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Aerospace & Defence Review

II/2020

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CONTACT

DCM Shriram Industries Ltd.
Kanchenjunga Building, 6th Floor,
18, Barakhamba Road, New Delhi-110001

www.zebuglobal.com
info@zebuglobal.com
+91-8448-690982

Cover : 155mm howitzer and the ASAT on display at DefExpo 2020

(photo: Vayu)

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Published By

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

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Group Captain Jagdish Chandra Malik

Jagdish Chandra Malik 'JC' was born in 1936 at Lyallpur in undivided Punjab (now known as Faislabad in Pakistan). After the trauma of partition, his family moved east of the Redcliffe line and 'JC' was educated at schools and universities of Delhi, graduating in English Honours. He was keen to join the armed forces and was commissioned in the IAF in January 1963, thereafter serving as instructor at a Ground Training Establishment at the Air Force Administrative Collage. He served as Chief Instructor at the Jungle and Snow Survival School and conducted 40 survival courses in difficult areas.

Then Squadron Leader JC Malik established the Public Relations Unit of the IAF at Headquarters Western Air Command in 1971 and in 1976, was appointed the Public Relations Officer (Air Force) at the Directorate of Public Relations of the Ministry of Defence.

JC made significant contribution to building of the image and publicity of the IAF. Prior to and during 1971 operations, he worked ceaselessly to secure wide publicity of air operations and allied activity in the Western Sector. He also wrote a series of articles on Air Operations, besides reporting on day to day activity. For his services of very high order, spread over a decade, the President was pleased to award him with the *Vishisht Seva Medal*. "The officer performed his job willingly and cheerfully with complete disregard to his personal comfort, at odd hours and often in adverse working conditions. His work has contributed greatly to better understanding of Defence Services among the masses."

After retiring from the IAF in April 1989, 'JC' was appointed as head of Public Relations of the Airport Authority of India at Safdarjung Airport, which organisation he served till superannuating at the age of 60. He joined the *Vayu Aerospace and Defence Review* in 1996 as an Executive Editor, remaining with the Journal for the next 24 years, till the very last.

He passed away on 30 January 2020 at home in New Delhi and is survived by his wife, two daughters and their families.

RIP, 'JC'

Strategic Relations

US President Donald Trump's first visit to India will signal the continued momentum of the strategic partnership between the two countries. With a trade deal unlikely to be struck during the two-day visit, the focus will be on defence, energy and other such partnerships. For Prime Minister Narendra Modi, this visit must be about impressing on President Trump India's strategic importance to maintaining a liberal world order.

New Delhi and Washington have divergent views on the desirable nature of the world order. Yet, India's vital role in maintaining a free and open Indo-Pacific region, free from Chinese domination is appreciated by both sides.

Public pomp and show combine with pushback and tough negotiations in private on sanctions for trade with Iran and Russia and the US deal with the Taliban that is likely to hurt India's, not to speak of Afghanistan's, interests, besides bilateral trade. Though like other partner countries, India too has been at the receiving end of the Trump administration's trade-related stick, it has not come in the way of deepening the Indo-US strategic relationship.

The failure to clinch a trade deal is likely to be balanced out with defence deals such as the sale of helicopters and a missile defence system. Other issues that are likely to figure in talks between the two leaders are 5G technology and the risk posed by Chinese vendors. For its part, India must push for clear answers on Washington's plan for the Af-Pak region and the Persian Gulf, both vital to India's economic, political and military security.

The India-US relationship has strengthened despite the America First foreign policy pursued by the Trump administration. This momentum needs to be maintained.

For Prime Minister Modi and his foreign policy team, the critical task is to impress upon the US president and his advisors is that while the tussle on trade can continue and will be resolved, it should not come in the way of a strong partnership. A strong India that has strategic ties with the US, Japan and Europe is a prerequisite to ensure that China's rise remains peaceful.

From *The Economic Times*

Stress on Defence Ties

US President Donald Trump left India on the 25 February night after a whirlwind 36-hour trip, but not before sealing a $3 billion agreement for the sale of military helicopters, and with the understanding of India soon signing the Basic Exchange and Cooperation Agreement for Geo-spatial Cooperation (BECA), the last of the four "foundational" agreements which America requires of its nearest politico-military allies.

BECA is crucial to the sharing of advanced satellite and topographical data for long-range navigation and missile-targeting. India and the US have signed the other three foundational pacts — General Security of Military Information Agreement in 2002, the Logistics Exchange Memorandum of Agreement in 2016, and the Communications Compatibility and Security Agreement in 2018 — earlier, all of them by BJP-led NDA governments.

Although the Congress-led UPA, after difficult negotiations clinched the historic civil nuclear agreement in 2008, which enabled India to break the shackles of nuclear apartheid, the Manmohan Singh government was sceptical about the foundational agreements. India's armed forces-especially the IAF-were then thought to harbour an anxiety about being locked into US communications and geospatial systems as that would render incompatible the acquiring of sophisticated weaponry from other sources. This was linked to the overall geo-strategic apprehension of being hurried into a veritable alliance system - even if it wasn't called that-as the US was changing its perception of China as being a strategic adversary.

In contrast, Prime Minister Narendra Modi has actively courted the US even at the risk of depletion of India's strategic autonomy. President Trump told the media that the PM had told him that if he had been President 30 years earlier, India would have sourced its military requirements from America even back then instead of going to other countries.

At the Motera Stadium in Ahmedabad, with the US leader by his side, the PM noted the India-US "vision"-first spoken of in 2015 with President Barack Obama-was not confined to the Indo-Pacific, but encompassed the world, with India being ready to partner America on global challenges, including in the security sphere. It's another matter that India's resources are no match for such a goal, but Mr Modi's orientation seems clear.

After discussions with Mr Trump in New Delhi, as the two leaders met the media without taking questions, Mr Modi spoke of attaining a Comprehensive Global Strategic Partnership with the US. These words themselves are shop-worn. Much depends on military, economic and political resources each side can bring to the table. The PM elaborated and said all aspects of the relationship — security, energy, technology, global connectivity and trade — will get a fillip.

He underlined defence as a "vital" aspect. He underlined his keenness for India and the US to be a part of each other's defence manufacturing and supply chains, as well as inter-operability and common military exercises. President Trump too underlined the military relationship, as well as energy and technology. What we are seeing here is the adumbration of an idea, rather than specific goals met on the US leader's trip, except for the sale of some military hardware.

From *The Asian Age*

An Uneasy Pact

The agreement signed in Doha on 29 February between the United States and the Taliban marks the beginning of a potentially dangerous phase in the unfortunate recent history of Afghanistan. Although it has been billed as a "peace agreement" it is more a phased "withdrawal schedule" for the 12,000 US forces currently stationed in Afghanistan. The promise to end America's "endless wars" in the greater Middle East region was one of the central themes of US President Donald Trump's election campaign in 2016. He is eager to demonstrate progress on that front in his bid for re-election later this year. Although he deployed additional troops in Afghanistan during 2017, Trump's conviction that America's longest ever war in Afghanistan is unwinnable was reinforced by the continuing US inability to put the Taliban under serious military pressure.

In agreeing to withdraw all US forces from Afghanistan over a period of 14 months, Washington has got Taliban's promise to prevent the use of Afghan soil by any group that threatens the

security of America and its allies. The Taliban has also agreed to join talks with various Afghan groups, starting later this month, to discuss a permanent ceasefire and a road map to install a new political regime in Kabul. The US has certainly made its promise of withdrawal conditional upon the Taliban holding up its commitments. This conditionality is unlikely to survive the diminishing political support in Washington for further military involvement with Afghanistan. The biggest casualty of the US withdrawal is the Kabul government that was kept out of the US talks with the Taliban. Growing internal squabbling in Kabul has further marginalised the government. The imminent intra-Afghan talks will involve many Afghan groups but the Taliban will be the most powerful player at the table and is bound to set the terms for the final agreement.

The Taliban, whose strength lies among the Pashtuns, is not known for a politics of accommodation with other ethnic groups that constitute more than half of the Afghan population. The return of a unilateral Taliban could set the stage for the next round of civil war that has hobbled the nation since the late 1970s. The lifting of the US military footprint and the uncertain political future of Kabul provide a fertile ground for meddling by other regional actors, especially the Pakistan army, which sees Afghanistan as its backyard. India, which has seen its influence grow in Afghanistan since the US intervention at the end of 2001, has never been enthusiastic about Washington's engagement with the Taliban. It has chosen to keep its political lot with Kabul, which is growing weaker by the day. Delhi has also held itself back from any formal contact with the Taliban. Critics say this policy is too rigid to cope with the dynamic Afghan situation. Supporters, however, argue that it is better to hold on to the allies you have rather than looking for new friends among the Taliban. Either way, Delhi must prepare for prolonged turbulence in Afghanistan as the curtains fall on Kabul's moderate political order.

From *The Indian Express*

A Historic Success

Calling the DefExpo 2020 a 'historic success', Defence Minister Rajnath Singh announced the signing of over 200 memorandums of understanding (MoUs) and transfer of technology agreements at the Expo. Besides the launch of 13 products, six major announcements, 18 transfer of technology agreements and 71 MoUs signed, over 100 MoUs were signed on the sidelines of the expo, taking the total number of agreements to over 200. These agreements include 23 MoUs signed with Uttar Pradesh Expressway Industrial Development Authority (UPEIDA) involving an investment of about Rs 50,000 crore in the defence corridor project in Uttar Pradesh.

"Our government has carried out many reforms…We have eased the industry licensing process. We have also increased the foreign direct investment (FDI) cap. We have streamlined the defence offset policy and it could be streamlined further," said Rajnath while speaking at the 'Bandhan' ceremony organised for product launch, new announcements, transfer of technology and signing of MoUs.

Mr Rajnath's observation about further streamlining the defence offset policy assumes significance in the backdrop of demands for the same. The minister announced that under the 'innovate for defence internship' scheme, students of 50 engineering colleges would be sensitised about innovation in the defence sector.

Listing out the highlights of the Expo, he said that the Defence Research Development Organisation (DRDO) had reached an understanding with UPEIDA to provide technology support to the companies investing in the defence corridor. The products launched at the expo, said Rajnath, included artillery guns, helicopters, anti-tank missiles and bullet proof jackets. Rajnath said India's defence exports were at Rs 10,745 crore in 2018-2019, which was seven times higher than the export figures for 2016-2017.

From *Hindustan Times, Lucknow*

Drumming up N-hysteria

Lt Gen Khalid Kidwai (retd), former Director General of Strategic Plans Division, Pakistan, in his speech at the International Institute for Strategic Studies (IISS), London, on 6 February, blamed India 'as the critical determinant of the state of strategic stability in South Asia'. In his speech, which was shadowed by an anti-India narrative, General Kidwai held India's actions responsible for the strategic instability in the region, and asserted repeatedly that Pakistan's N-programme, positioning, expansion, and most importantly, its full spectrum deterrence, is in response to India's hegemonic ambitions. General Kidwai's statements are a reflection of the continuation of Pakistan's position to fight its own insecurity and vulnerabilities. Its strategy has been to blame India for its nuclear positioning. The fact remains that India's military announcements have never been in isolation or with an expansionist objective, but in response to Pakistan-sponsored acts of terror. The need to reassert its position by Pakistan has been felt much more strongly after India's positioning of its redefined intolerance for terror strikes.

New Delhi's position saw a strong shift after the Pathankot terror attack in 2016. The Balakot strikes were critical and challenged Pakistan's projection of an irrational and low nuclear threshold, which grew with the widening disparities between the two countries. The projection of nuclear threat has remained critical to Pakistan's nuclear positioning, specifically after General Aslam Beg's announcement of offensive-defence doctrine in 1989. Pakistan accelerated the sub-conventional war not only in Kashmir, but also in other parts of India (Punjab). Pakistan has maintained a posture of low nuclear threshold with an element of uncertainty. In 2002, General Kidwai, announced the red lines of Pakistan's N-threshold in an interview to Italian journalists — specifying the space and military threshold, economic strangling and domestic destabilisation. It vaguely drew unlimited boundaries which could potentially include various steps taken up by India in the wake of acute tension or conventional confrontation. The objective of Pakistan's N-weapons has been to deter any form of Indian military response, and has relied on its first-use doctrine. India's nuclear objective, on the other hand, is to deter a nuclear war. New Delhi does not see nuclear weapons as weapons of war fighting and has a written *No First Use* (NFU) doctrine. Pakistani leadership has been convinced that they have managed to deter India with their posture of irrationality. This interpretation came out clearly in President Musharraf's 2002 statement. Although he did not specify the N-threat in his speech to the army corps re-union in Karachi, he said he was ready to take a decision and act during the 2002 crisis.

Shalini Chawla in *The Tribune*

OPINION

Admiral Arun Prakash probes

The neighbours' mind games

Even as thorny issues of force-modernisation, budget-prioritisation and joint command structures engage the attention of our newly anointed Chief of Defence Staff, he will, sooner than later, in his capacity as the first-ever Military Adviser to the National Command Authority (NCA), have to address India's nuclear deterrent. When he does so, he might ponder over US strategist Bernard Brodie's prescription for preventing a nuclear conflict: "Thus far, the chief purpose of our military establishment has been to win wars. From now on its chief purpose must be to avert them."

Just as "beauty" is said to lie in the "eye of the beholder", the credibility of nuclear deterrence lies in the "adversary's mind". He must never be permitted to entertain an iota of doubt that a nuclear first strike will invite a devastating nuclear response. The establishment of credible mutual deterrence between two nuclear rivals, by diminishing the possibility of a surprise nuclear attack, forms the basis of what is termed "strategic stability". So, when retired Pakistani Lt General Khalid Kidwai blames India for South Asia's endemic strategic instability, we must take note.

Speaking at a recent workshop organised by the International Institute for Strategic Studies, Kidwai claimed that the onus of maintaining strategic stability in South Asia fell on Pakistan's shoulders since "India's insatiable drive for regional domination, especially given its current irrational, unstable and belligerent internal and external policies" could lead to catastrophic consequences. Kidwai, as the Director-General of the Strategic Plans Division (SPD) for 14 years, was at the heart of Pakistan's National Command Authority (NCA), overseeing the operationalisation of its nuclear deterrent and evolution of its doctrines and strategies. Although his pronouncements are for public consumption, given the historic absence of a formal Indo-Pak nuclear dialogue, they should provide some food for thought.

Kidwai's discourse attempts to upend conventional wisdom in an effort to show that it is India, not Pakistan, which is a revisionist power bent on destabilising the Subcontinent. His description of "major destabilising strategic steps" initiated by India provides an interesting glimpse of the Pakistani capacity for self-delusion and the visceral hostility underpinning its paranoia about an "existential threat" from India.

The starting point of Kidwai's arguments is India's 1974 peaceful nuclear explosion (PNE), which, according to him, was the trigger for Pakistan's nuclear-weapon programme as the only way of redressing the "India-induced strategic instability". However, Pakistani nuclear expert Feroze Hassan Khan writes that Pakistan's "bomb decision" had come much earlier in January 1972, when then Prime Minister Z A Bhutto spoke to a gathering of scientists in Multan about waging a "thousand-year war" against India and famously boasted that "…we will make an atomic bomb even if we have to eat grass". US analyst George Perkovich, writing about India's post-PNE posture, mentions that "moral doubts, domestic priorities and international considerations" that prevented Indira Gandhi and successor PMs from authorising weaponisation till Pakistan's stealthy pursuit of an "Islamic bomb" forced India's hand.

Kidwai then refers to the massing of Indian forces for the military exercise *Brasstacks* in end-1986, which caused serious alarm in Pakistan. According to him, Pakistan not only counter-mobilised its forces, but also dropped hints of a nuclear capability due to which "India blinked and strategic stability was restored". In actual fact, the military crisis had wound down on its own by February 1987, and it was only in March that journalist Kuldip Nayar "broke" rogue nuclear scientist A Q Khan's boast about using the bomb if Pakistan's existence was threatened.

During the 1990s, alleges Kidwai, "India upped the ante" through the introduction of longer range ballistic missiles and eventually, by conducting nuclear tests in 1998. The resultant instability, according to him, compelled Pakistan to induct a new family of ballistic missiles and respond by conducting its own nuclear tests, thus restoring strategic balance. He fails to mention that with the clandestine transfer of missile technology from North Korea and receipt of nuclear-weapon designs and material from China, Pakistan, throughout the 1980s and 90s, had remained ahead of India, as the latter persevered with indigenous technology.

Pakistan, apart from reserving the right to the first-use of nuclear weapons, has refrained from declaring an official nuclear doctrine since 1998. The timeline of Pakistan's transition from "minimum credible deterrence" to "full spectrum deterrence" (FSD) is, therefore, not clear. Kidwai presents the FSD regime as a counter to the Indian army's *Cold Start* doctrine, meant to be a remedial for India's lethargic general mobilisation of 2001-02.

Kidwai claims that FSD focuses on a capability to bring "every Indian target into Pakistan's striking range" and provides options to select amongst counter-value, battlefield and counter-force targets. Consequently, he believes that the "Cold Start doctrine has been neutralised, nuclear deterrence holds" and Pakistan is assured that its FSD will bring "the international-community rushing into South Asia to prevent a wider conflagration".

Coming to India's February 2019 air-strike on Balakot, Kidwai vehemently denies that Pakistan's "nuclear bluff" was called, notwithstanding the IAF having crossed the international border to launch kinetic attacks. It was the presence of Pakistan's nuclear weapons, he says, that "deterred India from expanding operations beyond a single unsuccessful air strike". The robust PAF response, according to him, restored strategic stability and "no new normal" was established.

Finally, Kidwai is not above muddying the waters through disinformation and questions India's nuclear command and control system. Referring to the deployment of India's nuclear submarine, *Arihant*, during the Balakot crisis, he poses an obscure question that would interest our strategists: "One wonders whether India contemplated the use of nuclear weapons from a second strike platform even before its first strike options?"

Geo Politics

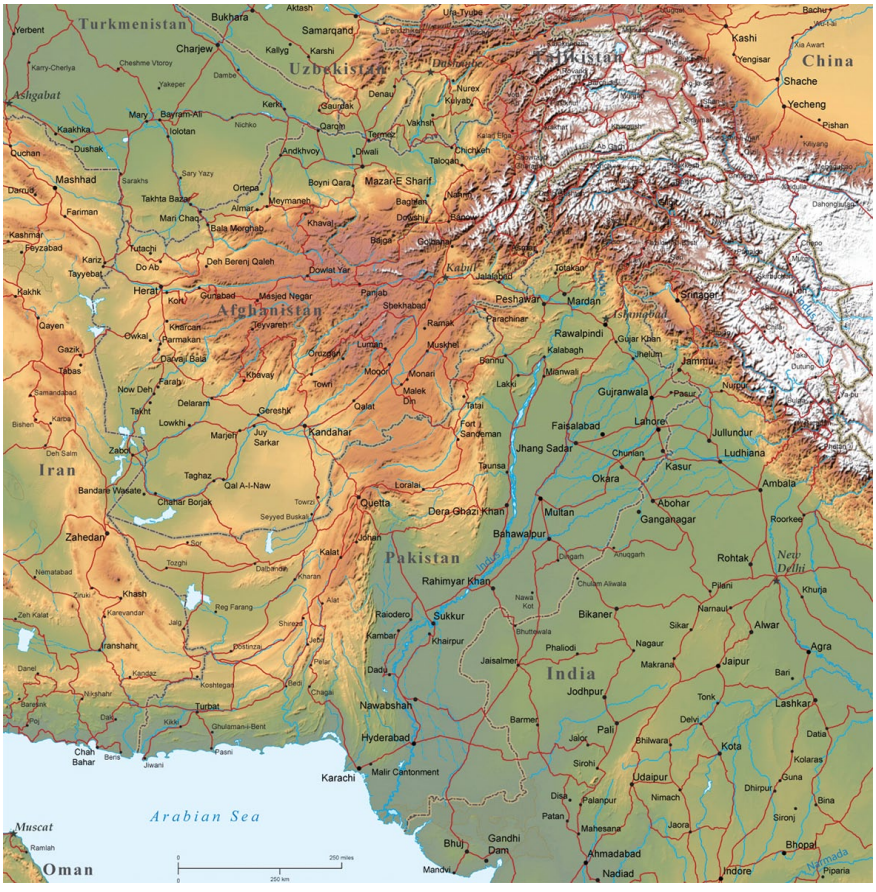
Brigadier Gurmeet Kanwal on the contingency that

India must send troops to Kabul – if invited

Afghanistan's National Security Advisor, Hamdullah Mohib, reportedly used a visit to New Delhi to privately press a request for at least a Brigade — perhaps even a Division —of Indian troops to be deployed in a peacekeeping role, ahead of a peace deal with the Taliban which is expected to lead to the final withdrawal of United States forces (*Praveen Swami, CNBC TV18*, 27 January, 2020).

The present situation in Afghanistan can be described as a strategic stalemate. Forces of the Afghan National Army (ANA), supported by the US-led International Security Assistance Force (ISAF), are not losing but the resurgent Taliban now control about one-third to one-half of Afghanistan. Even in the rest of the country, while the ANA control the towns, the writ of the Taliban runs in large areas of the countryside, especially at night. The devastating conflict has taken a heavy toll over two decades. According to one estimate, direct war-related casualties comprise over 111,000 dead and 116,000 wounded.

President Donald Trump of the US had announced his administration's policy for the resolution of the conflict in Afghanistan in August 2017 as part of his strategy for South Asia. Contrary to his campaign promise to pull out, he had pledged continuing US support for diplomatic, military and financial commitment to peace and stability and political reconciliation. He had also reiterated that US efforts for the elimination of the al-Qaeda and the Taliban in Afghanistan would continue. Trump had left the decision on the number of troops to be maintained in Afghanistan to the then



Afghanistan is akin to a 'crown' on head of the sub-continent

Brigadier Gurmeet Singh Kanwal, who passed away on 16 March 2020 was a noted strategic affairs analyst, an authoritative voice on strategic policy issues, in particular on issues concerning the armed forces. He was a regular writer for the *Vayu Aerospace & Defence Review*, this being his last contribution.

Commissioned on 31 March 1972 in the Regiment of Artillery, he served first with 80 Field Regiment and later commanded 150 Field Regiment, followed by an infantry brigade along the Line of Control during Operation *Parakram* (2001-2002).

After taking voluntary retirement in 2003, he became Director of the Centre for Land Warfare Studies (CLAWS) from 2008 to 2012 and also co-founded two think tanks: *Forum for Strategic Initiatives* (FSI) and the *South Asian Institute for Strategic Affairs* (SAISA).

Brigadier Gurmeet S Kanwal authored several books including *Nuclear Defence; Shaping the Arsenal, Indian Army; Vision 2020; Pakistan's Proxy War; Heroes of Kargil and Kargil '99: Blood, Guts and Firepower*.

Defence Secretary General James Mattis. Consequently, about 4,000 additional troops were sent to reinforce the 9,800 American troops who were then stationed in Afghanistan.

In a major departure from the policies of the Obama administration, Trump had invited India to join the US as a partner to work towards conflict resolution in Afghanistan. He had called India "a key security and economic partner of the United States" and said that developing a strategic partnership with India was a "critical part of the South Asia strategy for America."

The new strategy was welcomed in the region-except by Pakistan. As had been widely anticipated, Trump put Pakistan on notice for encouraging terrorist organisations to destabilise neighbouring countries and warned the country that "it has much to lose by continuing to harbour criminals and terrorists." Despite immense American pressure, Pakistan's ISI still supports several factions of the Afghan Taliban and provides them safe havens.

Efforts made towards political reconciliation to find a negotiated end to the protracted conflict have borne no tangible results. The reconciliation talks between the former US special envoy Zalmay Khalilzad and the Taliban representatives from its office in Qatar had stalled after some progress. A parallel Russian initiative, called the 'Moscow format', succeeded in bringing together the Taliban and Afghan representatives but the Afghans were from the High Peace Council, a "national but non-government institution".

According to a communique issued by the Russian Foreign Ministry, "The main topic of discussion was the question of the speedy launch of a direct inter-Afghan dialogue on peace in order to stabilise the situation in this country." Though there is general agreement that reconciliation negotiations should be "Afghan-led and Afghan-owned", the Taliban have consistently refused to meet representatives of the Afghan government.

[Images from the internet]

The Taliban continue to haunt government forces. Ambushes, suicide bombers, car bombs and IED explosions are commonplace. Sporadic strikes by terrorists belonging to ISIS Khorasan – the local branch of the ultra-extremist Islamic State that follows the Sunni-Wahhabi and Salafi school of Islam – to stoke sectarian conflict by attacking the Shias continue unabated. Governance is weak, crime is rampant and corruption and tax evasion are widespread. The presidential election that was scheduled for April 2019 was postponed to July 2019.

The troops drawdown ordered by President Trump has further emboldened the Taliban and weakened the Afghan government. One of the Taliban leaders gloated that they had "defeated the world's lone super power." They will now demand the withdrawal of all foreign forces before they agree to continue further negotiations without themselves making any concessions.

Given its geographical location on the strategic cross-roads to the Central Asian Republics (CARs) and West Asia, a peaceful and stable Afghanistan is a vital national interest for India *(see map)*. By definition, vital national interests are required to be furthered or defended by using military force if necessary. India has not been invited to join ISAF; nor is there any support for military intervention in India's policy community. However, after being kept away from the high table for decision making for conflict resolution by the George W Bush and Obama administrations in deference to Pakistan's sensibilities, India is now being urged by the Trump administration to do more to help resolve the conflict.

India has invested over $3 billion in reconstruction projects in Afghanistan, donated four Mi-25 attack helicopters, provided training to Afghan military personnel, civilian pilots and administrators and has been regularly providing humanitarian aid and medical supplies. The Indian embassy in Kabul and Indian consulates as well as road construction protection parties of ITBP have been attacked by the Taliban and have suffered a large number of casualties.

With the US drawdown likely to begin soon and others sure to follow, the clichéd Taliban taunt, "You have the watches, but we have the time," has begun to ring true. The worst case scenario for India would be the Taliban's return to power in Kabul, because Pakistan's ISI would be sure to divert many of the hard core fighters – of the factions over which has control – to Kashmir.

India's national interest lies in formulating a strategy jointly with the Afghan government that ensures that a Taliban takeover can be prevented. If invited, India must put boots on the ground. A brigade group can be logistically sustained and would make a good contribution to peace and stability.

Indian Defence Budget 2020-21

The Union Budget for FY 2020-21, presented by Finance Minister Nirmala Sitharaman in Parliament on 1 February 2020, has envisaged a total outlay of Rs 30,42,230 crore. Out of this, Rs 3,37,553 crore has been allocated for defence (excluding defence pension), for which an amount of Rs 1,33,825 crore has been provided in the Budget Estimates 2020-21. Total defence budget accounts for 15.49 per cent of the total central government expenditure for the year 2020-21.

The allocation of Rs 4,71,378 crore represents a growth of 9.37 per cent over the budget estimates (Rs 4,31,010.79 crore) for the financial year 2019-20. Of Rs 3,37,553 crore allocated for the financial year 2020-21, Rs 2,18,998 crore is for the Revenue (Net) expenditure and Rs 1,18,555 crore is for capital expenditure for the Defence Services and the Organisations /Departments under the Ministry of Defence. The amount of Rs 1,18,555 crore allocated for capital expenditure includes modernisation related expenditure. Meanwhile, defence exports in the country have grown seven fold in the last two years from Rs.1521.91 crore in 2016-17 to Rs.10,745.77 crore in 2018-19.

Reports from Parliament's Standing Committee on Defence

As per three separate reports presented to Parliament in mid-March 2020 by the Lok Sabha's Standing Committee on Defence, there is a 35% gap in capital outlay for the three Services compared with the projected demand. The Standing Committee has again recommended a non-lapsable fund for defence modernisation even as the 15th Finance Commission is looking into creating a non-lapsable fund for defence and internal security. The Committee has noted in its reports on *Demand for Grants for 2020-2021* that there "is a considerable shortage" and stated that "such situation is not conductive for preparation of country to modern day warfare".

India remains 2nd biggest weapons importer

The latest data from Sipri has India remaining as the second largest importer of weapons in the world, following Saudi Arabia. The information on international arms transfers released by the Stockholm International Peace Research Institute (Sipri) shows India accounted for 9.2% of the total global arms imports during 2015-2019, while Saudi Arabia registered 12%. China stood at the fifth position (4.3%), while Pakistan was at 11th (2.6%). Sipri, in fact, cited the example of India's Balakot air strikes and Pakistan's counter-strike in February 2019 to illustrate the overwhelming dependence of the two on foreign weapons. If India deployed French Mirage 2000s with Israeli Spice 2000 PGMs and Israeli-Russian AWACS, Pakistan used American F-16s, Chinese JF-17s and Swedish AEW&C aircraft.

DAC clears order for 83 LCA Mk.IAs

In first meeting of the Defence Acquisition Council (DAC) after separation of responsibilities between the Department of Defence (DOD) and Department of Military Affairs (DMA), and chaired by Defence Minister Rajnath Singh on 18 March 2020, the acquisition of 83 LCA Mk.IAs has been cleared. This is to be followed by formal approval by the Cabinet Committee on Security (CCS), "expected shortly".

LCA Mk.I (FOC) (photo: Deb Rana)

The LCA Mk.IA incorporates several new systems compared to the earlier Mk.I and includes the ELTA EL/M-2052 EASA radar, an electronic warfare (EW) suite with radar warning receiver (RWR), missile approach warning (MAW), laser warning receiver (LWR) and electronic countermeasure (ECM) system. The Mk.IA will carry a mix of CCM and BVR missiles plus air-to-surface weaponry on eight under wing/fuselage hard points, with some refinements in the fuselage for easier maintenance. Hindustan Aeronautics Limited will be responsible for the production and supply of the aircraft but significant percentage of manufacture will be carried out by companies in the private sector including Larsen & Toubro, Dynamatics, VEM Technologies and Alpha Design.

Maiden flight of FOC-Standard LCA Tejas (SP-21)

The first Tejas Light Combat Aircraft in Final Operational Clearance-standard (LA 5021) made its maiden flight on 17 March 2020. Piloted by Air Cmde. KA Muthana (retd), Chief Test Flying (Fixed Wing), the aircraft took-off from HAL Airport at around 1230 hours and was airborne for 40 minutes. "This flight signifies exemplary team work between various stakeholders of the Tejas LCA programme such as HAL, Directorate General of Aeronautical Quality Assurance, Centre for Military Airworthiness

LCA Mk.I (FOC) take off (photo: Deb Rana)

Air Cdre KA Muthana after the flight (photo HAL)

and Certification, Indian Air Force and Aeronautical Development Agency". HAL CMD, R Madhavan continued in saying that, "HAL achieved this momentous feat within a record time of 12 months after release of Drawing Applicability List (DAL) and SOP (Standard Operating Procedure) by CEMILAC".

This would pave the way for production of the remaining 15 fighters from FOC (Final Operational Clearance) block, planned to be delivered during the next financial year. The FOC aircraft are equipped with advanced features such as Air-to-Air refueling and Beyond Visual Range (BVR) missile systems. "It imbibes a lot of manufacturing improvements which were based on the operational feedback of LCA IOC (Initial Operational Clearance) fleet with IAF", the HAL spokesman stated.

HAL contract with IAI ELTA for AESA radar

HAL's Avionics Division, Hyderabad has contracted with IAI ELTA of Israel for manufacture and supply of 54 Active Electronically Scanned Array (AESA) radars for the Jaguar DARIN III upgrade aircraft under Transfer of Technology. As part of TOT, the Division will manufacture state-of-the-art Gallium

Arsenide-based Trans Receiver (T/R) elements of the radar antenna. Transfer of Design Technologies for the antenna with different configurations, development of radar processor application software and low voltage current source (LVCS) are also involved.

CCS clears procurement of 24 MH-60R Seahawk multi-role helicopters

The Cabinet Committee on Security headed by Prime Minister Narendra Modi have cleared the procurement of 24 MH-60R Seahawk multi-role helicopters worth $2.6 billion for the Indian Navy. The 24 Sikorsky-Lockheed Martin helicopters will be procured through the foreign military sales (FMS) route from the US government, the Defence Acquisition Council having cleared procurement of the 24 multi-role helicopters in August 2018, followed in April 2019 by the US State Department approving sale of the helicopters to India.

Meanwhile Dan Spoor, Vice President, Sikorsky Maritime and Mission Systems stated, "We are very pleased to learn that India is moving forward with the purchase of 24 MH-60R multi-mission helicopters. We stand behind the US Navy and look forward to having the Indian Navy become the fourth international country, joining Australia, Denmark and Saudi Arabia, to operate the MH-60R Romeo, the most advanced maritime helicopter in the world. This platform will provide the Indian Navy with the capability to identify, engage, and defeat maritime security threats along with the ability to perform secondary missions including vertical replenishment and search and rescue."

Integrated Air Defence Weapon System (IADWS) for India

The Government of India has requested procurement of an Integrated Air Defence Weapon System (IADWS) comprising five AN/MPQ-64Fl Sentinel radar systems; one hundred eighteen AMRAAM AIM-120C-7/C-8 missiles; three AMRAAM Guidance Sections; four AMRAAM Control Sections; and one hundred thirty-four Stinger FIM-92L missiles. Also included are thirty-two M4A1 rifles and forty thousand three hundred twenty M855 5.56mm cartridges. The principal contractors involved in this programme are The Raytheon Corporation and Köngsberg Defense and Aerospace.

In this connection, the Defence Security Cooperation Agency has made "a determination approving a possible Foreign Military Sale to India of an Integrated Air Defence Weapon System (IADWS) for an estimated cost of $1.867 billion", delivering the required certification notifying Congress of this possible sale on 7 February 2020.

MoD signs contract for Light Machine Guns with Israel's IWI

The Indian Armed Forces' long-standing requirement of a modern state-of-the-art Light Machine Gun (LMG) has finally fructified and the Acquisition Wing of Ministry of Defence has signed a capital acquisition contract with Israel Weapons Industries for procurement of 16,479 LMGs at a cost of Rs 880 crore. The contracted Negev 7.62X51 mm LMG is a combat proven weapon and currently used by several countries around the globe.

Kamov Ka-31 order reduced

Although the Indian Navy's requirement is for 10 additional Kamov Ka-31AEW helicopters, the DAC has reduced this to six numbers. These will supplement the 14 currently in service with INAS 339 and deployment on board the additional *Talwar*-class stealth frigates being acquired from Russia apart from the carrier INS *Vikramaditya* and, in the near future, INS *Vikrant* (IAC-1) after the latter's commissioning.

Six AH-64E Apaches for Indian Army

Six AH-64E Apache helicopters and lifecycle services support have been cleared for the Indian Army. "We welcome India's decision to acquire six AH-64E Apache helicopters and lifecycle services support for the Indian Army. The AH-64E Apache will be a force multiplier for the Indian Army, just as it is today for the Indian Air Force. We congratulate the US and Indian governments on this key milestone and welcome the positive momentum in the bilateral defence trade and industrial partnership," stated Salil Gupte, President, Boeing India.

HAL is "backbone of Indian Defence"

The Defence Minister Rajnath Singh has hailed HAL's contribution in nation building calling it as "the backbone of Indian Defence Forces…. while there is every reason to be happy about its performance especially in the last five years, the Company should prepare itself to take up the challenges in the emerging market. HAL should see the competition as an opportunity", he said at Kannada Naada Habba, a cultural event organised at HAL on 27 February 2020. The Minister inaugurated the programme in the presence of HAL officers, employees, Kannada luminaries and others. The Defence Minister complemented HAL for celebrating the rich heritage and the language of Karnataka which he said has contributed immensely in enriching India's diverse culture. "The state is a beautiful mix of modernity and tradition with great history", he said.

HAL's LCH production hangar inaugurated

Defence Minister Rajnath Singh inaugurated the new LCH Production Hangar at HAL's Helicopter Division on 27 February 2020. "The LCH is completely ready for operational induction and the Helicopter Complex is fully geared up for the production of LCH", stated R Madhavan CMD, HAL. The new production hangar will augment the LCH capacity to reach a peak production of 30 helicopters per year, added GVS Bhaskar, CEO, Helicopter Complex. The Techno Commercial Proposal for 15 Limited Series Production helicopters was submitted by HAL in March 2018 and the order is awaited, the total projected requirement being for some 160 helicopters.

HAL's IMRH project

HAL has apprised the Defence Minister on progress of the indigenous Indian Multi Role Helicopter (IMRH), the full scale mock-up being showcased to the Minister. The IMRH (for all three Services) is proposed as replacement for the existing medium lift helicopters such as Mi-17s, Kamovs and Seakings which will be phased out over next eight to ten years. HAL is keen to complete development of the IMRH the project having begun under the Chairmanship of Ashok Baweja nearly a decade back.

HAL plans overseas bases

Even as export initiatives are underway, Hindustan Aeronautics Limited are planning establishing logistics bases in Malaysia, Vietnam, Indonesia and Sri Lanka which countries presently operate Russian-origin aircraft and helicopters whose serviceability is "very poor". CMD of HAL R Madhavan said that "HAL is now seriously focusing on boosting exports in sync with the government's priority and identified South East Asia, West Asia and North Africa to sell key products such as the Tejas LCA and Dhruv ALH plus its variants.

HTFE-25 core engine sea level trials

Sea trials of HAL's Turbo Fan Engine HTFE-25 took place at Tambaram Air Force Station from 10 to 26 December 2019. Core engine of the HTFE-25 had been tested in various phases including starting trials with indigenously designed and developed Air Producer (AP) and Air Turbine Starter (ATS). Light-up trials with different fuel flow settings and air inlet temperature condition were successfully carried out, various Inlet Guide Vane (IGV) schedules implemented to establish the effect of IGV on engine performance. The engine was also tested with different exhaust nozzle throat to study the effect of back pressure, ascertain surge margin and stability aspects test trials, meeting the Cycle Design requirements.

Upgraded Su-30MKI cockpit simulator

An upgraded Sukhoi-30 MKI cockpit simulator was displayed at the HAL pavilion at DefExpo2020. This features two 230mm x 305mm high-resolution LCDs with a multifunction control panel with a wide 20°x30° field of view head-up display. This is similar to cockpit of the Sukhoi Su-35 and will be implemented as part of the Super-Sukhoi programme across the IAF's Su-30MKI fleet.

"Tata-SIA interested in Air India"

According to informed sources, Tata Sons and Singapore Airlines are actively considering the option to bid for Air India and a decision to submit an Expression of Interest (EoI) could be taken soon. Their joint airline Vistara, which has planned to launch international services to destinations including London, Paris, Tokyo, Moscow, is evaluating the possibility of 'acquiring' Air India. As Vistara Chairman Bhaskar Bhat stated "which company would not be interested in evaluating a sovereign airline of the country"?

Vistara's first Boeing 787-9 Dreamliner

India's fast expanding airline Vistara unveiled its first wide-body aircraft, the Boeing 787-9 Dreamliner, which arrived at Delhi on 29 February 2020 from Boeing's production facility in Everett, Washington. The airline celebrated its newest and 40th aircraft in a grand ceremony at Palam Airport, revealing its new cabin products for long-haul international flights soon. Vistara's Dreamliners feature 30 Business Class seats in a 1-2-1 configuration, upholstered in premium genuine leather that recline into fully-flat beds and offer direct aisle access to every passenger in the cabin. Among other features, Business Class customers enjoy 18" High Definition (HD) touchscreen in-seat TV, a Video Handset to navigate the In-flight Entertainment (IFE) system and ambient lighting in the generous stowage compartments and footwell area. The Premium Economy seats are by Recaro, one of the world's leading airline seat manufacturers.

Airbus H125 for Arrow Aircraft

Arrow Aircraft, a Delhi-based non-scheduled operator received its first H125 Airbus helicopter on 13 March 2020. The aircraft, taken on lease from Heliswiss Iberica, will soon start operations in the high altitude areas of north India for heli-pilgrimage (passenger transport) missions.

"Number of Expat pilots soars"

The number of foreign pilots commanding aircraft operated by Indian airlines rose by 176% in 2019 to 892 from 323 in 2018. DGCA gives these pilots FATA (foreign aircrew temporary authorisation), which allows them to fly in India. Country-wise data made public by the Directorate General of Civil Aviation (DGCA) shows that of the 892 FATAs issued in 2019, some 151, or 17%, were given to pilots from Iran, 100 from European countries, 71 from Brazil and 50 from the US. In addition, there were pilots from Mexico (49), Myanmar (45), Honduras (31), Cuba (39), Nepal (27), Ukraine (20) and some African nations (19).

Unmodified P&W engines to be replaced

The Directorate General of Civil Aviation (DGCA) has received a firm schedule involving IndiGo's remaining 60 unmodified Pratt & Whitney (P&W) engines to be replaced within the deadline while the schedule for replacing GoAir's remaining 32 unmodified PW engines is still awaited. IndiGo and GoAir currently have 92 unmodified P&W engines on their Airbus A320 Neos that need to be replaced with modified ones by 31 May 2020. In total IndiGo and GoAir were to get 180 modified engines both as replacement on aircraft already in their fleet and on new A320/321Neos delivered to them by May end.

COVID-19 affects Air India's disinvestment process

The global outbreak of Coronavirus has hit the disinvestment process of state-owned Air India. On 12 March 2020, the government deferred the last date to submit expressions of interest (EoIs) for the national carrier by more than a month to 30 April. "The above changes are in view of the requests received from interested bidders and the prevailing situation arising out of COVID-19) government notification said, the decision taken after India announced that it is suspending all visas till 15 April, virtually sealing off its borders. "It would have been impossible for foreign bidders to function normally with the closures and suspension. Hence the extension".

In related news, Air India announced that all its flights to Europe and the UK would be suspended from 19 to 31 March 2020, the last service being AI 111 to London on 18 March. GoAir have also suspended international operations till 15 April, initiating a temporary 'rotational leave without pay programme' while the DGCA has directed airlines to disinfect and deep clean aircraft at least once in 24 hours and place hand sanitisers in each aircraft to prevent spread of the coronavirus scourge.

Meanwhile, air traffic in China and other Asia Pacific countries has plummeted by more than half because of the coronavirus scare, according to a Boeing executive.

India and Finland MoU on bilateral defence cooperation

Defence Secretary Dr Ajay Kumar and the Permanent Secretary, Ministry of Defence of Finland Jukka Juusti have signed a Memorandum of Understanding "to further enhance defence cooperation between India and Finland". This will be on cooperation in the field of production, procurement, research and development of defence related equipment and industrial cooperation initiated on the sidelines of *Raisina Dialogue 2020*. On 13 February 2016, Prime Minister of Finland Juha Sipila had had bilateral discussions with Prime Minister Narendra Modi during his visit to India and on 17 April 2018, PM Modi held a bilateral meeting with Sipila during the first India-Nordic Summit in Stockholm, Sweden.

First anniversary of "Balakot air strikes"

On first anniversary of the 'Balakot air strikes', Air Chief Marshal RKS Bhadauria flew as part of a five aircraft mission from Air Force Station Srinagar along with pilots from the squadrons that had participated in the operations on 26 and 27 February 2019. The CAS flew in a MiG-21 Type 69 trainer along with CO No.51 Squadron, Gp Capt Kamran Nazeer in a formation comprising one MiG-21, two Mirage 2000s and two Sukhoi Su-30MKIs.

A.F. Special Forces parade

A 'Maroon Beret Ceremonial Parade' to mark completion of training of 131 Air Force Special Forces personnel took place at the Garud Regimental Training Centre, AFS Chandinagar on

LCA AF Mk2 (MWF)

Single Engine, Single-Seater, Multi-Role Supersonic Fighter

LCA AF Mk2 (MWF) is a state of the art multi role supersonic fighter with delta wing and close coupled canard with following features:

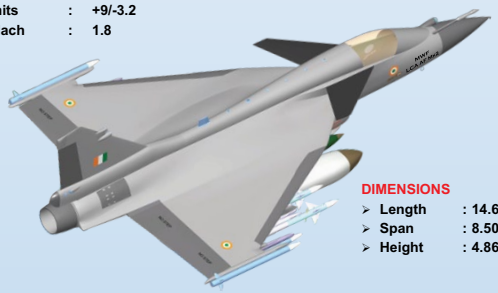
- **Higher Thrust Engine: GE-F414-INS6**
- **Long range and endurance extendable by in-flight refuelling & On Board Oxygen Generation System (OBOGS) to supply oxygen for unlimited duration**
- **Enhanced pay load carrying capability: 6500 Kg**
- **Eleven Hard Points to carry weapons**
- **Advanced Sensors like Active Electronically Scanned Array (AESA) & Infra Red Search & Track (IRST)**
- **Multi Sensor Data Fusion capability**
- **Integral Unified Electronic Warfare Suite (UEWS) with Radar Warning Receiver (RWR) and Jammers**
- **Missile Approach Warning System (MAWS) to detect enemy missiles and initiate counter measures**
- **Network Centric Capabilities**
- **Beyond Visual Range(BVR) missiles capable of neutralising the enemy aircraft from long distance**
- **Heavy Precision Guided Weapons with stand-off ranges more than 100 km to destroy targets in heavily defended enemy territories**
- **Fly-by-Wire Flight Controls with upgraded Digital Flight Control Computer (DFCC)**
- **Advanced Avionics with smart Large Area Display (LAD) and Smart Head Up Display (HUD)**
- **Quick turn around and role change**

PERFORMANCE

- **Service Ceiling : 50000 ft**
- **'g' Limits : +9/-3.2**
- **Max Mach : 1.8**

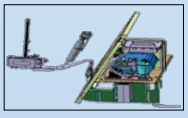
WEIGHT

- **Max All Up Weight : 17500 Kg**

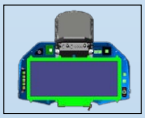


DIMENSIONS

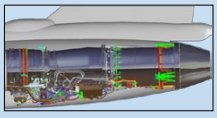
- **Length : 14.60 m**
- **Span : 8.50 m**
- **Height : 4.86 m**



On-Board Oxygen Generation System (OBOGS)



Smart Cockpit



Higher thrust Engine

18 January 2020. Air Vice Marshal T Singh, Assistant Chief of Air Staff Operations (Offensive) reviewed the parade, and congratulated the *Garuds* on successful completion of the rigorous training programme. Addressing the newly inducted *Garud* commandos, the importance of training and honing of skills to keep pace with the changing security scenario was emphasised.

Bio-jet fuel powered An-32 at Leh

On 31 January 2020, an Antonov An-32 of the Indian Air Force, powered with a 10% blend of Indian produced bio-jet fuel operated from Leh, the first time that both engines of an aircraft were powered by such bio-jet indigenous fuel. The aircraft was flight tested and its performance validated at Chandigarh prior to undertaking the operational flight to Leh. The technology to produce this fuel was developed by CSIR-IIP in 2013, the IAF sponsoring this project which channelised its human and material resources for the complete range of fuel testing. Bio-jet fuel is produced from non-edible 'Tree Borne Oils', grown and procured from the tribal areas of Chhattisgarh state.

IAF pilots prepare for *Gaganyaan* space mission

Four Indian Air Force pilots have reportedly completed their winter survival training at the Yuri Gagarin Cosmonaut Training Centre in Russia. This is part of the year long training course which involves "theoretical and practical exercises on tactics of behaviour and actions after landing a descent vehicle in extreme conditions using equipment on board a spaceship as well as improvised material". The IAF pilots will return to India for mission-specific training after a year of generic astronaut training in Russia. "Russian systems are different from those of the *Gaganyaan* and mission-specific training will then happen in India" according a spokesman.

Review of IAC-1 progress

Progress of the Indigenous Aircraft Carrier (P-71) project was reviewed by the Empowered Apex Committee (EAC) headed by Dr Ajay Kumar, Defence Secretary on 20 January 2020 at Cochin Shipyard Limited. The review critically examined current status of the project with the IAC at a very advanced stage of construction and scheduled to commence Basin Trials by early 2020 followed by

Sea Trials by mid-2020. This is the 13th EAC Review Meeting of the Project and the first to be held after signing of the Phase-III of the IAC Contract on 31 October 2019 between the Government of India, Ministry of Defence and Cochin Shipyard Limited. The Defence Secretary was accompanied by Vice Admiral Ashok Kumar, Vice Chief of Naval Staff, Vice Admiral GS Pabby, Chief of Materiel, Vice Admiral SR Sarma, Controller Warship Production & Acquisition from IHQ MoD (Navy) and other senior officers from IHQ MoD (Navy), Warship Overseeing Team and Carrier Acceptance & Trials Team.

IAC-I construction is at an advanced state with all its main engines comprising four gas turbines having been started, power generation systems comprising eight diesel alternators ready and trials of ship's major systems and auxiliary equipment being in progress. IAC had successfully completed the Pre-Contractors Sea Trials dry dock work package in December 2019. The aircraft carrier would be ready to commence sea trials once basin trials are successfully completed, according to the spokesman.

6th offshore patrol vessel (yard 45006) launched

The sixth offshore patrol vessel 'Yard 45006 ICGS *Vakra* was formally launched at Kattupalli Port on 27 February 2020. The vessel is built by Larsen & Toubro under the 'Make in India' campaign. Meanwhile the L&T-built Offshore Patrol Vessel ICGS *Varad* was commissioned into the Indian Coast Guard by Mansukh Mandaviya, Union Minister of State also at Kattupalli shipyard,

near Chennai on 28 February 2020. ICGS *Varad* has set a record in Indian shipbuilding industry being the first major defence ship to clear all Sea Acceptance Trials (SATs) in a single sea sortie, "underlining the high quality of design and construction of these ships". The vessel is fifth in the series of seven Offshore Patrol Vessels (OPVs) contracted by Ministry of Defence on L&T in March 2015.

INS *Airavat* provides HADR for Madagascar

In January 2020 even as INS *Airavat* was on patrol in the Indian Ocean near the Maldives and Sri Lanka, the ship was diverted to assist in Humanitarian Assistance and Disaster Relief (HADR) as part of 'Operation Vanilla' and was the first international respondent to the humanitarian crisis in Madagascar which was hit by *Cyclone Diane*.

Indian Navy Annual Refit Conference

Indian Navy's Annual Refit Conference (ARC) and Annual Infrastructure Conference (AIC) was organised at Eastern Naval Command, Visakhapatnam. The two-day conference chaired by Vice Admiral GS Pabby, Chief of Materiel (COM), was attended by all stakeholders representing Naval Headquarters, three Naval Commands, the Tri-Services Andaman & Nicobar Command Dockyards, Repair Yards and Material Organisations of the Navy.

GRSE delivers 4th ASW Corvette

Garden Reach Shipbuilders and Engineers Ltd. delivered Yard 3020 (INS *Kavaratti*), to the Indian Navy on 18 February 2020 being the 104th warship built and delivered by GRSE since its inception in 1960 and is last in the series of four Anti-Submarine Warfare Corvettes (ASWC) under *Project 28*.The first three ships of the series, INS *Kamorta*, INS *Kadmatt* and INS *Kiltan* were delivered earlier and now form an integral part of Eastern Fleet of the Indian Navy.

President's Colours to INS *Shivaji*

The President of India Ram Nath Kovind awarded President's Colours to INS *Shivaji* at Lonavala, commanded by Commodore Ravnish Seth, on 13 February 2020, during an impressive ceremonial parade comprising 130 officers and 630 sailors of the Indian Navy. Bhagat Singh Koshyari, Governor of Maharashtra, Admiral Karambir Singh, Chief of the Naval Staff, Vice Admiral AK Chawla, Flag Officer Commanding-in-Chief, Southern Naval Command along with senior defence and civilian dignitaries were present on the occasion.

The Indian Coast Guard is 44

The Indian Coast Guard marked its 44th Raising Day on 1 February 2020, having grown into a formidable force with 146 ships and 62 aircraft now in its inventory and likely to achieve a targeted force level of 200 surface platforms and 100 aircraft by 2025. "As the fourth largest Coast Guard in the world, the Indian Coast Guard has played a significant role in securing India's coasts and enforcing the regulations within the Maritime Zones of India" stated an ICG official.

"Israel key contributor to Indian defence preparedness"

According to Apurva Chandra, Director General (Acquisition) and Additional Secretary, Department of Defence, "Israel is the key contributor to India's readiness to face challenges". Speaking at the Seminar '*India-Israel Opportunities in Defence Cooperation: Future Vectors of the Digital Battlefield*', organised by FICCI, jointly with SIBAT (Israel Ministry of Defence) and Indian Ministry of Defence (MoD) during DefExpo 2020, Chandra said that Israel has been always forthcoming to share high-end technology. Brig Gen (Retd) Yair Kulas, Director SIBAT, said that Israel is looking forward to sharing its deep knowledge in their area, and added that cooperation and collaboration are the key to a strong India-Israel defence partnership.

IAI in strategic UAV collaboration with HAL and DTL

Israel Aerospace Industries (IAI) has signed a strategic collaboration MOU on UAVs with Hindustan Aeronautics Limited (HAL) and Dynamatic Technologies Limited (DTL). The MOU will reflect existing UAV capabilities developed by IAI over the years and promote the production of Indian UAVs, in line with the 'Make in India' policy. The strategic partnership with the Indian corporations will allow the implementation of optimal solutions for needs of the customer, based on their specific technologies and needs.

IAI and BEL MOU on Air Defence Systems

Israel Aerospace Industries (IAI) and Bharat Electronics Limited (BEL) have signed a Memorandum of Understating (MOU) on establishing a new centre for providing product life cycle support including repair and maintenance services for air-defence systems in India. The new centre will provide the required technical and maintenance support to the Indian Defence Forces who will be operating the air defence systems. "The collaboration will leverage the synergetic capabilities of IAI and BEL, which have already been proven in other collaborations".

MoU between HAL and Elbit Systems ISTAR Division

An MoU has been signed between HAL and Elbit Systems ISTAR Division, Israel and formalised by Arup Chatterjee, Director (Engg. and R&D), HAL and Roy Zentner, VP (Business Dev. & Marketing), Elbit Systems. The MoU is aimed at assessing the feasibility of joint development of a Vertical Take-off and Landing (VTOL) Unmanned Aerial Vehicle (UAV) (Rotary UAV of 2000 kg. class) for maritime and land based military operations which meet both domestic and global requirements.

HAL MoU with Elbit for Digital Head-Up Displays

HAL has signed an MoU with Elbit Systems for marketing Digital Head Up Displays (HUD) units. The MoU envisages extending cooperation for new HUD technologies and promote Digital HUD to the Indian Defence Services and other potential customers. The digital HUD would incorporate new features such as 'Wide Instantaneous' and 'Total Field of View' with minimal binocular disparity, large eye motion box and digital image source for increased pilot's situational awareness. The HUD system is also compatible with night vision imaging systems with improved maintenance features.

Rolls-Royce and Force Motors in JV

Rolls-Royce Power Systems and Pune-based vehicle manufacturer Force Motors have an agreement for a joint venture for manufacture of Rolls-Royce's MTU 10 and 12-cylinder Series 1,600 engines, suitable for power generation and rail under floor applications. The company had said that Force Motors will hold 51 per cent and Rolls-Royce Power Systems 49 per cent stake in the facility. "India will be the only destination where the Series 1600 engines will be made for all of Rolls-Royce's customers, globally, if everything goes well, we should open the facility in next couple of months", said Kishore Jayaraman, President Rolls-Royce, India and South Asia.

Adani-Elbit JV exports Hermes 900

Adani-Elbit Advanced Systems India Limited, a joint venture between Adani Defence & Aerospace and Elbit Systems of Israel have set up the first private UAV manufacturing complex at Adani Aerospace Park in Hyderabad to indigenise unmanned aerial platforms. The only Hermes 900 production facility outside Israel was inaugurated in December 2018 in Hyderabad, and has begun exporting Hermes 900 Unmanned Aerial Platforms to international customers. Hermes 900 is a state-of-the-art, combat proven multi-role unmanned platform with an endurance of 36 hours, payload capacity of 420 kg, altitude of over 32,000 feet (10km+) with applications across civil, defence and homeland security.

Thales and MKU to co-develop ELFIE NVDs

Thales and MKU will co-develop the ELFIE Night Vision Device (NVD) for the armed forces in India and across the

world. The companies have moved forward after the MoU signed in 2018 for strategic co-operation on developing optronic devices, which involves co-development at MKU's facility in Kanpur. A lightweight monocular with the widest field of view, ELFIE provides mobility and night combat capability. When mounted on a weapon, it provides a red dot sight or laser pointer to the user.

L&T MBDA Missile Systems Integration Facility in Tamil Nadu

L&T MBDA Missile Systems (LTMMSL), a joint venture between Larsen & Toubro (L&T), and MBDA, have set up a Missile (inert) Integration facility for both domestic and global markets. LTMMSL has set up the assembly, inert integration (without explosives) and testing facility for missile sub-systems and missile weapon launch systems at the Special Economic Zone in Coimbatore, part of the Tamil Nadu Defence Industrial Corridor. Founded in 2017, LTMMSL has received a few export orders and the new facility will delivering sophisticated weapon systems using state-of-the-art test equipment such as Missile Launchers and Airframe segments, including control actuation units, from CY 2020.

Javelin JV MoU with BDL

The *Javelin Joint Venture*, a partnership of Raytheon and Lockheed Martin, has signed a Memorandum of Understanding with Bharat Dynamics Limited (BDL) to explore co-production of the Javelin anti-tank missile system to fulfill potential future requirements of Indian Forces. "We look forward to working with BDL, a leading guided weapon system manufacturer, to evaluate the possibility of manufacturing Javelin in India," said David Pantano, Vice Oresident, *Javelin Joint Venture*. "With BDL's 50 years of experience, combined with Javelin's reliability and proven performance, we are excited to see how this partnership will support the needs of the Indian Ministry of Defence."

Rolls-Royce and IIT Madras in collaboration

Rolls-Royce is collaborating with the Indian Institute of Technology Madras to promote and explore opportunities for joint research programmes. Rolls-Royce will also roll-out a 'Technical Higher Study Framework' to facilitate higher education for its engineers, in partnership with IIT Madras. An MoU on this collaboration was signed by Jayaram Balasubrahmanyan, Head of Engineering, Rolls-Royce India and Prof V Kamakoti, Associate Dean (Industrial Consultancy and Sponsored Research), IIT Madras, in the presence of Kishore Jayaraman, President, Rolls-Royce India and South Asia and Prof Krishnan Balasubramanian, Department of Mechanical Engineering, IIT Madras. As part of the MoU, Rolls-Royce and IIT Madras also aim to pursue advanced research in areas of relevance to future technological and programmatic needs of the company.

"Self-reliance in small arms manufacturing a necessity"

Vice Admiral R Hari Kumar, Chief of Integrated Defence Staff to The Chairman Chiefs of Staff Committee (CISC), Headquarters Integrated Defence Staff, stated that self-reliance

in the small arms sector is fundamentally necessary for the nation. Speaking at the *International Conference on Small Arms: From Current Paradigm on Small Arms to Next Level*, organised by FICCI, jointly with Centre for Joint Warfare Studies on 20 February 2020, Vice Admiral Kumar stated, "We need to make it happen through the *Make in India* initiative. We need to develop these weapons, make them cost effective with adequate production capacity and modernise our inventory with indigenous weapons." Vice Admiral Kumar added that while India is importing majority of these to meet urgent requirements, it is essential that basic weapons like small arms are manufactured in India. While highlighting the various initiatives launched by the government like the amendments to the Arms Rule 2016, he urged for more investment from the private sector.

50th set of L-40 stage of GSLV-MKII

HAL has handed over the 50th L-40 stage of Geo Synchronous Launch Vehicle (GSLV-MKII) to ISRO on 28 February 2020 at Bangalore. The L-40 stage is for the GSLV MKII- F12 flight planned by ISRO in August 2020.The Aerospace Division of HAL has so far integrated and supplied L-40 stages for 12 flights of the GSLV MKII including GSLV MKII -F10 flight planned in the first week of March 2020. Apart from the Integrated L-40 stages, HAL is manufacturing the riveted structures, propellant tanks, feedlines of PSLV, GSLV MKII and GSLV MKIII launch vehicles and structures of various satellites for ISRO. HAL remains "one of the most reliable partners of ISRO for the past three decades and has contributed and participated in almost all of ISRO's ambitious projects including the *Chandrayaan-I*, *Chandrayaan-II*, *Mangalyaan* and upcoming projects like the *Gaganyaan*".

Chandranyaan-3 launch in 2021

File photo of Chandrayaan-1

According to ISRO Chairman K Sivan, the Organisation is planning to launch *Chandrayaan-3* during the first half of 2021. Although ISRO will attempt to land the rover on the same selected area of the moon's surface, the revived configuration is more robust in design and has capacity enhancement for flexibility. *Chandrayaan-3* would have a lander, rover and propulsion module like its predecessor, the spacecraft costing around Rs 610 crore, including Rs 360 crore for the launch vehicle itself.

India-Bangladesh joint exercise SAMPRITI-IX

The joint military training exercise SAMPRITI-IX was conducted at Umroi, Meghalaya, from 3 to 16 February 2020, part of bilateral defence cooperation between India and Bangladesh and ninth edition of the exercise which is hosted alternately by both countries. During the joint military exercise, a Command Post Exercise (CPX) and a Field Training Exercise (FTX) was conducted in a scenario where both nations worked together in a Counter Terrorism environment under the UN Charter. Subsequently, the joint tactical exercise was conducted wherein battle drills of both the armies were practiced. The training culminated with a final validation exercise in which troops of both armies jointly practiced a Counter Terrorist Operation in a controlled and simulated environment.

Exercise Ajeya Warrior-2020

Fifth edition of Joint Military Exercise Ajeya Warrior-2020 between India and the United Kingdom was conducted on the Salisbury Plains, United Kingdom from 13 to 26 February 2020. The exercise comprised 120 soldiers each from the Indian and British Armies, aim of this exercise being to conduct company level joint training with emphasis on counter terrorist operations in urban and semi urban areas.

Joint IAF - RAF Ex *Indradhanush* 2020

The Indian and (British) Royal Air Forces jointly conducted the fifth edition of Ex *Indradhanush* at Air Force Station Hindan from 24 February 2020. The focus of this exercise was 'Base Defence and Force Protection', this theme being of significance considering the recent threats to military establishments from terror elements. The RAF team comprised 36 specialised combatants of the RAF Regiment while the IAF fielded 42 combatants of the *Garud Force*. Both sides jointly exercised specialised weapons, equipment and vehicles and validated joint employability, including paradrops from C-130J aircraft, tactical insertion by Mi-17V5 helicopters and use of various airborne sensors.

SC's judgement on Permanent Commission for Women in Army

Defence Minister Rajnath Singh has welcomed the Supreme Court's judgement on Permanent Commission for women in the Army. "I wholeheartedly welcome Hon'ble Supreme Court's

judgement on giving the women officers permanent commission in the Armed Forces. Prime Minister Narendra Modi has supported the idea of permanent commission for women and announced the change in policy in his Independence Day speech in 2018," he tweeted.

A historic decision to allow women in field operations came earlier when the then defence minister Nirmala Sitharaman announced that women will be inducted into the Military Police. "The plan was to recruit women in roles ranging from probing crime cases to assisting the army in field operations wherever required. In 2019, the Defence Ministry granted permanent commission to women in all 10 branches of the Indian Army, including Signal Corps, intelligence, aviation, engineering, service corps and ordinance corps," added Rajnath Singh.

Supreme Court directive on permanent commission for Women in Navy

The Supreme Court on 17 March directed that officers of both genders had to be treated equally in granting permanent commission in the Indian Navy. "There couldn't be gender discrimination in granting permanent commission to Short Service Commission (SSC) women officers citing psychological conditions, once the statutory bar for inducting women in the Navy had been lifted", a Bench headed by Justice DY Chandrachud said. The order came a month after the Supreme Court ordered the government to consider granting permanent commission to all women officers in the Army.

(photo: Business Insider)

K-4 submarine-launched ballistic missiles test fired

Augmenting India's capabilities to neutralise enemy targets from submarines, the DRDO successfully carried out test firings of the 3,500 km strike range nuclear-capable K-4 submarine-launched ballistic missile off the coast of Andhra Pradesh on 19 and 24 January 2020. The test-firings were carried out from an underwater platform in the sea. The solid-fuelled K-4 missile is intended for deployment on the fleet of *Arihant*-class nuclear submarines being built indigenously.

"More than 180 contracts since 2014": MoD

According to an official statement, the Ministry of Defence has signed more than 180 contracts valued at over Rs 1,96,000 crore with Indian industry since 2014, with others in the pipeline to be signed in the near future.

A contract for manufacture of Frigates under Project P-17A was signed in February 2015 with Mazagon Dockyards Limited (MDL), Mumbai valued at Rs. 45,000 crores while 2 Frigates under Project P1135.6 are to be manufactured by Goa Shipyard Limited (GSL) under a contract signed in October 2018 valued at Rs. 14,100 Crore.

Further, contracts for manufacture of 41 Advanced Light Helicopters for the Indian Air Force and 32 ALH for the Indian Navy were signed with Hindustan Aeronautics Limited (HAL) in March 2017 and Dec 2017 with a combined value of Rs. 14,100 crore. This is in addition to procurement of 14 Dornier 228 aircraft from HAL valued at Rs. 1100 crore, through a contract signed in February 2015.

Seven squadrons of the Akash Missile System are being procured from BEL following a contract in October 2019 valued at Rs. 6,300 crore as also the Integrated Advanced Command and Control System (IACCS) Nodes valuing Rs. 7,900 crore.

OFB have been tasked to supply 464 T-90S/SK main battle tanks worth Rs. 19,100 crore for which indent has been placed on it by the Ministry in November 2019. 100 numbers of 155x52mm cal self-propelled guns are being procured under the 'Make in India' initiative of the government from Larsen & Tubro valued at Rs. 4,300 crore. Contract for *Modernisation of Airfield Infrastructure* (MAFI), to be executed through Indian vendors is under final stages of contracting.

Services have also placed a number of contracts on the Private Sector vendors Titagarh Wagons Force Motors, Tata Power SED, Tech Mahindra, Tata Motor, Ashok Leyland, Bharat Forge, MKU, SMPP Delhi and Alpha Design for items including 1000 ton Fuel Barges, Light Strike Vehicles, Portable Diver Detection Sonar (PDDS), RFID based SMART Card, 6x6 and 8x8 High Mobility Vehicles with Material Handling Crane, Dual Technology Mine Detector, Ballistic Helmet, Bullet Proof Jacket (BPJ) and Integrated Gunnery.

However, three major areas, these being for P-75(I) submarines, Naval Utility Helicopters (NUH) and 114 multi-role fighters for IAF, presently "stuck" in long-winded procedures, are being progressed under the SP Model. However, even the cases under SP model have been processed expeditiously as evident from the fact that the responses to EOIs [Expression of Interest] have been received in respect of P-75(I) and NUH cases and are under final stages of selection while SQRs are being finalised in respect of the 114 fighter aircraft.

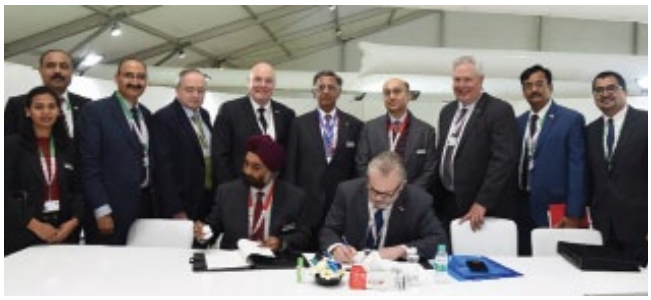
Under Make-II, 44 projects have been given approval. Under 'Innovations for Defence Excellence (iDEX)', forty plus startups are working in new technology-related products. Make-II and iDEX reflect new level of active engagement with the industry where not only manufacturing but technology development in defence is being prepared.

CONTROP wins DRDO's tender for supply of iSky-50HD systems

CONTROP Precision Technologies Ltd., a company specialising in the field of electro-optics and infrared (EO/IR) for defence and homeland security solutions, has won a tender by India's Defence Research and Development Organisation (DRDO) for the supply of its iSky-50HD systems, for use on unmanned air platforms.

The iSky-50HD is a member of Controp's iSky family of lightweight, compact EO/IR observation systems, which have been specifically designed for use in challenging airborne environments. The iSky-50HD features highly-sensitive multi-spectral sensors, which are gyro-stabilised and have advanced image processing algorithms, thereby providing maximum sensor ranges and performance, for a variety of airborne defence applications. In daily operation around the world since the 1990s, the iSky systems are integrated into a wide variety of UAV, helicopter, fixed-wing aircraft and aerostat platforms.

Bharat Forge signs MoU with General Atomics, USA



Bharat Forge Ltd (BFL)., the world's leading technology solutions provider and forging company signed a Memorandum of Understanding (MOU) with General Atomics, US, a global leader in the research, design, and manufacture of a diverse portfolio of electromagnetic and advanced power and energy technologies. Under the terms of the MOU, BFL and General Atomics' Electromagnetic Systems Group (GA-EMS) will investigate opportunities to develop and integrate power generation, storage, control and distribution technologies related to surface and undersea naval platforms, and advanced projectiles for weapon system platforms to address Indian defence requirements.

HAL receives modification document for Dornier 228 civil version from DGCA

Hindustan Aeronautics Limited (HAL) received the modification document for the HAL Dornier 228 (Upgraded) civil aircraft for 5700 kg all up weight (AUW) from the DGCA during DefExpo 2020. The document was handed over by G. Rajsekhar, JDG, DGCA to Apurba Roy, General Manager HAL Transport Aircraft Division, Kanpur in the presence of R Madhavan, CMD, HAL and senior executives from HAL and DGCA.

Two Civil Dornier 228s produced by HAL for air services under the UDAN scheme, have state-of-the-art configuration certifications from the DGCA for MTOW of 6200 kgs. However, in order to meet the prospective operator's requirement for transport aircraft flyable under Commercial Pilot License (CPL) category, HAL undertook efforts to reduce the aircraft's weight to under 5700 Kgs.

Apart from this weight criterion, HAL Dornier 228-201(Upgraded) civil aircraft will also be equipped with a digital cockpit to ensure more accurate readings, precise information and ergonomic data displays with feedback loops and capability for self-check to alert pilots in emergencies. "The Glass Cockpit architecture-enabled aircraft is poised to become most sought after in this new age of aviation technology," as per HAL.

Further, the incorporation of civil certified TPE331-10 engine gives more reliable torque sensing system, higher component life, is lighter in weight with higher time between overhaul (TBO) as compared with the earlier dash 5 engine. "Integration of a five bladed propeller on the HAL Dornier 228-201(Upgraded) aircraft will also significantly reduce noise levels, enable faster engine starts with better damping characteristics."

Bharat Forge and Thales Collaboration on F90 rifles

Annouced at DefExpo was the collaboration of Bharat Forge with Thales for production of F90 rifles to serve with India's defence and law enforcement agencies. "This cooperation is testament to

the 'Make in India' initiative of the Indian government and paves the way to a potential licensing agreement."

Seen in the photograph above are Pascale Sourisse, Senior Executive Vice President – International Development, Thales, and Col. Rajinder Singh Bhatia, President and CEO, Defence and Aerospace, Bharat Forge in presence of Baba Kalyani, Chairman and Managing Director, Bharat Forge

Airbus MoU with Adani Defence and Aerospace

Airbus India and Adani Defence & Aerospace have signed a Memorandum of Understanding (MoU) "to leverage synergies in aerospace and civil aviation sector". The MoU was signed by Anand Stanley, President and MD, Airbus India & South Asia and Ashish Rajvanshi, Head of Adani Defence & Aerospace.

"Airbus and Adani will explore opportunities for collaboration in the area of aircraft services for the Indian and South Asian markets. Airbus' Global Services forecast envisages the Indian aircraft services market to grow to US $6.3bn by 2025."

APPOINTMENTS

Lt Gen Kanwal Jeet Singh Dhillon is DG, DIA

Lt Gen KJS Dhillon has taken over as Director General Defence Intelligence Agency and Deputy Chief of Integrated Defence Staff (Intelligence), under the Chief of Defence Staff in the newly created Department of Military Affairs. General Dhillon was earlier GOC XV Corps in the Kashmir Valley and has been credited with several successful 'people-friendly' operations during the crucial previous year. The DIA is nodal agency for all defence related intelligence which collects information technically as well as through satellites in interest of the country.

Lt Gen Satinder Kumar Saini is VCOAS

Lt Gen Satinder Kumar Saini has become Vice Chief of the Army Staff. In his last appointment as GOC-in-C, Southern Command, "he steered transformation of the Operational Philosophy of the Southern Army to overwhelm emerging threats and validation of many new concepts during training exercises".

The General Officer is a graduate of the Army Command and Staff Course at the Staff College, Camberley in UK and has studied at the Royal College of Military Science, Venham, UK. He is also graduate of the Higher Command Course and the National Defence College, Bangladesh, has served as Deputy Chief Military Personnel Officer in the UN Mission in Iraq-Kuwait.

Rear Admiral Krishna Swaminathan is Commander, Western Fleet

The Navy's Western Fleet, known as its 'Sword Arm' has had a change of command when on 14 February 2020, the baton was handed over by Rear Admiral Sanjay Jasjit Singh to Rear Admiral Krishna D Swaminathan. The new Fleet Commander is a specialist in Communications and Electronic Warfare and has commanded frontline warships such as INS *Vidyut*, INS *Vinash*, INS *Kulish*, INS *Mysore* and aircraft carrier INS *Vikramaditya*.

Rear Admiral Sanjay Vatsayan is Eastern Fleet Commander

Command of the Eastern Fleet was handed over to Rear Admiral Sanjay Vatsayan by Rear Admiral Suraj Berry, at Visakhapatnam on 10 February 2020. The Admiral, who is a Gunnery & Missile systems specialist, has vast experience at sea and ashore. He has commanded missile vessels *Vibhuti* and *Nashak*, the guided-missile corvette INS *Kuthar* and has also been the commissioning CO of the indigenously constructed state-of-the-art stealth frigate INS *Sahyadri*.

Rear Admiral Antony George appointed as CSO (Training)

Rear Admiral Antony George assumed charge as the Chief Staff Officer (Training) on 20 February 2020 at Headquarters, Southern Naval Command. An Anti-Submarine Warfare Specialist, the Flag Officer has tenanted several important appointments, both at sea and ashore. His major sea assignments include Fleet ASW Officer of the Western Fleet, Commands of the Missile Corvette INS *Khanjar* and the Guided Missile Frigate INS *Tarkash* (which he commissioned in Kaliningrad, Russia). Other important shore assignments include Command ASW Officer of the Eastern Naval Command, instructor at the prestigious Defence Services Staff College and as Commodore Bureau of Sailors.

Rear Admiral Sanjay J Singh is Commandant, NWC Goa

Rear Admiral Sanjay Jasjit Singh took over as Commandant of the Naval War College, Goa on 18 February 2020. Prior to this appointment, he was the Flag Officer Commanding, Western Fleet. The lead drafter of the Indian Navy's *Maritime Doctrine, 2009*; *Strategic Guidance to Transformation, 2015*; and the *Indian Maritime Security Strategy, 2015*, he has completed several post graduate study programmes including MSc and MPhil in Defence and Strategic Studies from Madras University; MA in Defence Studies from Kings College, London and MA (History), MPhil (Pol) and PhD (Arts) from the University of Mumbai.

Lt Gen Madhuri Kanitkar posted to IDS

Madhuri Kanitkar has been elevated to the rank of Lieutenant General on 29 February, 2020 becoming the third woman officer in the Indian Army and first woman paediatrician in this rank. She has been posted to Headquarters, Integrated Defence Staff (IDS) under the Chief of Defence Staff (CDS). Her husband Rajiv is also a serving Lieutenant General.

Amitabh Bhatt is CEO HAL Bangalore Complex

Amitabh Bhatt has taken over as Chief Executive Officer (CEO) of HAL's Bangalore Complex, before which he was heading the LUH project as Executive Director. Mr. Bhatt is a Post Graduate in Management and earlier served in SKF India Limited for 15 years before joining HAL. He led the team as Chief of Projects (LUH), played a key role in setting-up an integrated new Helicopter Factory, the 3000 crore 'greenfield' project. He is Director on Board of HAL's Joint Venture, 'Indo Russian Helicopters Limited', formed to build Kamov Ka-226T helicopters for the Defence Services.

STOP PRESS

COVID-19: impact on India's airline industry

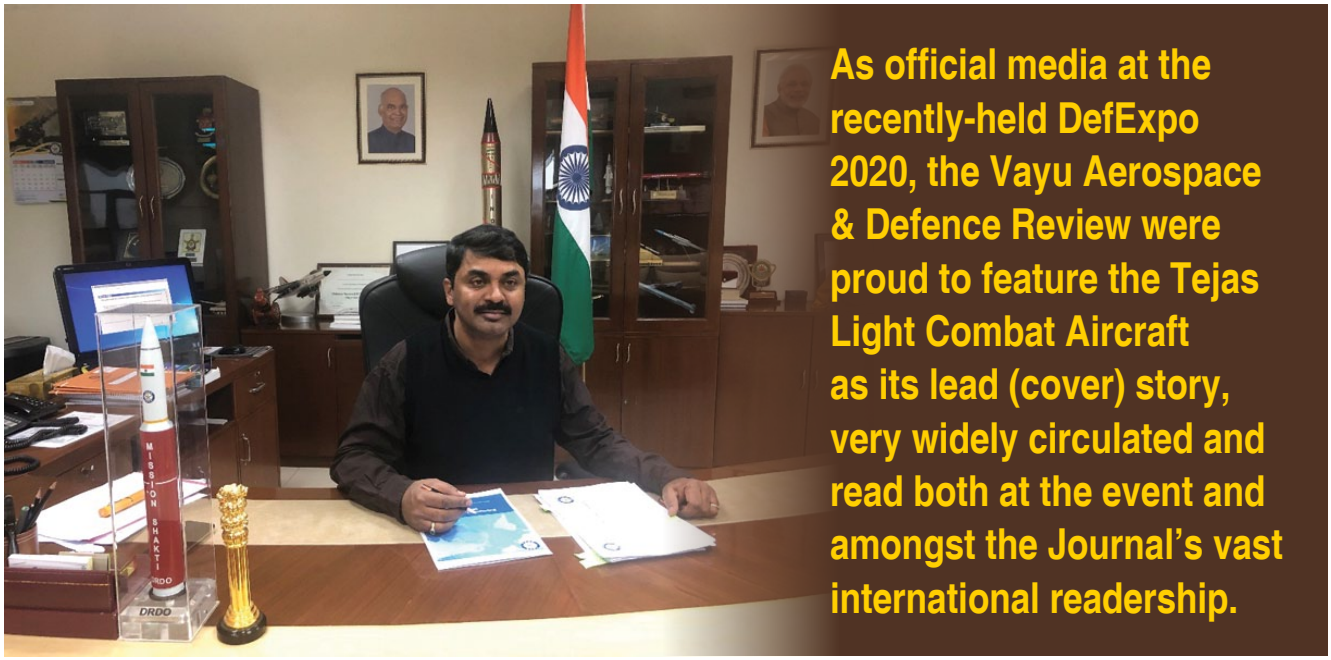
According to the Ministry of Civil Aviation, airlines in India could well ground 68% of their aircraft fleet as a consequence of the outbreak of coronavirus in the country and neighbourhood. There are some 630 aircraft listed on the register of which only about 200 would be operated. According to reports, the Government is planning a range of measures as part of some relief packages, including lower tax on jet fuel, waiver off air navigation charges as also parking charges at airports besides easier loans at reduced interest rates to increase liquidity.

According to reports in the Business Standard, Air India will slash staff allowances by 10 per cent, reduce onboard services, renegotiate contracts, and explore invocation of force majeure clauses in agreements to prune expenses. Aviation consultancy CAPA estimates Indian airlines (except Air India) will post $500-600 million loss in the first quarter. Carries are cutting salaries and enforcing leave without pay to battle the demand slowdown due to the crisis. All international flights from India ceased in the afternoon of 18 March, with Air India's flight AI 111 from Delhi to London being last for the present.

Meanwhile Air India has been carrying out Herculean efforts to fly back Indian nationals stranded in various countries abroad beginning with the epicenter at Wuhan in China where over 637 Indians and some foreigners were evacuated in early February. Later Air India flew back stranded Indians from Yokohama in Japan and recently from Rome in Italy.

VAYU Interview with

Dr G Satheesh Reddy, Chairman DRDO



As official media at the recently-held DefExpo 2020, the Vayu Aerospace & Defence Review were proud to feature the Tejas Light Combat Aircraft as its lead (cover) story, very widely circulated and read both at the event and amongst the Journal's vast international readership.

"Self Reliance in Critical Technologies"

***VAYU:** Over the past many decades, the DRDO has recorded major sucesses in various areas of defence research and development. Could you kindly enumerate on some of the major breakthroughs?*

Dr Reddy: DRDO has played its intended role, being indigenous development of weapon systems, platforms and equipment for tri-services of the country, effectively over the past decades. We are on the path to achieve self sufficiency in the field of missiles, radars, EW systems, sonars and torpedoes. We are now capable of designing any kind of missile system as per the requirement. The recent success of 'Mission Shakti' showcased our capability in designing systems for execution of complex missions. We have gained technological capability in the area of different propulsion systems, avionics and navigation systems as building blocks, so that new systems can be configured based on the available expertise. We have our own Main Battle Tank *Arjun* with superior fire power, fighter aircraft for

The ASAT 'Mission Shakti'

The Netra AEW&C aircraft developed by CABS

The Arjun main battle tank

multiple roles, AESA radars for different applications, sonars for submarines and EW systems, AEW&C and the indigenous towed gun system ATAGS, which are some of the major spectacular technological breakthroughs for the country.

***VAYU**: The LCA Navy programme has recorded significant milestones, with the prototype (NP-2) achieving defined targets to much satisfaction. Will this experience result in a definitive LCA Navy Mk II, which would operate from indigenous aircraft carriers in the near future?*

Dr Reddy: Recently the LCA Naval version has successfully landed on INS *Vikramaditya* using arrester barrier. The take-off from the carrier has also been smooth, which is a big achievement and is culmination of all round design efforts. With this milestone we are quite optimistic to complete the naval version of Tejas in all respects. Since the LCA Navy Mk.1 was an adaptation of the Air Force Tejas, it had limited operational capabilities owing to the increased weight and bigger undercarriage. LCA Navy Mk.II is being conceptualised as an ab-initio design for a Naval Aircraft to meet all operational requirements of Indian Navy, using a more powerful engine. The design utilises the experience gained through flight testing of LCA Navy Mk.I. Concept design activities of LCA Navy Mk.II have been completed.

***VAYU**: It is understood that ADA is on track to develop the LCA AF Mk.II aircraft, also referred to as medium weight fighter (MWF) for the Indian Air Force which has placed much trust on its availability from the early 2030s. Could you please give an overview of the timelines for this important programme in terms of first flight and entry into service?*

Dr Reddy: The LCA AF Mk.II is conceived as a re-engineered version of the LCA AF Mk.I with a more powerful 98 kN-class engine. It was also envisaged that LCA AF Mk.II would have higher powered engine along with improved maintainability, accessibility and interchangeability.

Design of the existing systems is being improved based on LCA AF Mk.I experience. Maintainability improvements were incorporated in the design. While LCA AF Mk.I would be replacement for MiG-21s the IAF has targeted the LCA AF Mk.II as replacement for Mirage 2000s. We are confident that LCA Mk.II development will be completed early and meet the IAF expectations.

***VAYU**: The next gen Advanced Medium Combat Aircraft (AMCA) will perhaps be the most vital development programme undertaken in the country. According to ADA, metal cutting of the AMCA is to begin shortly with first flight targeted for 2024-25. Would you consider this as rather ambitious, considering challenges posed in both stealth shaping of the aircraft and identifying appropriate power plants? Concerning the latter, have more modern alternatives been considered beyond the present F.414?*

Dr Reddy: The AMCA is a 5th generation twin engined fighter aircraft in the medium weight category with advanced technologies such as stealth, serpentine air intakes, internal weapon bay, advanced avionics, net-centric warfare, etc. The AMCA configuration design is at an advanced stage. The basic building blocks like airframe, avionics, software and design data for such fighter class aircraft have been developed and have matured during the LCA development. Now, to get the new configuration rolling out will not take that much time.

Yes, advanced features have been added in the AMCA design which were already thought about during development of the LCA. Some work has already been done in those lines for configuration studies. Considering the experience accrued while developing different versions of the LCA, we are confident that the challenges posed during AMCA development can be effectively addressed, including that of the power plant selection.

***VAYU**: The ASAT missile programme is imperative for the country with obvious strategic implications. Please give our readers a brief on the road map in*


DRDO ATAGS

LCA (Navy) during test flight
(Photo by Deb Rana)

Tejas LCA Mk.I of the Indian Air Force

achieving such cutting edge technologies that will endow India with such critical capability.

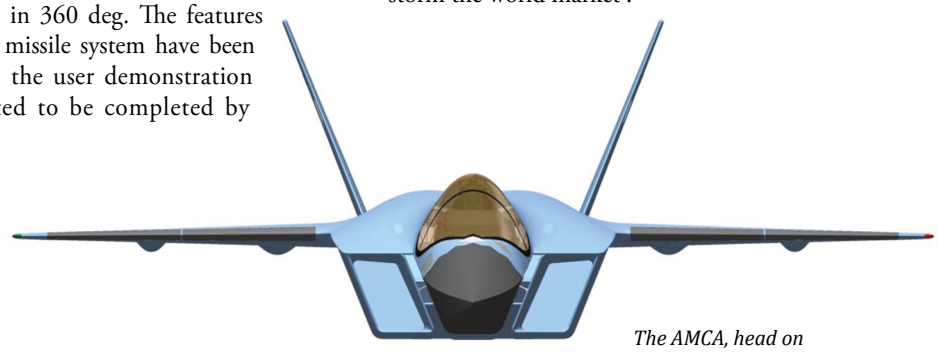
Dr Reddy: The ASAT test has been a capability demonstrator of the country's technological advancement. The anti satellite test, *Mission Shakti* was conducted to demonstrate the capability of the nation to neutralise enemy satellites. The core technologies for the test have been derived from the Ballistic Missile Defence programme of the DRDO which would continue to work on development of advanced technologies for air and missile defences and some of these would be available for future, challenging missions as required.

VAYU: At the tactical level, the DRDO has recently test fired the quick reaction surface-to-air missile (QRSAM), even as various foreign-origin weapons are being considered by the Services. When could this indigenous system be operationalised?

Dr Reddy: QRSAM has completed development trials, being an air defense mobile which searches & tracks targets on the move and engages multiple targets in 360 deg. The features of the missile system have been tested, the user demonstration expected to be completed by 2021.

VAYU: In broad terms, please outline the DRDO's road map till 2035 for achieving maximum self-reliance in the challenging and vast field of defence technologies.

Dr Reddy: DRDO has attained self reliance in critical technologies in the field of missiles, radars, sonars, torpedoes, armament and EW systems. Over the next five to ten years, our endeavour is to ensure that, after indigenous development, no imports are made by the country in these areas. The thrust would also for India to become a defence exporter. Many of our systems should reach the world, paving the way for our industries to flourish. The 'defence corridors' would play a major role in transforming our vision into reality. The future battle space will see a marked change and will be challenges in weapons and systems development. Looking ahead into the future, we have already started work on technologies which will be essential for futuristic weapon systems. The day is not far when Indian-made defence systems will storm the world market !



The AMCA, head on

Looking Ahead !

Combat Aircraft Programmes at ADA

Aeronautical Development Agency (ADA) is the premier design house in the country handling multiple fighter aircraft development programmes. The ADA was established in the mid-1980s as a nodal organisation for combat aircraft development, since when it has synergised and developed strategic capabilities in various disciplines with identified partners for realising a range of advanced technologies and final products for users.

Tejas LCA is the premier programme undertaken by ADA having achieved Full Operational Clearance in February 2019. The LCA Mk.I has been inducted in IOC configuration into the IAF, with the first squadron (No.45 *Flying Daggers*) formed at Sulur in Tamil Nadu.

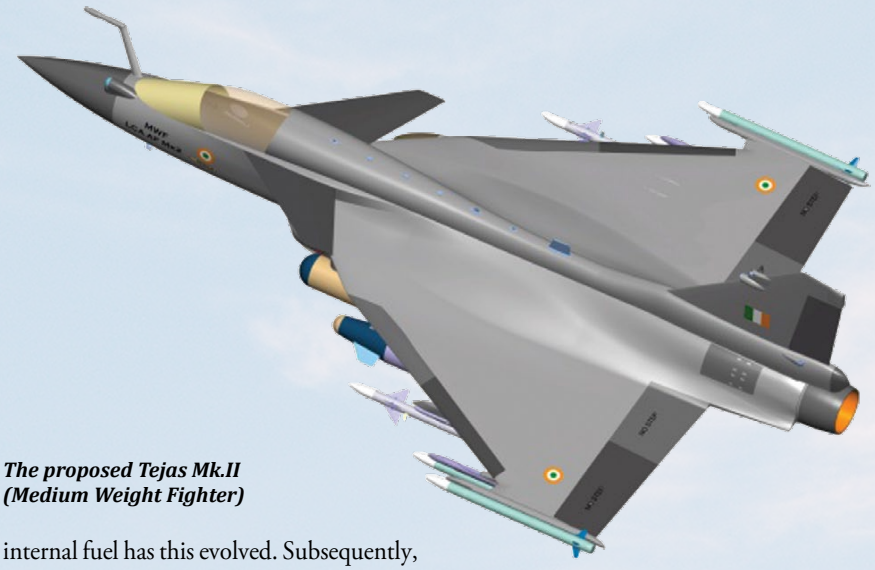
The Light Combat Aircraft is powered a single engine, has compound delta wing, relaxed static stability and advanced digital fly-by-wire control system, making it an agile war machine being the smallest multirole all-weather supersonic fighter in its class. The fly-by-wire flight control system enables excellent handling qualities, making it a pilot`s delight. Its advanced glass cockpit enhances situational awareness and aids the pilot for decision support in all missions. The aircraft is equipped with computerised utility management system and Health & usage monitoring system for eases of maintenance.

The LCA Navy Mk.I programme has completed more than 300 flights including 43 day and 2 night ski-ramp launches and 27 day and 1 night arrested landings at the SBTF. Carrier Integration has been proven with successful operations from the flight deck of INS *Vikramaditya*, a total of 18 arrested landings and 18 ski-ramp take offs carried out from INS *Vikramaditya* in 5 days.

The LCA Navy Mark 2 is planned to be a single engine fighter with higher thrust engine, increased internal fuel and

improved weapon carrying capability, with enhanced mission performance and better maintainability. However, as per requirement of the Indian Navy, this programme will be converted to being a twin engine deck based fighter (TEDBF), and studies have been initiated at the ADA.

The Tejas Mk.II for the Air Force was initially planned to have a higher thrust engine. However, in its new configuration it is no more a light combat aircraft but will be a Medium Weight Fighter (MWF). This evolution of the MWF began with the IAF projecting a platform to replace the Mirage 2000, Jaguar and MiG-29 in the 2030s. The IAF wanted a multi-role fighter with improved range, endurance, lethality and increased payload carrying capacity. Based on these requirements, configuration optimisation studies were initiated by ADA in November 2016, a configuration with improved performance and increased



The proposed Tejas Mk.II (Medium Weight Fighter)

internal fuel has this evolved. Subsequently, the IAF also indicated their requirement for integrating heavier standoff weapons. The final configuration was agreed to in September 2018 to meet these capabilities.

The Mk.II (MWF) will be state-of-the-art multi role supersonic fighter aircraft with delta wing and close coupled canard, having an enhanced payload capability of 6.5 tons with max all up weight of 17500 kg. The MWF will have 11 hard points and is integrated with advanced avionics system and sensors including an Active Electronically Scanned Array (AESA) radar, Integral Unified Electronic Warfare Suite (UEWS), Missile Approach Warning System (MAWS) and Infrared Search & Track (IRST) System. Its range and endurance will be enhanced by an On-Board Oxygen Generation System (OBOGS) and Inflight Refuelling Probe (IFRP). The cockpit will have larger size, smart Large Area Display (LAD) and smart Head Up Display (HUD) to provide enhanced situational awareness.

Preliminary design of the MWF is at the final stages of completion and detail design activities are to begin from March 2020. The procurement of raw material and LRUs has been initiated and development activities towards new LRUs initiated. The engineering cockpit simulator of the MWF was on display at Defexpo 2020, with a Large Area Display (LAD), sleek Head Up Display (HUD) and side control stick.

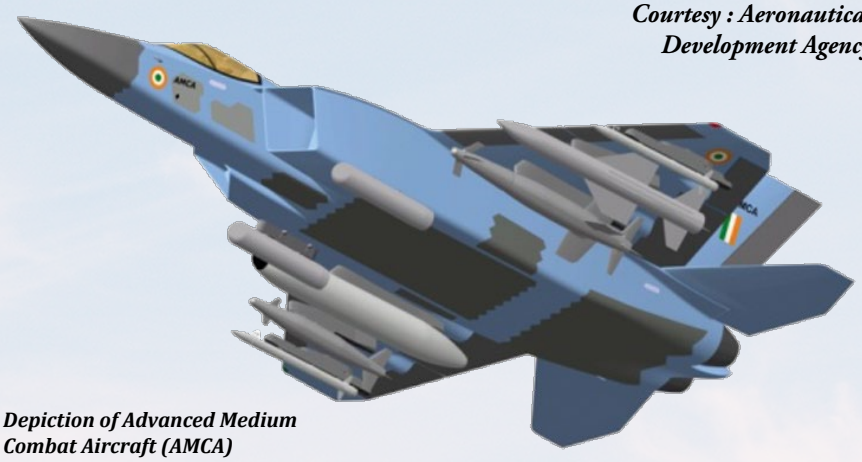
The Advanced Medium Combat Aircraft (AMCA) will be a fifth generation, multi role combat aircraft with state-of-the-art technologies, under design and development at the Aeronautical

Mock up of the MWF Cockpit

Development Agency (ADA). The AMCA will be a twin engine stealth fighter, its balanced design having trade-off between aerodynamics, stealth and structure for achieving high endurance levels. Enhanced survivability will be provided by the stealth factor and electronic warfare capabilities: "AMCA will be a jewel with the Indian armed forces". AMCA design will have stealth features including its air frame, internal weapon bay, serpentine air-intake and conformal antennae. It will have advanced integrated avionics, integrated vehicle health management and net centric warfare capability.

These indigenous fighter development programmes are proceeding with high impetus at ADA, the organisation's aim being to provide the entire fighter aircraft fleet of the IAF by 2035.

Courtesy : Aeronautical Development Agency



Depiction of Advanced Medium Combat Aircraft (AMCA)

Air Marshal Harish Masand writes on

India's ASAT missile – and the indigenous defence industry

The ASAT on display at the Republic Day Parade, 26 January 2020

27 March 2019 is recalled in Indian history as a proud day when Indian scientists demonstrated their prowess to successfully test an Anti-Satellite (ASAT) missile and so register the country as "a space power". As PM Narendra Modi stated, this made India the 4th country in the world, after the US, Russia and China, to possess such strategic capability. Without going into the politics of this test, in my opinion, the PM was absolutely right in announcing this important landmark to the nation even as he congratulated scientists as well as the entire nation on this achievement. The world over such events are brought before the nation – and the world – by heads of state owing to the strategic significance and security implications of such developments and achievements. Going back to 1998, the nuclear tests of 1998 were also announced by the then PM, Atal Bihari Vajpayee, without any kind of controversy at that time!

Be that as it may, the strategic implications and the boost in our national security because of the ASAT capability have already been widely debated by experts and I do not intend to repeat these. What I consider equally, if not more, significant in this achievement was the fact that the entire development and test was totally indigenous, as claimed by then Finance Minister Arun Jaitely, who was accompanied by then Defence Minister and others in a press conference that very afternoon. To be sure, as we have learnt from our nuclear and missile programmes over the years, no nation parts with such advanced technology without major strings attached.

Charting a course of strategic autonomy with India's stance of non-alignment, we have had to live with sanctions after the nuclear tests of 1998, which denied us even dual-use technology for a long time and impacted on other indigenous programmes including the LCA. It is to the credit

Pair of LCAs in formation take off

of our dedicated scientists that, in these spheres where no help from outside was forthcoming and stringent obstructions put, they were able to meet the challenge and indigenously develop requisite technologies and expertise in cost-effective manner. In layman terms, the essential technologies involved in the ASAT capability included surveillance and tracking at large distances, missile engine and control systems, mid-course guidance and terminal homing systems integrated with a jam-resistant data communication system to make the ASAT missile successful. Having interacted with scientists in these areas during my time in the Air Force, I understand the difficulties in developing such complex technologies indigenously without a system to even study, copy – or reverse engineer !

Having developed such complex technologies, the issue that should really bother all of us is why the same breed of scientists and engineers, working in other departments or PSUs involved in defence production, are unable to produce even a world-class assault rifle, much less other weapon systems, which are far lower in the technological ladder, Surely, technologies involved in the ASAT test have been under research and development for some time and did not come about overnight. It is, therefore, logical to assume that the individual system technologies were developed and tested over the years before integration and trials and should have been available to other departments in the DRDO and defence PSUs for application

in other weapon systems which we keep on importing at hugely inflated costs.

The ASAT, like nuclear weapons, is a strategic deterrent that, hopefully, would never have to be used. This is in contrast to many other less complex systems that our armed forces regularly need to be able to train and fight for conventional and sub-conventional warfare. If our scientists are capable of developing an ASAT system, the question that naturally arises is why we cannot develop and produce cost-effective ground-based and airborne radars for surveillance, Surface-to-Air Missiles, Air-to-Air Missiles, precision attack weapons, modern inertial navigation systems and even artillery and small arms, apart from basic trainers aircraft much less advanced combat aircraft ?

The point which clearly emerges is that when denied technology and assistance, we are capable of developing the requisite technology indigenously at very economical costs as exemplified by our space and missile programmes. However, when technology is available to us in the international market, we remain content to buy or go for a collaborative approach and transfer of technology in these acquisitions. But even after such initial transfer of technology, we are seemingly unable to progressively improve our technological competence in such areas with new and more advanced systems, either by adapting or even reverse engineering. It is also obvious that the international arms industry would hardly like to see a market like India disappear from their calculations owing to indigenous development and self-reliance, much less become a competitor and would employ every resource at their disposal, fair or unfair, to ensure this! Despite aspirations of becoming a world power, we continue to remain in this *chakravyuh* without any of our policy-makers or leaders really overhauling the system to find a way forward. Dependence on imports does not merely bleed us in costs but also ensures that the best, and sometimes critical, technologies would not be made available to us apart from spares when critically needed.

Some examples are apt. Our integrated guided missile programme began in the 1990s but we are still unable to field a world-class anti-tank or anti-aircraft missile system. If we had been so able, we would not have had the need to go in for the LRSAM and MRSAM programmes with Israel. Work on the *Astra* indigenous beyond visual range (BVR) AAM, started at the turn of the century but we still extol the virtues of the MICA missile and "missed" the Meteor missile during the dogfight on 27 February 2019!. Even during the Balakot strike, we found the expensive SPICE bomb kits to be the most effective and suitable weapon for the strike. Our warships continue to be armed with the Barak-8 missile system while for strategic air defence, we have opted for the Russian S-400.

Something is seriously amiss in our system of research and development, both with the DRDO as well as Defence PSUs. If we must seriously march towards the goal of self-reliance, at least to a large extent in critical areas, the system needs complete overhaul. The subject is vast and a lot has already been written but not much attention seems to have been paid. In my opinion, the system needs an overhaul starting from being freed from bureaucratic shackles. Once India's political leadership is committed to the goal of self-reliance – and has the vision and the authority to act along with the intrinsic responsibility and accountability – we can surely achieve the desired goals. Surely the leadership knows the problems of the system, and the solutions to these, without having to be told by someone from the outside!

Privatisation of the defence industry cannot be considered as a panacea to all the existing problems. Private enterprise first looks to the profits to be made, with a large focus on the short-term, and is largely unwilling to invest in research unless it has an assured market and returns. The current approach of partnership with foreign players is unlikely to yield the desired results and may just turn out to be another saga of transfer of screwdriver technology at escalated costs unless there is a strong manner of oversight from the top.

Alas, we still have a long way to go in our quest for self-reliance in defence!

(All images from the internet)

The Defence Kumbh

"Uttar Pradesh should emerge as Defence Manufacturing Hub": Defence Minister Rajnath Singh

Defence Minister Rajnath Singh described DefExpo 2020 as "an unprecedented success which not only witnessed participation of a large number of exhibitors but also forged new partnerships, attracting more than 12 lakh visitors". Speaking at the valedictory ceremony on the fourth day of DefExpo 2020 at Lucknow, Mr Rajnath Singh said that "UP stands for *Unlimited Potential*" and that DefExpo succeeded in projecting a new identity of the State in the defence sector, with the Defence corridor receiving a huge boost for attracting new investments with the signing of 23 MoUs. "DefExpo would also establish India as a Defence manufacturing hub of the world and exporter". Thanking Prime Minister Narendra Modi for inaugurating the DefExpo, he said that adopting policies had that improved image of India on world stage.

The Lucknow Declaration which was adopted at the first ever India-Africa Defence Ministers Conclave was another landmark achievement of this DefExpo. The Raksha Mantri expressed gratitude to the Uttar Pradesh Government headed by Chief Minister Yogi Adityanath for the successful organisation of this event, who had earlier said that his government had organised many international events during the last few years such as Prayagraj Kumbhmela, UP Investors' summit and Pravasi Bharatiya Diwas and successful organisation of DefExpo had enhanced the image and prestige of Uttar Pradesh. Describing DefExpo as a "Defence Kumbh", he said that the event witnessed presence of more than 3,000 foreign delegates, 10,000 Indian delegates and 12 lakh visitors, which laid a strong foundation for development of UP Defence corridor.

In his opening remarks, Defence Secretary Dr Ajay Kumar described DefExpo as a "job well done" as various

14 MoUs with Russian OEMs

The 5th round of India-Russia Military Industrial Conference (IRMIC) was conducted on 6 February 2020 on the sidelines of Defexpo-2020 at Lucknow. The conference was co-chaired by Dr. Ajay Kumar, Defence Secretary and Mr Oleg Ryazantsev, Deputy Minister of Industry and Trade of the Russian Federation.

In his opening remarks, Dr Ajay Kumar, recalled that the Inter-Governmental Agreement (IGA) on Joint manufacturing of spares in India had been signed at Vladivostok, Russia on 4 September 2019. The IGA provides framework for partnership of Russian OEMs with Indian industry for manufacturing of spare parts of Russian origin equipment in use by the Indian Defence Forces. Dr Ajay Kumar elaborated that the Indian side has taken a number of steps to expedite the collaboration between the Indian and Russian Companies and looked forward for expeditious commencement of manufacturing in India. The Russian Deputy Minister, Mr Oleg Ryazantsev confirmed that the Russian side would actively participate in the collaborations under the ambit of the IGA and would take all necessary steps to facilitate manufacturing of parts in India.

During the conference, 14 MoUs were exchanged between the Russian OEMs and the Indian companies. The first 'Request for Proposal' for manufacturing of parts in India under the provision of IGA was also handed over by the Indian Navy to the identified Indian industry.

"Make in India...for India ....and the World"

Prime Minister Narendra Modi on inauguration of DefExpo 2020

The Prime Minister of India Mr. Narendra Modi inaugurated DefExpo 2020 in the afternoon of 5 February at a largely attended ceremony at the Expo site in Vrindavan Yojna, a new development area of-UP's capital Lucknow. The PM was forceful in his address that India needed to not only enhance its defence production capability and range but become a major defence exporting nation which is intrinsic to the objective of achieving an economy' of US$ 5 trillion. The new mantra is "Make in India...for India...and the World", the Prime Minister quoting some telling statistics in that from Rs 2000 crore worth of defence equipment exported in 2014, this increased to Rs 17,000 crore in 2019. Referring to the theme of this, the 11th edition of this biennial event, being the first time in Uttar Pradesh where the second defence corridor in the country is being implemented. The PM stated that "Digital transformation of defence is very important for the future of Indian armed forces" and gave the objective of developing 25 products based on artificial intelligence over the next five years.

Mr Modi also referred to the strides made by DRDO which has created new products and systems and Indian industry could benefit from such transfer-of-technology without any cost. Further, the licensing regime has been liberalised to specially benefit MSMEs: "The target is to increase their numbers to reach 15,000 in the next five years".

The Indian Prime Minister announced that the government was working to attract increased foreign direct investment (FDI) in the defence sector, making it more liberal. "The path to 100% direct investment has been cleared and 49% of this can be through the indirect route... which has the potential of attracting Rs 17,000 crore of FDI in the near future."

events concluded smoothly. The event was successful in raising awareness and interest of investors in UP Defence corridor he added. At Defexpo 2020, some 1024 exhibitors had participated, 172 of them being foreign companies. 40 Defence Ministers were part of total 70 foreign delegations that visited Lucknow.

At the Valedictory ceremony, Mr Satish Mahana, Minister for Industrial Development Uttar Pradesh Government, Mr Barun Mitra, Special Secretary Department of Defence Production, Ministry of Defence, Mr Awanish Kumar Awasti, CEO UPEIDA, Mr Madhavan R, CMD HAL were also present during the occasion.

During the public days, DefExpo was open to all, with crowds thronging the venue. Thousands of young and senior, men, women and children visited various pavilions and acquainting themselves with defence equipment on display.

DRDO – developed Varunastra torpedo

Inauguration and Seminars

The "biggest ever" DefExpo organised in India, had been inaugurated by Prime Minister Narendra Modi on 5 February where he set a target of US$ 5 billion for defence exports from India, to be achieved in the next few years. "India with its huge population and democracy, cannot remain long dependent on defence imports", he ascertained. "The DefExpo is part of Government efforts to make India a net exporter of Defence equipment".

More than 22 seminars held during the four days highlighted the technological changes, digital transformation of Defence


CM of UP Yogi Adityanath with Dr. Vivek Lall at the Lockheed Martin stand

Dr. Sateesh Reddy presents IoC certificate to HAL Chairman Mr. R. Madhavan for the LUH

and the positive policies implemented by the Government, such as relaxation in FDI investment, encouraging innovation in defence start-ups, opening up of testing facilities to private sector and sharing of technology innovations of DRDO at no cost among others, to make India a defence manufacturing hub. DefExpo 2020 offered "unique opportunity for the Indian Defence Public Sector Units to showcase their technological innovations and new products to the world".

DefExpo 2020 covered a lot of ground in creating an environment where Indian industry forged partnerships through MoUs, ToT agreements for innovation and manufacturing. *Bandhan* ceremony on 7 February witnessed launch of 13 products including HAL's Light Utility Helicopter,

Future of (Indian) Aircraft Carriers

"There is immense potential for making India the hub for shipbuilding and export of naval vessels" stated Mr Shripad Yesso Naik, Raksha Rajya Mantri. He was speaking at the international conference organised by PHD Chamber on 6 February during DefExpo 2020. The Minister emphasised that India "must also utilise its shipbuilding strength to help *friendly countries*".

Defence Secretary Dr Ajay Kumar

In his address during the same conference, Dr Ajay Kumar, Defence Secretary reiterated the government's drive to enhance export of Indian-manufactured defence items, including warships, both surface and under water as also unmanned systems. He said that the ministry has taken steps to "encourage the huge pool of talent and energy that exists in India for shipbuilding".

Rear Admiral Devinder Sudan with PHD Chamber Secretary

The proceedings that followed were on the '*Future of Aircraft Carriers*', chaired by Rear Admiral Devinder Sudan (retd.) and included the present ACNS (Air) Rear Admiral Mukul Asthana, Capt. Chirs Bolt (retd), Director, Strategic Development for Carriers, Surface Ships, General Atomics India and Mr VP Shiraz, Project Manager, IAC at Cochin Shipyard Ltd. A range of presentations during this interactive session were made

Naval Officer making his point

by the panel with lively questions and comments from the learned audience. On the dogged question "why aircraft carriers?" there were straight answers from the professional naval aviators who have spent their lifetime operating from carriers at sea.

The Indian Navy has always maintained its need for three aircraft carriers and the present INS *Vikramaditya* is to be joined shortly by IAC-1, the new INS *Vikrant* built at the Cochin Shipyards. The Indian Navy is clear in its projection for the third carrier (IAC-2) which would be considerably larger and hence carrying more aircraft for credible projection of airpower at sea. IAC-2 would be of some 65,000 tonnes, having electric propulsion, embarking a mix of fighter, strike and AEW aircraft, launched by the revolutionary EMALS system.

the OFB *Sharang* 155mm howitzer were the highlights amongst others. More than 120 MoUs were signed between DPSUs, private and global defence manufacturing companies. Among those MoUs signed, 23 of them were by Uttar Pradesh Government. These MoUs envisage Rs 50,000 crores investment in the *Defence Corridor* in the state which should generate 3 lakh job opportunities.

A major announcement during DefExpo 2020 was issue of the Initial Operational Clearance (IOC) certificate for HAL's Light Utility Helicopter (LUH). This new generation helicopter, in the 3-tonne-class, incorporates state-of-the-art technology features and is designed to replace the large numbers of HAL-built Chetak and Cheetah helicopters serving with the Indian Armed Forces. BDL launched the Amogha-3 man portable fire and forget missile anti-tank guided missile as also the *Varunastra* anti-submarine torpedo, manufactured under technological guidance of the DRDO.

Among the MoUs signed, 23 of them were with the Uttar Pradesh Government, Chief Minister Yogi Adityanath saying that these adding upto Rs 50,000 crores investment in the defence corridor of the state. He assured all that investments coming to the State

were secure and the state investment policy was the most attractive in the country.

One of the highlights at Defexpo was the *India Pavilion* which gave a review of futuristic technologies including Artificial Intelligence (AR), Augmented Virtual Reality (AVR), Autonomous Systems, Internet of Military Things (IoMT) and Industry 4.0.

A major attraction for peoples of Lucknow were live demonstrations by the Indian armed forces at two locations in the city, both at the DefExpo site, while the Indian Navy and Indian Coast Guard carried out demonstrations on the Gomti River front.

Vayu's Cover Story in Real Life!

Vayu were delighted to welcome Capt Shivnath Dahiya ("Dax") at their stand Q12 in Hall 3. The naval test pilot presently with the National Flight Test Centre of the ADA at Bangalore has been strenuously involved with the LCA Navy and its flight testing including arrested landings and take offs from the INS *Vikramaditya*.

Vayu's DefExpo issue cover had the LCA (Navy) Mk.1 flown by Commodore JA Maolankar making the milestone landing with 'Dax' as the landing signals officer (LSO), seen on right of the photograph.

The 'Air' over DefExpo 2020

The Defence Exhibitions Organisation of the MoD have been organising and holding air and defence shows for the past quarter century, being *Aero India* at Yelahanka (north of Bangalore) and in alternative years, *DefExpo* which was always held at Pragati Maidan in the heart of New Delhi before it was shifted to southern Goa in 2016 and two years later to the temple town of Kanchipuram, south of Chennai in Tamil Nadu in 2018.

DefExpo 2020 was held at a virgin site in a new development area of Lucknow the capital of Uttar Pradesh, at Vrindavan Yojna, Sector 15, touted on the internet as "the *biggest park in Asia, having space for family outing, friends,masti, and gf-bf timepass...most of the area is unreachable from families and you can find love birds performing our old ancient art" (sic)*..

Nonetheless, the area had been converted to a massive exhibition site with areas dedicated for display and demonstration of weapon systems including AFVs, howitzers and other machines of war. The biggest defence public sector undertaking in the region is Hindustan

IAF Surya Kiran display team perform at Defexpo (Photo: Deb Rana)

Surya Kiran Team (photo: @Suryakiran_IAF)

MiG-21M with armament displayed at DefExpo 2020

Aeronautics Limited, whose Accessories Complex is headquartered at Lucknow and on whom much of the responsibility to organise this edition of *DefExpo* rested – and was successfully executed.

Unlike Aero India Shows which are unabashedly about aircraft and their systems, *DefExpo's* highlight the land and maritime warfare domains with large presence of companies and personnel from these disciplines. The 'Air' dimension is normally missing at DefExpos or in low profile with aerospace companies content to display aircraft models or large posters of their wares.

But not so at DefExpo 2020, which many observers felt was a virtual 'air show', with aircraft including helicopters dominating the space (and sounds) over the four day event. To begin with, as DefExpo 2020 was inaugurated on 5 February by the Prime Minister himself, accompanied by

HAL light utility helicopter (LUH) at the static display area

Pride of place for HAL-Dornier 228

From the very start, at the Curtain Raiser event on 4 February 2020, eve of DefExpo 2020, HAL's Dornier 228 light transport aircraft was toast of the event, with the Chief Minister of Uttar Pradesh Yogi Adityanath announcing that two Dornier 228s have been 'engaged' by the UP Government to boost regional air connectivity, with an increasing number of airports being set up in the state, including that proposed at Jewar, which is sought to become the biggest international airport in South Asia. The Dornier 228s which will be operated by a private airline will be based at Lucknow and provide scheduled air services between the capital city and Varanasi, Bareilly and Agra amongst others. HAL signed a lease agreement with Turbo Aviation Pvt Ltd who would operate the Dornier 228s under the UDAN scheme.

Pride of place at HAL's large and very well laid out pavilion at DefExpo 2020, was given to the full scale mockup of the HAL-Dornier 228 glass cockpit, this 'new generation' variant being offered to Indian and International operators with uprated engines and a five-blade propeller.

On 7 February HAL signed a contract with the Indian Coast Guard for mid-life upgradation of 17 HAL-Dornier 228s, the Service presently operating near 40 such aircraft from several air stations on both the western and eastern sea boards and the A&N Islands. A formation of four Coast Guard Dornier 228s also took part in the fly past during the DefExpo 2020 inauguration.

Meanwhile HAL has signed an MOU with the IIT Kanpur for providing Dornier 228s and extending logistic support to the Institution's project in the field of 'cloud seeding'; the versatility of this German-origin, Indian-built light transport aircraft continues to be exploited!

Mr Sajal Prakash, Chief Executive Officer of HAL's Accessories Complex, Lucknow

HAL-Dornier 228s at HAL Pavilion

HAL Dornier 228 glass cockpit

The Indian Coast Guard is one of the biggest operators of the HAL-Dornier 228


(source: Outlook)

the Defence Minister and Chief Minister of Uttar Pradesh, there were some 40 aircraft taking part in the fly past, formation aerobatic display and other dramatic aerial menuoveres. In fact, there was more 'air' over the Vrindavan Yojna in Lucknow than had been over the Rajpath in New Delhi on 26 January 2020!

On the ground were displayed several helicopters including HAL's Dhruv Mk.IV (Rudra) and the new light utility helicopter (ULH) and the Air Force highlighted its MiG-21M (Type 96) in what was touted as its approach to digitisation. The Indian Air Force had a large (although with modest layouts) hall, promoting careers in the force alongside a mobile trailer from the recruitment wing.

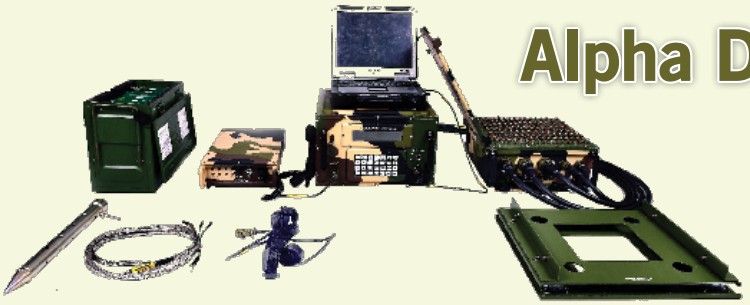
However, the 'ground' was not forgotten. At the live demonstration the Army display included various air defence assets including the Tunguska and Schilka air defence systems alongside deployment of howitzers including the DRDO-developed Advanced Towed Artillery Gun System (ATAGS). Cheetah helicopters of Army Aviation inducted special forces and 'held ground' as All Terrain and Light Strike Vehicles moved in before the heavy armour which included T-90, T-72 and Arjun main battle tanks alongside BMP-II infantry combat vehicles.

When the audience thought that the Army was now dominant, the 'air' arrived again in the form of the Tejas LCA Mk.I which carried out an attractive display over the Vrindavan Yojna.

Through the rest of DefExpo 2020, the skies over Lucknow continued to reverberate with sounds of fighters and helicopters, all of them having a considerable percentage of their avionics and accessories built not far away, at HAL's Accessories Complex whose address is appropriately given as 'Opposite Tejas Marg'.


The Tejas resplendent over Lucknow

VAYU Interview with Col. HS Shankar, CMD, Alpha Design Technologies



VAYU: What have been the most recent developments in the defence and space arena for Alpha Design Technologies (ADTL)?

HSS: We are pleased to announce that ADTL was declared as L1 for the important Pichora radar/ Missile Upgrade Project which is to be completed in next 3 years. The MoD has also contracted ADTL for manufacture and supply of indigenously developed ULSB Mk III, the follow on order of 1545 in addition to the 2000 already supplied three years back.

ADTL has also made significant progress in major R&D projects, such as the BMP-2 Upgrade (with modified T-72 TIFCS), software defined radios, both for IAF and Army, high capacity radio relay, tactical access switch, EW suites and others.

As for Space, the ADTL-led consortium of engineers and technicians, under ISRO's guidance, has assembled, integrated and tested (AIT) two 1.635 tonne Satellites (IRNSS 1 (h) and 1 (i) for the Indian GPS programme.

This same team have carried out AIT under ISRO's guidance of the third and bigger 3.5 ton GSAT 30 Satellite (Communication Set), successfully launched on 17 January 2020. ADTL's teams are now carrying out AIT under ISRO's guidance with one such important satellite to be launched in April 2020.

The highlight for ADTL was the Minister of State of Home launching the POLNET 2.0 (Pan India Police Network 2.0) at Delhi on 20 January 2020. ADTL continues to execute major hub and ground antenna receiving terminals at SAARC countries, (recently, India's PM inaugurated ADTL's 140 stations at Bhutan), the A&N Islands and elsewhere.

ADTL, as part of its Investor the Adani Group are part of the consortium with BEL and BEML for production of five PSLV launchers.

VAYU: Kindly elaborate on the role played by ADTL in the Tejas LCA and Su-30MKI programmes as well as their simulators and helicopter upgrades?

HSS: ADTL's subsidiary Alpha-Tocol was awarded the contract by HAL for manufacture and supply of LCA rear fuselage assemblies as also manufacture and assembly of jigs, nose box, pylons, RF assemblies for the LCA.

For the Su-30, Alpha-Tocol makes ailerons, flapperons, engine mounts, and other assemblies which have so far been fitted on 120 aircraft. Alpha-Tocol is also involved with overhaul of the Su-30 at HAL Nasik.

VAYU: What are the latest developments at the Alpha ELSEC Joint Venture?

HSS: Major breakthrough for A-Elsec JVC has been establishment of facilities for UAVs (Sky Lark and Sky Striker) and the export of airframes for these to Israel. Alpha-Elsec's EO manufacturing group also exports critical units for the COAPS (Commander's Architectural Panoramic Sight) and for the TIFCS version to Thailand for upgradation of US-origin M-16 AFVs.

VAYU: Please elaborate on ADTL's partnership with DRDO and the DPSUs.

HSS: Tremendous strides have been made both by DRDO and ADTL on major IFF projects for the CABS (Interrogator, Transponder and Combined RF Seeker for MR-SAM, Missile Launch Detection System (MILDS) for the Mi-17 and Mi-17 1V Upgrade, EW sub-systems and others.

VAYU: As for exports, what are the successes achieved by ADTL?

HSS: During 2018-19 and the current year (2019-20), ADTL's sales turnover includes more than 85% in exports, which is the highest ratio in the Public/Private sector.

GA-ASI makes Persistent Situational Awareness "more affordable"

The new Integrated Intelligence Center (I^2C) from General Atomics Aeronautical Systems, Inc. (GA-ASI) presents innovative ways to improve the user experience for operators of Remotely Piloted Aircraft (RPA) and other multi-domain Intelligence, Surveillance and Reconnaissance (ISR) platforms using automation and user experience-based design (UX). And best of all, the system makes situational awareness more affordable for all involved, including intelligence analysts, mission supervisors, and decision makers.

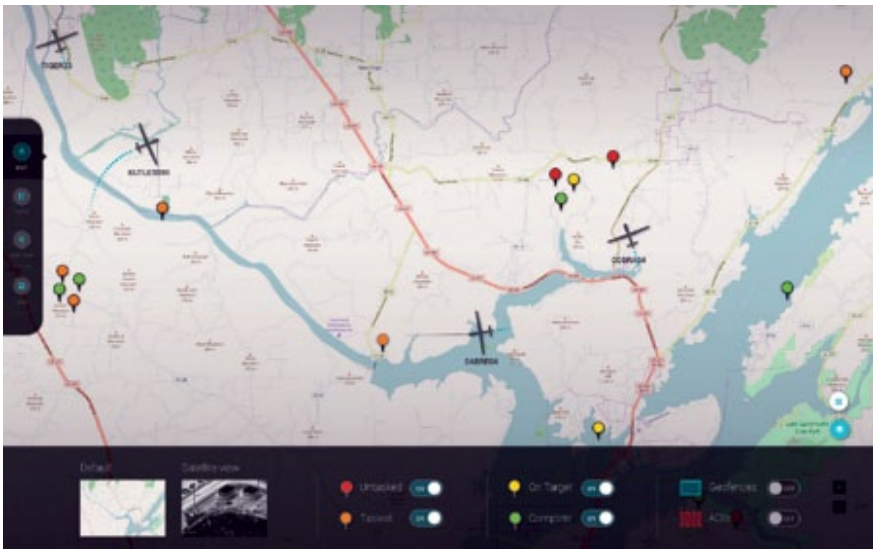
"I^2C will rapidly transform data into actionable intelligence for operators," stated David R. Alexander, President, GA-ASI. "We see benefits to the warfighter on many fronts, including the reduction of operational cost – whether it's Ground Ops, Air Ops, or Intel Ops. By combining XC2, Automatic Takeoff and Landing, Multi-Mission Control and our single-seat Certifiable Ground Control Station, we will reduce manning by 50 percent."

GA-ASI's modular and open software architecture design promotes horizontal integration of third party software and rapid integration of new capabilities making the following developments the ideal set of ISR tools for streamlined and improved collaboration. This extends to multi-INT data across multi-domain platforms:

eXpeditionary Command & Control (XC2): XC2 laptop leverages GA-ASI's Advanced Cockpit development by porting select capabilities to a ruggedised laptop. A forward-deployed maintainer can use the laptop to employ automated pre-flight and post-flight checklists that reduce setup times by up to 50 percent.

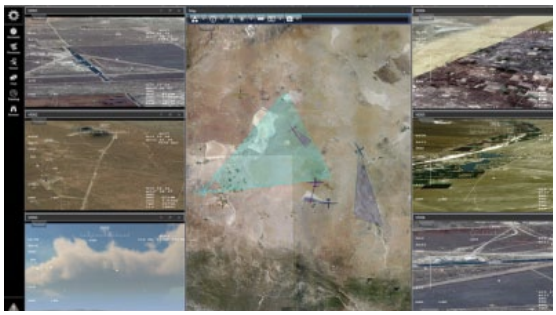
Certifiable Ground Control Station (CGCS): The CGCS enables single-seat operations to reduce manpower requirements. Its tactical situation display unifies ISR and C4ISR data, as well as mission planning into a single Common Operating Picture (COP).

Multi-Mission Controller (MMC): The MMC enables a single user to safely control multiple aircraft and perform transit and routine ISR missions using a hand controller. When an aircraft is tasked with performing more dynamic ISR or a strike mission, MMC allows a rapid handoff of the aircraft to a dedicated GCS.



Metis is a map-based interface that enables a pre-approved Metis user to request ISR products from the RPA

Metis: Metis is a map-based interface that enables a pre-approved Metis user to request ISR products from the RPA, similar to ordering a car from Uber. Once the Metis user sends a task, it's transmitted to MMC in real time. The MMC user selects the task and an integrated third party auto-router automatically generates a safe route to the requested target.



The System for Tactical Archival, Retrieval, and Exploitation's (STARE) Common Operation Picture shows aircraft locations, as well as ISR assets and their payload data

STARE: The System for Tactical Archival, Retrieval, and Exploitation's (STARE) Common Operation Picture shows aircraft locations, as well as ISR assets and their payload data. The Multi-INT exploitation tool ingests, archives, disseminates and makes ISR data discoverable for imagery analysts to utilize. STARE reduces data exploitation tasks from hours to minutes.

Automation of Intel Ops: I^2C integrates third party capabilities and software services to make Intel analysts more effective. Automated Activity Alerts – based on Multi-INT data correlation – reduces the need for eyes-on RPA sensor data to pick out significant activity. GA-ASI is partnering with best-of-breed companies specialising in Artificial Intelligence (AI) and Machine Learning with proven AI-based systems deployed across multiple commercial sectors.

These tools and capabilities are either operationally deployed, undergoing customer operational assessment or are actively flying aircraft. I^2C is made to ingest ISR data from any airborne, ground, or space based system, not just GA-ASI aircraft.

VAYU Interview with Chairman BEML

VAYU: What is the theme for BEML at DefExpo 2020? Are you displaying anything new?

BEML: In line with theme of 'Digital Transformation', BEML is launching AI-based Mobile Healthcare Diagnosis System to address medical needs of the Armed forces. Further, BEML are also showcasing new crew-protected vehicles such as the Medium Bullet Proof Vehicle and Armoured Command & Control Vehicle, Bulldozer with hydrostatic transmission drive technology (BD50HST) and 20T class heavy transportation vehicles.

VAYU: Kindly tell us about the orders, deliveries and backlog at BEML?

BEML: In M&C business, after successful trials of in-house designed & developed 180T (BE1800E) eco-friendly electric excavator (India's biggest), we have received orders for five numbers, planned for delivery in FY2019-20. Further, more orders are in the pipeline including those for 150T & 190T high-end dumpers.

In the Rail & Metro business, we have considerable orders in hand, having delivered the first driverless metro coach to MMRDA's Mumbai Metro project, well ahead of schedule. At present, we are executing orders related to Kolkata Metro (KMRCL), Bangalore Metro (BMRCL), MMRDA (through DMRCL) and DMRCL.

Currently, the Defence & Aerospace order book is around Rs 2600 crore, with major major orders for Recovery Vehicles, Bridge Systems, 1500hp engine and aggregates for ISRO. BEML Defence is aiming to reach orders of around Rs 4000 crore by March 2020.

VAYU: What about your pact with L&T?

BEML: BEML has signed a MOU with L&T to explore and address defence products and systems for domestic and export opportunities. BEML and L&T are working together for supply of various bridging systems amongst others, based on BEML Tatra vehicles for the Indian Army.

VAYU: What about your supplies to the Indian Army?

BEML: We have supplied around 8500 high mobility military trucks of various types to the Indian Army over the past three decades, involving operations such as for missiles, launchers, bridging systems, ground support vehicles, radars etc. BEML has also supplied armoured recovery vehicles, wagons, tank & missile aggregates, trailers, towing tractors and others to the army. Our spares and service support has increased multifold to ensure that the vehicles are on-road, meeting strategic requirement of the Indian Army.

Dr Deepak Kumar Hota, CMD, BEML

VAYU: In the aerospace sector, what are your plans on air defence systems?

BEML: As a part of its growth and diversification strategy, BEML started its aerospace journey with a humble beginning, offering design & engineering services, design & development of ground-support and ground-handling equipment followed by establishment of exclusive facilities to manufacture of rocket motor casings for various missile programmes, precision machining, fabrication and manufacture of airborne sheet metal structures.

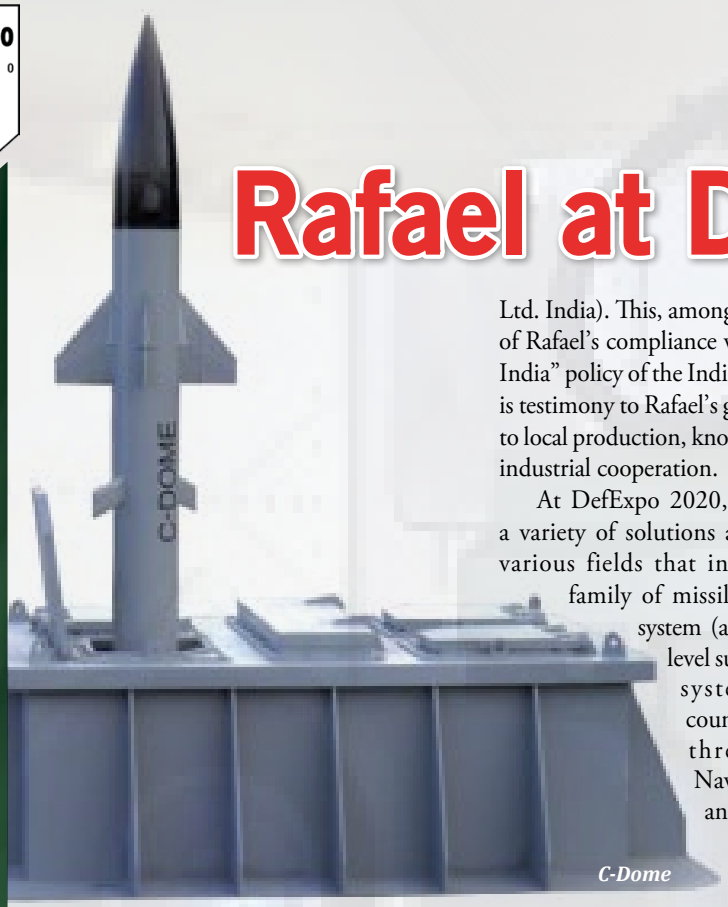
BEML has been awarded AS9100 D accreditation for Quality Management Systems and is in the process of acquiring NADCAP certification for the special processes to explore business opportunities from global OEMs. Furthermore, we are associated with ISRO for providing structural assemblies and rocket motors for their Launch Vehicles.

BEML plans to tie-up with other global leaders for manufacturing aircraft structures and systems that would enable BEML reaching the level of a 'Lead Integrator' in the area of missile systems.

VAYU: Concerning 'Make in India' initiative, where does BEML stand?

BEML: We are exploring establishment of JVs with technology partners for the manufacture spare parts in the designated Defence Corridors in order to reduce import burden and develop manufacturing eco-system amongst MSMEs. For manufacture of major need equipment, BEML plans collaborate with global OEMs to introduce and subsequently manufacture select products for the Indian Army, ensuring maximum indigenisation of around 50 - 60% by value of the products.

Rafael at DefExpo 2020



C-Dome

For more than two decades, Rafael Advanced Defense Systems has been supporting the Indian Armed forces with state-of-the-art systems, during which Rafael has stood by India to supply systems at short notice in various operational contingencies, including air-to-air, air defence, ATGMs, targeting and reconnaissance pods, SDR communication and more.

Rafael is already working with different branches of the Indian military and the Indian security apparatus and has cooperated to integrate its electro-optical systems, advanced ordnance, as well as its air-to-air and air defence systems. The company has been working steadily to create technology partnerships or joint ventures with major Indian companies to address various projects and has created structures to ensure technological transfer to India.

Over the last few years, Rafael has continued to realise its commitment to the Indian market and to its economy, including last summers' inauguration of a state-of-the-art facility at Hardware Technology Park, Hyderabad for local manufacturing of the SDR BNET communication system for the Indian Air Force, with a $30 million purchase order. In addition, Rafael has placed a $100 M order for Barak-8/ MRSAM missile kits for the Indian Army and Air Force from KRAS (Kalyani Rafael Advanced Systems Ltd. India). This, among other steps, is part of Rafael's compliance with the "Make-in-India" policy of the Indian government and is testimony to Rafael's global commitment to local production, knowledge transfer and industrial cooperation.

At DefExpo 2020, Rafael showcased a variety of solutions and capabilities in various fields that include the SPIKE family of missiles, Spyder missile system (a quick reaction, low level surface-to-air missile system designed to counter attack by aerial threats), C-Dome: Naval Defence System and the Iron Dome.

For defence against hostile UAVs, there is the Drone Dome- an end-to-end system designed to provide effective airspace defence against hostile drones (micro and nano UAVs).

Then there were guidance kits for rockets which is the EPIK. This is a new concept of Rafael to upgrade existing Rocket Artillery Systems for Autonomous, Pin-Point hit accuracy and increased range capability.

On the communication front, there was the BNET which is a broadband IP SDR (software defined radio), supporting the modern digital battlefield's needs with high-speed, low-delay, reliable connectivity for broadband data, voice and video on the move. Delivering unprecedented network capacity in terms of data rates, number of users and minimal delay, BNET enables all land, sea and air radio units to participate in a single, seamless, scalable mobile ad hoc network (MANET).


Spike on Tiger

On dispay was the Sea Spotter, a new generation infrared, passive staring system designed to be installed on naval vessels and capable of automatically locating all types of surface and aerial targets/threats. For naval platforms, Rafael offers the Typhoon, a family of lightweight, stabilised, remote controlled weapon systems with a full range of weapons, including small or medium caliber guns, coaxial machine guns and missiles.

Last but not the least, there were displays of UAS by Aeronatics (a Rafael subsidiary) at the Rafael Pavilion. The Orbiter 4 STUAS is an advanced multi-mission platform and delivers top mission performance with its lightest, most versatile and most advanced covert platform available today, for both land and maritimeoperations. The Pegasus 120 is a multi-rotor platform, designed especially for defence and security missions.

Courtesy: Rafael Advanced Defence Systems.


The Spyder

Boeing showcases advanced defence and services capabilities

Boeing showcased a range of advanced defence capabilities at DefExpo 2020, including models of the F/A-18 Super Hornet, KC-46 tanker, AH-64E Apache and the P-8I.

India is a crucial defence partner for Boeing, with some of its most mission-critical platforms integrated with the Indian armed forces. Today, India has 11 C-17 Globemaster IIIs, eight P-8Is (with four more on order), 17 AH-64 Apaches (against an order of 22) and 10 CH-47 Chinook (against an order of 15). "Boeing's local sustainment and training capabilities are making Indian armed forces mission ready."

Boeing's exhibit at Hall 3, Booth S16 with the theme 'Building The Future Together' focussed on its partnerships with India's armed forces, and the strategic investments the company has made in developing India's indigenous aerospace and defence ecosystem. These include the engineering and technology centre in Bengaluru and Chennai, the joint venture with Tata Advanced Systems, and work with over 200 suppliers and partners in support of "Make in India" and "Skill India."

"We're honoured to support India's armed forces with advanced platforms such as the P-8I, C-17, AH-64 Apache and the CH-47 Chinook that are delivering superior capabilities. Additionally, our support and services have played a significant role in ensuring enhanced operational readiness," stated Salil Gupte, President, Boeing India. "We continue to remain committed to strengthening the Indian aerospace ecosystem and look forward to engaging with our customers, partners and industry at DefExpo 2020."

Boeing also provided visitors a virtual flying experience with the F/A-18 Super Hornet Block III simulator to understand a wide range of missions, carrier-based aviation and capabilities the aircraft can offer the Indian Navy. The F/A-18 Super Hornet serves as the frontline multi-role fighter of the US Navy and air forces of several countries, and is currently on offer to the Indian Navy and Indian Air Force. The combat proven F/A-18 Block III Super Hornet will "bring the most contemporary next generation war fighter technologies" to the Indian Navy through battle-space situational awareness, counter stealth targeting, greater range and improved survivability, reduced radar signature and room for growth.

In addition to defence platforms, Boeing also focussed on its local sustainment and training capabilities for its Indian customers. "As Boeing steadily increases its sourcing from India, and expands its supplier network, it is highlighting its contribution towards 'Make in India' that fully harnesses India's manufacturing capability, talent, innovation and productivity".

IAI's Drone Guard against "the new menace"

Since their appearance in the late 2000s, multirotor drones have taken the world by surprise. Unlike unmanned aerial systems (UAS) pursued by the world's military forces under military research, development and supply channels, these drones, originally introduced for recreational use by hobbyists and filmmakers utilsed highly integrated, miniaturised, cutting edge electronics designed for consumer, communications systems that pack ultra-advanced capabilities including remotely controlled and autonomous systems (RC), that perform remote surveillance, precision navigation, secure communications and agile, jam-resistant communications.

By end of 2020, more than 100,000,000 drones are expected to roam global skies, used in civilian, commercial and scientific roles. They carry remote monitoring, metering, sensing and security missions, infrastructure surveillance, agricultural services, fishery, forestry monitoring and control, delivering parcels and medical supplies, carry video cameras to cover sports events and more. Using open-source navigation and flight controls, amateurs and experts can hack drones to carry out missions they were never designed to do.

As they become more common in daily life, drones also become potential menaces, when they land on the wrong hands. So far, lethal use of drones was limited to the combat zones in Iraq, Syria and Afghanistan, but security forces around the world are certain that future drones' lethal use will not be limited to warzones. In fact, the uninterrupted accessibility of drones could turn critical infrastructures such as gas and oil tanks, or chemical facilities into mega-explosives if exploited by terrorists using drones.

As small, slow and low flying vehicles, multirotor drones are hardly spotted from the ground by radar, camera or the human eye and, when strapped with rudimentary weapons, their simple yet effective control enable operators to use them as loitering weapons. In Iraq, they were used by ISIS to spread havoc among Iraqi forces, defeated only with dedicated Counter-UAS (C-UAS) equipment that was rushed to the combat zone.

One of these C-UAS weapons is the Israeli Drone Guard, an integrated system that relies on multiple sensors to detect, classify, identify and defeat drone target. Developed by IAI Elta Systems, Drone Guard employs a multi-layered approach for detection, classification and targeting. For detection, the company's ELM-2026B X-band radar and passive Communications Intelligence (COMINT) to detect and classify targets from five kilometers. Electro-optical sensors may also be used to detect targets that maintain minimal or no radar signature.Once a drone presence is verified, the radar directs the Electro-Optical (EO) system to identify it. The combination of radar and SIGINT is part of Elta's multilayered detection capability that maximises the system's efficiency.

Once detected and identified, targets are mitigated by Drone Guard using multilayered effects. The most basic effectors are electronic emitters used to jam and disrupt the drone's control and navigation channels, following different protocol that can 'fend off' the drone from the guarded premises or bring it down safely using cyber 'takeover' methods. Elta's effector portfolio may also has include other effectors such as electronic warfare (EW) and 'Hard Kill' measures, to deal with specific environments and defeat existing and evolving threats.

Offering a sophisticated and agile C-UAS capability, Drone Guard is well positioned to secure civilians and military forces against the growing menace of drones.

MKU at Defexpo 2020

MKU, a leading defence and security solutions provider, participated at DefExpo 2020. MKU is committed to 'Make in India' and has been transforming the defence industry landscape in India by deploying newer and advanced technologies in electro optics and armour solutions. MKU's products are indigenously designed, developed and manufactured at their manufacturing units in India and Germany and used by Indian and international forces across 100 countries.

In this edition of Defexpo, MKU displayed:

- Versatile range of Night Vision (Image intensified) weapon sights, monocular and bi-oculars that deploy Gen 3 sensor technology for excellent performance in very low light conditions
- Rugged Thermal Weapon Sights for assault rifles, sniper rifles, LMG, MMG etc that offer longer ranges and better performance even in zero visibility conditions (for, smoke, smog etc)
- Instavest series, is the all-new line up of quick release survivability and protection jackets as per BIS Standards for male and female soldiers in tactical, combat and law enforcement configurations. Instavest series feature the highest level of protection in the lightest configurations using Gen 6 armour technology
- The newly designed Insta Load Distribution System (ILDS) for the jackets, based on the Exo Skeleton technology
- Polyshield – H bolt free helmets that are capable of providing uniform protection across the head, from faster and more lethal fragments at higher velocities

MKU will be engaging with its customers, partners, leaders from India and the global defence industry and participants from the services as well as the government.

Insta ILDS Tactical

NETRO NC-3000

MACS Helmet

Boeing and Nammo to jointly develop Guided Artillery Projectile

Boeing and Nammo have signed a teaming agreement to jointly develop and produce the next generation of extended range artillery projectiles. The strategic agreement will leverage the companies' combined expertise in guided munitions, projectiles and ramjet propulsion to provide a superior, affordable capability for the United States and its partners and allies. "Boeing is a world leader in precision guided munitions and Nammo is a world leader in projectiles and propulsion. We look forward to building a best-in-class industry team that will deliver operational capability and industrial value to both countries," stated Maria Laine, vice president, International Strategic Partnerships for Boeing Defense, Space & Security.

The partnership is a result of the growing need by US and allied forces to address the range gap between their own artillery systems and those operated by potential adversaries. *The US Army now ranks the introduction of long range precision fire as its highest acquisition priority*, with several allied countries also showing interest in acquiring similar capabilities. "We are really pleased to have partnered with Boeing, and together we have assembled a world-class group of engineers that will help us meet these new requirements," stated Morten Brandtzæg, Nammo President & CEO. "Boeing and Nammo also have highly complementary skill sets that will allow us to complete development far faster and more efficiently than each of us could have done on our own."

Nammo unveils revolutionary ramjet artillery shell

Rocket-assisted projectiles (RAP) have been around for decades, but Nammo has gone a step further by using a solid fuel ramjet to reach ranges of over 100km, which requires no modification to the 155mm howitzer. Nammo has now introduced the new product. "This could be a game-changer for artillery. With the exception of a small number of precision-guided shells with 50-60 km range, most artillery systems still reach the same distances as they did when the M109 was introduced more than 50 years ago. This could completely change that," stated Thomas Danbolt, VP of Nammo's Large Caliber Ammunitions unit.

Nammo's revolutionary design is built around a compact solid fuel ramjet which is kick-started by launching it from a cannon, and is a collaborative programme between ammunition and rocket engineers in Nammo. "We have been building rocket motors for about 60 years, and have specialised in small and powerful motors for air-to-air missiles, such as the Sidewinder, IRIS-T and AMRAAM.

Some years ago, we began looking at using air-breathing motors to help extend their range, but we quickly saw the massive impact this could have if we fitted it to an artillery shell," stated Erland Ørbekk, VP Technology with Nammo's business unit for Aerospace Propulsion.

Israel's UVision announced JV with Aditya Precitech "AVision"

Hero 30

Israel's UVision Air Ltd., a global leader in the area of Loitering Munitions Systems of all sizes for a variety of missions, has strengthened its presence in India and announced a joint venture with Aditya Precitech, an Indian company, for the manufacture and marketing of loitering munitions under the brand PALM (Precision Attack Loitering Munition) Hero Systems.

These systems are already in service and combat-proven. AVision, the company formed under the joint venture agreement, addresses the needs of the Indian defence and paramilitary sectors.

AVision will explore various opportunities in India for Loitering Munitions Systems with the intention of initiating a full range of activities including the design, manufacture, sales, maintenance, support, upgrading, and lifecycle management. The partners will also maintain a supply of spare parts for the warranty and post-warranty periods for current and future versions of the smart munitions systems.

AVision will be responsible for and will provide the following: design, development manufacture and maintenance support for all PALM Hero series, marketing strategy development and implementation; facilities for the new company's operations; human resources and personnel; supply chain creation and implementation; platform integration; and, after-sale training and customer support services.

Commenting on the Joint Venture, Shane Cohen, VP Sales & Marketing at UVision and AVision Board Member, stated, "We are very pleased to have partnered with Aditya, a highly respected company with extensive experience as development partner for many of India's Defence Research and Development Organisation's (DRDO) most important projects. Aditya has a skilled team able to produce a wide range of complex components, and is an ideal partner for our innovative, cost-effective loitering munitions systems designed for the battlefield of the future."

Regarding this partnership, Aditya's representative and Avision's CEO, Col. (ret.) Anil Yadav, remarked, "This Joint Venture is a major step forward enabling India to achieve significantly higher levels of self-sufficiency in the defence sector with the transfer of state-of-art cutting-edge technologies for the futuristic loitering munitions. We look forward to producing the full range of loitering munitions, which will be offered to India's military, paramilitary forces as an effective response to multiple threats with minimal collateral damage."


Shane Cohen, VP Sales & Marketing at UVision and AVision Board Member


Col. (ret.) Anil Yadav, CEO, Avision

The PALM HERO Series and Simulation System are at the AVision booth Hall 1 R48

At Defexpo, the company also displayed the entire PALM HERO Series of Lethal Loitering Systems highlighting the high-precision PALM Hero-30 and the Long-Range PALM Hero-400EC as well as the recently launched PALM Hero-120 a modular, customisable loitering weapon system fitted for a variety of missions.


Long-Range PALM Hero-400EC

Rolls-Royce MT30

Powering Next-Gen Naval Defence Capabilities

Rolls-Royce shares a rich heritage with the Indian Armed forces, dating back over eight decades when it powered the country's first military aircraft. The company has played an integral role in securing the nation's future with products that are aligned with India's defence policy in the army, navy and air force segments. As part of this partnership, Rolls-Royce today has a very well developed naval and maritime presence in India.

With over 50 years of naval propulsion experience, Rolls-Royce has pioneered some of the most important technical advances in marine propulsion including the use of aero gas turbines for surface ship propulsion. Today, with gas turbines on many key naval programmes, Rolls-Royce offers a world-leading range of integrated power and propulsion solutions for future fleets.

This portfolio includes the "mighty" MT30 marine gas turbine. It's just over ten years since the MT30 first powered the US Navy's Littoral Combat Ship (LCS) USS *Freedom*. Since then, and with a growing demand for power across the world's navies, the world's most power-dense in-service marine gas turbine is finding favour across the globe. Typically rated between 36MW to 40MW at 100 degrees Fahrenheit (depending on application), and with 100% power-retention through-life, the MT30 is powering some of the world's most capable and advanced naval ships.

MT30 offers a superior power-to-weight ratio, generating up to 40MW from a 30-tonne packaged unit, including most of the auxiliary systems. It gives navies more power in less machinery space than alternative engine types, and offers ship designers much more options and flexibility in designing the naval vessels of tomorrow. The MT30 also supports the 'lean manning' concept by virtue of its ultra-low on-board maintenance requirement.

The MT30 is derived from the Rolls-Royce Trent aero family and its aerospace parentage with over 100 million flying hours accumulated has played a key part in the success of the engine, not only in its selection by a growing number of navies, but also in the performance we've seen over the past decade.

Kishore Jayaraman, President, Rolls-Royce, India and South Asia at DefExpo 2020

There is much potential for this product to power vessels of the Indian Navy. At the same time, Rolls-Royce's commitment to support India's goals of indigenisation and self-reliance remain as strong as ever. The company is well placed to support India's 'Make in India' campaign, demonstrated by successfully transferring whole-engine capability, knowledge and expertise in multi-national combat engine programmes.

Trusted and demonstrated partners in progress, cutting edge global product, emergent Indian naval need and the nation's priority of indigenisation make MT30 the ideal product of choice for the Indian Navy in the 21st century. "The company remains firmly committed to building on Rolls-Royce's rich heritage of partnership with the Indian defence forces.Rolls-Royce is ready to serve the needs of the Indian Navy and is keen to customise its advanced technology products to best serve the Navy's power needs."

Airbus showcased its range for India

Airbus showcased its military products and defence technologies at Defexpo and their displays demonstrated capabilities and commitment to 'kick-start a defence industrial base in the country'.

The stand had scale models of the C295 aircraft which is proven around the world as a tough, reliable and high-performance workhorse with 'outstanding lifecycle costs and excellent performance' on short or unpaved runways. Airbus has bid to manufacture the C295 in India together with Tata Advanced Systems. Visitors also learnt about the A330 MRTT, the new generation aerial refueller.

In addition, exhibits of the AS565 MBe Panther, the H145M and the H225M helicopters were on display. Airbus has offered to build the Panther or the H145M in India under the government's Strategic Partnership (SP) model for the Naval Utility Helicopters (NUH) programme. The H225M has been offered as part of the Naval Multi Role Helicopter (NMRH) programme. Designed to cater to all the needs of India's armed forces, these helicopters would be produced in India in partnership with Mahindra Defence.

"Airbus is uniquely placed to participate in the ambitious growth journey of the Indian defence industry and will take it to new heights. Defexpo is a key platform to showcase our commitment to the country's ever-growing aerospace and defence needs," stated Anand Stanley, President & Managing Director, Airbus India & South Asia.

Airbus currently works with more than 45 suppliers in India and the annual procurement from them is worth more than $650 million. Airbus' network of Indian suppliers provides engineering and IT services, aerostructures and materials for several of Airbus' aircraft. Over 7,000 people, including 1,500 engineers, are currently employed across Airbus projects in the country.

CONTROP announces enhanced capabilities for the iSea-50HD: a new HD thermal camera and SWIR channel

"Controp continues to strengthen its technical capabilities, while participating in several maritime tenders in India."

Controp Precision Technologies Ltd., a company specialising in the field of electro-optics and infrared (EO/IR) for defence and homeland security solutions – announced new capabilities for its iSea-50HD, replacing the thermal camera with a new HD thermal camera, and adding a SWIR channel which enables clear observation in the harsh environmental conditions typical of the Indian maritime climate.

The iSea-50HD system provides maximum-range surveillance using highly sensitive sensors, including an HD Thermal Imaging (TI) Camera working in the 3-5μ band with a continuous zoom lens, a high-sensitivity colour day camera, a SWIR channel and a long-range Eyesafe Laser Range Finder (ELRF). Among its additional features are advanced image processing and unique video enhancement algorithms.

Providing a full solution for naval and maritime operational requirements, Controp's compact, lightweight iSea surveillance systems have been mission proven since the 1990s, integrated across the globe on a wide variety of vessels and in daily operation for maritime missions such as search & rescue, maritime surveillance, law enforcement, EEZ protection, counter piracy and special operations. In India, the iSea-30HD is already installed and active on multiple vessels belonging to the Indian Coast Guard. Controp is actively pursuing new contracts in this market and participating in local tenders for Indian shipyards, with the goal of continuing this successful cooperation.

"Controp continues to lead the development of customised technologies, tailored to meet customer demand and the challenging field conditions in which their forces operate," says Mr. Hagay Azani, CONTROP's CEO & President. "Being able to operate in harsh environments with limited visibility, at specific times of day and night, is critical to customers in this region."

Controp specialises in the development and production of electro-optical and precision motion-control systems for surveillance, defence and homeland security. Controp's main product lines include: high-performance stabilised observation payloads used for day/night surveillance onboard UAS, small UAS and aerostats/balloons, helicopters, light aircraft, maritime patrol boats, remote weapon stations and ground vehicles; automatic intruder-detection systems for coastal and border surveillance, port/harbour security, the security of sensitive sites, ground-troop security and anti-drone applications; thermal imaging cameras with high-performance continuous zoom lens and state-of-the-art image enhancement features and more. Controp's products are in daily operational use in many of the most critical surveillance, homeland security and defence programs worldwide.

Thales in India: "A Perfect Match"

"Making substantial progress and business reforms over the past few years, India as a country provides tremendous opportunities for business partnerships and bilateral investment projects across sectors. According to the latest World Bank's ease of doing business 2020 report, India jumped to 63rd position vis-a-vis 77th rank in the previous year. This clearly indicates the favourable prospects India offers to foreign OEMs like us to explore business opportunities and form new relationships with local partners in the country. The ecosystem created by government not only facilitates ease of doing business but also attracts foreign investors and creates job opportunities."

Over the years, Thales has played a major role in strengthening the industrial and defence base of the country through the government's *'Make in India'* programme. By offering its expertise and strengths in defence, transport, aeronautics, and digital identity and security markets, Thales has been "a perfect match" for India's various ambitious objectives. The organisation today has over 1600 employees currently working with Thales and its joint ventures (JVs) in India.

Reinforcing its presence in the country, and with over 65 years of strong legacy, Thales continues to contribute towards *Make in India* as well as exports from India. The company has formed various co-operative partnerships with public and private sector industries, bringing in its expertise in delivering high-end technology solutions. Thales has been working closely with Hindustan Aeronautics Limited (HAL) for over five decades and has successful JVs with Bharat Electronics Ltd (BEL) dedicated to radars, Samtel, which isdedicated to military avionics and Reliance Aerostructure Limited for electronic warfare and radar. Currently Thales is working with over 75 local supply chain partners in the country, engaged in its global supply chain across defence and civil markets.

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

Aiming to go beyond production and support innovation, the company is now operating two engineering competence centres located in the National Capital Region (Gurugram and Noida) and Bengaluru. The Bengaluru engineering competence centre specialises in defence, aerospace and transportation, while the one in Noida and Gurugram is focused on Digital Identity and Security including cybersecurity, IoT, biometric as well as big data analytics solutions. Going forward, Thales seeks to continue developing capabilities for local engineering, procurement from India and strengthen its local partnerships.

Thales was enthusiastic about its participation at DefExpo India 2020 – the biennial premiere defence exhibition, this mega event supporting innovative solutions and a platform for stakeholders to foster partnerships and raise the level of technology in the country. In alignment with DefExpo 2020's focus – 'Digital Transformation of Defence' – Thales showcased defence technologies that are digitally driven and future focused. With the display of such unique digitally driven technologies across four categories - Land, Naval& Air defence, Digital Transformation and Security – Thales not only reiterated its commitment towards *Make in India* but also showcase its upcoming plans towards the development and modernisation of the Indian armed forces.

"As a global technology leader, Thales remains committed to India and helping its operators prepare for tomorrow – but today!" The company stays on the drive to offer cutting edge technology solutions to help operators master their decisive moments in an increasingly complex world.

BEL at Defexpo 2020

Tripartite MoU with Elbit and GRSE for USVs

Bharat Electronics Limited (BEL) signed a tripartite MoU with Garden Reach Shipbuilders & Engineers Ltd (GRSE) and Elbit Systems, Israel. Mrs Anandi Ramalingam, Director (Marketing), BEL, Cmde S Nayyar (IN Retd), Director (Ship Building), GRSE, and Mr Yaron Levi, Vice President (Naval Systems), Elbit Systems, signed the tripartite MoU on behalf of BEL, GRSE and Elbit. The MoU aims at leveraging the individual strengths of BEL, Elbit and GRSE for the development and customisation of Elbit's Unmanned Surface Vessels (USV) for the requirements of the Indian Navy.

MoU with OFB

Ordnance Factory Board (OFB) and Bharat Electronics Limited signed an MoU "to continue their existing co-operation in the field of air defence & artillery gun systems, armoured fighting vehicles, arms & ammunition and related products, systems and accessories, leveraging complementary strengths", to meet the requirements of Indian Armed Forces as also others.

Mrs Anandi Ramalingam, Director (Marketing), BEL, and Mr E R Sheikh, Sr DDG, OFB, exchanging MoU documents in the presence of Shripad Yesso Naik, Raskha Rajya Mantri, Hari Mohan, DGOF & Chairman, OFB, and Gowtama M V, CMD, BEL.

Contract for Coastal Surveillance System, Phase-II

Bharat Electronics Limited signed a contract with the Ministry of Defence, Government of India, to establish Phase-II of the Coastal Surveillance System or Chain of Static Sensors developed for the Indian Coast Guard (ICG). The contract envisages, setting up of 38 Radar Stations and five Command and Control Centres against a tight time line, and at challenging geographical locations along the coast line of India, including in the Lakshadweep, Andaman and Nicobar Islands.

BEL had earlier implemented Phase-I of the project on turnkey basis by establishing 46 Radar Stations and 16 hierarchical Command and Control Centres. The system, which is now operational, is being operated by ICG for more than four years. The BEL Coastal Surveillance System (CSS) comprises a network of Remote Radar Stations equipped with sensors like Radar Systems, AIS (Automatic Identification System), Electro Optic Systems, Meteorological Systems and VHF Radio Communication Systems integrated with the Command and Control Centres. The CSS solution provided by BEL is software intensive and has been developed entirely in-house. Such Coastal Surveillance software can be customised to meet the operational requirements of customers, depending on their need. This CSS software is also provided with various decision support features.

The system caters to the requirement of maritime surveillance applications "to detect, track, identify and monitor suspected threats to facilitate appropriate action by the security agencies." The data from all the connected Remote Radar stations received at the respective Command and Control Centres are correlated, processed, integrated and displayed in real time on a Common Operation Picture Display for carrying out surveillance operations. The data may further be communicated to higher hierarchical level Command Control Centres for facilitating decision-making and initiation of suitable action, if required.

Mr Gowtama M V, CMD, BEL, Mrs Anandi Ramalingam, and Mr Mahesh V, Director (R&D), with Mr. Rajnath Singh, Raksha Mantri, Yogi Adityanath, Chief Minister of Uttar Pradesh, and Coast Guard officers

Lockheed Martin and BEL to explore opportunities in F-21 fighter programme

Lockheed Martin signed an MoU with Bharat Electronics Limited to explore industrial opportunities in the F-21 programme. Lockheed Martin is strengthening and growing its partnerships with the Indian industry to support the company's F-21 proposal for the Indian Air Force. "We are excited to begin exploring F-21 opportunities with BEL, one of India's leading aerospace and defence companies," stated Dr Vivek Lall, Vice President of Stragety and Business Development, Lockheed Martin Aeronautics. "An F-21 partnership with India integrates Indian industry, including BEL, into the world's largest and most successful fighter aircraft ecosystem and demonstrates Lockheed Martin's commitment to India."

In turn, Mrs Anandi Ramalingam, Director (Marketing), BEL, stated, "We are happy to collaborate with Lockheed Martin which is a global major in the aerospace sector. We are eagerly looking forward to cash in on this co-operation to address domestic and international market needs in this sector."

MBDA at Defexpo 2020

A particular highlight is that L&T MBDA Missile Systems Ltd has submitted its first bid to the Indian Armed Forces – offering Sea Ceptor, the latest generation naval air defence system – in its RFP response for the Indian Navy's Short-Range Surface to Air Missile (SRSAM) requirement with the aim to 'Make in India'. This development comes soon in the JV's history, which only made its debut at the previous edition of Defexpo in 2018.

This year is particularly noteworthy as it also sees the arrival in India of the first Rafale fighter aircraft for the Indian Air Force, which will be armed with a game changing set of weapons from MBDA including the SCALP deep strike and Meteor air-to-air missile.

MBDA has been actively working in par tnership with the Indian government and industry to build India's defence industrial capabilities for over 50 years. MBDA is recognised world-wide as an absolute leader in the field of missile technologies. It is also recognised as being the only truly integrated multi-national company in the defence sector – co-operation is in their DNA in a way that is unique in the defence sector, and particularly in the field of missiles. This makes their uniquely able to partner with India, to work with the DRDO, the Indian MoD, and to support the development of India's public and private defence-industrial capabilities.

"To deliver this we have a dedicated and strong industrial cooperation and offset (ICO) team that works solely on partnerships with India. This MBDA ICO

team has delivered extensive and significant transfers of technology to develop India's defence-industrial capabilities. This includes the manufacturing by Indian industry of 15 major subassemblies of MICA missile covering various complex technologies such as mechanical, electrical, electromechanical and pyrotechnic items. Similar transfers to build India's defence-industrial capabilities have also occurred on the Mistral and ASRAAM missiles, including ToT for setting up industrial capabilities, complete missile integration and final assembly and test".

L&T MBDA Missile Systems Ltd is a key channel for MBDA in delivering the next generation of complex weapons capabilities to the Indian Armed Forces and developing the capabilities of India's defence industry in the complex weapons sector. L&T MBDA Missile Systems Ltd again had its own unique stand and showcased a number of products, including SRSAM, ATGM5 and Exocet MM40 B3.

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

MMP firing training Canjuers military camp France

Sea Ceptor CAMM launch

Exocet MM40 Block 3 is the latest version of the famous Exocet missile family, and includes the replacement of the missile's traditional rocket motor with a turbojet to extend the range of the system to beyond 200 km, while the missile's already excellent navigation system has seen further enhancements. As the Indian Armed Forces already operate SM 39, which is part of the Exocet family, it is a logical step to also use Exocet in other operational areas. In doing so, it would provide significant operational, logistics and training advantages. MM40 Exocet Block 3 is being offered by L&T MBDA Missile Systems Ltd in response to India's RFI for the Medium Range Anti-Ship Missile.

Loïc Piedevache,
India Country Head, MBDA

A great show for Brahmos!

General Manoj Mukund Naravane, COAS at the BrahMos pavilion

Mr. Rajnath Singh, Defence Minister of India lauded the Brahmos supersonic cruise missile system! He was briefed about the universal Brahmos supersonic cruise missile system by Dr. Sudhir Kumar Mishra, DS & DG (BrahMos), exhibited at the pavilion along with other 'Make In India' products and systems.

Air Chief Marshal Rakesh Kumar Singh Bhadauria, CAS, IAF also visited the BrahMos Aerospace pavilion. The Indian Air Force has recently inducted a squadron of Sukhoi-30 MKI fighter aircraft with capability to carry the supersonic cruise missile, at Thanjavur on 20 January 2020.

General Bipin Rawat, CDS at the BrahMos pavilion

Admiral Karambir Singh, CNS, Indian Navy at the pavilion

Air Chief Marshal Rakesh Kumar Singh Bhadauria, CAS visited the BrahMos Aerospace pavilion

Defence Minister of India Rajnath Singh, applauds the BRAHMOS supersonic cruise missile system

BrahMos Aerospace exhibited the Brahmos air-launched version besides the land-attack and anti-ship variants of the 'world-class' supersonic cruise missile system.

Dassault Aviation reaffirms commitments to India

Dassault Aviation were at Defexpo 2020 and this "participation was consistent with Dassault Aviation's endeavor to demonstrate its continued commitment to India and to Indian defence interests". For this first appearance at such an exhibition, Dassault Aviation displayed, a scale 1:10 Rafale mockup in tribute to induction of the aircraft in the Indian Air Force.

This Rafale wearing colours of the Indian Air Force, "illustrated the determination of Dassault Aviation to take part in Indian Air Force preparedness and its commitment to meet all future additional fighter aircraft need's." A mockup of the Rafale M (Rafale naval variant) was also displayed with this Rafale variant taking part in the tender for 57 aircraft to equip Indian Navy aircraft carriers. A scale 1:10 model of the Mirage 2000 I/TI complemented the fighter aircraft expertise and a space dedicated to the 'Make in India' achievements of Dassault Aviation, had engine doors manufactured in the Dassault Reliance Aerospace Ltd (DRAL) facility in Nagpur.

The first Falcon 2000 cockpit front section made by the Dassault Reliance Aerospace Limited facility at MIHAN, Nagpur had been shown at Aero India in Bangalore in February 2019 before being sent to Dassault Aviation's Falcon final assembly line in France. These highlight Dassault Aviation's commitment to build up an Indian aerospace manufacturing eco-system, both in civil and military fields, matching the "highest standards in this field and positioning India as an international reference in the global aerospace market. It demonstrates the company's mobilisation to establish in India state-of-the-art manufacturing facilities with cutting edge technologies as well as best-in-class international aeronautical standards in terms of efficiency in production and competitiveness.

Larger structures are currently being considerd and will allow the ramp-up of DRAL capabilities towards an entire line of Falcon 2000s fully manufactured and assembled in India, thus paving the way towards future manufacturing and assembly of Rafale aircraft in India.

"Dassault Aviation is totally focused on supporting India in meeting the strategic and economic challenges of its inspiring vision for the future. My decision to have Dassault Aviation to participate to Defexpo for the first time is the expression of our full dedication to contribute to India's outreach and our absolute conviction of the major role of India in the concert of nations, today and tomorrow" stated Eric Trappier, Chairman and Chief Executive Officer of Dassault Aviation.

(photos: Tejaswi Singh)

Kalyani Group showcases platforms

Pune-based Kalyani Group showcased its range of indigenous products at Lucknow. Three new artillery platforms unveiled by them at the show included MarG Extended Range, a 155mm/52 cal Ultra-Light Howitzer; Garuda-105 V2, which is a 105mm gun mounted on their 'Go Anywhere Vehicle'; and 4x4 MGS, which is a 155mm/39 cal gun system mounted on a 4x4 platform. All three gun platforms and the 'Go Anywhere Vehicle' have been indigenously designed and developed by the Kalyani Group incorporating niche and advanced technologies. 'Kalyani M4', is a 4x4 armoured protected fighting vehicle to provide side blast protection against 50 kgs of TNT explosives, the highest in its class. Another product on display was the 6x6 ECARS, which is a UGV developed by the group which offers enhanced collision avoidance system, threat analysis and missions planning.

The Kalyani Group announced its progressive growth plans by partnering with global defence technology and manufacturing companies to create indigenous products and promote 'Make in India' initiative. Some of the MoU's signed were: with General Atomics, USA, with BFL and General Atomics' Electromagnetic Systems Group (GA-EMS) "investigate opportunities to develop and integrate power generation, storage, control and distribution technologies related to surface and undersea naval platforms, and advanced projectiles for weapon system platforms to address Indian defence requirements."

Bharat Forge Ltd., signed a Memorandum of Understanding with Dastan Corp., Kyrgyzstan, engaged in development of torpedoes with advanced homing heads for shipborne and submarine platforms, used by Indian Navy. Both firms are coming together for joint upgradation of CET-65E torpedoes.

Kalyani Strategic Systems Ltd. (KSSL), Defence Arm of Kalyani Group and Arsenal Joint Stock Company, Bulgaria signed a Memorandum of Understanding to form a strategic alliance in India for manufacturing small arms and ammunition. KSSL and Arsenal will be 'aggressively' developing a manufacturing capability in India for the "AR" 7.62 x 39mm Assault Rifle and "MG" 7.62 x 51mm Machine Gun series.

Bharat Forge MoUs

Bharat Forge and Paramount Group announced the signing of a strategic, high level collaboration agreement to set up a joint venture to combine the technologies, capabilities and expertise of both groups in the industrialisation and indigenisation of defence and aerospace systems.

Bharat Forge and Thales joined hands to develop the F90 rifles which will serve the defence and law enforcement sectors in India and abroad. This cooperation is a testament to the "Make in India" initiative of the Indian government and paves the way to a potential licensing agreement.

Naval Group enhances Indian industrial partnerships

At Defexpo 2020, Naval Group reiterated its commitment to deepen sustainable cooperation with the Indian industry. Naval Group, with its track-record in terms of technology transfers worldwide, has been a pioneer in policy of Make in India and now gearing up for "Make from India". With their presence of more than a decade in India, Naval Group has firmly supported the self-reliance of the Indian Navy for its naval programmes. Naval Group's international strategy is to build long-term strategic partnerships with the 'most qualified and innovative industrial actors of the countries for our clients in order to ensure their sovereignty'.

Naval Group is proposing a robust offset package in the competitive and technically advanced offer for the Indian tender for modern heavy weight torpedoes. "This is the natural extension of our industrial presence in India achieved through the ongoing project for Kalvari-class submarine" declared Patrice Pyra, Commercial Director of Naval Group Underwater Weapons.

"Our partners share essential features with us such as high-level of quality standards and the search for ever increasing innovation and we are eager to take them on-board our global projects" stated Massi Begous, Naval Group Senior Vice-President for International Industrial Development, while welcoming and signing MoUs with about 13 qualified Indian companies.

HAL leads at DefExpo 2020

Hindustan Aeronautics Limited (HAL) took the lead role in organising the 11th biennial edition of DefExpo 2020 in coordination with the MoD at Lucknow. Besides providing massive logistic support, HAL showcased its prowess in defence and aerospace centered on the theme 'Digital Transformation of Defence'.

"HAL is instrumental in organising major defence expos in last couple of years including this edition of DefExpo 2020. HAL's indigenously designed and developed fixed and rotary wing platforms are evident

Another view of the HAL display at DefExpo 2020

Mr R Madhavan, CMD, HAL

HAL and Coast Guard formalised contract for midlife upgradation of 17 Dornier 228 aircraft. Seen here are Mr Apurba Roy, GM, HAL TAD Kanpur and Mr Sanjai Singh, Joint Secretary (Air) & AM, MOD

at the show," stated Mr R Madhavan, CMD of HAL.

HAL displayed models of the Light Combat Aircraft, Light Combat Helicopter, Advanced Light Helicopter, Dornier 228 LTA and Hawk AJT at its indoor Stall (R-46, Hall 5). Some of the avionics, accessories, assemblies, products such as Indigenous Digital Map Generator (i-DMG), Engine & Flight Display Unit, Gas Turbine Electrical Generator (GTEG)-60, Air Producer Engine, Glass Cockpit for Do-228, Automatic Target Recognition (ATR), Digital Sand Rapid Prototyping Technology etc. were on display.

An upgraded Sukhoi-30 MKI cockpit simulator was another attraction at the HAL display.

The Light Utility Helicopter (LUH) was displayed at the outdoor static area with the Rudra (ALH Mk IV), LCH, LUH, Dornier 228 civil, Tejas LCA were on flying display.

HAL and Rosoboronexport in spares/ services MoU

HAL and JSC Rosoboronexport signed a MoU at DefExpo 2020 which envisages export of spares and services to "friendly" countries for which license has been given to HAL. The parties will subsequently sign an agreement on mutually agreed terms and conditions, the scope of the MoU including support of the Sukhoi Su-30 MKI, its AL-31FP engines, RD-33 engines (of the MiG-29), accessories and others.

HAL LUH given IOC

Prototype of the HAL light utility helicopter (LUH) at DefExpo 2020

Hindustan Aeronautics Limited (HAL) has received Initial Operational Clearance (IOC) for its Light Utility Helicopter (LUH), paving the way for its SERIES production. Mr R Madhavan, CMD, HAL received the IOC document from Mr G Sateesh Reddy, Secretary, Department of Defence R & D and Chairman, DRDO at the '*Bandhan*' programme at DefExpo 2020 in the presence of Defence Minister Mr Rajnath Singh and Uttar Pradesh Chief Minister Mr Yogi Adityanath and others.

As Mr Madhavan stated, "This is a momentous occasion for HAL. It reinforces our commitment towards indigenous R&D programmes on self-reliance and enhancing operational effectiveness of the Indian Armed Forces. HAL is fully geared up to fulfil the requirements of its customers in a time bound manner". Mr Arup Chatterjee, Director, Engineering & R&D, HAL, said the performance of basic configuration of LUH in all terrains and under all weather conditions was satisfactory and HAL was moving towards the next phase of integrating and flight testing of Mission & Role Equipment on LUH.

One LUH prototype was part of flying display and another a part of static display at the DefExpo 2020. LUH is a single engine, light weight, highly agile 3-ton utility helicopter, indigenously designed and developed to meet the operational requirements of Indian Army and IAF. LUH will soon replace the ageing fleet of Cheetah and Chetak helicopters. Three prototypes have been built and cumulatively completed over 550 flights under various terrains and climatic conditions like cold weather, hot weather, sea-level and high altitude complying to stringent certification and user requirements.

Its endurance and reliability were established during the hot weather and high-altitude trials where in LUH was ferried from Bengaluru, covering over 7000 kms of distance and continuously flying for 17 days without any abnormalities.

Dr Sateesh Reddy hands over the IOC certificate for HAL LUH to Mr R Madhavan, CMD HAL in presence of Raksha Mantri Rajnath Singh and UP Chief Minister Yogi Adityanath

Saab at DefExpo 2020

"Saab Committed to Make in India - and the building of a Sustainable Aerospace Industry"

Saab had an eminent place at Defexpo India 2020 demonstrating "how its advanced technology and innovative thinking can deliver the best solutions for strong national defence and an independent industrial future for India".

As Ola Rignell, Chairman and Managing Director, Saab India Technologies said "Saab will contribute to India's vision of building a larger indigenous defence industry, and help build capability that will enable India to design and build its own next-generation defence systems. At Defexpo India 2020, we showcased our latest technologies which are changing defence and security planning, deployment and future force readiness. We hope that our proven perspective on technology sharing along with our ambition to build an ecosystem in India to sustain and develop capabilities will create long lasting benefits far beyond the initial contracts, and form a joint future for the next century".

Saab's commitment to build an aeronautical ecosystem in India along with local system suppliers is undiminished. Saab will be a partner in the continuing the development of a world-class Indian defence industry. Saab is best-placed to deliver true transfer-of-technology and long-term industrial cooperation to design, produce, support and innovate in India. As part of its global supply chain Saab hopes to establish an industrial network that will be the heart of the Gripen programme for the Indian Air Force".

Saab products and systems on display at Defexpo India 2020 included models of the:

- **Gripen E** "which combines exceptional operational performance, highly advanced net-centric warfare capability, sensor fusion, unique BVR capability, cost efficiency with true transfer of technology and a comprehensive industrial partnership:".

- **Skeldar VTOL UAV** a NATO-compliant, heavy fuel-powered, fully autonomous VTOL UAV designed for harsh environments and proven in both land and maritime operations. The Skeldar can take-off and recover in small, restricted areas with minimum preparation and minimum support. Its modular design makes it easy to adapt and customise a wide range of payloads.
- **The Giraffe 1X** compact lightweight high-performance 3D radar for fixed, mobile or deployable applications with a small footprint which is easily integrated in any type of platform. It is a ground-breaking capability for short range air surveillance and ground based air defence.
- **The Carl Gustaf M4** man-portable multi-role weapon system which provides high tactical flexibility through its wide range of ammunition types. Weighing less than 7 kg and meeting the needs of modern conflict environment while offering compatibility with existing ammunition and future innovations such as the **Guided Carl Gustaf Munition;** this provide pinpoint, multi-target engagement capability at substantially extended ranges.
- **AT4CS AST** lightweight, man-portable, unguided and fully disposable weapon system is optimised for ease of operation and maximum versatility.
- The **Next-Generation Light Anti-tank Weapon (NLAW)** system "a shoulder-launched, top attack anti-tank missile system that is a true tank killer for infantry. It operates dismounted in all environments including built-up areas".
- **Saab's Mobile Camouflage System** a tailor-made, multi-spectral (visual, near IR, short wave IR, thermal IR and radar from 1 to 100 GHz), multi-purpose system for mobile fighting platforms enhances survivability and sustainability in the battlefield. Saab's range of Multi-Spectral Camouflage Nets including the Advanced Reversible Camouflage Screen and C-90 Net protect all kinds of vehicles and other static military equipment.
- The **AUV62 System** the latest generation of Saab modular AUV systems meant for mine reconnaissance with a high-resolution side-looking sonar. It can autonomously search for and identify sea mines with a high area search capability. High-resolution images give excellent situational awareness and data.
- The **Double Eagle Sarov** which can operate both as an AUV, with an onboard inertial navigation system, and as an ROV with a several kilometres-long fibre optic tether. For MCM operations the Double Eagle Sarov can be used for detection, classification and disposal.
- The **Saab Light Weight Torpedo (SLWT),** a new anti-submarine warfare solution that gives total control of the challenging littoral environment and operates equally well in both shallow and blue water.

Saab's 'A' team at DefExpo 2020 were (left to right) Mats Palmberg, Ola Rignell and Dean Rosenfield

Lockheed Martin and "Start-up India"

With a presence in India for over 25 years, Lockheed Martin opened its India subsidiary in New Delhi back in 2008 and has supported and aligned itself with various initiatives of the Government of India. "Lockheed Martin continues to explore opportunities for closer collaboration and partnerships, including supporting the Digital India initiative."

As a part of its larger commitment to enhance the growth and development of India's innovation, Lockheed Martin has sponsored and supported the India Innovation Growth Programme (IIGP) since 2007 in partnership with the Indian Department of Science and Technology, Indo-US Science and Technology Forum, Federation of Indian Chambers of Commerce and Industry, Stanford Graduate School of Business, and the IC2 Institute at the University of Texas.

Resonating with Prime Minister Narendra Modi's 'Start-up India' call, the IIGP has pioneered an initiative that has supported more than 400 innovators and start-ups with in-depth technology commercialisation training and handholding support to commercialise and scale their ventures in India and across the world, particularly in the United States. To date, the revenue generated for the Indian entrepreneurs through this programme is approaching $1billion, and it is a flagship innovation programme in the Department of Science and Technology.

The C-130J in India

The C-130 programme represents a strong legacy of partnership between the US and India. All C-130Js delivered to operators around the world have major aerostructure components from India included in their build through partnership with Tata Advanced Systems Limited (TASL) in Hyderabad, India. This partnership with TASL also includes an on-the-job training element that supports the broader "Skills India" initiative.

The Indian Air Force operates a fleet of five C-130J-30s and it will receive an additional six C-130J-30s as well. India is one of 16 countries operating the C-130J Super Hercules, which is the world's choice for tactical airlifters. The IAF uses its C-130Js to support a variety of missions, from cargo delivery to providing vital humanitarian aid. The Super Hercules is also part of India's C-130J Roll On/Roll-Off University Design Challenge. Through this initiative, Lockheed Martin provides research grants for teams from Indian universities to work with local industry partners and mentors from India's Defence Research and Development Organisation to develop design specifications for proposed modules that could be used on a Lockheed Martin C-130J Super Hercules cargo aircraft.

The F-21 for India

Adding on to Lockheed Martin's successful programme of C-130J empennage, S-92 cabin, and now F-16 wing manufacturing in India, the F-21 will be a step function in furthering technology insertion, indigenous manufacturing and global export opportunities. The F-21 is the optimal platform to meet the Indian Air Force's near and long-term capability and affordability requirements. No other fighter in the competition goes further, stays longer or delivers more ordnance per mission than the F-21. A partnership with Lockheed Martin also positions Indian industry to become a key part of the world's largest fighter and sustainment ecosystem.

First JF-17 Block III

First flight of the JF-17 Block III took place at Chengdu on 15 December 2019. A further development of the JP-17 Block II intended for the Pakistan Air Force, this latest variant features a new active electronically scanned array (AESA) radar and other updated systems. Based on initial images, the most obvious changes are a new wide-angle holographic head-up display (HUD) similar to that in the J-20 fifth generation fighter and missile approach warning system, sensors behind the engine air intakes and on top of the tailfin, similar to those on the latest J-10C.

The prototype is not yet equipped with AESA radar and it's unclear which radar the PAF will opt for. Options are the KLJ-7A developed by the Nanjing Research Institute of Electronics Technology's 14th Institute or the LKF601E from the 607th Institute. New avionics include a helmet-mounted display, upgraded electronic countermeasures suite, full-authority digital fly-by-wire controls and the ability to use new weapons such as the infrared-guided PL-10E air-to-air missile (AAM) and active-radar E PL-15E long-range AAM.

Eight JF-17Bs for PAF

Meanwhile, Pakistan Aeronautical Complex Kamra has completed production of an initial batch of eight twin-seat 1F-17Bs for the PAF. The aircraft were rolled out during a ceremony on 27 December 2019, with production completed in just five months.

'Gripen for Canada Team'

In bidding for Canada's *Future Fighter Capability Project* (FFCP) Saab has announced that leading Canadian aerospace companies IMP Aerospace & Defence, CAE, Peraton Canada and GE Aviation will be the 'Gripen for Canada Team'. Saab is offering its Gripen E, with support of the Swedish government, for Canada's future fighter requirement of 88 new aircraft to replace the Royal Canadian Air Force's existing CF-18 Hornet fighter fleet. The Canadian Request for Proposal requires companies to deliver high-quality industrial and technological benefits, "such as Saab has demonstrated with Gripen for Brazil and is offering for Finland and India's fighter requirements". Saab's bid to the Government of Canada includes a comprehensive proposal to deliver those benefits, with high quality jobs and technology, adding greater economic value and knowledge across Canadian industry coast to coast.

Boeing-Saab T-7A export market

Boeing has offered the T-7A Red Hawk advanced jet trainer for export. In September 2018, the US Air Force (USAF) had selected the type for its $9 billion T-X contract to replace Northrop T-38C Talons. 351 examples will be built for the USAF, with the first aircraft scheduled for delivery in 2023. There are plans to produce up to 48 aircraft per year for the USAF but there is capacity to expand annual production to support export sales.

Boeing forecasts a global market for 2,600 T-7As, both as trainers and light-attack aircraft.

According to Thomas Breckenridge, vice-president of international sales in Boeing's strike, surveillance and mobility business unit, "Having the fighter-like performance that the T-7A provides pilots to train more effectively, and enables air forces to use a more affordable option rather than the advanced fighters that were intended for operational use."

Poland orders F-35A Lightning II

Poland has confirmed its order for 32 F-35A Block 4 fighters worth US$4.6bn under a Foreign Military Sales programme. Poland's Minister of National Defence Mariusz Blaszczak signed the letter of offer and acceptance at the 41 *Baza Lotnictwa Szkolnego* (41st Training Base) on 31 January 2020.

The F-35As will replace the air arm's MiG-29s and Su-22s, the first six new fighters scheduled for initial delivery to Luke Air Force Base, Arizona in 2024, for operational training, the first Poland-based jets expected to arrive around a year later, deliveries continuing at an annual rate of four-to-six aircraft, with the last examples to be handed over in 2030. Initial operational capability is planned for 2028. As part of a *Total Package Approach*, the US will supply the 32 aircraft (and one spare F135 engine), plus aircraft, pilot and maintenance support training, eight mission simulators, ongoing aircraft, maintenance and a logistics support system.

Singapore to acquire 12 F-35Bs

The US State Department has approved a potential US$2.75bn Foreign Military Sale (FMS) of F-35B short take-off and vertical landing (STOVL) jets, as well as associated spare parts, logistics and training support for Singapore. The US Defense Security Cooperation Agency has announced that the Singaporean government has requested an initial batch of four F-35Bs, with the option to acquire an additional eight. The proposed package includes up to 13 F135 engines, plus electronic warfare, communications

and navigation systems, the Autonomic Logistics Information System (ALIS) maintenance and logistics planning suite, software development and integration, and training equipment. Singapore's defence ministry had earlier declared the Lightning II as the "most suitable replacement" for its F-16C/D fleet.

Portuguese F-16AMs to Romania

A second batch of F-16AMs retired from the Portuguese AF has been sold to Romania with contract signed by Portuguese defence minister Joao Gomes Cravinho and his Romanian counterpart General Nicolae-Ionel Ciuca, The €130m agreement covers five upgraded F-16AMs for the *Forca Aerea Portuguesa* (FAP, Portuguese Air Force) necessary maintenance and modernisation work to bring them up to Operational Flight Programme M5.2 standard, plus technical support in Romania. These five F-16s will join the earlier 12 ex-Portuguese aircraft operated by the FAR since 2017, providing a total of 17. The FAP will receive a further four airframes that will be upgraded locally to Mid-Life Update (MLU) standard by OGMA at Alverca, making an inventory of 28 operational F-16 MLUs (24 F-16AMs and four F-16BMs).

Croatia RfP for new fighters

The Croatian government has issued a request for proposal (RfP) to seven countries so as to acquire a modern multi-role warplane to replace its seven single-seat MiG-21bis and four two-seat MiG-21UMD fighters. Croatia has issued the RfP to the United States for new F-16 Block 70/72s, Sweden for new JAS 39 Gripens, France for secondhand Rafales, Italy for secondhand Eurofighters, and to Norway, Greece and Israel for secondhand F-16s. Initial responses to the RfP are to be issued by 7 May, the offers to be studied until early August, when a governmental commission will "determine the preferred option".

Germany to acquire Global 6000s

The German Government is to acquire sensor-equipped Bombardier Global 6000s, having abandoned earlier plans for four MQ-4C Triton unmanned aerial systems intended for signals intelligence. It was felt that the drones would be unable to operate safely in European airspace by 2025.

New RfP for Swiss fighter

Switzerland has issued a second request for proposal for new fighters under their *Air2030* programme. This time the competition is between Germany (Eurofighter), France (Rafale) and the US (F/A-18E/F and F-35A) and is based on an analysis of the first proposal and on findings from flight, simulator and ground tests as well as audits with armed forces operating the evaluated fighters. The RfP seeks data on the cost of 36 and 40 aircraft, before negotiations begin with the selected candidate. *Armasuisse* have given the deadline for proposals as August 2020.

Modernised Tu-160M

A modernised Tu-160M strategic bomber made its maiden flight from the Gorbunov Kazan Aircraft Plant airfield on 2 February, being the fifth aircraft from the new production series, originally built in February 1989. The Tu-160M mid-life upgrade involves complete replacement of the bomber's mission system and avionics, the Obzor-K radar supplanted by the NV1.70 from Zaslon's Novella family. In parallel with modernisation of operational Tu-160Ms preparations are underway for the manufacturing of new bombers

in Kazan, the decision to resume Tu-160 production made in 2015, with an order for ten aircraft signed then the first Tu-160M expected to fly in 2021, followed in 2023 by series production at a rate of three aircraft per year. Meanwhile, a pair of VKS Tu-160 bombers completed a 16hr flight over the Barents Sea, Norwegian Sea and Arctic Ocean in February.

Cambodia orders AW109s

AW109S Trekker helicopters have been recently delivered to the *Force Aérienne Royale Cambodgienne* (Royal Cambodian Air Force) going into service during December 2019. These have been acquired through local operator HeliStar Cambodia and were delivered via Thailand to the Helicopter Squadron at Phnom Penh International Airport at the end of November, being first new helicopters acquired by Cambodia since delivery of a dozen Z-9 Haituns from China in 2013.

Vietnam orders Yak-130s, considers Su-57Es

Vietnam has ordered Yakovlev Yak-130 advanced jet trainers, the contract is believed to be for about a dozen aircraft to equip a single squadron. In Vietnamese service, the Yak-130 will replace aged Aero L-39 jet trainers procured some 40 years ago, the new aircraft expected to join the 915th Training Aviation Regiment. Apart from the L-39s, it also operates Mi-8 helicopters belonging to the Higher Flight School of the Vietnamese People's Army. There are also media reports about Vietnam being the first export customer for the Sukhoi Su-57E fifth generation fighter which will join the large numbers of Su-27SK/UBK fighters in Vietnamese service.

Apache selected by Bangladesh

The AH-64E Apache has reportedly been selected for Bangladesh's attack helicopter requirement. On 21 January, in a media briefing, company officials confirmed that the Apache would be offered to the country under the FMS procedure.

More Skytrucks for Nepal

Two new build M28-05 transports were delivered to the Nepal Army Air Service last December and were officially handed over on 18th of the month. Acquired with US government funds, the Skytrucks join at least one more aircraft that was delivered previously. PZL Mielec facility, belonging to Lockheed Martin, had earlier signed the contract with the US DoD, valued at US$ 19 million, financed by the US, within the framework of the Foreign Military Financing programme.

Chinooks for Afghanistan

Afghanistan's Special Mission Wing is to receive CH-47 Chinooks to replace the present fleet of Mi-17s. Under the proposal, an undisclosed number of Chinooks would be delivered by the end of 2023, as announced in a December 2019 report titled 'Enhancing Security and Stability in Afghanistan'. The Special Mission Wing supports Afghan Special Security Forces, or ASSF, and other Afghan forces for nocturnal raids, casualty evacuation and key reconnaissance operations. According to the US Department of Defence, the SMW is the only unit under Afghan security forces with "night-vision and rotary-wing air assault capabilities."

RTAF orders Airbus H135s

Airbus Helicopters have received an order for six H135s from the Royal Thai Air Force (RTAF). Deliveries of the H135s will begin in 2021, with the RTAF employing them for conversion training. Thailand has remained a major operator of Airbus Helicopters: its air force operates 12 H225M heavy-twins, and its army and navy are operating the UH-72 Lakota and H145M respectively.

Israel orders 8 KC-46As

Israel is to acquire eight Boeing KC-46A air-refueling aircraft. As per the US State Department, "a determination approving a possible Foreign Military Sale to Israel" of up to eight KC-46 aircraft and related equipment for an estimated cost of $2.4 billion has been made, with the Defense Security Cooperation Agency delivering the required certification notifying Congress of this possible sale.

Airbus C295 air-to-air refuelling tests

The Airbus C295 tactical airlifter carried out first 'wet contacts' during an air-to-air (AAR) tanker flight test campaign in December 2019 which was achieved using a closed ramp configuration, 100ft hose and remote vision system. The wet contacts, conducted out of Seville in Spain, took place between one Airbus C295 aircraft in tanker configuration and a Spanish Air Force C295 acting as receiver at flight speeds between 100-130 knots.

LM delivers 500th F-35

Lockheed Martin and the F-35 Joint Programme Office have delivered the 500th F-35 even as in February 2020 the F-35 fleet had surpassed 250,000 flight hours. The 500th production aircraft is a US Air Force F-35A, to be delivered to the Burlington Air National Guard Base in Vermont. The 500 F-35s include 354 F-35A conventional takeoff and landing (CTOL) variants, 108 F-35B short takeoff/vertical landing (STOVL) variants and 38 F-35C carrier (CV) variants for the US and international customers. The 250,000 flight hours include all F-35s in service, comprising developmental aircraft training, operational, US and international air force aircraft.

Elbit in USAF contract to Supply Missile Warning Systems

Elbit has been awarded a US Air Force firm-fixed-price contract with a ceiling of $471 million over a 10-year period to equip F-16 aircraft of the US Air National Guard and Air Force Reserve Command, with pylon-based infrared missile warning systems.

50 C-130Js ordered by US Government

Lockheed Martin will deliver 50 C-130J Super Hercules to the US government through a *C-130J Multiyear III* award, which is a delivery order under an existing *Indefinite Delivery Indefinite Quantity* contract of August 2016. The overall award, worth more than $3 billion, involves Super Hercules aircraft for the US Air Force (24 HC/MC-130Js), Marine Corps (20 KC-130Js) and Coast Guard (options for six HC-130Js). Aircraft purchased through the C-130J Multiyear III award will be delivered between 2021-2025.

LM delivers 2nd KC-130J for French AF

Lockheed Martin has delivered the second of two KC-130J Super Hercules aerial refuelers to the *Armée de l'Air,* at the company's Aeronautics facility in Marietta, Georgia. France has received a total

of four Super Hercules aircraft; two C-130J-30 combat delivery airlifters and two KC-130J aerial refuelers through FMS route. The two C-130J-30 airlifters were delivered in 2017 and 2018, and first KC-130J delivered in September 2019, all of these operated in conjunction with France's existing C-130H fleet.

Saab Digital Tower for RAF

Saab Digital Air Traffic Solutions (SDATS) have been selected to provide a Digital Tower system as an Operational Concept Demonstrator for the Royal Air Force at RAF Lossiemouth in Scotland. A technological evolution in Air Traffic Control (ATC) for civil airports is creating new possibilities which are equally relevant for military airfields. The RAF is investigating new concepts and capabilities, which could eventually change the way military ATC is conducted, both during normal operations and during time of increased threats.

Franco-German FCAS demonstrator phase

The Franco-German future combat air system (FCAS) has moved into its demonstrator phase.

The framework contract "covers a first period of 18 months and initiates work on developing the demonstrators and maturing cutting-edge technologies with intention for flight tests to begin by 2026". Dassault will lead the proposed Next Generation Fighter, supported by Airbus Defence & Space, alongside unmanned remote carriers, these headed by the Airbus unit and MBDA. Safran and MTU Aero Engines are to develop a new propulsion system for the FCAS while the combat cloud developed by Airbus and Thales will underpin network operations.

Elbit Systems for maritime UAS trials

Elbit Systems UK has been selected by the Maritime and Coastguard Agency (MCA) to conduct demonstration flights in the UK using a number of its unmanned aerial systems (UAS), including the Hermes 900. The flights are to prove long-range unmanned capabilities in civilian airspace and will utilise multiple sensors on a single platform. Meanwhile, UK Ministry of Defence has confirmed that its plans to deploy operational 'swarming drones' by the middle of 2020 is likely to be delayed as No. 216 Squadron, which has been charged with fielding the capability, has not yet been reactivated and its base has yet to be determined.

Airbus and MBDA to develop 'Remote Carriers'

Airbus and MBDA have joined forces to develop demonstrators for *Remote Carriers*, with MBDA focusing on development of small and medium-class platforms together and under the lead of Airbus while the latter will address the entire *Remote Carrier* scope and in particular 'teaming intelligence', whilst focusing on medium to large platforms. Designed as force multipliers, the *Remote Carriers*, are unmanned aerial vehicles (UAV) reducing risks for manned aircraft by taking over specific air operational roles in high risk environment, providing new air warfare capabilities and teaming in combination with and coordinated by other manned air assets.

Airbus and Thales collaborate on 'Air Combat Cloud'

Airbus and Thales are developing the *Air Combat Cloud* in support of the FCAS 'system of systems'. Airbus and Thales will jointly work on structural design of the *Air Combat Cloud* to support collaborative air operations at national and multinational levels, and perform a first phase of technology demonstrations of air combat cloud capabilities. This agreement supports the *Air Combat Cloud* pillar of the FCAS Demonstrator Phase 1A covering the next 18 month period and will serve as a starting point for demonstrators and technology development.

Boeing's US Army Future Attack Reconnaissance Aircraft

Boeing has offered the US Army "an agile, fully integrated, purpose-built system" for the *Future Attack Reconnaissance Aircraft* (FARA) prototype competition. The Boeing FARA is designed to meet the Army's current mission needs, still evolving as technologies and missions change. The thrust-compounded single-main rotor helicopter boasts a six-bladed rotor system, a single engine, tandem seating and a modular, state-of-the-art cockpit with a reconfigurable large area display and autonomous capabilities.

Second GA-ASI's Gray Eagle ER demonstrator

General Atomics Aeronautical Systems, Inc. (GA-ASI) have demonstrated a suite of long range sensors on its Gray Eagle Extended Range (GE-ER) Unmanned Aircraft System (UAS) during flight operations at Yuma Proving Grounds. The second in a series of demonstrations, GA-ASI partnered with industry to integrate best-of-breed long-range ISR payloads and Air Launch Effects (ALEs) on the GE-ER. The aircraft showed a persistent stand-off capability with up to 40 hours of endurance "that Commanders can leverage to orchestrate forces in the Multi-Domain Operations (MDO) environment".

GA-ASI concludes series of MQ-9 demonstrations

General Atomics Aeronautical Systems, Inc. (GA-ASI) has concluded a series of flight demonstrations using its MQ-9 Guardian Remotely Piloted Aircraft System (RPAS). The demonstrations on maritime surveillance capabilities of the MQ-9 are to prove the GA-ASI-developed Detect and Avoid (DAA) system for traffic-deconfliction in civil airspace. The flights were sponsored by the Hellenic Air Force (HAF) and the Hellenic Coast Guard (HCG) and were staged out of Larissa Air Base in Greece, the flights performed for various European military and civilian representatives.

Rafael's Drone Dome and LASER technology

In recent demonstrations conducted in Israel, Rafael's Drone Dome C-UAS system performed interceptions of multiple drones, including maneuvering targets, using its hard-kill *Laser Beam* director, the system achieving 100% success in all test scenarios. The stages of the interceptions included target detection, identification, and interception with a high-power Laser Beam.

Singapore collaborates on A330 SMART MRTT development

Airbus and Singapore are to collaborate on development of the A330 SMART Multi Role Tanker Transport (MRTT) for the Republic of Singapore Air Force (RSAF). The SMART MRTT programme will develop, certify and implement Automatic Air-to-Air refuelling (A3R) capability as well as enhanced maintenance solutions for the A330 MRTT.

Rafael unveils MicroLite

Rafael Advanced Defense Systems Ltd. has unveiled MicroLite, a compact, lightweight, EO/IR sensor for airborne Wide-Area Persistent Surveillance missions. MicroLite joins Rafael's family of advanced aerial electro-optical systems that includes the Litening advanced targeting pod, of which over 1700 Systems have been operationally deployed world-wide, the RecceLite real-time Digital ISR pod, the Toplite EO/IR System, and more. First of its kind, Rafael's MicroLite has been integrated onto the Orbiter-4 UAV by Aeronautics to begin flight tests, bieng the first example of the tight synergy created by a Rafael product and an Aeronautics platform following Rafael's acquisition of Aeronautics in 2019.

New MBDA Marte ER missile

MBDA's Marte ER anti-ship missile has carried out its second firing carried out at the PISQ (*Poligono Interforze del Salto di Quirra)* test range in Sardinia. This firing confirmed the overall design and performance of the missile, marking a critical milestone in its development. Several additional features and functionalities were tested, which included an integrated navigation system, proximity fly-over fuze, with weapon controller and actuation system in advanced configuration. The missile also featured the terminal guidance with a new seeker, engineered and developed by MBDA Seeker Division.

MBDA's Sea Venom/ANL Missile

MBDA carried out the first qualification firing trial of the Sea Venom/ANL anti-ship missile at the DGA Essais de missiles (DGA EM) test site at Ile Du Levant on 20 February 2020, another significant milestone for the Anglo-French co-operation programme. This latest firing builds on two previous ones that have all tested the missile to the very edge of its capability, the previous firings having demonstrated Sea Venom/ANL's lock on after launch (LOAL) and lock on before launch (LOBL) capabilities.

Airbus performance in 2019

Airbus delivered 863 commercial aircraft to 99 customers in 2019, surpassing its previous record set in 2018 by eight percent. In their seventeenth yearly production increase in a row, Airbus progressed on the transition to all NEO variants and by year end Airbus had delivered 173 wide-body aircraft, its highest number in a single year.

Maiden Flight for C919 (AC 106)

The sixth Chinese C919 (AC106) made its maiden flight on 27 December 2019, with all six C919 flight test aircraft now carrying out flight tests. The programme has entered into the intensive flight test phase with the six aircraft carrying out flight tests at four locations.

COMAC delivers 22nd ARJ21

The 22nd ARJ21 (B-604D) made its maiden flight from Nantong Xingdong International Airport on 28 December 2019. This marks delivery of the 22nd ARJ21 aircraft by Commercial Aircraft Corporation of China, Ltd. (COMAC), the ARJ21 fleet now having accumulated more than 23,000 hours of flight and 12,000 sorties of take-off and landing, flying more than 660,000 passengers.

PNG launch customer for ATR 42-600S

PNG Air of Papua New Guinea has ordered three ATR-42-600S to replace its De Havilland Canada Dash 8-100 turboprop fleet. The new aircraft can operate on 200nm (370km) missions with 40 passengers from 800m (2,620ft) paved runways in standard conditions.

Airbus promoting A321XLR

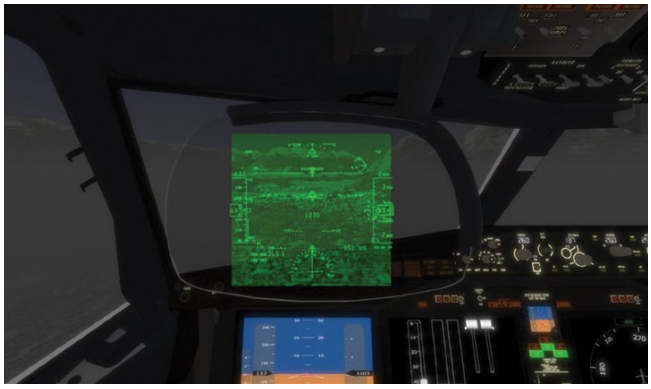
Airbus is confident that sales of the A321XLR extended range single-aisle airliner "will easily exceed 1,000 aircraft within the next decade". The variant A321XLR was launched at the Paris air show in 2019 and firm orders now exceed 450 aircraft. The XLR is proving popular in the Asia-Pacific region, with five customers having placed orders in the wake of the launch: including AirAsia, Cebu Pacific, Qantas Group and Vietjet Air.

First A350-900 for Aeroflot

The Russian flag carrier Aeroflot has taken delivery of its first A350-900, becoming launch operator of the latest-generation widebody aircraft in Eastern Europe and CIS. Aeroflot's A350-

900 features a distinctive new livery embracing its almost 100-year heritage. Aeroflot has a total of 22 A350-900 aircraft on order and operates an Airbus fleet of 126 aircraft (107 A320 Family and 19 A330 Family aircraft).

Collins Aerospace provide FAA with HUDs



The US Federal Aviation Administration (FAA) has ordered a Head-Up Display (HUD) Virtual-Reality (VR) training device from Collins Aerospace Systems, a unit of United Technologies Corp., to be used in scientific research in areas such as pilot-HUD interface, pilot performance and crew workload. The HUD VR trainer provides a unique out-of-the-window view of what a pilot would actually see when flying with a HUD that uses Collins Aerospace's Head-up Guidance System (HGS) and Enhanced Vision System (EVS).

Airbus BelugaXL into service

The BelugaXL has recently entered service, providing Airbus with 30% extra transport capacity to support on-going production ramp-up of its commercial aircraft programmes. The aircraft, which is an integral part of Airbus' industrial system, made its first operational flight on 9 January 2020, the first of six BelugaXL to

operate alongside its BelugaST predecessors, with the additional aircraft being introduced between 2020 and 2023. The BelugaXL has the largest cargo bay cross-section of all existing cargo aircraft in the world.

ATR 72-600s for US-Bangla Airlines

TrueNoord, the specialist regional aircraft lessor, has placed two more new ATR 72-600 aircraft on long-term operating leases with expanding Bangladesh domestic and international operator, *US-Bangla.* These new aircraft supplement the recently re-marketed ATR72-600 which TrueNoord transitioned from Air France HOP in October and bring TrueNoord's total fleet placed with US-Bangla to three ATRs.

Maiden flight of Boeing 777X

The new Boeing 777X jetliner has flown, entering the next phase of a rigorous test programme. The first of four dedicated 777-9 flight test aircraft (WH001) will undergo checks before resuming testing. The test fleet, which began ground testing in Everett in 2019, will go through a comprehensive series of tests and conditions on the ground and in the air to demonstrate safety and reliability of the design. Boeing expects to deliver the first 777X in 2021, which has already 340 orders and commitments from leading carriers around the world, including ANA, British Airways, Cathay Pacific Airways, Emirates, Etihad Airways, Lufthansa, Qatar Airways and Singapore Airlines.

Jazeera signs LEAP-1A engine services Agreement

Jazeera Airways has signed a long-term Rate Per Flight Hour (RPFH) agreement with CFM International to support the LEAP-1A engines that power the airline's fleet of 20 Airbus A320neo aircraft. The agreement also covers five spare engines. RPFH agreements are part of CFM's portfolio of flexible engine service support packages, under the terms of which agreement, CFM Services guarantees maintenance costs for Jazeera's LEAP-1A engines on a dollar per engine-flight-hour basis.

Rolls-Royce UltraFan demonstrator

Rolls-Royce has started manufacture of the world's largest fan blades for its UltraFan demonstrator engine "that will set new standards in efficiency and sustainability". The composite blades are of140-inch diameter, almost the size of a narrowbody airliner fuselage, being made at the company's technology hub in Bristol, UK. UltraFan will offer a 25 percent fuel reduction compared to the first generation of Trent engine, and deliver the same percentage reduction in emissions.

Rafael's new SPIKE SR

In a recent series of tests in the Negev Desert in southern Israel, Rafael has demonstrated its Spike SR (Short Range) precision guided missile. Spike SR is an electro-optical guided missile designed for shoulder launch by an infantryman. It is the smallest and lightest variant of the Spike Missile family, weighing only 10kg in use today by several nations, including those within NATO. The SPIKE Family is now operational with 34 nations, more than 33,000 rounds being produced and supplied, and as many as 45 different platforms integrated, including on attack helicopters, ground vehicles, marine vessels.

Slovakia selects Rafael's SPIKE LR2 ATGM

The Slovak Ministry of Defence has signed a contract with Eurospike (a European Joint Venture between Rafael Advanced Defence Systems Ltd., Diehl Defence and Rheinmettal Electronics) for supply of the advanced 5th generation SPIKE LR2 ATGM and dismounted advanced ICLU launchers (Integrated Control Launch Units). The procurement was carried out through the NATO Support & Procurement Agency (NSPA). Slovakia is among nineteen EU / NATO SPIKE missile user nations, with more than 33,000 SPIKE missiles supplied.

Poland orders Javelin ATGMs

The US State Department has made a determination approving possible Foreign Military Sale to Poland of one hundred eighty (180) Javelin missiles and seventy-nine (79) Javelin Command Launch Units (CLUs) and related equipment.

Saab Arthur systems for UK

Saab has received an order from the UK Ministry of Defence for a mid-life extension and support for the Arthur weapon locating system. Arthur protects forces (and civilians) by providing warning of incoming fire and is also used for tasks including counterbattery missions and fire control. The mid-life extension will represent a major programme of obsolescence management by the insertion of modern technology, ensuring that this critical operational counter-fire capability can be sustained on a cost-effective basis through to its extended out-of-service date.

Charles de Gaulle returns to operations

After routine maintenance the French Navy aircraft carrier *Charles de Gaulle* has been deployed in support of *Operation Chammal* in the Middle East. The warship and its air group are to operate against so-called Islamic State before sailing to the Atlantic Ocean and the North Sea.

EMALS and AAG systems cleared for all CVN 78 aircraft

General Atomics Electromagnetic Aircraft Launch System (EMALS) and Advanced Arresting Gear (AAG) have been cleared for shipboard launch and recovery of all currently deployed Naval aircraft types aboard USS *Gerald R. Ford* (CVN 78). The US Navy issued Aircraft Launch Bulletins (ALB) and Aircraft Recovery

Bulletins (ARB) which identify the weights and engaging speeds authorised for shipboard aircraft launch and recovery and signal that EMALS and AAG are operationally safe for use aboard CVN 78. On 31 January 2020, CVN 78 completed at-sea Aircraft Compatibility Testing (ACT) utilising a range of aircraft for the flight deck testing, including the F/A-18E/F, E-2D, C-2A, EA-18G, and T-45C, to clear EMALS and AAG for all air wing aircraft. GA-EMS is also delivering EMALS and AAG for the future *John F. Kennedy* (CVN 79) and *Enterprise* (CVN 80).

Saab 'Next Generation' Combat Management System

The Australian Government has signed an Enterprise Partnering Agreement with Saab Australia to deliver their 'Next Generation' Combat Management System. The agreement forms part of the Australian Government's multi-billion dollar strategic enterprise approach to naval combat systems. The Saab 'Next Generation' Combat Management System will be delivered across the Australian Navy's fleet including the *ANZAC*-class frigates, new *Arafura*-class offshore patrol vessels and *Supply*-class replenishment ships. Saab Australia will also leverage their 'Next Generation' Combat Management System experience in the development of the Australian interface to the Aegis system, for the *Hunter*-class frigates and the *Hobart*-class destroyers.

BAE to acquire Collins Aerospace Military GPS Business and Raytheon Airborne Tactical Radios Business

BAE Systems Inc. announced that it has reached definitive agreements for the proposed acquisitions of Collins Aerospace's military Global Positioning System (GPS) business and Raytheon's Airborne Tactical Radios (ATR) business. Raytheon's ATR business is a leading provider of airborne tactical radio solutions. Based in Fort Wayne, Indiana, and Largo, Florida, the ATR business designs, manufactures, and supplies a wide array of mission-critical communication systems to the US Department of Defence, allied governments, and large defence aircraft manufacturers. The business has leveraged its innovative technologies to develop secure communications solutions that are installed on a broad range of military airborne platforms.

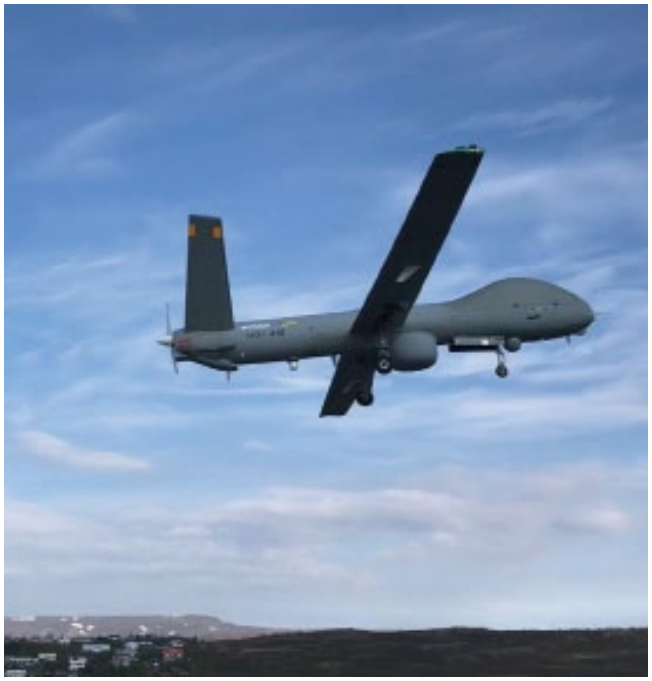
Orbit's Airborne Audio System for Heron TP

Israel Aerospace Industries have placed a $US1.8 million order for Orbit's Orion airborne audio management systems for integration aboard its next-generation medium-altitude, long-endurance (MALE) Heron TP unmanned aerial vehicle (UAV). Delivery of the systems is expected later in 2019 and 2020. Orbit's Orion enables essential communication between the UAV and civil Air Traffic Control (ATC) and other ground stations.

GA-ASI to enhance Gray Eagle ER capabilities

General Atomics Aeronautical Systems, (GA-ASI) has teamed with the US Army to enhance capabilities and survivability of the MQ-1C ER Gray Eagle Extended Range (GE-ER) Unmanned Aircraft System (UAS). This involves upgradation of the Gray Eagle ER's avionics, datalinks and software in order to improve the UAS's operational capability in contested environments. The modernisation initiative provides an open architecture concept on the aircraft that is capable of hosting government-owned software, as well as increased autonomy required to support Scalable Control Interface and the rapid integration of long-range sensors.

Elbit's maritime UAS patrol services for EU

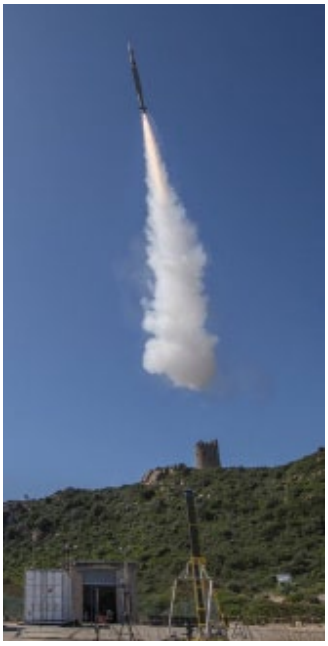


Elbit Systems has started operating maritime UAS patrol services available to the European Union (EU) under a contract between the European Maritime Safety Agency (EMSA) and the Portuguese company CEiiA. Iceland is the first EU country to use this particular long-range UAS patrol service. The Icelandic maritime authorities have based the Hermes 900 Maritime Patrol operation at the Egilsstaðir airport in east of the island, from which maritime UAS patrol has the capability of covering more than half of the Icelandic Exclusive Economic Zone (EEZ).

Germany orders more MBDA Meteor missiles

MBDA has received orders to build further Meteor beyond visual range air-to-air missiles for the German Air Force. Unlike traditional air-to-air missiles that glide unpowered for most of their flight, limiting their ability to hit agile targets at long distances, the Meteor's ramjet provides sustained thrust at speeds in excess of Mach 4 all the way to the target.

MBDA CAMM-ER in major trials milestone



MBDA has successfully completed a series of trials of the CAMM-ER air defence missile, validating the high-performance of the system. The trials have been conducted in the past months and saw a series of successful firings of CAMM-ER that proved the performance of the missile at extended ranges and high altitudes while conducting a number of challenging manoeuvres.

CAMM-ER is an extended range member of the new-generation CAMM air defence family of weapons. All members of the CAMM family share the same cutting-edge active radar seeker and soft-launch system, with CAMM-ER featuring a larger rocket motor to provide extended range out beyond 40 km.

MBDA showcases Tank Destroyer vehicle

MBDA and PGZ have unveiled a Tank Destroyer armed with the Brimstone precision strike missile. PGZ Companies and MBDA also signed a statement of co-operation at MSPO to confirm readiness to co-operate on offering this solution to Poland and export markets, recognising the combination of MBDA's Brimstone missile with PGZ's armoured vehicle expertise offers the best solution for Poland's Tank Destroyer requirement from a military capability, sovereignty and industrial perspective.

BAE Systems' IFV CV90 tested with Rafael's SPIKE LR missile

BAE Systems has fired an integrated, long-range anti-tank guided missile from the CV90 Infantry Fighting Vehicle in a recent series of tests. "This advancement further diversifies the CV90's operational capabilities on the battlefield by enabling indirect fire at long distances or at air targets, boosting the vehicle's lethality while increasing crew safety." The testing, which took place in difficult arctic conditions, used a Rafael Advanced Defense Systems' Spike-LR (long range) missile mounted on a BAE Systems Hägglunds' CV90 to destroy a target at more than 2,000 metres.

BAE Systems contract for US Navy guided-missile cruiser modernisation

BAE Systems has received a $175 million contract from the U.S. Navy to modernise the guided-missile cruiser USS *Vicksburg* (CG 69). BAE Systems initiated the first phase of *Vicksburg's* modernisation programme in May 2017. Under the new contract, the shipyard's employees and industry partners will work on the ship's weapons and engineering equipment, including its gas turbine propulsion system; restore crew habitability spaces, and support the installation of a new Aegis combat system, communication suite and CANES (Consolidated Afloat Network Enterprise System). The *Vicksburg's* MODPRD is scheduled to be complete in July 2021, and the ship with rejoin the operational fleet thereafter.

Dassault Falcon 8X Archange to serve the French Air Force

The French Defence Procurement Agency (DGA) has ordered the Archange airborne strategic intelligence programme, comprising three Dassault Aviation Falcon 8X aircraft equipped with the Thales new-generation payload CUGE (universal electronic warfare capability).

"The Archange Falcon will serve the French forces in the same way as the Falcons 10, 200, 50, 2000, 900 and 7X are already doing", stated Eric Trappier, Chairman and CEO of Dassault Aviation. "The special mission Falcons provide the perfect illustration of the dual competences of Dassault Aviation: our civil aircraft benefit from the cutting-edge technologies developed for our combat aircraft, which in return benefit from the industrial processes deployed for the highly competitive production of the Falcon aircraft".

Rosoboronexport signs first export contract for the Mi-38T

Rosoboronexport JSC has signed first export contract to supply a foreign customer with the Mi-38T medium-range multi-purpose helicopters manufactured by the Kazan Helicopter Plant, a subsidiary of Rostec's Russian Helicopters Company

The Mi-38T is designed for an around-the-clock airlift of up to 40 people with landing on unprepared sites, evacuation of the wounded (up to 12 lying-down or up to 30 sitting cases, accompanied by 2 medical attendants), transportation of goods weighing up to 5000 kg in a cargo compartment or up to 5000 kg on an external sling. The capability to move up to a platoon of infantry to a distance of up to 800 km is provided. The helicopter is also adapted for search-and-rescue operations and is capable of hoisting in persons and cargo weighing up to 300 kg from the ground or water in hover mode. Its rear cargo hatch is equipped with a hydraulically powered loading ramp, and there is a starboard hatch with a wide sliding door. The ramp is adapted for quick loading and unloading, including rolling of wheeled and tracked vehicles.

Airbus' stealth UAV 'LOUT'

Airbus' has recently its concept for a stealth unmanned combat aerial vehicle demonstrator for the German Government. Model of the Low Observable UAV Tested (LOUT) was displayed during a media briefing in November, but the project remains highly secretive and very limited details were provided. LOUT development work began in 2007 at Manching near Munich and Bremen in what the company calls "Skunk Works approach". LOUT was developed to demonstrate, "wideband signature reduction technologies and (be) a testbed for further VLO integration". The LOUT concept has a distinctive diamond-shaped planform with a configuration intended to support "radar, infrared, visual and acoustic stealth".

New Electronic Attack Jammer Pod in the Air

Saab carried out the first flight tests with its new advanced Electronic Attack Jammer Pod (EAJP) with successful results on 4 November 2019. The pod's interfaces with the aircraft's hardware and software as well as cockpit control and monitoring were tested during the flight. The purpose of Saab's new EAJP pod is to protect aircraft against radars by sophisticated jamming functions, thereby blocking the opponent's ability to attack them. The first flight marks an important step of the pod's development programme.

Saab is sharpening its electronic attack capabilities and the new advanced pod is an important element of this development. The EAJP is a strong complement to the built-in electronic attack capabilities of the highly advanced on-board electronic warfare system on Saab's new Gripen E/F fighter. It can also be used on other aircraft types. The pod forms part of Saab's Arexis family of electronic warfare systems.

Order for Finnish 'Squadron 2020'

Saab has signed a contract with the Finnish Defence Forces Logistics Command, and received an order to provide and integrate the combat system for the Finnish Navy's new *Pohjanmaa*-class corvettes within the Squadron 2020 programme. This follows the previously announced selection on 19 September. The order value is 412 million Euro and the contract period is 2019-2027. The Finnish shipyard RMC Defence will build the Finnish Navy's four new corvettes, with construction 2022 to 2025. The corvettes will be fully operational by 2028. The contract includes, among other things, Saab's Combat Management System (9LV) and Saab's radars Sea Giraffe 4A Fixed Face and Sea Giraffe 1X. The communication system TactiCall as well as the remote weapon station Trackfire, are also included in the contract.

Guided Carl-Gustaf Series of flight tests

Raytheon and Saab have successfully completed a series of guided flight tests for the shoulder-launched, guided Carl-Gustaf munition. Tests were conducted at Saab's Bofors Test Centre in Karlskoga, Sweden, and at Mile High Range in Sierra Blanca, Texas. The Carl-Gustaf weapon system built by Saab is used by the US Army and ground forces of more than 40 other countries. The new semi-active, laser-guided munition will allow militaries to accurately engage stationary or moving targets at distances up to 1.2 miles (2,000 meters).

Saab and Boeing firing of Ground-Launched SDB

Saab has along with Boeing conducted successful long-range test firing of the Ground-Launched Small Diameter Bomb (GLSDB) in Norway. The objective of the test firing was to hit a predetermined target in the sea, 130 km away from the launcher. The launcher used at test firing was a custom made, fully autonomous, 20 foot container.

First P-8A Poseidon for the RAF

In early November 2019, Boeing delivered the first of nine P-8A Poseidon maritime patrol aircraft (MPA) to the Royal Air Force. The United Kingdom is acquiring the multi-mission aircraft through the Foreign Military Sales process as replacement for the U.K.'s retired Nimrod aircraft.

Air Marshal Andrew Turner, spoke of the "profound challenge" of enemy submarines threatening the U.K. and other nations. "P-8 is the key to solving this challenge on the surface, the sub-surface and in the waters of the North Atlantic. There is no place [for our enemies] to hide. We will make the oceans transparent and we will prevail."

Boeing had formally delivered the aircraft to the US Navy during a ceremony at the Boeing Military Delivery Center in Tukwila, Wash. From Tukwila, the aircraft flew to the US Navy's Naval Air Station Jacksonville, Florida, where Royal Air Force crew worked with the aircraft before flying it to the United Kingdom in January 2020. All nine P-8A aircraft will be based at Lossiemouth, in Scotland.

(photo: RAF)

As part of a collaborative programme with the US Navy, pilots and maintainers from the RAF have been stationed at Naval Air Station JAX since 2012. As *Project Seedcorn*, the arrangement has allowed RAF members to fly the P-8A with Patrol Squadron Thirty (VP-30), the US Navy's Maritime Patrol and Reconnaissance Fleet Replacement Squadron, to hone their maritime patrol skills in advance of receiving the P-8A.

(photo: RAF)

15° Stormo: Italy's Combat Search and Rescue Wing

For over 50 years, 15° *Stormo* (or 15th Wing) has been tasked with Search and Rescue (SAR) duties for the *Aeronautica Militare* (Italian Air Force). Spread over the whole of Italy, the main base of the unit is at Cervia on the north-east coast, along the Adriatic Sea. The Wing has different squadrons, or Centro CSAR, seven of these being strategically located around Italy at various bases, operating alongside other front-line squadrons. Ready to provide services 24 hours a day, 365 days a year, these squadrons perform search and rescue missions for the Italian Air Force as well as on public utility activities including search for missing persons at sea or in the mountains, providing emergency medical transport for critical patients. Their geographical distribution is to ensure that rescue helicopters are not more than 90 minutes of flight 'away' from any location in mainland Italy.

Re-organised in 1965 by the Air Force as a Search and Rescue Wing, the unit initially operated a mixture of helicopters including the Agusta Bell AB-47 and Agusta Bell AB-204B, plus fixed wing aircraft including the Grumman HU-16A. In 1977, this become a full helicopter wing with introduction of the Sikorsky S-61R, locally designated as HH-3F *Pelican*. In 1986, the Italian Air Force added the Agusta Bell AB-212 to the unit to further boost capabilities. The Wing has accumulated much experience over the years with the Pelican and the AB-212 and from 1993 onwards, were also engaged in search and rescue tasks in conflict areas abroad, conducted by Italian armed forces such as those in Somalia, Albania, Bosnia, Kosovo and Iraq. With the move in 2010 to its current base at Cervia, the 15° *Stormo* was able to further develop its skills and expand mission such as for *Slow Mover Interceptor* (SMI) in air defence, which task was assigned to the unit several years earlier.

The HH-139 is more agile compared to the larger HH-101

With deployments in different hostile environment and also tasked with personnel recovery missions, Combat Search and Rescue (CSAR) was developed further with the HH-3F as a key platform. There is also continuous used for regular training with the Co.F.S. (Special Forces Command).

During 2008, the Italian Air Force began evaluating replacement for its aging Pelican helicopters and a different role was envisaged for future tasks of the Wing. The final decision taken was to procure the AgustaWestland AW139 medium-sized twin-engined helicopter (locally designated HH-139A) to replace the HH-3F and AB-212 specifically in the SAR role. The first of thirteen HH-139As were handed over on 8 March, 2012.

In addition, for the CSAR role, the Italian Air Force told the decision to procure the AgustaWestland AW101 medium-lift helicopter (locally designated HH-101A Caesar), 15 of these being ordered, the first entering operational service on 25 February 2016. Introduction of the Caesar provided the Wing with a state-of-the-art helicopter providing much boost in operational efficiency. Operational envelope of the helicopter was quickly expanded with more capability, the Wing being the first in Europe to achieve certification for helicopter night aerial refuelling in autonomous manner with the KC-130J Hercules tanker. This dramatically increased range of the helicopter and enabled the crew to operate for a longer time and to places much further away from their operating base. With such split in task, it also enabled the Wing and crews to dedicate their time and effort in these specialised areas.

HH-101s of 15° Stormo over a mountain monastery

With the introduction of the HH-139 and HH-101, 15 Stormo has been able to split the tasks between SAR and CSAR

With introduction of the Caesar helicopter, the 1st *Brigata Aerea Operazioni Speciali* (Special Operation Air Brigade) then moved to Cervia, the 1st *Brigata Aerea Operazioni* supporting Special Forces unit of the Air Force. With the HH-101A chosen as the dedicated CSAR platform, these will work closely with this unit while having both units at one base will enable more efficient training and further development of operational tactics.

The HH-101A can carry a combination of up to five crew members plus twenty fully equipped troops for Special Operations and can be equipped with up to three M134 7.62 mm Gatling-type machine guns. The helicopter is equipped with state-of-the-art avionics, self-protection systems, Identification Friend and Foe (IFF), Link 16, Gabbiano radar system, Missile Launch Detection System (MILDS) and a Laser Warning Receiver (LWR).

The HH-139A on the other hand is smaller and lighter, but is equipped with similar state-of-the-art equipment, including Night Vision Goggle (NVG) compatible glass cockpit, automatic flight control system with SAR modes, weather/search radar, Forward Looking Infra-Red (FLIR) and Auto Deployable Emergency locator transmitter (ADELT).

Text and Photos: Erik Bruijns and Mark de Greeuw

This HH-139A shows the FLIR and hoist to enable SAR duties

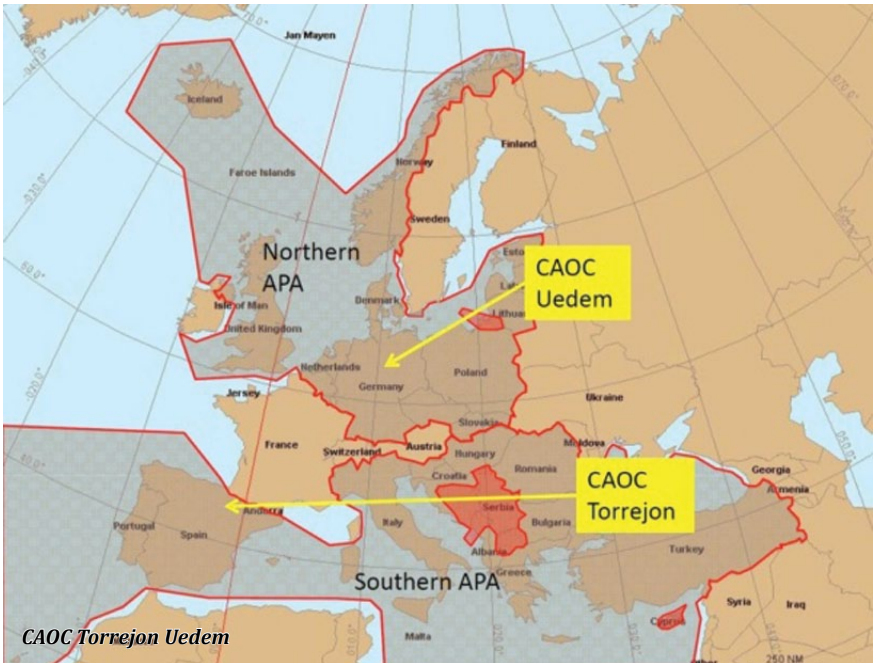
Allied Air Command-Air Policing flight

On 14 January 2020, a media flight was organised by *NATO Allied Air Command Ramstein*, overflying several countries in northern Europe that sent up their QRA/Air Policing aircraft to intercept our Belgian Airbus A321.

This Belgian Air Force Airbus A321 began a tour that flew over various countries of Europe, taking off from Brussels/ Melsbroek AB (Belgium) then flying via France, the United Kingdom, Denmark, Sweden, Finland, Estonia, Latvia to Lithuania. At the Šiauliai Air Base in Lithuania, the Belgian Baltic Air Policing (BAP) detachment was visited after which the Airbus A321 flew back to Brussels via Poland and Germany.

During the flight, the Airbus was intercepted by various European QRA aircraft as under:

- Finland: 2 Boeing F/A-18 Hornets from an undisclosed air base in Finland
- France: 1 Dassault Rafale from *Base Aerienne* St. Dizier
- Poland: 2 Lockheed Martin F-16s from BAP Ämari Air Base and 2 Lockheed Martin F-16s from an undisclosed air base in Poland
- United Kingdom: 1 Eurofighter, Typhoon from RAF Coningsby
- Denmark: 2 Lockheed Martin F-16s from Skrydstrup air base



CAOC Torrejon Uedem

Due to various reasons, the planned intercepts by QRA fighters from Air Forces of the Netherlands, Sweden and Germany were cancelled, owing to bad weather in Lithuania and Estonia, the intercept by the Belgian Baltic Air Policing F-16s was also cancelled.

After a peak in 2014-2015, the number of BAP intercepts has decreased to some 145 intercepts in 2018, but in 2019, were scaled upto 200. Most QRA intercepts take place along the airways between the Russian area of St. Petersburg and Russian enclave Kaliningrad located between Lithuania and Poland; as the only way to travel to/from Kaliningrad is by sea or by air, without requesting visa and custom-clearances. Besides that, sometimes unidentified helicopters fly between Kalinigrad and some oil rigs at sea.


(photo: J V Boven)

Briefings were given to us by Lieutenant General Klaus Habersetzer of the German Air Force, commander of CAOC Uedem in 2020. The NATO Centre for Combined Air Operations Uedem (Germany) is responsible for the northern European airspace, including Baltic Air Policing and the Iceland Air Policing. As the CAOC commander explained, "We had a peak in 2015-2016. In recent years, we have observed almost the same level of activity in the airspace, but it depends on exercises on the NATO and the Russian sides. If we conduct exercises, they try to observe us, we do the same - that's professional actions!"

Text and photos: Alex van Noye & Joris van Boven

North European Airspace F-16 (Alex van Noye)


North European Airspace F-16 (Alex van Noye)

North European Airspace Rafale (Alex van Noye)

North European Airspace EF2000 (Alex van Noye)

Belgian Baltic Air Policing 2020

On 14 January 2020, a media visit was organised by NATO Allied Air Command and the Belgian Air Force to visit the Belgian detachment at Šiauliai Air Base, in Lithuania.

The Belgian detachment commander, call sign 'Ron', briefed us on aspects of *Belgian Baltic Air Policing*. In 2004, the Belgian Air Force became the first NATO Air Force to participate in the Baltic Air Policing programme and 16 years later, its 349 Squadron from Kleine-Brogel AB, is one of the present two BAP contributors, the other being the Polish Air Force with its F-16s at Ämari Air Base in Estonia and at Malbork Air Base in Poland.

The Belgian detachment is on a 24 hours, 7 days a week readiness with two aircraft which can be airborne within fifteen minutes after the scramble command, the fighters being on Quick Reaction Alert (QRA). Two aircraft are kept as reserve and at high readiness as well.

The Belgian detachment consists of a 'lean' group of just 60 personnel, split into three branches: the *operational branch* with pilots and mission planners, but also firefighters and a meteorologist; the *maintenance branch*, including personnel for the F-16 avionics and weapons, and the *support branch* with medic, military police and a fighter-controller at the Control and Reporting Centre at Karmėlava in Lithuania.

As standard armament are two AIM-120 AMRAAM beyond visual range missiles, two AIM-9 Sidewinder close combat missiles plus the integrated M61A1 six-barrel Gatling gun with some 500 rounds. Placed close to the radar is the Sniper Advanced Targeting Pod (ATP) which zooms in on the target even before the pilots have visual sight. With the targeting pod, it becomes easy to recognise the target and select appropriate armaments.

The F-16s are also equipped with flares, normally to be used as defence against heat-seeking missiles, but these can also be used to attract attention of the pilots of an intercepted aircraft.

During night flying operations, the Belgian pilots also employ Night Vision Goggles (NVG) to amplify the limited light in the sky. Within fifteen minutes, the F-16s must be airborne and thereafter the CRC guides them towards the aircraft being intercepted. When a 'rogue' aircraft has been intercepted, a report is sent to the CRC and a photo taken for conformation. If the intercepted aircraft is posing a danger to other aircraft, or is heading towards a forbidden zone, or in an emergency, the F-16s needs to escort this aircraft into another direction. In 99% of intercepts, there is just R/T interrogation, with the F-16s flying close to the integrated aircraft and the cockpit visually checked.

There are 3 manners of Scramble:

Alpha-Scramble: this is the 'real thing' where the aircraft is launched within fifteen minutes

Tango-Scramble: this is for training where the full 'Scramble' is exercised, without any aircraft to be intercepted

Sierra-Scramble: this is also training Scramble where the full scenario is exercised, without a take-off.

Since September 2019, some 20 Alpha-Scramble intercepts were carried out by the Belgian detachment, intercepting fighters, transport aircraft and once even a strategic bomber.

After our briefing, a *Tango-scramble* was planned for the media, but owing to uncertain weather conditions, only a *Sierra-Scramble* was carried out. Instead, some archive photos of previous NATO Allied Air Command QRA missions were shared.

Photos and text by: Joris van Boven and Alex van Noye.

Brazilian Army Aviation today

The embryo of what would become Brazil's Army Aviation Instruction Centre (*Centro de Instrução de Aviação do Exército or CiAvEx*) was created by the then Ministry of War a century back. The Brazilian Aviation School operated for just over six months in 1914, ending its activities owing to cyclical difficulties that arose after outbreak of the First World War. The institution was reorganised and re-opened in June 1919, under technical auspices of the French Military Mission and was named as the Military Aviation School, operating at Campo dos Afonsos, in Rio de Janeiro.

In 1927, after many internal changes, the school received much boost in the form of a large number of aircraft for training of pilots "for protection of national airspace", a mission that fell on the Brazilian Army until creation of the Ministry of Aeronautics in 1941. Experience in conflicts after the Second World War, showed the need for forces to operate in the third dimension of the battlefield.

In 1985, then Minister of the Army, General Leônidas Pires, ordered a study to determine the need for a specific Army Aviation Branch for the Ground Forces, which subsequently led to creation of *Aviação do Exército* (Army Aviation) on 3 September 1986. Intended as a helicopter force, the plan was to attach a flying unit with each army brigade. The Taubaté army complex was importantly chosen as first base of the 1st Army Aviation Battalion (1ºBAvEx, *Batalhão de Aviação do Exército*) while an aviation material command was also created (DMAvEx, *Diretoria de material de Aviação do Exército*). Facilities were created and hangars, ramps, a runway, a housing area and classrooms built.

Meanwhile, the Army sought to acquire helicopters and selected French types which could (in part) be license built by Helibras of Brazil. The first two helicopter types were the AS.350L1 Squirrel, or *Helicóptero de Ataque* (HA-1) and AS565AA Panther or *Helicóptero de Manobra* (HM-1) as christened in Brazil. The first Squirrel was officially inducted during a ceremony on 21 April 1989 and the long-sought army requirement came into fruition.

The Brazilian army is gradually expanding its own air arm. Re-organisation took place in 1990 and 1993 and the original 1st battalion was renamed 1º *Esquadrão de Aviação de Exército* and reorganised into the 1st Group (1º *Grupo AvEx*) together with the newly formed 2nd, 3rd and 4th squadrons. In 1992 *CiAvEx* got a 5th squadron, following the first Aviation Sergeant's Training Course. Training improvement and specialisation courses for officers and NCOs of Brazilian Army Aviation are imparted at this school. Taubate is also resident of 1º *Batalhão de Aviação do Exército* (1º *BAvEx*) and 2º *Batalhão de Aviação do Exército* (2º BAvEx) the first operating a mix of HA-1, HM-1 and the new HM-4.

2º *BAvEx* operates a mix of HA-1 and HM-1s and the squadrons are no longer only at Taubaté. At beginning of the 21st Century, a third base was created

in southern Brazil, at Campo Grande in the province of Mato Grosso do Sul. 3º *Batalhão de Aviação do Exército* (3º *BAvEx*) which operates a mix of HA-1s and HM-1s. The 4th squadron, 4º *Batalhão de Aviação do Exército* (4º BAvEx) is based at Manaus in the Amazon basin and is majorly involved in anti-drug operations, the only unit employing Black Hawk (HM-2) helicopters, but also the HM-1 and HM-3.

Four Black Hawks were acquired for the military monitoring mission along the Ecuadorian-Peruvian border (MOMEP, *Military Observation Mission Ecuador-Peru*). Some years earlier, the first Cougars (HM-3) began to arrive and the latest acquisition is the Super Cougar, with the army receiving sixteen of the 50 ordered by the Brazilian Ministry of Defence. Given the designation HM-4, these will further boost Brazil's troop transport capabilities, with the *Aviação do Exército*, or *Exército do Brasil* (EB) strength now approaching the 100 helicopter mark.

Main mission of the *Exército do Brasil* is to provide aero mobility for the Ground Forces and has been present at major events

in which the Army is employed, including playing an outstanding role during the 2014 World Cup, during the 2016 Olympic Games and numerous missions in support of the Brazilian people. Besides the obvious training mission, the *CiAvEx*, also works on creation of new doctrines applicable to Army Aviation, as well as updating AvEx personnel in the knowledge of technical and professional matters related to aviation. The Centre is also responsible for standardisation of technical and tactical procedures within the AvEx.

Text and photos: Erik Bruijns

The Samurai Phantoms

Over the years, the F-4EJ Kai has built up a great reputation in Japan, this Phantom fleet majorly updated over the years to the 'Kai' standard. The type is currently in the last days of its operational career with the Japan Air Self Defense Force (JASDF) and will soon be replaced by new gen Lockheed-Martin F-35A Lightning II. The most colourful Phantoms in Japan are the photo reconnaissance aircraft of the 501 Hikotai. After more than 45 years in service of the JASDF, the aircraft are to be phased out by end 2020, the tasks of this version of the legendary Phantom taken over by the F-15J Eagle using SAR pods. The Phantoms have served with the Japanese Air Force for over 45 years and have equipped eight squadrons during their service.

The legendry McDonnell Douglas F-4 Phantom II continues in frontline operational service with the Japan Air Self Defense Force (JASDF). In the near future, this will change, as in the course of 2020, the Phantoms will be phased out and replaced by the next gen Lockheed-Martin F-35A Lightning II. After 45 years of service with the Japanese Air Force, the Phantom is now obsolescent and due for replacement, having been in decline with the JASDF for several years. Of the original seven squadrons and a test unit, only two squadrons and a test unit are now active with different versions of the F-4 Phantom. The other squadrons have since been re-equipped with the Mitsubishi F-15J Eagle. After a long evaluation on a successor to the F-4 Phantom II, by the Japanese Government decided in December 2011 to purchase the Lockheed-Martin F-35A Lightning II. Japan had initially chosen the Lockheed-Martin F-22A Raptor but this move was rejected because the aircraft would be far too expensive and beyond the Japanese defence budget.

The F-35A Lightning II is going to be Japan's first fifth generation fighter plane and will therefore, play a most important role with the JASDF. The very first Japanese F-35A arrived at Luke Air Force Base in the United States on 29 November 2016 and since then, the JASDF has been training the first batch of its fighter pilots on this new fifth generation fighter aircraft. Japan is part of an international training unit that trains pilots on the F-35A Lightning II at Luke Air Force Base. At the beginning of 2019, the first F-35s were relocated to Japan itself to form the first operational unit there.

The first Japanese operational squadron re-equipping from the F-4 Phantom to the

One of the first JASDF F-35As

Mixed formation of JASDF aircraft types

F-35A Lightning II is the 302 *Hikotai*, which has flown the Phantom for many years from Nyatubaru and later also from Hyakuri. In August 2017, it was announced that 302 *Hikotai* would be the first unit in the JASDF to switch to the F-35 Lightning, the squadron eventually stopped flying the F-4 in March 2019, the unit moving from Hyakuri Air Base to Misawa Air Base in northern Japan that same month, Misawa being in the northern part of the main Japanese island of Honshu. Since the first Lightnings were moved to Misawa, thirteen aircraft have already been delivered to the squadron over the fifteen months, 302 *Hikotai* being declared IOC on the F-35 on 29 March 2019. In 2020, the unit will receive more aircraft, and the squadron would be at full strength.

Going back to the Phantom, ever since introduction of the RF-4 with the JASDF in 1974, the Japanese have had an excellent photo reconnaissance aircraft, their Phantoms performing this most exacting photo reconnaissance task.

After the last RF-4E(J) Kai is phased out end March 2020, the 301 *Hikotai* will remain as the only unit with the F-4EJ Kai but this unit too will also start transition to the F-35 in April next year. Like the 302 *Hikotai*, the 301 *Hikotai* will be moving from Hyakuri Air Base to Misawa Air Base in northern Japan.

At the end of 2019, a Phantom farewell was organised during the annual air show at Hyakuri *Phantom Pharewell in Japan*. There are plans to base a squadron of Mitsubishi F-2s at Hyakuri Air Base.

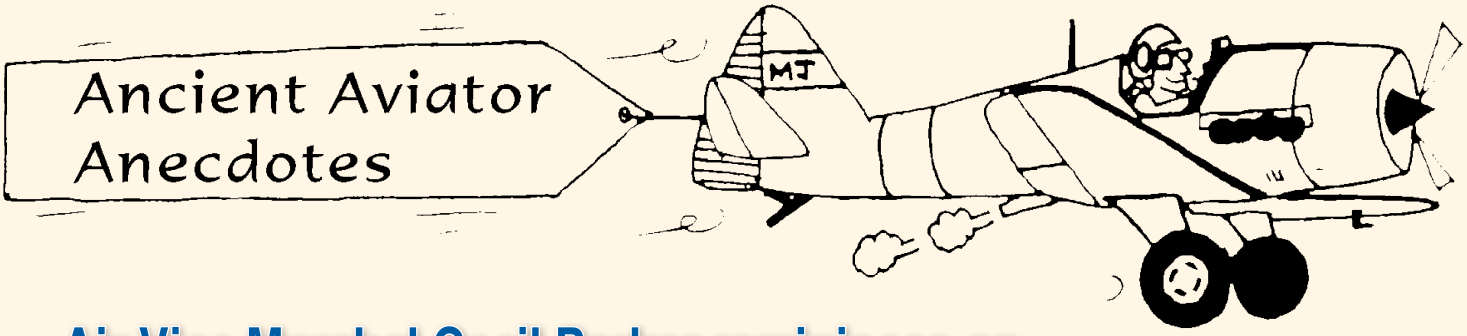
The new F-35A Lightning IIs are being built under license in Japan by Mitsubishi Heavy Industries and Japan plans to eventually purchase a total of 157 F-35s, consisting of 115 F-35A Lightning IIs for the JASDF and 42 F-35Bs for deployment at sea. Meanwhile, after 45 years of "loyal service", the *Samurai Phantoms* will be taking off for the last time in 2020 and after their retirement, the JASDF Phantom can only be admired in museums.

Photos and text: Joris van Boven and Alex van Noye

'Phantastic' view of the F-4 Phantom II in Japanese markings

Line-up of JASDF Phantoms

Ancient Aviator Anecdotes



Air Vice Marshal Cecil Parker reminisces on

ONE PILOT, MANY LANGUAGES !

Most Indian children grow up bilingual but very few would have been exposed to four languages even before they commenced schooling. My mother (an ethnic Bengali) was born and brought up in Surat as her (Bose) family relocated from Bengal to Gujrat at end of the 1800s. By profession she was a language teacher who was fluent in Bangla, Gujarati and English. My father an engineer by profession, was born and brought up in Bilaspur (Madhya Pradesh), was fluent in Hindi but learnt English only in college. English therefore was the only language my parents had in common at the time of their marriage. I was born in 1932 in Anand (Gujrat) and, because of my father's postings, we were a very nomadic family. For my first few years, I communicated in the four languages I heard, depending upon my location, be it in Gujarat, MP, Bihar or Bengal where my father was regularly posted.

In 1942 I was enrolled in a Raj-era public school as a boarder where we were not permitted to speak in any language other than English and where, from Std IV onwards, French was an elective for the SC (Senior Cambridge) exam. However, as Independence became imminent, the school added a Hindi pandit to the faculty and nearly all of us Indian students took it as a subject for the SC exam in 1948. Thereafter I joined a college in Calcutta where most of my fellow students and friends were Bengali, hence I regained some of my childhood fluency in that language. In 1951 I joined the IAF as a flight cadet in Ambala; my 50 coursemates came from all four corners of the country hence I was exposed to newer languages and dialects.

The life of any language is dependent upon its utility and usage. To my generation, the air force offered a 'lingo' of its own. To begin with I added a couple of very expressive and colourful phrases in Punjabi to my vocabulary. Some of our seniors still vocalised some colonial-era linguist leftovers from the RAF / RIAF (*p.c. prune*, *prang*, *popsie*, *pongo*, *pyfo* and a few more that are unprintable); R/T natter added some new words (*wilico*, *roger*, *angels* et al) while some signals brought in new meanings (*thumbs up* / *down*). Linguist indigenisation commenced with Hindi words of command on the parade ground and proficiency tests in the language were made mandatory to pass promotion exams.

In 1956 I married a young Mulkhi lady teacher from Hyderabad who was fluent in the Tamil language and who had studied Urdu as a second language in her convent. Four postings to the south (one to FIS Tambaram and three to DSSC Wellington) introduced me to Tamil but I did not progress much beyond a few simple phrases. Having settled in AP /Telengana, we are now working on our Telegu. As I enter my 88th year, I must confess my very limited ability to cope with the digital e-language of the virtual world created by technology. Of course the internet and smart phones are part of life but our lack of training makes for ineffective usage; I greatly fear that emojis will soon replace words! Like learning the skills of flying, the e-language too requires continuous self-learning in the course of which I even created my own e-alphabet:

A	- Amazon	:	B	- Browser	:	C	- Computer	:	D	- Data	:
E	- E-mail	:	F	- Facebook	:	G	- Google	:	H	- Huawei	:
I	- Internet	:	J	- Java	:	K	- Kilobyte	:	L	- Laptop	:
M	- Mobile	:	N	- Netflix	:	O	- Online	:	P	- Password	:
Q	- Quicktime	:	R	- Reliance	:	S	- Skype	:	T	- Twitter	:
U	- Uber	:	V	- Voice	:	W	- Whatsapp	:	X	- Xerox	:
Y	- YouTube	:	Z	- Zuckerberg	:						

Looking back, I feel that communicating in four languages in the real world over 80 years ago, was comparatively child's play ☺☺!

A Ferry Flight in the Fifties

In 1957, as a young flight-lieutenant, I was posted to Ambala which housed three squadrons, two of which were equipped with Toofani aircraft while the third (No.10) was awaiting re-equipment. As an interim measure, Air HQ decided to loan allot a few piston-engined Harvard trainers to them. One was allotted from the ASU (Aircraft Storage Unit) in Sulur. As a QFI still current on type, I was detailed to ferry the aircraft from Sulur, via Bangalore, Begumpet, Nagpur, Kanpur and Palam, to Ambala. I had earlier ferry experience of Vampire Mk 52s from HAL Bangalore to my first squadron (No. 7) in Palam, but these flights were always flown in pairs or more. This would be my very first long, solo ferry flight.

I was given maps, authorisation sheets, a parachute and sanction for civil flight by the then IAC night air mail service, Delhi-Nagpur-Madras. It still took over 48 hours to reach Coimbatore from where I got to Sulur which turned out to be a quiet airfield with almost no flying activity. The only officer of the GD(P) / Flying Branch was the wing commander commanding the air base who was very kind and helpful to this lone ferry pilot. The allotted Harvard had been in storage for a few months and it took two air tests before it was cleared of all snags. On the evening before my departure, the base commander invited me to dinner and asked if he could take a lift in the rear cockpit to Bangalore as he was required there on TD (Temporary Duty). I agreed immediately but pointed out that I had only one parachute! He burst out laughing and confirmed that he would arrange one for himself.

As per my log book, on 6 June 1957, I took off in Harvard IIB (HT 826) for Bangalore with a Wg Cdr Sathyanathan as co-pilot. The weather was fine and we had an uneventful flight to Bangalore where we were received by the Comn Flight and where a jeep awaited the Wg Cdr. After thanking me and being dropped off at his destination, he very kindly left the vehicle at my disposal; we never met again. I got in touch with my two coursemates who were test pilots on deputation with HAL. One of them, learning I was routing through Kanpur where he himself was headed to ferry back an aircraft, asked if he could take a lift with me? Coursemates are of course a lifetime relationship and next morning I was happy to have his company. En route we re-capped our experience as flight cadets five years earlier at No 1 AFA when we had flown the same route(s) Begumpet-Bangalore-Begumpet on our solo navigation sortie on Harvard aircraft.

The third leg to Nagpur was also uneventful but for the first time, I had to do and sign the DI (Daily Inspection) of the travelling copy of the Form 700 myself owing to lack of some tradesmen at Nagpur. There was some pre-monsoon cloud build-up on the leg to Nagpur but we were flying VMC and reached Chakeri airfield where I was pleasantly surprised to meet up with the Sgt heading the Duty Crew, an ex-member of my second squadron (No.3) at Ambala earlier. The fifth leg from Kanpur to Palam was flown with an empty rear seat but with strong head winds for a change. I was received by 'C' Flight of Air HQ Communication Squadron; little did I know that in a few months I myself would be posted there! My last leg to Ambala was flown in a totally overcast sky but over familiar terrain and it was one very tired but satisfied pilot who handed over the ac after a great learning experience 63 years ago.

Twelve years later in 1969, as a wing commander, I led a Hunter Mk.56A ferry flight from Dunsfold in the UK to Kanpur, but that is another ferry tale which has been told in an earlier AAA feature.

An IAF T-6G Texan (Harvard) of the Vintage Flight

25 Years Back

From Vayu Aerospace Review Issue II/1995

Indian Defence Budget 1995-96

India's Finance Minister Dr Manmohan Singh has effected a modest increase of Rs.1956 crore ($630m) in the defence outlay for 1995-96 despite the "worsening security environment" on India's borders. The outlay has now been pegged at Rs. 25,500 crore ($8.2 billion) as against Rs. 23,544 crore in the revised estimates for 1994-95. Although this signifies a 8.3 per cent increase over the revised estimate of Rs.23,544 crore for 1993-94 but given an 11 per cent inflation rate, the marginal hike in allocation will be barely enough for the upkeep of the forces leaving virtually nothing for modernisation, upgradation and expansion.

PAC presses for ALH production

Parliament's Public Accounts Committee (PAC) has told the Ministry of Defence to ensure that development of the Advanced Light Helicopter (ALH) be expedited and its production commenced without any further modifications. The helicopter, whose induction was recommended 25 years ago, is still at the development stage. In its 84th Report (on the action taken by the Government on an earlier Report on the subject), this was down from Rs 46.47 crore to Rs 28.33 crore in the budgeted estimates of 1995-96.

New strategic ties between India and Russia

"It will not be an exaggeration to state that India, as a strategic partner, is most important for Russia (even more so) than during existence of the USSR". This was underlined repeatedly by Andrei Kokoshin, Russia's first deputy Defence Minister during his week-long visit to India.

It is learnt from highly authoritative sources that the agreement includes upgradation of the MiG-21bis fighter, supply of 10 additional MiG-29 air superiority fighters, 'modernisation' of the existing MiG-29 fleet, provision of R-73E close combat and RVV AE medium range AAMs, new generation anti-tank missiles for Mi-25/-35 gunship helicopters, besides comprehensive spares for An-32 and 1l-76 transport aircraft, Mi-8 and Mi-17 helicopters, new long-range surveillance radars and EW equipment.

Boeing push in India

After their repeat success is selling additional Boeing 747-400s to Air India, the Boeing Commercial Airplane Company has vigorously renewed its marketing and industrial activities in India. In the first week of March 1995, Boeing announced contracts with HAL for manufacture and supply to Boeing of 100 over-wing exit doors for the Boeing 757. At the same time, Boeing have signed agreements with the Indian Institute of Science (IIS). National Aeronautical Laboratory (NAL), Aeronautical Development Agency (ADA) and HAL covering advanced-technology projects in a number of areas, including computer-aided design among others.

First Dornier 328 in Asia-Pacific

The very first Dornier 328 new generation turboprop regional airliner to be delivered to an operator in the Asia-Pacific region, flew into Delhi International Airport on the evening of 29 March 1995. This aircraft, registered VT-VIF, is the first of five Dornier 328s ordered by start-up airline VIF Airways of Hyderabad.

IA, AI merger "imperative"

Mr Russi Mody, Chairman of Air-India and Indian Airlines visualises merger of both the airlines in two to three years time as the emerging aviation scene will make this imperative. One airline would be better a placed to be a major player in s the emerging aviation market to expand its network. Asserting that it would be "a survival of the fittest" in view of the liberalised aviation market.

Indo-Russian Light Transport Aircraft

The 14-seater light transport aircraft (NAL Saras and MDB Duet) being jointly developed by India's National Aerospace Laboratory (NAL) and Russia's Aerospace Laboratory (NAL) and Russia's Myasishchev Design Bureau (MDB) could be powered by a Russian engine (the TVD 20M turboprop) as well as the Pratt & Whitney Canada PT-6A-66 flat rated to 850 shp. Official sanction for the LTA project has been received from both Governments, with the Russian Prime Minister Victor Chernomydrin having endorsed the agreement and likewise the Indian Cabinet Committee on Economic Affairs (CCEA).

Travails of the AJT

Pending decisions on the long-awaited selection of an Advanced Jet Trainer (AJT) for the Indian Air Force, being pursued since the mid-80s, there has been procurement of some second-hand MiG-21U tandem-seating operational trainers from Eastern Europe. Meanwhile, the technical sub-committee appointed by the Government six months back for final evaluation of the Hawk and Alpha Jet, has submitted its report. Commercial negotiations for the final selection of an AJT are reportedly to be held in the coming months. The IAF has an initial requirement of 66 AJTs, the first batches of which will form an Operational Flying Training Unit at Kalaikunda.

IAF order additional HAL-Dornier 228s

The Indian Air Force is to place additional orders for HAL-built Dornier 228 light transport aircraft, augmenting its current fleet of 25 by another 18 aircraft of this type. The IAF has two logistic support/communication squadrons (Nos.41 and 59) operating the Dornier 228 as also a number of communication and special flights.

Tale Spin

Deadly Serious

Even as *Vayu*'s Issue goes to press, India joins most of the world in a lockdown to fight the deadly Covid-19 virus which has taken a deadly toll already. The country has gone into quarantine for an indefinite period to fight this scourge and *Vayu* is racing against time before its press too succumbs to the global pandemic. However, this aerospace journal will be in interesting company with the US-origin *Playboy* (girlie magazine) ceasing printing for remainder of the year as a result of Covid-19 and working on a transformation "to better suit what consumers want today".

What do readers really want from us today?

Reinforcing Army Aviation

The Republic Day 2020 fly past included four HAL Advanced Light Helicopters, including the Rudra variant of Army Aviation which preceded formations of IAF jet fighters. Wait! There was a fifth shape in the sky, an eagle which nonchalantly flew across Rajpath causing much worry to aviators, but fortunately no 'bird hit'.

Ornithology has it that our feathered friends have been in the skies ever since creation while man's heavier than air flight took place barely one hundred years ago.

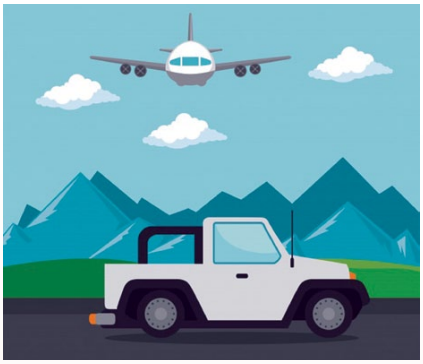
Perfect touch down !

Naval Aviators landing on moving aircraft carriers are rightly considered 'Top Gun' but guess who has been landing on a moving deck since always? In this remarkable picture, a crow descends ever so perfectly for landing on an owl in flight, both obviously quite in sync.

Fly Navy, Fly!

It's my right !

Without doubt, the joint use of Air Force (and Naval Air) bases by civil airlines has created situations for both sides but since these are national imperatives, there must be tolerance so as to live and let live. Thus, a recent incident where an Air India A321's fuselage was damaged when the pilot unstuck prematurely to avoid an Air Force Jeep on the Lohegaon runway, this was stark reminder of the inherent risks that remain. Over the past two decades, civil air traffic has grown exponentially which impacts on Air Force (and Navy) operations in mixed



use airfields such as Lohegaon, Chandigarh, Dabolim and others.

Right of way?!

AI Aliens

According to a research paper, Artificial Intelligence could well trick real intelligence (aka human minds) into believing that we have found potential aliens from outer space. A new study has it that even computers could be tricked into identifying shapes as evidence of extraterrestrial intelligence. There is this study of the dwarf planet Ceres, which is in the asteroid belt between Mars and Jupiter, creating frenzied speculation as astronomers noted bright moving lights on its surface as indicating aliens driving vehicles!

Stand easy! There were only volcanic ice and salt emissions!

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