US Navy has established a ‘special missions’ unit at Naval Air Station Jacksonville, Florida, to operate P-8A Poseidons “with specific capability”. According to a directive from the Office of the



Chief of Naval Operations, the establishment of Fleet Support Unit One (FSU) 1 at NAS Jacksonville was to provide a follow on special mission capability to its maritime patrol community after VPU-2 retires its P-3C Orions. FSU-1’s mission is provision of “oversight, training operations, maintenance and configuration management for the P-8 quick reaction capability aircraft”.

Upgraded An-32B for Bangladesh



Ukraine’s State Enterprise Plant 410 has completed overhaul and upgrade of the third and final Bangladesh Air Force (BAF) An-32B, the aircraft, returning in 2018, to re-join No.3 Squadron at BAF Base Sergeant Zahurul Haque, Chittagong. The work undertaken on all three An-32s includes total refurbishment, upgraded equipment, a ground collision avoidance system and satellite navigation.

C295W for UAEAF & AD

The first C295W of five ordered by the United Arab Emirates Air Force and Air Defence (UAEAF&AD) was delivered in November 2018. These aircraft will replace the service’s remaining PT Dirgantara Indonesia (PTDI)-built CN235M-100s delivered between August 1993 and early 1995.



Leonardo's new C-27J Spartan baseline configuration



The new C-27J Spartan baseline configuration, with a new avionics system, new cockpit control panels and LED aircraft lights, made its first flight recently at Leonardo's Aircraft Division Turin plant. The C-27J's new avionic system complies with Next Generation Air Traffic Control requirements, including SESAR and NextGen, and provides TCAS 7.1 (*Traffic Collision Avoidance System*) capability. It features many major upgrades such as a new FMS (*Flight Management System*) with RNP (*Required Navigation Performances*) and LPV (*Localizer Performance with Vertical Guidance*) approach capabilities. The IFF Mode 5 has been updated to the latest standard.

More Chinooks for RAF



The US Government has granted approval for the UK's procurement of 16 additional CH-47F Block II heavy-lift helicopters. These will be in an extended-range configuration, to be delivered in a special forces configuration similar to the US Army's MH-47G, also featuring an extensive countermeasures suite, multi-mode radar and 'fat' extended-range fuel tanks. The RAF currently operates 60 Chinooks, with the most recent 14 HC6 versions originating from a 2011 order and delivered between December 2013 and December 2015.

Upgraded Ka-27M with Baltic Fleet



Initial tests of the upgraded Ka-27M maritime helicopter have been completed by the Russian Navy at their Baltic Fleet's Chernyakhovsk airfield in Kaliningrad Oblast, one of the five modernised examples delivered the previous week to Donskoye airfield, Kaliningrad, where they will be permanently stationed. The Ka-27M mid-life upgrade features the RKTS (*Radiolokatsionnaya Komandno-Takticheskaya Sistema*, radar command-tactical system) Bumerang suite that includes a Kopyo-A radar with active phased antenna array, Kema radio sonobuoy system, Ros'-VM dipping sonar, fixed magnetic anomaly detector, electronic support measures (ESM) suite and navigator's tactical display.

MH-139s to replace UH-1s

Boeing MH-139 helicopters, based on the Leonardo Helicopters AW139, are to be delivered to the US Air Force to replace the obsolescent Bell UH-1N Huey (Iroquois) helicopters. Leonardo will assemble the helicopters in Philadelphia and Boeing will integrate the military-specific equipment. The MH-139 will be used "to protect the United States' intercontinental ballistic missile bases" and some 84 helicopters will be acquired under the \$2.4 billion deal.

MD530Fs for Kenya

Kenya plans to acquire up to 12 MD530F armed light helicopters, with MD Helicopters receiving an order for six MD530F Cayuse Warriors. The order covers logistic support, aircraft systems and ground support equipment. Deliveries will take place between April and August 2019. Kenya's MD530Fs will be outfitted with a full complement of mission equipment including ballistic armour protection, FN Herstal .50 calibre HMP 400 machine gun pods and M260 7-shot rocket pods for 70mm rockets.

Lebanon orders six MD530Gs

The Lebanese Air Force has bought six armed MD530Gs from MD Helicopters, the new MD530G scout helicopters to be delivered to Lebanon by the fourth quarter of 2020 [see article in *Vayu VII/2018*].

First series H160 in flight



The first series-production H160 to roll off the brand new assembly line in Marignane performed its flight demonstration on 17 December 2018 in an end-of-the-year celebration of the programme's achievements in 2018. The helicopter, which will be delivered to launch customer Babcock in 2020, had already performed its first flight on the 14 December 2018.

Indonesian Air Force order eight additional H225Ms



The Indonesian Air Force has ordered eight additional twin-engine multirole H225M helicopters as part of the country's fleet-strengthening initiative for a combat search and rescue-capable fleet. Under an agreement between the Indonesian Ministry of Defence and PT Dirgantara Indonesia (Persero), the 11-ton helicopters will be delivered to the air force upon reassembly and completion of the mission equipment outfitting and customisation by PTDI at its facility in Bandung, Indonesia. These additional helicopters will join the air force's existing fleet of six H225Ms to perform similar combat search and rescue missions.

Leonardo contract for 22 AW169Ms

Leonardo has signed a contract with Italy's *Guardia di Finanza* for 22 new generation AW169M twin engine helicopters. The contract, valued at 280 million euro, includes a comprehensive



support and training package which could be further extended with optional services valued at an additional 100 million euro. Deliveries are expected to start in summer 2019 and completed by 2024. The aircraft will be used for a range of roles including patrol and reconnaissance, law enforcement, rescue and homeland security, complementing a fleet of 14 AW139 intermediate twins, six of which are already in service with the following eight due to be delivered in 2019.

Bell V-280 Valor's anniversary



Bell Helicopter and Team Valor marked anniversary of the V-280 Valor's first flight, continuing to prove the aircraft's performance and technical maturity. As part of the US Army-led Joint Multi-Role Technology Demonstrator (JMR-TD) programme, the V-280 demonstrates that "close collaboration between government and industry can deliver transformational speed, range and agility in vertical lift, in a fast and sustainable process". The V-280 continues to expand the envelope in flight testing and expects to complete all the key performance parameters in the coming months, including additional low-speed agility tests and full cruise speed in forward flight.

Sikorsky and Boeing reveal SB 1 Defiant



Sikorsky and Boeing have provided a first look at the Defiant helicopter which has been developed for the US Army's Joint Multi-Role technology demonstrator programme. "The Defiant is designed to fly at twice the speed and range of today's conventional helicopters and offers advanced agility and maneuverability." As the next generation of military helicopters and part of the US Army's Future Vertical Lift programme, the helicopter is participating in the Army's Joint Multi-Role-Medium Technology Demonstrator programme.

Boeing to modernise Spanish Chinook helicopters



Boeing will upgrade all 17 Spanish CH-47D Chinook helicopters to the F-model configuration, adding features such as the digital automatic flight control system, common avionics architecture system and advanced cargo handling to align that country's fleet with those of other nations. This is the first order from a non-US customer placed through a contract Boeing and the US Army signed in July 2018. That contract covers six new F-models for the US and options for up to 150 more Chinooks for US and international customers. Deliveries to Spain begin in 2021.

More H225Ms for the Royal Thai Air Force



The Royal Thai Air Force has taken delivery of two more H225M (EC725) Caracal helicopters, from Airbus Helicopters. The new helicopters are the seventh and eighth of twelve on order for the service, as part of its fleet modernisation plan. The RTAF had ordered eight EC725s between 2012 and 2016 and in September 2018, Airbus Helicopters announced a further order for four H225Ms, with delivery by the end of 2021. The H225Ms will be used for combat search and rescue (CSAR), search and rescue (SAR) and troop transport operations.

Japan to buy Standard Missile-3 (SM-3)

The US State Department is processing a possible Foreign Military Sale to Japan of eight Standard Missile-3 (SM-3) Block 1B Missiles and thirteen Standard Missile-3 (SM-3) Block 2A Missiles for an estimated cost of \$561 million. Also included are SM-3 1B and 2A missile canisters, US Government and contractor-provided technical assistance, engineering and logistical support services, and other related elements of logistical and programme support, the total programme cost being \$561 million.



\$1.8 bn contract for PAC-3 Missiles



The United States and allies are to upgrade their missile defence capabilities under a \$1.8 billion 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 includes deliveries for the US Army and Foreign Military Sales of PAC-3 and PAC-3 MSE interceptors, launcher modification kits and associated equipment. The family of PAC-3 missiles are high-velocity interceptors that defend against incoming threats, including tactical ballistic missiles, cruise missiles and aircraft.

Raytheon contract for Sweden's Patriot

Raytheon has received a \$692.9 million US Army contract to produce Sweden's Patriot Integrated Air and Missile Defense System including spare parts, support and training. Previously announced by the Department of Defense, Raytheon will build and deliver an undisclosed quantity of Patriot fire units and GEM-T interceptor missiles. Raytheon's Patriot is a missile defense system consisting of radars, command-and-control technology and multiple types of interceptors, all working together to detect, identify and defeat tactical ballistic missiles, cruise missiles, drones, advanced aircraft and other threats.



"1390 Regional Jets for China"



At *Airshow China* in Zhuhai in early November, Embraer issued its forecast for regional jet aircraft demand in this country, the manufacturer predicting there will be a need for 1,390 new jets with up to 150 seats over the next 20 years. Embraer has sold 22 of its latest-generation E-Jets E2s in China so far. Regional aircraft manufacturer ATR is also predicting major growth in the Chinese market, forecasting a demand for 1,100 new turboprops by 2037.

IAG's future fleet planning



The International Airlines Group (IAG), parent company of British Airways, Iberia, Aer Lingus, Level and Vueling, has announced its future airliner fleet. By the end of 2018, the IAG Group will have 386 short-haul aircraft in service with plans to grow to 402 aircraft in 2019, 411 in 2020, 437 in 2021, 448 in 2022 and 467 in 2023. In the long-haul sector, numbers will grow from 201 airliners in 2018 to 208 in 2019, then 224 in 2020, 237 in 2021, 245 in 2022 and 249 in 2023.

The long-haul network will have arrival of more Airbus A350s, introduced by Iberia, in 2019. Ten will be in IAG service by the end of next year, including four with British Airways. The phasing-out of older types, coupled with the arrival of new A350s and 787s for long-haul plus more A320neo-Family aircraft for short-haul (as well as longer-range A321LRs for Aer Lingus), reduces the average age of IAG airliners considerably.

First SSJ100 delivered to Severstal



On 26 December 2018, Severstal Air received its first SSJ100 from Sukhoi Civil Aircraft Company and the GTLK (State Transport Leasing Company). There are to be another three SSJ100s delivered during 2018-2019, with an option of layout change to a two-class configuration. The Superjet 100 (SSJ100) new-generation Russian airliner has been designed by SCAC incorporating the latest technologies for “ensuring operational efficiency and a high level of passenger comfort”. The SSJ100 commenced scheduled services from 2011.

Republic Airways order 100 E175s



Republic Airways, the world’s largest E-Jet operator, have affirmed their orders for 100 E175 regional jets, which was first announced as a ‘Letter of Intent’ at the Farnborough Airshow in July 2018.

JAC receives ATR 72-600

Japan Air Commuter (JAC) has taken delivery of its first ATR 72-600 following the conversion in June 2018 of an ATR 42-600 to the larger ATR 72-600 version. The aircraft has a 70-seat configuration. JAC had previously put five ATR 42-600s into service



and ATR said the conversion by the airline of its order “reflects the ATR 72-600’s ability to effectively open and grow routes with the lowest possible risks”.

Emirates Airbus 380 operations



Emirates has extended its Airbus A380 operations to 50 destinations with recent introduction of services with the type to Osaka and Hamburg. The airline has stated that the A380 “provides an increase in capacity of 38% to Osaka and 22% increase to Hamburg”. Emirates now operates 105 A380s.

ARJ21-700s for ‘Genghis Khan’

China’s Commercial Aircraft Corporation (COMAC) is to shortly deliver the first of 25 ARJ21-700 90-seat regional airliners to Genghis Khan Airlines. The airline, with its headquarters



at Hohhot Baita International Airport, is a start-up in China's Inner Mongolia region and will begin revenue operations in 2019 and take delivery of its 25 aircraft by 2023. COMAC has announced that it will also be establishing an airliner maintenance facility in Inner Mongolia.

MC-21's PD-14 engine certified

The Irkut MC-21 airliner has had its intended Russian-built engine option certified by the Federal Air Transport Agency. The first three Aviadvigatel PD-14 turbofans were to be delivered to Irkut by the end of 2018, two for an MC-21 prototype for flight-testing plus one for ground testing. The PD-14 is to enter series production in 2019. The certification followed the PD-14's successful completion of ground testing under simulated icing conditions by the Baranov Central Institute of Aviation Engine Construction in Moscow. Meanwhile the Pratt & Whitney PW1400G-JM engine, the initial powerplant certified for the MC-21, will be used to power the aircraft to go through European Air Safety Agency (EASA) certification. The PW-1400C-powered version of the MC-21S is scheduled to enter commercial service in 2020.

A330-900neo certified

The Airbus A330-900neo has been certified by EASA with delivery made to launch customer TAP Portugal. Airbus is also preparing TAP's second example, with several other operators to follow including Air Mauritius, Azul Brazilian Airlines, WOW Air in Iceland and RwandAir in Africa. The aircraft has Rolls-Royce Trent 7000 engines, a new 3D-optimised wing with sharklets and outfitted with the Airspace cabin. Airbus has sold 224 A330-900s.

Delta A220 test flights

Delta Air Lines' first A220-100 has started test flights from Mirabel, Quebec, after undertaking static tests, engine runs and ground taxiing and then carrying out first flight. Pre-delivery testing and cabin outfitting will continue before the jet is handed over to Delta by the end of 2018. Delta plans to put the A220 into service early in 2019, the airline being the first North American carrier to use the new airliner and the fourth overall after Swiss,

Air Baltic and Korean Air. Delta has ordered 75 examples with options for 50 more, the A220s replacing ageing MD-88s. By end-2018, there were 45 A220s in service, Swiss having 25 examples (27 A220-300s and eight A220-100s), Korean eight A220-300s and Air Baltic 12 A220-300s.

More A320Neos for Lufthansa

The Lufthansa Group has placed an additional order for Airbus A320neo Family aircraft, taking its total orders for the jet to 149. The Group has ordered 27 more aircraft consisting of 24 A320neos and three A321neos. Ten of the 27 new aircraft are earmarked for Swiss, with the remaining 17 distributed across the Group.

Nigeria Air in suspense

The Nigerian government has reportedly suspended plans to create a new national carrier, *Nigeria Air* that was first announced earlier in 2018. The Nigerian government was to provide \$ 55 million as start-up capital and deposit for new aircraft, whose delivery was to begin in 2021. The airline was to be run through a public-private partnership with Ethiopian Airlines being a leading contender. Nigeria Airways was founded in 1998 but ceased operations in 2003 and its successor Air Nigeria operated from 2005 to 2012.

Rolls-Royce celebrates 2000th RR Trent 700 delivery milestone

Rolls-Royce has marked another milestone with delivery of its 2,000th Trent 700, the original member of the now seven-strong Trent engine family, "which is the clear market leader and engine of customer choice for the Airbus A330." Rolls-Royce have also have been awarded a contract by Delta Air Lines for Trent 7000 engines to power its ten Airbus A330neos, which includes the RR 'Total Care' long term service support. The Trent 7000 is the latest member of the successful Rolls-Royce Trent engine family and exclusive powerplant for the A330neo, the new order taking the total of Trent 7000-powered A330neos to 35. The 68-72,000lb thrust Trent 7000 benefits from a bypass ratio double that of its predecessor, the Trent 7000 will improve specific fuel consumption by 10%.



SaudiGulf Airlines select CFM LEAP-1A engine

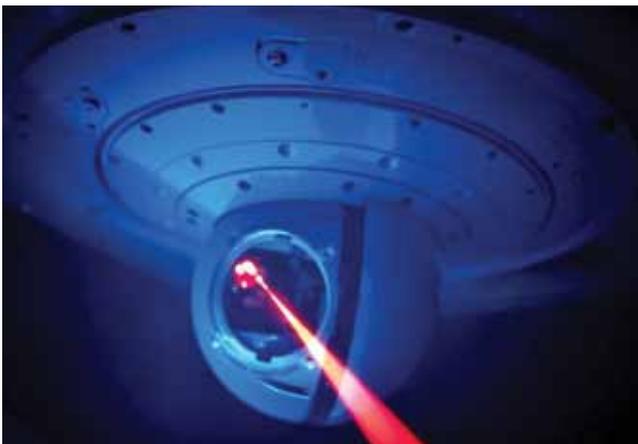
Al-Qahtani Aviation, parent company of Saudi Gulf Airlines, and CFM International have signed a purchase agreement for LEAP-1A engines to power 10 firm, 10 option A320neo family aircraft that are scheduled for delivery in 2023. The airline is also leasing an additional 20 LEAP-powered A320neo aircraft with delivery of first aircraft planned for 2020.

Emirates, Etihad, flydubai and Air Arabia in unique flypast



Emirates, Etihad, flydubai, Air Arabia and *Al Fursan* carried out a remarkable formation flight over Dubai to celebrate the UAE's 47th National Day. This also commemorates "the legacy and values of HH Sheikh Zayed, the late founding father of the UAE". The formation flight showcased the country's aviation success story, being a world-first and a UAE civil aviation milestone, which involved over 11 aircraft: a flydubai Boeing 737 MAX 8 (*Zayed 1*), an Air Arabia Airbus A320 (*Zayed 2*), an Etihad Airways Airbus A380 (*Zayed 3*) and an Emirates Airline Airbus A380 (*Zayed 4*), as well as seven MB 339s of the *Al Fursan* aerobatic display team from the UAE Air Force.

NGC Contract for Infrared Countermeasures Systems



Northrop Grumman Corporation has received a \$3.6 billion "indefinite delivery, indefinite quantity" award for Large Aircraft Infrared Countermeasure (LAIRCM) systems and support from the US Air Force, the initial task order, for \$2.4 million concerning logistics support services.

Russian hypersonic missile tested

According to Russian President Vladimir Putin, a new hypersonic anti-ship missile, with maximum speed of Mach 8 or 6,000 miles an hour or 1.7 miles a second, has been tested for the fifth time. The missile, identified as Zircon, is multi purpose, for both anti-ship and against land-based targets and expected to enter production in 2021 going into service with the Russian Navy in 2022. Under development by NPO Mashinostroyeniya Military-Industrial Corporation, this could well be a new version of the Indo-Russian BrahMos II hypersonic missile system.

Boeing-Leonardo Team selects FLIR EO/IR

FLIR Systems have announced their selection by Boeing to provide the FLIR Star SAFIRE 380-HDc EO/IR surveillance sensor for the United States Air Force's current fleet of USAF UH-1N helicopters, which support the service's nuclear intercontinental ballistic missile bases in Wyoming, Montana and North Dakota.



"China, China, China"!

Patrick Shanahan, acting US defence secretary, started his first full day at the Pentagon on 2 January 2019 by stating "While we are focused on ongoing operations ... remember China, China, China"! He told key Defence Department staff to focus on the National Defence Strategy, a broad review that highlights a new era of "Great Power competition" with Russia and China. The US accuses China of an ongoing pattern of military and economic espionage and has criticised China's ambitious "Belt and Road" trade and infrastructure initiative as being a form of economic coercion.

Pak-China joint military exercise 'Warrior VI'

The sixth Pakistan-China Joint Military Exercise 'Warrior VI' was held in late December 2018 and culminated near Kharian in Pakistani-Punjab. Troops from Special Forces of both Armies participated in the exercise which was aimed at "sharing respective



experiences in the field of counter terrorism operations and to learn from each other's expertise". Inspector General Training and Evaluation, Lieutenant General Sher Afgan met the participating troops on last day of the exercises, along with Major General Chen Wenrong of the Chinese Army (see picture).

M-20B anti-ship ballistic missiles for Pakistan ?

A shorter range version of the Chinese Dong Feng-21D anti-ship ballistic missile (ASBM), which has the ability to strike at targets at sea over 1500 kms away ("carrier killer") has reportedly been developed. This, the M-20B, with a range of 280 kms and adhering to the missile technology control regime (MTCR), has reportedly been offered to Pakistan "which could have serious implications for the Indian Navy." According to Vice Admiral Pradeep Chauhan, Director of the National Maritime Foundation, if such missiles are arrayed along the Makran coast of Pakistan, these could well sanitise approaches to Karachi and Gwadar ports and "complicate our operational calculations".

Chinese Type 054AP stealth frigates for Pakistan

China is building four Type 054AP stealth frigates for its "all-weather ally" Pakistan, as part of the major bilateral arms agreement between the two countries. Equipped with modern detection and weapon systems, these are equipped for anti-ship, anti-submarine and air-defence operations and are being constructed at the Hudong-Zhonghua shipyards in Shanghai. This class of Chinese multirole frigates (NATO codename *Jiangkai II*) first entered service



with the People's Liberation Army Navy Surface Force in 2007 and are equipped with HQ-16 medium-range air defence missiles plus various anti submarine rockets in a VLS system, sited between the two rows of rectangular launching tubes and also capable of firing anti-submarine rockets.

US law on the 'Indo-Pacific'

President Donald Trump has signed into law a legislation aimed at enhancing America's leadership in the Indo-Pacific region, strengthening multifaced ties with India and reacting to Chinese actions that "undermine the rules-based international system". Recognising the vital role of the strategic partnership between the United States and India in promoting peace and security in the Indo-Pacific region, Section 204 of the Act calls for strengthening and broadening of diplomatic, economic, and security ties between the two countries. The Indo-Pacific is a bio-geographic region, comprising the Indian Ocean and the western and central Pacific Ocean, including the South China Sea.

Chinese probe lands on moon's 'far side'

A Chinese space probe successfully touched down on far side of the moon on 3 January 2019, which is seen as an important step in China's space programme. After the 'soft landing' the Chang'e-4 lunar probe, transmitted the first-ever 'close range' image of the dark side of the moon, lifting a mysterious veil from far side of the moon which has "opened a new chapter in human lunar exploration".

The probe, which includes a lander and a rover, touched down at a preselected landing area, the official Xinhua news agency later posting a wide-angle colour picture of a crater from the moon's surface. The tasks of Chang'e-4 include astronomical observation, surveying the moon's terrain, landform and mineral composition, plus measuring the neutron radiation and neutral atoms to study the environment on the far side of the moon, according to the China National Space Administration has stated.



Airbus Commercial Aircraft in 2018



Continuing record deliveries

Airbus delivered 800 commercial aircraft to 93 customers in 2018, meeting its full year delivery targets and setting a new company record. Deliveries were 11 percent higher than the previous record of 718 units, set in 2017. For the 16th year in succession, Airbus has increased the number of commercial aircraft deliveries on an annual basis. In terms of sales, Airbus received 747 net orders during 2018 compared with 1,109 in 2017. At the end of 2018, the backlog of Airbus commercial aircraft had reached a new industry high and stood at 7,577 aircraft, including 480 A220s, compared with 7,265 at the end of 2017.

Over the last 16 years, Airbus has steadily increased production year-by-year with the final assembly lines in Hamburg, Toulouse, Tianjin and Mobile complemented by the addition of an A220 line in Mirabel, Canada during 2018. A notable contribution to Airbus' delivery increase in 2018 came from the final assembly lines in the US and China. For the top-selling A320 Family in particular, the Final Assembly Line (FAL) in Mobile, Alabama, saw its 100th delivery, which is now producing in excess of four units per month. Meanwhile, Airbus' *FAL Asia* in Tianjin, China, achieved its 400th A320 delivery, while in Germany Airbus commenced operations of its new, fourth production line in Hamburg. Overall, the A320 Family programme is on track to achieve rate 60 per month by mid-2019. "The Airbus teams successfully reached an important industrial milestone for the A350, achieving the targeted rate of 10 aircraft per month."

CDB Aviation 100th A320

CDB Aviation, a wholly owned Irish subsidiary of China Development Bank Financial Leasing Co., Limited has taken delivery of its 100th Airbus A320 Family aircraft. The A320neo aircraft, which will be operated by India's low-cost carrier Go Airlines Ltd. is part of a purchase and leaseback agreement signed with the carrier earlier in 2018. The delivery marks the overall 125th Airbus aircraft to join the lessor's fleet.

400th A320 assembled in FAL Asia

Airbus has delivered the 400th A320 Family aircraft from its Final Assembly Line Asia (FALA) in Tianjin, China. The A320neo was delivered to national flag carrier Air China based in Beijing. Powered by Pratt & Whitney GTF latest generation engines, the aircraft features a two-class cabin layout with 158 seats: 8 business and 150 economy.



JetBlue Airways order 60 Airbus A220-300s

JetBlue Airways has firmed its order for 60 A220-300 aircraft, the larger model of the new A220 series. JetBlue's existing Airbus fleet includes 193 A320 and A321neo aircraft in operation, with an additional 85 A321neo aircraft on order.



Moxy orders 60 Airbus A220-300s

The start-up US airline Moxy has signed a firm order with Airbus to purchase 60 A220-300 aircraft. Moxy is the new airline venture led by David Neeleman, one of the industry's most innovative entrepreneurs and founder of JetBlue Airways. In addition to JetBlue, Neeleman also founded Azul Brazilian Airlines and is the controlling investor in the revitalisation of TAP Air Portugal.

First ANA A380 in unique livery

The first A380 for All Nippon Airways (ANA) has rolled out of the Airbus paint shop in Hamburg, Germany, bearing the airline's distinctive and unique Hawaiian Green Sea Turtle livery. ANA has firm orders for three A380s, becoming the first customer for the mega airliner in Japan.



First A330-900 to launch operator TAP Air Portugal

TAP Air Portugal has taken delivery of the first new A330neo the Portuguese carrier to take of a further 20 A330-900s in the coming years. TAP Air Portugal's first A330-900 is leased from Avolon and features 298 seats in a three-class lay-out with 34 full-flat business class, 96 economy plus and 168 economy class seats.



100th A320 Family aircraft from Mobile

Airbus has delivered its 100th aircraft from the company's US manufacturing facility in Mobile, Alabama, the A320neo delivered to Frontier Airlines. Airbus' Mobile facility is delivering four A320 Family aircraft per month having delivered to eight US-based customers thus far, including Air Lease Corporation, Allegiant Air, American Airlines, Delta Air Lines, Frontier Airlines, Hawaiian Airlines, JetBlue Airways and Spirit Airlines.



SaudiGulf Airlines order 10 more A320neos

Al-Qahtani Aviation, owner of SaudiGulf Airlines, has signed an agreement to purchase ten A320neo family aircraft. SaudiGulf Airlines currently operates a fleet of six A320 aircraft from its hub in Dammam.



Delta Air Lines order 10 additional Airbus A330-900s

Delta Air Lines has ordered 10 additional Airbus A330-900 widebody aircraft, expanding their A330neo order book from 25 to 35 aircraft. Simultaneously, Delta and Airbus will defer 10 previously ordered A350 XWBs to 2025-26 as part of the airline's long-term growth strategy. Delta currently operates 11 A350-900 aircraft and expects a further four in 2019-2020. Delta's A330 fleet today includes 42 widebody aircraft.



Avolon order 100 A320neo Family aircraft

Dublin-headquartered aircraft lessor Avolon has firmed an order for 75 A320neos and 25 A321neos, the single largest order for Airbus aircraft ever placed by Avolon. The agreement takes Avolon's cumulative orders with Airbus to 284 aircraft (240 single-aisles and 44 wide-body aircraft) including the A321neo, the A330neo and the A350 XWB. 🦋

CRUZEX 2018



INTERNATIONAL EXERCISE IN BRAZIL

The Brazilian Air force (FAB) hosted an international exercise CRUZEX at Natal Airbase in the north of Brazil from 18 to 30 November 2018. FAB has been conducting this exercise past 16 years which has now become one of the biggest multinational exercise in South

America. One of the participating countries in the 2018 CRUZEX edition was the Royal Canadian Air force, which first joined the CRUZEX exercise in 2013.

The RCAF participated in CRUZEX 2018 on a broader level to back its Global Engagement Strategy (*Strong, Secure,*

Engaged) which enables RCAF to strengthen its ties with Brazil and other participating nations. The RCAF operates all over the world and also support humanitarian relief missions and disaster response. Canada participated with two CC-130J Hercules along with nearly forty personnel (*image above*).



Brazilian F-5E Tiger II



USAF F-16C

The two CC-130J Hercules flew in from Trenton Airbase in Canada with all personnel, mainly from 436 Squadron and some members of the Army Advanced Warfare Centre. The Canadians had to adjust to the Brazilian climatic conditions as back in Canada, the temperature was

minus 20 degrees, in Brazil, the average temperature was plus 30 degrees! During the CRUZEX exercise, both Hercules flew two missions a day, practicing tactical missions.

CRUZEX provides modern combat training in combined operations with participating countries. In a typical scenario,

personnel are given air task orders with objectives, with one team conducting offensive actions simulating the invasion of a fictitious country. The second team conducts actions trying to defend against the aggressor. To make it more complicated, the area where the action took place, in



Brazilian Navy A-4 Skyhawk



Brazilian Embraer E-99 AEW & C

Also Participating :

Country	Aircraft Type
Brazil	A-1A/M (AMX)
	A-4 Skyhawk
	A-29 Super Tucano
	C-105 (CN-235)
	C-130 Hercules
	F-5E/EM Tiger II
	H-36 Caracal
E-99 Embraer	
Canada	CC-130J Hercules
Chile	F-16 A/B
	KC-135 Stratotanker
France	CN-235
Peru	Mirage 2000 B/C
	A-37 Dragonfly
Uruguay	A-37 Dragonfly
United States	F-16C
	KC-135 Stratotanker

some CAMAO exercises, had almost 57 aircraft flying simultaneously. Coordination was the key to success and in CRUZEX, coordination between all participants with different doctrines and assets was quite

challenging. The RCAF spokesman complimented the Brazilian Air Force, as CRUZEX 2018 was very well organised! 🇺🇸

Henk de Vries

[Thanks to Lt Iris from the Brazilian Press Office and Cpt Trevor Reid from the Canadian Armed forces for their hospitality and cooperation.]



Brazilian H-36 Caracal



USAF European Special Operations

RAF Mildenhall in the UK is home base of the United States Air Force (USAF) 352 Special Operations Wing (SOW) flying the CV-22B Osprey and the MC-130J Commander II. The unit is scheduled to move to Germany in few years, the country where the unit was originally raised in 1964. *Vayu* recently visited the unit which operates mainly after daylight.

Mission

The 352 SOW is part of the US Air Force Special Operation Command (AFSOC) with its headquarters at Hulbert Field, Florida USA. AFSOC also employs the other regional, but not US-continent based, 353 Special Operations Group at Kadena Air Base, Japan. The AFSOC organises, trains and equips personnel to execute global special operations and provides Air Force Special Operations Forces (SOF) for worldwide deployment and assignment to regional unified commands. The command's SOF are composed of highly trained, rapidly deployable personnel, conducting global special operations missions ranging from precision application of firepower, to infiltration, exfiltration, resupply and refueling of SOF operational elements. The Mildenhall 352 SOW plans and performs, specialised operations using advanced aircraft, tactics and air refueling techniques to transport and resupply military forces. Furthermore, infiltrating, exfiltration and resupplying of Special Forces by air drop or air land, often intruding politically sensitive or hostile territories. Thus the aircraft fly primarily missions at night to reduce probability of visual acquisition and intercept by airborne threats.

Unique Aircraft

In 2012, upgradation of 352 SOW started and the first 67th SOS *Night Owls* was transformed with brand new MC-130J Commando II aircraft. The MC-130J is a two-pilot flight station with fully integrated digital avionics, multifunctional liquid

crystal display, head-up displays, improved defensive, navigation, refueling and communication systems, as well as new updated engines. The crew includes two loadmasters and a Combat Systems Officer (CSO). The CSO manages the mission and integrates systems and crew with the aircraft commander to collectively achieve and maintain situational awareness and mission effectiveness. The other squadron, 7th SOS, replaced its MC-130H Combat Talon II aircraft with the revolutionary new tilt-rotor CV-22B Osprey. With its unique characteristics, it is ideal for SOF ops. The CV-22 crew consists of a pilot, co-pilot and two flight engineers/loadmasters. The aircraft can carry up to 24 seated SF personnel and can be aerial refueled by the MC-130Js at low altitude to expand mission range. For self protection, a .50 calibre machine gun is mounted at the rear end ramp and operated by one of the flight engineers. The USAF Special Operations Command plans to have 51 Ospreys in operation by 2019, of which 10 are already at the 7th SOS at Mildenhall.



Back to Germany

In 2015, the US government launched a cost cutting plan to re-shape its European structure into a leaner organisation. As per the drafted plan, current Mildenhall units like the 352 SOW would re-locate to Spangdahlem, Germany, which is in fact close to where the unit was located at Sembach AB in 1964. It is expected that the 352 SOW will move around 2022, with a detachment already preparing steps required for the re-location such as construction work and concurrently also planning the logistics of moving men and equipment. Amongst the preparations was one to capture acoustic signatures of the CV-22 in different configurations. Ospreys then visited Spangdahlem AB several times for acoustic tests. Various special manoeuvres such as approaches and take-offs at various heights and directions, hovering and taxiing were executed and monitored under responsibility of German Defence Command, partnering with the USAF, to be



MC-130J Commando II at RAF Mildenhall

used to develop noise models that will help establish noise protection zones around Spangdahlem.

Although the 352 SOW continues its regular training flights out of Mildenhall, the unit is simultaneously preparing themselves for the future. Germany is being visited more often and partnership with German SOF units has increased.

For example, recently concluded autumn Special Forces exercise “Nighthawk 2018” at Karup Air Base, Denmark, where several Ospreys and a MC-130J trained closely with German CH-53Gs and EC-645T2s of *Kommando Spezialkräfte* – KSK (German special forces command) for two weeks. 🦅

Text and photos: Peter ten Berg



Air refueling pod of C-130J with retracted basket and signal lights to guide receivers at night



Osprey turning in for landing while tilt rotors turn into horizontal position



CV-22 loadmaster providing visual information to pilot during taxiing



Interior of CV-22 in Special Forces troop configuration with fast rope and .50 machine gun



Mildenhall 7th SOS flight line, with CV-22Bs rotors in horizontal and vertical position

The new shape of Turkish Army Aviation

CH-47F Chinooks



Requirement for heavy transport helicopter supply for Turkish Army Aviation emerged while fulfilling these important tasks and dates back to the early 1990s. Although the criticality of air transportation and operations, especially in the fight against terrorism and in internal security operations has been increasing, in a country such as Turkey which is surrounded mostly by mountainous terrain, no serious steps were taken in the procurement of helicopters. This was mainly because of political unrest, tension between countries and many economic crises that Turkey had experienced. Even the purchase of second hand helicopters did not happen owing to the absence of approval from the US Congress.

On 30 June 2006, the first positive steps were taken to acquire the heavy load helicopters that the Land Forces Command required. For this purpose, proposals were requested for the Boeing CH-47 Chinook and Sikorsky CH-53K. After conducting extensive trials, it was decided to opt for the Boeing CH-47 Chinook. Sales approval of the helicopters, to be supplied under the Foreign Military Sales, was given by the US Congress in December 2009 and negotiations with Boeing begun. The approved package

The Turkish Land Forces have considerable experience in air-mobile operations with helicopters. In internal security operations and during the *Euphrates Shield* and *Olive Branch* operations in Syria, helicopters were an important part, inducting special troops behind enemy forces with these air-mobile operations. Helicopters have performed key tasks in the transportation of troops, supply of materials and other requirements in the southeastern border regions in varied geographical conditions.





included 14 CH-47F Chinook helicopters, 32 T55-GA-714A turbine engines, 28 AN/ARC-201E single channel ground and airborne radio systems (SINCGARS), 14 AN/APR-39A(V)1 radar signal detecting sets, support equipment, personnel training and training equipment, ferry services etc at an estimated cost of \$1.2 billion. Following negotiations, 5 more CH-47 helicopters were ordered by the Defence Industry Executive Committee on 7 January 2015, for a total

of 11 CH-47F Chinook helicopters to be purchased. 6 of the helicopters were for the Land Forces Command, 4 for Special Forces Command and 1 for the Ministry of National Defence.

Strategic and logistics location of the helicopters was carefully considered which was decided to be Güvercinlik Air Base of the Army Aviation Command in Ankara. Since the CH-47F Chinook helicopters were of a different class compared to

other lighter and medium transport/utility helicopters with the Army Aviation Command, a new maintenance unit and helicopter battalion was created for operation of these CH-47F helicopters in Ankara. Under the 1st Army Aviation Regiment Ankara, a Heavy Lift Helicopter Battalion was established. The first 3 helicopters in inventory of the Land Forces Command were brought to Izmir port on 14 July 2016 by sea, the other 3 in November of the same year. The helicopters then flew from Izmir to Güvercinlik and delivery of 6 helicopters for the Army Aviation Command completed. In August 2018, the helicopter ordered for the Ministry of National Defence, to be operated by the Turkish Army Aviation Command, joined the inventory. It is planned that CH-47F helicopters of the Special Forces Command would be delivered in mid-2019, with a fast drop feature under the body.

The CH-47F helicopters in Turkish Army Aviation Command, have a crew of 5 : 2 pilots, 2 technicians and 1 ramp operator. Accommodation is for 33 troops, but which can be increased to up to 55. If required, the helicopter can be transformed into a flying hospital as well, housing 24 stretchers. Three machine guns can be mounted as required, two on the right



Turkish Army Aviation Chinook and Blackhawk in formation flight



and left window and one on the ramp. (Its maximum mission time is 2 hours and 15 minutes). There are various self-protection systems, such as the Common Missile Warning System, APR-39 Radar Warning Receiver and Infrared Suppression System.

After the CH-47 Chinook helicopters joined the Turkish Army Aviation Command, intensive training activities were carried out in coordination with the Turkish Land Forces Commandership's Land Units and other Force Commands. 🇹🇷

*Text and photos by
Onur Kurc & Tayfun Yaşar*



'Flying Tigers' of 74th FS Win !



Hawgsmoke 2018

The Michigan Air National Guard also brought their special color bird to the competition (Photo: Stefan Goossens)

While the very expensive B-2 Spirit normally steals the show in and around Whiteman Air Force Base in Missouri, it was all about the A-10s in mid-October 2018, the base being temporary home for numerous Warthogs participating in *Hawgsmoke 2018*. From 17 to 20 October 2018, 303d Fighter Squadron hosted the exercise *Hawgsmoke 2018* at Whiteman. Since the rules state that the same unit cannot host the event twice in a row and with the *Dogpatchers* of 47th FS winning the exercise in 2014 and 2016, it was up to another unit to take care of this year's edition. So *KC Hawgs* stepped in.

Hawgsmoke is an aerial gunnery competition between active duty, Air National Guard and Air Force Reserve A-10 squadrons. Since 2000, this exercise is organised after every two years. This year, A-10 Thunderbolt II squadrons participated with teams of four aircraft, pilots and ground crew to compete against each other. Besides a competition, *Hawgsmoke* can also be considered as a gathering of A-10 pilots with opportunities to exchange notes, show and hone skills, discuss strategies and experiences. It started with the arrival of the teams at Whiteman AFB on 17 October 2018. Same day, ACC A-10 demonstration team gave a stunning demo and under the watchful eye of many colleagues, the pilot made sure that it was impressive. The demo was followed by the *Lost Hawg* ceremony.

The actual gunnery and bombing competition was flown on Thursday 18 October. Twelve participating teams took part, in the following order:

- 303d FS, Whiteman AFB, Missouri
- 358th FS, Whiteman AFB, Missouri
- 75th FS, Moody AFB, Georgia
- 354th FS, Davis-Monthan AFB, Arizona
- 107th FS, Selfridge ANG Base, Michigan
- 47th FS, Davis-Monthan AFB, Arizona
- 190th FS, Gowen Field ANG Base, Idaho
- 104th FS, Warfield ANG Base, Maryland

- 163d FS, Fort Wayne ANG Station, Indiana
- 357th FS (using 354th FS jets), Davis-Monthan AFB, Arizona
- 76th FS (using 303d FS jets), Moody AFB, Georgia
- 74th FS (using 75th FS jets), Moody AFB, Georgia

The last three teams didn't bring their own aircraft, but borrowed them from fellow competitors.

Hawgsmoke 2018 project officer, Maj *Fodog* Glen, had drafted five tasks to be completed during the competition. After take-off, teams received the coordinates of a convoy of trucks. Each team had to locate and identify these targets and perform an attack with inert Mavericks. The teams then continued towards the Cannon Range, Missouri for four more events, three including dropping of GBU-33 practice bombs and finishing with strafing runs. For that, the awesome GAU-8/A Avenger Gun was employed. Each A-10 was equipped with 100 rounds to hit the target. With each aircraft making at least two strafing runs (the first to qualify, followed by one or two longer runs), the cannon range visitors enjoyed over 100 *BRRRTs* during the day.

The 74th Fighter Squadron (*Flying Tigers*) of Moody AFB, Georgia, top team of *Hawgsmoke 2018* was bestowed with Al *Mud* Moore Trophy during the Awards Banquet on 19 October. Capt *Pinch* Vincent, Capt *Otter* Ott, Capt *2Sock* Razack and Lt *Hack* Goodman were honoured with Top Tactical and Top Conventional Team awards. "Hawgsmoke presented opportunities to get creative with our weapons delivery, but the judges did all they could to throw us curveballs in our weapons events," said Ott. "For example, our low altitude bombing attack was a delivery that only one person in the flight had ever actually executed, so we had to adjust and really think through how we would execute." With 74th FS winning, Moody AFB will host *Hawgsmoke 2020*.

We would like to thank Lt Col. Walter, TSgt Jennings and SrA Kleyh for the hospitality and cooperation! 🦁

Stefan Goossens / 4Aviation and Michel van de Mheen



A-10s of the winning team at the platform of Whiteman AFB after the competition. (Photo: Stefan Goossens)



For each Hawgsmoke exercise a new patch is designed. The patch is worn by all participants during the exercise (Photo: Stefan Goossens)



The location for Hawgsmoke 2018 was Whiteman AFB, also home of the B-2 Spirit fleet of the USA (Photo: Stefan Goossens)



The cannon range saw 48 A-10 aircraft attacking on 18 October 2018. Impressive sights and sounds throughout the day (Photo: Michel van de Mheen)



Famous for its GAU-8/A Avenger gun, the A-10 is an asset well respected by the military (Photo: Stefan Goossens)



Ground crew make sure that all aircraft are ready for action all the time (Photo: Michel van de Mheen)



Teamwork was key during Hawgsmoke (Photo: Stefan Goossens)



"Rock on", this A-10 prepares for action ! (Photo: Michel van de Mheen)

Ancient Aviator Anecdotes



Air Vice Marshal Cecil Parker recollects...

The last of the few

28 October 2018 marked the 66th anniversary of my bail-out from a Tempest aircraft on fire while undergoing my fighter conversion at CTU Hakimpet in 1952. On that date I was still in my teens and was probably the youngest Indian member of the Caterpillar Club. It continues to remain one of the more unforgettable experiences in my life. Many years later, while researching for articles on the safety record of the Tempest IIA—and Indian membership of the Caterpillar Club—Air HQ made available to me their entire flight safety data. Both articles have since been published but it was the one on the Tempest that elicited many responses from aviation enthusiasts with air force ancestry in the Spitfire and Tempest era of the Indian Air Force.

The data provided to me was recorded only from 1950 onwards and for earlier years I had to depend upon the personal recollections of my seniors who were very helpful and headed by our late MIAF Arjan Singh, DFC. Partition had left our fledgling

air force with a truncated inventory of trainer aircraft (Tiger Moth and Harvard), some combat aircraft (Spitfire and Tempest) and T/ME transport / bomber (Dakota and Liberator). Thanks to World War II however, we had a young but experienced corps of aviators, technicians and administrators who laid the foundation of the IAF post-Independence in 1947. It was they who ensured that nascent Indian military air power (Dakota and Tempest) was provided immediately and effectively for air support in the 1947-48 operations in Kashmir.

The Tempest IIA (a mark flown only by the IAF) served the IAF from 1946-53. It did not have a very good safety record owing to the many connecting-rod failures in its suspect Centaurus aero-engine. In the early 1950s, No. 4 Squadron in Poona had a 3-D sequence of Tempest fatalities: first Sqn Ldr Ken David (CO), followed by Fg Offr Divecha (ex 56 PC) and Plt Offr Dave (ex 57 PC). The story doing the rounds then was that Air HQ immediately posted out Flt Lt Desa – but I cannot vouch for that!



Rare photograph of Hawker Tempest II in early RIAF 'chakra' markings with No.1 Squadron 'Tiger' crest painted front of the cockpit



Tempest IIs of the IAF's No.8 Squadron with the standard saffron-white-green roundels adopted in 1948

Meanwhile in late 1952, 14 of us from No 58 PC (Pilots Course) had our own trio of Tempest accidents at Hakimpet. The first was a dead-engine wheels-up forced landing on the side of the runway done very well by one of my coursemates. This was followed by my own bail-out which is the only recorded successful one from a Tempest. The third was the unfortunate first fatal accident in our course post-commissioning; we lost our naval aviator trainee who went down with his aircraft. There were reports of similar mishaps and accidents from Barrackpore, Ambala and Jammu. The Tempest was grounded and the 13 of us joined the generation of pilots who transitted directly from piston-engined aircraft to jets (Vampire FB Mk.52) as type-trainers and simulators were still in the future; we learned to cope.

With the passage of time there must now be very few of us ancient aviators alive who have flown Spitfires and Tempests. Since these two aircraft were grounded or decommissioned in early 1953, my pilots course was the last to have flown them. Of the 13 of us who graduated from CTU Hakimpet in December 1952, five are still very much around. For the record (and benefit of any future historian) these are: Wg Cdr MW Tilak (4331) in Perth WA; Sqn Ldr RC Mariano (4357) in Adelaide SA; Wg Cdr RL Badhwar (4341) in Gurugram; AVM DE Satur (4339) in NOIDA and this writer (4346) in Secunderabad. Their average age is a shade older than our air force which marked its 86th anniversary on 8 October 2018. For these last of the few the experience will remain a collective #WeToo memory.

Politics, religion and sex

If the reader is expecting an intellectual dissertation on the titled subject(s), he/ she will be disappointed and is advised to read no further. In the air force academy 67 years ago, we teen-aged flight cadets were taught that 'officers-and-gentlemen' must never (R) never discuss 'politics', 'religion' or 'sex' in any officers mess. The origin for this social injunction was traced to 'Customs of the Service' authored by one Gp Capt Stradling of the RAF in the 1940s. Since the IAF evolved from the RAF, many of the latter's policies on

training, tactics and traditions were continued by our air force till we created our own.

One lasting legacy from our ex-colonial rulers is the apolitical nature of our armed forces. As a college student in the late 1940s in Kolkata (then Calcutta), politics was only a word, but at that stage most of us lads were football crazy, both on the field and in support of our favourite team(s). A certain 'forward looking' political party let it be known that members of its youth wing would get free tickets to the forthcoming IFA cup finals. This was incentive enough to sign up. We were required to march up and down College Street carrying banners and shouting the refrain to protest or demand slogans in both English and Bengali. At the end we were given a motivational talk and a coupon for a cup of coffee and a cutlet at the Coffee House. It was great fun but in a few months, the strict warden of our hostel (a Belgian Jesuit father) got wind of our Sunday outings and put a stop to some promising political careers! (Thankfully the IFA finals were also over).

In the course of my final interview at the Air Force Selection Board in 1950 my IO (Interviewing Officer) casually asked if I had ever been involved in politics. I was unsure how to answer so decided to share the political experience related above. He merely smiled and advised me to stay away from politics if I were selected. I joined the air force in 1951 and was soon immersed in the joys of learning how to fly and making new friends from communities all over India. Religion per se had always been a personal issue but thanks to my colleagues and new friends I had the opportunity and privilege of visiting gurudwaras, temples, mosques, a synagogue (in the USA) and various denominations of churches in many countries. I came to learn and better understand the strengths of differing faiths/ beliefs. Almost every single-engined, single-cockpit fighter pilot has, at least once in his flying career, muttered 'Oh God' when faced with a sudden, unexpected emergency in the air, and this includes declared atheists! This did not make us any more or less religious but it certainly sharpened our flight safety practices.

To the generation of my youth, the word 'sex' related exclusively to gender and certainly not to any activity. Of course the subject of 'girls' was of great interest to young lads learning to cope with hyper active hormones. However, in those days, having a girl

friend involved no more than holding hands but had the promise of being invited to a home cooked meal – a pleasurable change from mess food! Since we young bachelor officers moved frequently

on postings, the quest for home cooked meals had, on occasion, to be periodically repeated !

Our media today (print/ electronic and professional/ social) is replete with the three topics of politics, religion and sex. Our flight cadets of today, which includes young ladies, are freely exposed to the media and are certainly more knowledgeable than my generation at the same point of time. I sometimes wonder if the prohibited subjects are still under embargo or perhaps, with the passage of time, discarded by default in the Indian Air Force of 2019? 🦋

To all my readers, a Happy New Year !

Reader's Respond

Mail from Gp Capt CA Dalton of the Canberra Association, Pune

Sir,

For your kind information please, there are a few inaccuracies in the *Vayu* article 'Out of Africa' in your issue (V/2018) which are important enough to be pointed out.

- Hammarkjld died on 18 September 1961 not 1960.
- Flt Lt MM Takle was also awarded the VrC along with Wg Cdr Soares
- Sqn Ldr Wilson (not Flt Lt) was part of the second Canberra detachment, not the first.
- The term 'motley' used for the air element (actually the UNEF : United Nations Expeditionary Force) is needlessly derogatory.
- The second Canberra Detachment in the Congo has barely been acknowledged.

Thank you Group Captain, points taken !

We quote from 'Tusker Charge : Illustrated History of No.5 Squadron, IAF :

A second detachment from No.5 Squadron, which served with ONUC from February to October 1962, was led by Wing Commander (later Air Marshal) Saroj Jena. There were no "shooting opportunities" for this second detachment, but they provided road and airfield reconnaissance services, both visual and photographic, as well as occasional cover for transport and search-and-rescue missions.

Synonyms for 'motley' include "miscellaneous, disparate, diverse, assorted, sundry, varied, mixed, diversified, heterogeneous ..." no offence meant !

Also reproduced are some images of No.5 Squadron's intrepid personnel and aircraft in the Congo 1961-1962. 🇺🇦



Then Wg Cdr AIK Soares, CO No.5 Squadron with aircrew at Elizabethville in the Congo, October 1961



Tuskers in the Congo : Pete Wilson is the tallest at the centre with 'Pete' Gautam standing third from the left



The top middle image shows two IAF Canberras flying in formation with a pair of Swedish J.29s and a pair of Ethiopian F-86 Sabres, which epitomises the nature of the United Nations effort in the Congo

25 Years Back

From Vayu Aerospace Review Issue I/1994

AVIA India'93 : The First Bangalore Air Show

The Governor of Karnataka formally inaugurated the first ever international air show in the country – *Avia India'93* – billed as one of the biggest aviation events in South Asia which put “Indian aviation on the world map”. The flying display was flagged off by Chief of the Air Staff, Air Chief Marshal SK Kaul, in the afternoon at Air Force Station, Yelahanka. Of significance, the airshow, which saw about two hours of flying displays daily, coincided with the 90th anniversary of heavier-than-air flying when the Wright Brothers flew the Kitty Hawk way back in 1903 on 17 December, which also marked Golden Jubilee on the Aeronautical Society of India.

Momentous and historic decisions

The last weeks of 1993 witnessed India's first international air show and exposition (*covered and analysed extensively in the issue*) and the mood is upbeat as the economic indicators continue to swing positively. In the civil aviation sector, 1994 must witness some momentous and historic decisions. Firstly, the repealing (or at least much modifying of) the Air Corporations Act of 1953. The moment of truth is nigh : the Light Combat Aircraft (LCA) prototype is to “roll-out” in mid-1995 : the Advanced Light Helicopter (ALH) must complete its test flying over the next 18 months : the Pilotless Target Aircraft (PTA) must go into service soon, the various missile programmes must mature in the year ahead.

No Shows !

Allowing for the fact that this was the very first air show of its kind, the types of aircraft, the variety and the flying skills demonstrated, were of a high standard. As many as eight indigenous aircraft designs of different types and varieties were shown at *Avia India 1993*, some flying, some on ground, proving amply the enthusiasm and vitality of the Indian aircraft industry. Disappointingly a number of aircraft expected to be present from abroad, including the Sukhoi Su-27, Rafale, Alphajet, ATP, ATR 42/72, MiG-31 and others were absent although the parent companies were quick to reassure that this was not because of any lack of interest.

Certainly the flying display was dominated by the aviation wing of the Indian Navy. Where was the Indian Air Force during the main flying display ? Even the Mirage 2000, a type long in the IAF's service had to be displayed by the French Air Force ! Was the abstinence deliberate, or because of bureaucratic hurdles ?

Akash SAM test-fired

The DRDO-developed *Akash* surface-to-air missile was successfully test fired at the interim test range, Chandipur-on-Sea on 4 February. The 650-kg *Akash* missile has range of 25 km and is designed to function with the *Rajendra* phased-array radar, which has multiple target capability. Meanwhile, the Prithvi surface-to-surface battlefield missile (SSBM) formed part of the military parade marking the country's 44th Republic Day.

5-Year plan for Coast Guard

The Ministry of Finance has approved the Five-Year Coast Guard Development Plan for the period 1992-97. The total budgetary allocation has been finalised at Rs 1,223 crore for the plan period, but is far short of the Coast Guard's own projection of roughly about Rs 2,000 crore. In the absence of a plan allocation so far, the Coast Guard had been meeting its expenditure from supplementary grants provided by the government, resulting in an inability to do long-term planning for expansion.

India's role in an 'All-Asian Airliner'

Indian Ambassador to China visited Hindustan Aeronautics Limited Bangalore on 17 January 1994, was received by Dr CG Krishnadas Nair, Managing Director, Bangalore Complex and shown around the facilities. The Ambassador was briefed on the recent MOU signed by HAL with Daewoo Heavy Industries Ltd., South Korea for production of the proposed 100-130 seater *Asian Airbus* airliner to be jointly developed between India, China, South Korea and Singapore. Considering that the aerospace industries in both India and China have large infrastructure skills and capabilities to produce structures for civil aircraft, there are opportunities for co-operation between the two countries.

US Fly-By-Wire System for LCA

India's much-delayed Light Combat Aircraft (LCA) project came a step closer to reality in late November, when Martin Marietta was awarded a contract to supply the fighter's fly-by-wire (FBW) flight control system. They will work with the Aeronautical Development Establishment (ADE) to design, develop and produce the hardware, software and test equipment for the planned quadruplex FBW system. Other foreign contractors already involved in the LCA project include Ericsson and Ferranti assisting in the development of the aircraft's multi-mode pulse-Doppler radar, and Dowty and Smith Industries, which are supplying the full authority digital engine control system. The prototypes and test aircraft will be powered by General Electric F404 turbofans, but the plan is to power the production LCA with the GTX-35V, currently being developed by the Gas Turbine Research Establishment. Dassault has been acting as a consultant to ADE on the airframe design. ✈

Griffin or Wolfpack ?



Born on the same day and bearing the same number (No.9) are two sub-continental squadrons, on different sides of the Radcliffe line. No.9 Squadron IAF were equipped with Hurricane IICs on 3 January 1944 and were soon operating in earnest during the Arakan campaign. After the war, and re-equipped with Tempest IIs, No.9 (with their *Griffin* squadron crest) were at Peshawar when the sword of partition cleaved them off and so they became the RPAF's premier fighter squadron, later flying Starfighters and presently F-16s.

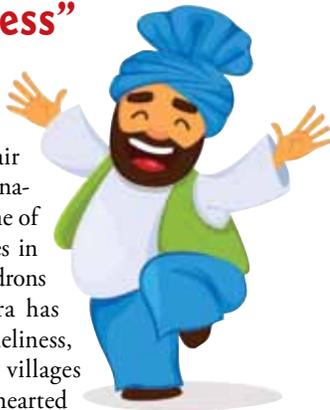
The IAF re-raised their own No.9 Squadron in March 1964, with the Gnat light fighter but did not formalise a crest till many years later, finally choosing a 'Wolfpack', the artwork being considered somewhat amateurish. Still, flying top of the line Mirage 2000s they recently celebrated their Platinum Jubilee, thus tracing their roots back to that winter day in Lahore, 75 years back.

Nostalgia or Amnesia ?

“Halwara Happiness”

Under UDAN, Halwara is to be part of the civil aviation air connectivity scheme. One of the IAF's first post-partition air stations, Halwara, off the Ludhiana-Ferozpur road, is regarded as one of the most important fighter bases in the north. Hosting frontline squadrons since the early fifties, Halwara has acquired a reputation for homeliness, being surrounded by Punjabi villages with their characteristic open-hearted hospitality. Through war and peace, this relationship has been nurtured and the appellation “Halwara Happiness” bestowed upon it to emphasise the relationship.

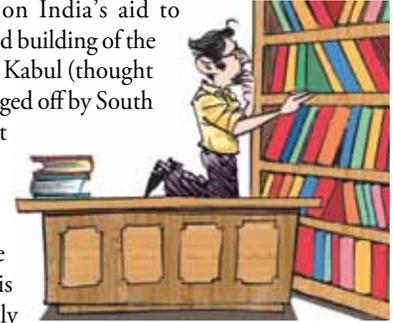
Main Sadkey Jaavan !



Better books than boots

President Trump's jibe on India's aid to Afghanistan, which mocked building of the new Afghan Parliament at Kabul (thought it was a 'library') was shrugged off by South Block with the comment instead that there was “no question of putting boots on the ground”. India's developmental assistance to that war-torn country is highly appreciated, certainly by their young generation who are looking beyond guns and mines, with cricket also now becoming a craze amongst young Afghans.

Howzat ?



Jumbo to Kullu



Leading Indian newspapers announced that Air India have resumed its regular flights between Chandigarh and Kullu in the Himalayas, the flights having been cancelled in mid-December owing to bad weather conditions. Hooray ! Except that the news item included an image of the Air India Boeing 747 Jumbo which can carry some 400 passengers but needs an international size airport, while Kullu's short runway can only accommodate a 40-seater ATR.

But when I grow up

The Gorkhas have it !

The Indian (and British) Army's have long recruited Gorkhas to serve under their colours and this proud tradition has continued for nearly two centuries. In August 1947, the all-volunteer



Indian Army retained six Rifle Regiments while four marched off with the departing British. Today, seven decades later, the ratio of manpower numbers is actually 15 : 1 and likely to remain so.

Now across the English Channel, and faced with reducing 'volunteers', the German Army are actually considering recruiting those with migrant background or even of dual nationality : yet another opportunity for the plucky Gorkhas ?

Ayo Gorkhali !

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