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V/2018

Aerospace & Defence Review



The IAF at 86

Interview with the CAS

Indian Women (Air) Power

In Defence of the Rafale

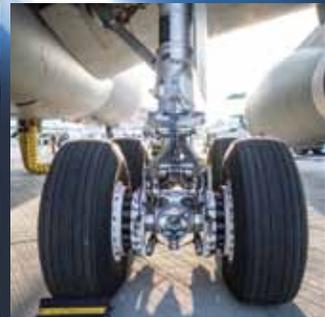
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Cover : Pair of Dassault Rafales fully loaded with long range tanks and weaponry (photo : Rafale International)

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32 Interview with the CAS



In Vayu's interview with Air Chief Marshal BS Dhanoa, the CAS emphasised that the case for 114 new fighters will be progressed through the Strategic Partnership route and as per Chapter VII of the DPP-16. The Chief also referred to the FRA and AEW&C requirement and importantly, on the procurement of 83 LCA Mk.1As for the IAF.

36 The Indian Air Force at 86



In his concern of the IAF's declining squadron strength, Sanjay Badri-Maharaj looks at various options and the challenges facing the Service. Listing the IAF's current inventory of combat squadrons, he believes that the delays and lack of focus on the LCA programme has been the main cause of the declining strength. Referring to what he terms as the 'MMRCA 2.0', the author feels that India's selection of new fighter will depend on capabilities offered as also technology transfer and cost-effectiveness.

31 (Air) Defence of the Realm (Rafale)

A special seminar on IAF Force Structure 2035 was hosted by the Centre for Air Power Studies at New Delhi on 12 September 2018. The CAS Air Chief



Marshal BS Dhanoa gave a special address on the rationale behind the Rafale acquisition programme as also on the IAF's modernisation roadmap.

42 Air Combat Enablers



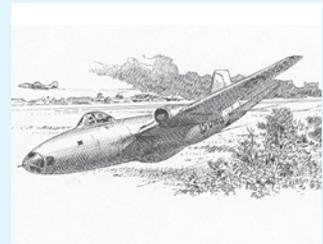
Air Vice Marshal Manmohan Bahadur writes on the equally important need for combat enablers, specifically flight refueling aircraft and AWACS platforms, without which the IAF would be severely handicapped in bringing force to bear in an optimal manner.

44 Indian Women (Air) Power



Indian women are now flying combat fighters with the Indian Air Force, their ranks being slowly augmented as additional batches are trained for the purpose, writes Nitin Konde. Meanwhile the neighbourhood also has women flying fighters, both in Pakistan and China.

98 Out of Africa



This evocative article looks back to the early 1960s when the Indian Air Force deployed a flight of Canberra interdictor bombers to central Africa, in support of the United Nations in the Congo. As part of the motley 'UN Air Force', the IAF turned the tables, providing the UN with their real 'force multipliers'. The article includes some very rare images then taken by Air Marshal (ret'd) SC Lal.

81 Raptors on a roll



In August 2018, 12 Lockheed F-22 Raptors were on deployment to the United States Air Force Europe (USAFE) in Germany, and later made visits to Norway, Greece, Spain, Romania and Poland, truly a summer tour of arguably the world's most advanced 5th generation fighter.

Also : China's Indigenous AWACS; Army 2018 International Military Technical Forum; Vostok 2018; Nammo's .338 Lapua Magum Story; Centennial of the Azerbaijani Air Force; Aviadarts 2018; APROC 2018; Dornier 328s at Farnborough; The Dakota returns 'Home' and honouring Air Marshal GD Sharma.

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At last: some guns, missiles and helicopters

The Defence Ministry's big-bang announcement on its approval of purchases worth Rs 46,000 crores for guns, missiles and helicopters must please India's military. Any focused purchase of sophisticated defence systems like missiles and combat-ready helicopters must go towards propping up preparedness, which is a primary task to be handled, besides being the price to pay for securing our freedom and protecting our borders. It's quite another matter that the timing lends itself easily to this being a sop in military trade and ties with the United States, as the 2+2 India strategic dialogue featuring the US secretary of state and the defence secretary and their Indian counterparts (was) just over a week away. While Russia remains India's top military supplier and is also to supply the \$5 billion S-400 *Triumf* air defence missile system, the approvals for the current US purchases will balance India's strategic ties.

The Rs 46,000-crore deal may be mild compared to what the Rafale deal would potentially do for the Air Force, which is in desperate need of squadrons and fit-to-fly fighters and bombers. The deals, however, also encompass several proposals for the 'Make in India' initiative, including 111 utility and surveillance helicopters for the Navy, besides multi-role copters for submarine warfare intent. The initiative itself has not truly taken off, nor paid good dividends over the years despite efforts made by successive governments to indigenise arms production. A large portion of India's purchases as the fifth biggest defence spender in the world are still to be paid for in foreign exchange. The \$6.5 billion deals may be minuscule for US defence manufacturers, but the industry does not scoff at any business coming its way. At a time of some dissent over trade thanks to the declaration of trade wars by Donald Trump against the rest of the world, such arms procurement must help bilateral ties.

The very fact that India is considering arms purchases with greater ease now is a relief. The Indian defence ministry has been tied down by such inhibitions in the wake of the accusations over Bofors bribes that there have been an atmosphere of fear ruling arms purchases for 30 years. A UPA defence minister had taken this to such an extreme that nothing moved in terms of defence preparedness for years. Given the history, the announcement coming well before any of the earmarked funds lapsing at the end of a financial term is to be welcomed. A pitiful paralysis had struck defence deals for a while. But, even at a time when they are being done to take care of defence needs, the poisonous atmosphere of sharp polarisation in our society means that none of this will go unchallenged. The biggest fear is still about the atmosphere of suspicion spoiling the delivery schedules of Rafale fighters in a time-bound manner to enhance Air Force capabilities.

From *The Asian Age*

Giant leap

Prime Minister Narendra Modi's Independence Day announcement that India will develop a programme to put an Indian into space sets new targets for the Indian Space Research Organization (ISRO) and the Indian aerospace community. Unlike the Russian space programme and the National Aeronautics and

Space Administration (or NASA) in the US, Indian space research has always focused completely on unmanned missions. Moving to a manned programme will involve research and development of a whole new range of technologies. Apart from the unquantifiable benefit of inspiring young scientists with a new set of goals and boosting national pride, there are concrete benefits to putting human beings in space.

That's because space stations and habitats are tightly contained ecospheres, presenting conditions that cannot be simulated anywhere on Earth. These are low-gravity, or microgravity environments, conducive to all sorts of research that cannot be performed within a gravity well. Space ecospheres are surrounded by conditions extremely hostile to life. Space may be very cold (a few degrees above absolute zero) or very hot (above 300 degree Celsius). A manned spacecraft must be adequately shielded against radiation and deal with both heat and cold, often at the same time. Space is airless, and a near-vacuum. A space ecosphere must not only contain an oxygen atmosphere, it must contain its own food and water, and it must contain the equipment required to recycle waste products such as carbon dioxide, urine and excreta to extract oxygen, water and food. These facts also point to the challenges that such a programme must surmount. Living in space is a highly risky business and there have been a fair number of disasters in manned programmes in the past.

There are other concrete benefits to manned programmes. One is simply that human beings can improvise on the fly if an unexpected situation arises or there is an opportunity to observe something unusual. We are only beginning to learn the effects of microgravity and cosmic radiation on bio-organisms ranging from bacteria and plants to large mammals. There's room for an enormous range of experiments in this regard and some of the research at the International Space Station has already started paying off in concrete terms. Over the years, blue skies space research has led to huge advances in multiple technologies ranging from weather research to disaster management to ballpoint pens. Modern communications depend on satellites. Putting humans into space has also led to massive advances in medical technology and the basic understanding of how our bodies work.

Creating habitable space ecospheres requires a host of technologies, including the development of exotic materials and first-class recycling systems. Water purification and sewage recycling can, for example, be transformed by adapting such technology at scale; indeed, NASA's water purification techniques are being deployed in Africa. An ethylene removal system called *Advanced Astroculture* (ADVASC) was developed in space. It removes viruses, bacteria and mould and is now used to prolong the shelf-life of fruit and vegetables and in winemaking.

Keeping astronauts fit and healthy has also led to massive advances in medicine. To take some examples, microgravity can lead to a debilitating loss of muscle and bone density. There have been breakthroughs in the treatment of osteoporosis and exercise systems that maintain muscle mass, as scientists

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developed systems for keeping fit. Telemedicine, including miniaturised ultra-sound units and remote monitoring systems, also developed through space research. So did laser surgery as a spin-off from developing better laser technology and robotic surgery is also an adaptation of space technology.

It's also worth noting that manned space research is a much larger employment generator (ISRO has estimated that the plan will create 15,000 jobs) than unmanned research because many more technologies are involved. In that sense, it could be just the ticket for boosting India's space programme. Of course, it would require very substantial increases in the budget. That, in itself, would not be a bad thing since ISRO has had to work on a shoestring since inception.

From *Business Standard*

Get closer, but not too (much) closer

No surprises at the 2+2 Ministerial Dialogue. Its bottom-line outcome reflects a remarkable continuity, and the steady incremental advance in Indo-US relations from the waning years of the Bill Clinton administration, through those of George W Bush and Barack Obama. This is noteworthy, especially because the current Donald Trump administration has been a major disrupter of ties between the US and its long-standing political and military allies.

With India designated as a 'major defence partner' of the US, and provided licensing exception under the Strategic Trade Authorisation (STA-1) category by Washington, there should be no doubt about the focused US effort in maintaining ties with India when ties with others, from Canada to Japan, are on the negotiating table. India has played its cards well, drawing out the US in prolonged negotiations on the 'foundational agreements' that the Pentagon demands as a condition for close cooperation. This is best exemplified by the Communications Compatibility and Security Agreement (COMCASA). In its original form, it's the Communications Interoperability and Security Memorandum of Agreement (Cismoa), and it was on the negotiation table for the last 20 years. The India-specific Cismoa is COMCASA. India is allergic to the word 'interoperability', which would suggest that it is a military ally of the US. No doubt the detailed agreement will also take into account various hurdles in seamless communications, such as the existence of major Russian equipment in the Indian defence systems.

A lot of what is happening is the result of the US recognition of China as a strategic competitor. India is a problem area for China's neighbourhood policy, since it is simply too large to overawe through the use of Beijing's money and military power. The border dispute and Beijing's relations with Pakistan lock us into an adversarial relationship.

India has needed to step carefully with the US, since foundational agreements are usually meant to promote interoperability between the militaries of the US and its allies by creating common standards and systems. It has been drawing closer to the US. But it doesn't see itself as its military

ally. Though the Indian military has close relations with US, this happens only through the US Pacific Command, now renamed Indo-Pacific Command.

There is no conversation, let alone cooperation, in the area that's vital for India —the Saudi peninsula and the north Arabian Sea off Pakistan. 60% of India's oil comes from there, and some eight million Indians work there sending back \$35-40 billion in remittances annually. The joint statement from the 2+2 talks states that "the ministers committed to start exchanges" between the US Central Command and the Indian Navy, and deepen cooperation in the western Indian Ocean as well. But this is still in the future. Another signal of the limited geographic scope of the relationship emerged from the report that the two sides will hold a major tri-service exercise in 2019 on the *eastern* coast of India.

As of now, US policy is aimed at getting Indian military power to offset Chinese strength in the western Pacific Ocean. New Delhi needs to ensure that this exercise is carefully calibrated to ensure that, in turn, the US helps us secure our vital interests in the region of our primary interest: the *western* Indian Ocean. An Indo-Pacific strategy cannot be premised on arbitrary geopolitical limits.

Dr Manoj Joshi in *The Economic Times*

Military's SM dilemma

The increased venting of the forces' grievances as well as purveyance of fake news might have motivated the Army Chief, General Bipin Rawat, to deliver his recent homily on social media. There are actually three messages bundled in the Chief's address: (i) the tendency of soldiers to take to social media, (ii) the need to insulate the forces from honey traps and anti-India propaganda, and (iii) the Army's plans to vastly scale-up its current social media reach. It is a mystery why the Army Chief publicly disclosed plans to enlarge psychological operations (psy ops) that are usually kept under wraps. But what is not a mystery, and as the Chief himself acknowledged, is the dilemma about the extent of insulation from social media that is practical and implementable.

The soldier of today is not the callow, wet-behind-the-ears village simpleton of yesteryear. He is now plugged into social media even before turning up at his first recruitment rally or entrance examination. The awareness level about society and its traits is at an all-time high and the Chief is right in saying that a ban is not the answer. The armed forces are destined to constantly play catch up with the new media unless they acknowledge the fact that social media is an elephant in the room.

The elephant was present for a while but in a different form: word of mouth. There was no social media to trigger the unrest in a few units after *Operation Bluestar* or for that matter, the 1857 revolt, while honey traps were around even before wireless communication became widespread. Uploading of content has been easy to control: by informing the ranks that commenting or posting material that violates the basic rules of a soldier's conduct are prohibited. But the antidote to discontent and unhappiness with service conditions is to sympathetically review the outdated soldier-officer dynamics which perturbs the other ranks more than what the soldier imbibes from social media.

From *The Tribune*



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A Self-Defeating Debate

Air Marshal Brijesh Jayal on the IAF's Rafale

In an unprecedented low, a petition has recently been filed in the Supreme Court by over 300 serving army officers, JCOs and NCOs on issues relating to their duties in disturbed areas and the dilution of AFSPA. Close on its heels, we are also witnessing another low point where the highest IAF leadership has been compelled to wade into a political controversy in order to shield their force from its corrosive and negative consequences. The world is witness to nations where their militaries have undermined democracies. Indian democracy seems determined to be experimenting with the reverse. It is time for our nation to pause and reflect.

In early September, three French Air Force Rafale jet fighters landed at Air Force Station, Gwalior with a view to conducting joint operations with their IAF counterparts. The French contingent was in transit after having participated in the multi-nation combat exercise *Pitch Black* held in Darwin, Australia in which IAF Sukhoi had also participated. On this occasion the French Embassy in New Delhi lauded “the depth of the Indo-French strategic partnership” and the trust that prevails in relations between the respective armed forces.

Ironically, neither the French Embassy nor their contingent in Gwalior would have been unaware of the political slugfest that has embroiled the name of the Rafale fighter, and perhaps silently wondered whether their hosts actually understood the vital strategic potential of the proposed Rafale weapon system, in shadow of the sub-continental nuclear threat environment.

The French would not have been the only ones to be so confused. We have also had the first two-plus-two dialogue held between the Indian and US Foreign and Defence Ministers where future direction of the evolving strategic partnership was under discussion. This time around, it would be the US Government teams, being conscious of the Rafale controversy, who perhaps wondered whether some of the past procurements through government-to-government programmes with the US like the C-17 heavy lift transport aircraft, C-130 Hercules, P-8I LRMP aircraft, Chinook heavy lift helicopters and others, along with their

offset obligations, could fall prey to similar controversy, thus harming reputation.

Clearly such ominous clouds of daily political recriminations would have cast a deep shadow not only over the skies of Gwalior, but across all IAF crew rooms and messes, perhaps undermining confidence and morale of the force. This would perhaps explain why senior IAF leadership have been compelled to take the unprecedented step of making public statements, indirectly jumping into what is essentially a political and media fracas. The VCAS is responsible for operations and when questioned, termed the Rafale as “very capable aircraft that will give India unprecedented advantage over its adversaries, a capability that was needed very quickly”.

The DCAS, who as head of Plans and Procurement would have intimately been involved in the entire process, went a step further and countering allegations of any wrongdoing stating “what is being alleged does not match with the facts at all”. On the question of higher costs, he clarified “I can tell you that the Rafale that we have gone for is substantially lower in price than that was on the table in 2008”. And finally, on allegations that the offset contract had been awarded to certain private players, he said, “The facts on record, indicate that there is no truth in those allegations”.

It needs recalling that similar sentiments were expressed by the Air Chief himself late last year and repeated at Adampur in July 2018 (*and New Delhi in September, see following report*). Clearly, the IAF leadership appears concerned that this public slugfest is having an adverse impact not just on the morale of the service, but their confidence in the professional integrity of its leadership as well.

Unknown to those who sally forth daily in TV studios and the mass media (and more importantly their minders), what has been a strategic step forward in the modernisation and strengthening of Indian air power is unfortunately turning out to be unsettling and self-defeating. If combat pilots “on the otherside” of our northern and western frontiers are chuckling, and our French counterparts in Gwalior embarrassed, we have only our domestic politics to blame.

As if to remind the nation of the dire straits that the IAF finds itself in flying obsolete platforms amidst declining combat force levels, the IAF has in the last three months, lost two MiG-27s, one MiG-21 and two Jaguars with the sad loss of some lives. A cruel reminder of the strains of keeping up force levels. Unmindful, the sterile debate rages on, demonstrating that political one-up-manship means far more to our democracy than the operational capability and safety of our armed forces.

Ironically, even as the government is being accused of favouring a certain private offset partner, the Tata Advanced Systems and Lockheed-Martin Corp have announced an agreement whereby Tatas will manufacture in Hyderabad wings for all future Lockheed F-16 customers. This should have been a matter of much jubilation for our make-in-India efforts. Instead, since Lockheed are also amongst the potential bidders for the new IAF tender, they have been defensive and actually declared that this agreement is not contingent on the success or otherwise of that bid! Clearly, international weapon system suppliers are ever mindful of having not only to compete in the technical and commercial domains, but in India's political minefield as well!

The price issue is a red herring and for cost comparisons to be meaningful, must be based on the total system cost on a like-to-like basis. This would need a detailed cost benefit analysis by a body of specialists, who would still be left guessing about weighing operational value which is not readily quantifiable monetarily. One example is the commitment to providing product support for two years ensuring 85% fleet availability in the IAF's operating conditions. No one has ever, including HAL, ever committed to such an in-service operational fleet availability.

The current DPP gives foreign companies complete freedom to choose their Indian Offset Partners and, over the years, many aircraft procurement programmes have involved offset programmes. These include the C-17 Globemaster, Mirage 2000 upgrade, Pilatus PC-7 basic trainer and the C-130 Hercules amongst others. The corresponding Indian offset entities include the likes of DRDO, HAL, Tata Advanced Systems, Mahindras and many others. Mercifully, never has the integrity of these come under question and progressively both the public and private sector are taking the country forward towards self-reliance in the defence field. An effort to derail this initiative will certainly undermine progress.

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Brigadier Gurmeet Kanwal on

Pakistan-China relations – and the CPEC

The vision of a ‘naya’ (new) Pakistan enunciated by new Prime Minister Imran Khan, chairman of Pakistan Tehreek-e-Insaf (PTI) party, faces seemingly insurmountable challenges. The new government has inherited poor relations with India, continuing conflict along the Af-Pak border, intractable internal security challenges, a failing economy with huge external debt, and a steady souring of relations with the USA. It also faces the possibility of cooling relations with China.

By accommodating and promoting the geostrategic interests of China and the United States in Southern Asia over several decades, Pakistan made itself virtually indispensable to both. However, the Trump administration is unwilling to continually accept the Pakistan Army’s doublespeak. The Pakistan Army has been fighting Jihadi extremists, who are an internal security threat – such as the Tehrik-e-Taliban Pakistan (TTP) – while simultaneously aiding and abetting those who fight US and Afghan forces such as the Haqqani Network. The US has drastically curtailed military aid. Additionally, China has entangled the country in a web of debt accompanying the China-Pakistan Economic Corridor (CPEC). China intends to make CPEC the flagship project of its ambitious

Belt and Road Initiative (BRI), conducted to facilitate the expansion of its sphere of influence in keeping with President Xi Jinping’s Chinese dream of national rejuvenation.

The China-Pakistan relationship, continuously called an “all-weather friendship,” has been variously described as “higher than the mountains, deeper than the oceans, stronger than steel, and sweeter than honey.” China has blatantly provided nuclear warhead technology and ballistic missiles to Pakistan. The two countries have also leveraged their close relationship to jointly manufacture military hardware, including fighter aircraft and main battle tanks. Pakistan’s support has been a major factor in China’s quest to strategically encircle India. The relations between the two have deepened further as the CPEC has begun to take shape, even though apprehensions are rising in Pakistan regarding the feasibility and likely benefits of the project.

Passing through disputed territory in Gilgit-Baltistan and Pakistan occupied Kashmir (PoK), the \$62 billion CPEC project will link the Chinese province of Xinjiang with Gwadar Port on the Makran Coast, north-west of Karachi. As part of its

‘string of pearls’ strategy, China has been engaged in accruing port facilities along the rim of the Indian Ocean. There is little doubt China hopes that in future, Pakistan would provide logistical support facilities to the PLA Navy, enabling operations in the northern Indian Ocean.

However, doubts have been expressed regarding the economic viability of China using Gwadar as a warm water port. Funds for this ambitious project will be provided by China, through both the Asian Infrastructure Investment Bank (AIIB) and by way of direct government-to-government soft loans. For example, to help China recover its capital investment in the Gwadar Port complex, it will get a 91% share of the revenue from the operations of the port and terminal, as well as 85% of the revenue generated by the free trade zone. Under this arrangement, although the port is expected to handle one million tonnes of cargo annually, the sentiment in Pakistan is that benefits will mainly accrue to the Chinese. There are also misgivings within Pakistan regarding the possibility of a “debt trap” resulting from the huge CPEC investment. The Pakistani elite are no doubt watching the disaster that Belt and Road related-developments have been

for Sri Lanka, with China acquiring de facto possession of both the port and airport at Hambantota after Sri Lanka was unable to repay its debt.

In the past, US and Pakistani interests coincided during the conflicts against Communism, leading to Pakistan's joining both the Central Treaty Organization (CENTO) and the Southeast Asian Treaty Organisation (SEATO) in the 1950s. The US has been a major supplier of modern weapons and military equipment to Pakistan, including F-16 fighter aircraft, provided ostensibly for counter-insurgency operations and to support the Pakistan army in its efforts to maintain stability against a potential Jihadi takeover of the country. In recent decades, military aid was also provided to encourage Pakistan to conduct operations against the Afghan Taliban; however, Pakistan failed to act decisively.

As had been widely anticipated, President Trump has put Pakistan on notice for encouraging terrorist organisations to destabilise neighbouring countries, blaming Pakistan for creating "safe havens for terrorist organisations, the Taliban, and other groups that pose a threat to the region and beyond." Trump told Pakistan that it has "much to gain" from partnering with the US, but also warned the country that "it has much to lose by continuing to harbour criminals and terrorists."

Since 2002, the U.S. has provided security assistance worth approximately \$33 billion to Pakistan. For fiscal year 2019, this has been reduced to \$150 million, with other changes including cuts related to the participation of Pakistani officers in training programmes. In addition, the US warned the International Monetary Fund (IMF) not to approve a new bailout package for Pakistan, as it feared new loans would essentially be used to repay Chinese debt.

Estrangement with the US is likely to further propel Pakistan into China's arms. Russia too is waiting in the wings to exploit the emerging situation to its advantage, providing military equipment to Pakistan and even offering to train Pakistani officers to fill the gap created by the restrictions imposed by the Pentagon. Iran, which is also facing tougher US sanctions, has invited Pakistan to join hands for the development of Chabahar Port, which would provide a new route to Afghanistan and the Central Asian republics.

Gwadar is an important foothold for China's 'String of Pearls' strategy in the region. If Gwadar Port is converted into a naval base in the future, it will enable the PLA Navy to maintain permanent presence in the Arabian Sea and the Gulf of Oman. Both China and Pakistan view the development of Gwadar Port as a "win-win situation."

However, the new challenges posed by China in the Pacific is unlikely to go uncontested. In a declarative move, the U.S. has renamed its Pacific Command as the 'Indo-Pacific Command,' highlighting a new focus on the region. In November 2017, senior officials of Australia, India, Japan, and the U.S., meeting on sidelines of the East Asia Summit in the Philippines, agreed that a "free, open, prosperous and inclusive Indo-Pacific region serves the long-term interests of all countries in the region and of the world at large." This development led to speculation that the idea of a Quadrilateral Security Dialogue (also called the Quad) is being revived after a hiatus of ten years. Though India does not currently favour a formal security arrangement, the Quad's focus on cooperative security would likely lead to strategic realignment in the region.

With its growing investment in infrastructure projects in Pakistan and increased numbers of its citizens on Pakistani soil, China will have a greater stake in regional peace and stability and could, if it so desired, play a positive role in helping to resolve a future crisis of any kind in South Asia. However, should China continue its quest for domination and choose to play a more strategic role in the region, it will only add to the tensions that are already building up.



Gwadar port in the making

Tejas fighter tests mid-air refueling



On 10 September 2018, a Tejas LCA piloted by Wg Cdr Siddharth Singh of the NFTC carried out the first 'wet' mid-air refueling trials, an IAF Ilyushin IL-78MKI transferring 1900 kgs fuel, this being done at an altitude of 20,000 ft over the Gwalior region. "The aircraft speed was 270 knots and all the internal tanks and drop tanks were refueled." Some days earlier, on 4 September, the initial 'dry' docking by the LCA was done with an IL-78MKI, important steps in the process of the LCA achieving FOC. The Indian Air Force currently operates nine Tejas fighters built to an Initial Operating Clearance (IOC) standard. These jets are being flown by No.45 Squadron, the *Flying Daggers*, based at Sullur Air Force Station in Tamil Nadu.

LCA Navy in arrestor hook trials



On 2 August 2018, LCA Naval Prototype 2 (NP2), piloted by Capt Shivnath Dahiya of the IN safely executed the first contact of the arrestor hook system with arresting wire at moderate speeds on location at the Shore Based Test Facility, INS *Hansa*, Goa. The first taxi-in engagement was monitored closely by the Landing Signal Officer Cmde J A Maolankar and Test director Gp Capt A Kabadwal.

HAL's Aircraft Research and Design Centre (ARDC) has designed and developed the Arrestor Hook System (AHS) for Ship

Deck operations of the LCA Naval version, the LCA Naval Prototype 2 (NP2), which was integrated with this AHS. Having first verified operation of Arrestor Hook System in Bengaluru on 23 July 2018, NP2 began operating at INS *Hansa* from 28 July 2018. Carrier Compatibility trials (CCT) are to be carried out at shore based test facilities, built at INS *Hansa* in Goa. The CCT involves completion of extensive shore based trials before embarking on an actual deck, stepping stone towards completion of CCT trials of the LCA Navy.

Retiring HAL CMD flies in LCA

T Suvarna Raju, who retired as CMD of HAL on 31 August had earlier been flown in the LCA trainer (PV5) from HAL Airport, piloted by Group Captain KK Venugopal, HAL's Chief Test Pilot. "It is a wonderful flying machine, capable of being the backbone of IAF combat power in the years to come," stated T Suvarna Raju under whose tenure LCA series production had commenced.



Two more AWACS for IAF?

The Indian Air Force are reportedly to acquire the long awaited additional two airborne warning and control systems (AWACS) aircraft, in a tripartite contract signed with Israel and Russia in a deal worth \$800 million. Indian MoD sources have stated that this additional procurement requirement is now with the Cabinet Committee on Security for clearance. This acquisition has been pending since the first three A-50 'Phalcon' AWACS were inducted by the IAF in 2009-2011 under a \$1.1 billion deal contract between India, Israel and Russia in 2004.



AMCA Technology Demonstrators



Two 'next generation technology demonstrators' (NGTD) of the Advanced Medium Combat Aircraft (AMCA), being developed by Aeronautics Development Agency (ADA) as India's next generation fighter, are expected to make their first flight by 2032. According to sources in Bangalore, "The AMCA will feature geometric stealth and will initially fly with two GE-414 engines. Once we develop our own engines, it can be replaced with those..." Amplifying, the AMCA designer said, "There are two major ways of making a military platform stealthier. One is geometric stealth and other is material stealth. In geometric stealth, the shape of the aircraft is designed at such angles so as to deflect away maximum radar waves thereby minimising its radar cross section. In material stealth, radar-absorbing materials are used in making the aircraft which will absorb the radio waves thus reducing the radar footprint. The AMCA will initially be based on geometric stealth, we can look at material stealth at a later stage. Apart from the technologies developed from the LCA project, the new fighter programme is important as technologies now being demonstrated will be applicable to the AMCA project."

It is learnt that the NGTDs are being built by a consortium which includes private industry at a new facility at Salur, near Coimbatore, where the Indian Air Force has given land to the DRDO. "The plan is to build on the capabilities and expertise developed during the development of the light combat aircraft (LCA) and produce a medium fifth generation fighter aircraft".

IAF team in France for Rafale training

Amidst considerable media attention on the Rafale fighter programme, an Indian Air Force team has been seconded to France for conversion training on this new multi-role combat



aircraft, 36 of which are on order. This first six member IAF team, led by Wing Commander Neeraj Jhamb, whose background includes operational flying experience on MiG-27s and instructor rating on Hawks. The IAF team, which includes an engineer and four technicians reportedly flew to the French Air Base at Saint-Dizier on 10 September and they will be followed by several more pilots, engineers and technicians. These IAF personnel will form core of the selected unit (No 17 Squadron), which will be the first to form on the Dassault Rafale, to be based at Air Force Station Ambala.

The first of 36 Rafales are to be handed over in September 2019, with the first six to be ferried to India by IAF pilots in early 2020, the last of 36 Rafales arriving in India by September 2022, as per the contract. The second Rafale base is identified as Hashimara in northern Bengal, although the second squadron has not yet been identified.

DCAS flies Rafale in France

On 21 September 2018, Air Marshal Raghunath Nambiar, then DCAS Indian Air Force, flew in a Dassault Rafale two-seat fighter while on an official visit in France. This particular aircraft is reportedly used as test bed for the India-specific avionics and weapons system chosen for the Indian Air Force.



India and USA sign COMCASA

On 6 September 2018, a military-information sharing pact between India and the USA “which will give India access to the US technology particularly on surveillance and intelligence”, was formalised at the 2+2 bilateral summit in New Delhi, as also, a pact on cooperation between defence innovation organisations of the two nations. The *Communications Compatibility and Security*



In the picture above are (left to right) US Secretary of Defence Jim Mattis, US Secretary of State Mike Pompeo, Indian Foreign Minister Sushma Swaraj and Indian Defence Minister Nirmala Sitharaman.

Agreement (COMCASA), would “give India access to advanced new defence systems including armed drones and enable the armed forces to exploit existing US-origin platforms much more efficiently.” The government of India had earlier raised specific issues which have reportedly now been addressed, an Indian official stating that “The COMCASA is an India-specific agreement in which ‘certain legal arrangements’ have been added to safeguard interests. These include an assurance that full access will be maintained for all equipment supplied by the US and that it would not disrupt communications or shut the systems down without an advance notice of at least six months.” The agreement will enable installation of specific communications systems on Indian aircraft such as the C-130J Super Hercules and the Navy’s Boeing P-8 (I) aircraft.

COAS visits Myanmar and Malaysia

Air Chief Marshal Birender Singh Dhanoa, Chief of the Air Staff made an official visit to Myanmar and Malaysia from 3 September 2018 “for enhancing the strong camaraderie and partnership that the nations and their Air Forces share”. Presently, areas of cooperation include exchanges in military training course, mutual visits by experts and joint air exercises. During the visit, the CAS visited various operational establishments and interacted with senior functionaries of the Myanmar and Malaysian Air Forces. In the recent past, Malaysian Air Force personnel have received flying and maintenance training support from the Indian Air Force



on MiG-29 fighters. However, in the case of Myanmar, it is the Pakistan Air Force that have assisted this country including recent induction of JF-17 fighters.

Saab IDAS-2 for HAL Dhruv

Saab has received follow-on orders from Hindustan Aeronautics Limited for the IDAS-2 self-protection suite for the Indian Army’s Dhruv ALH, which also includes the IDAS-2 (Integrated Defensive Aids Suite). The production will take place at Saab’s facility in Centurion, South Africa with deliveries to begin during 2019. “IDAS is designed to provide platform self-protection for rotary and fixed wing aircraft in sophisticated, diverse and dense threat environments and has achieved outstanding operational



success with a growing list of customers in Europe, Asia, Africa and the Middle East. The product is in operational use in many countries on helicopters, commercial transport aircraft as well as fighters.”

HAL demonstrates 10kg rotary-wing UAV

On 3 August 2018, HAL flight demonstrated its 10 kg Rotary Wing (Helicopter) Unmanned Aerial Vehicles (RUAV), which has a 2-stroke petrol engine, twin blade main rotor and tail rotor, payload capability of 2.5kg including live stream video camera, range of the vehicle is 8-10 km with an endurance of one hour. The flight lasted for about ten minutes during which the Attitude Control



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Attitude Hold (ACAH) mode, Position Control, Position Hold mode (autonomous hover), low speed flight in forward, backward and sideward directions, were demonstrated. The video feed from onboard the helicopter was streamed live and seen on the dedicated video receiver. Location of the helicopter, its parameters and its real-time position on the map were also shown.

MoD plans new establishments in Andhra Pradesh

According to recent reports, the Indian Air Force is planning to establish a new air base in Andhra Pradesh “in view of the growing strategic importance of the eastern coast”. This would be apart from establishing a helicopter training facility at Donakonda in Prakasam district, other plans including establishing a UAV production facility in Anantapur district, and a cyber security centre in Amaravati. Presently, major air bases in the region are those of the Indian Navy, INS *Rajali* at Arakkonam near Chennai, and INS *Dega* at Visakhapatnam. The IAF has reportedly also sought operations from existing civilian airports at Rajahmundry and Vijayawada .

SPEEDEX contract launched by IAF

The *Stores, Proactive, Efficient and Expeditious Despatch of Extra Size with Consignment* (SPEEDEX) contract was recently



launched by Air Marshal RKS Shera, Air Officer-in-Charge Maintenance in the presence of senior IAF officers, MoD dignitaries and CEOs of the companies concerned. The ability to ‘lift, shift and move’ is the essence of sound transportation management and it has a profound impact on all principles of Military Logistics.

Govt to disinvest in Pawan Hans

The government of India plans 100% disinvestment in Pawan Hans, issuing an addendum to the disinvestment document “as ONGC is ready to sell its entire stake in the company”. Pawan Hans is a joint venture between the government, which holds 51% stake, and state-owned ONGC, which owns the remaining 49% of shareholding. Pawan Hans has a fleet of 46 helicopters.



Earlier, on 13 April, the government had indicated its intent for a 51% strategic stake sale in Pawan Hans and had sought Expression of Interest (EoI) from interested bidders by 18 June. Some six bidders are believed to have responded. However, ONGC has expressed its resolve to exit Pawan Hans simultaneously with the government’s stake.

Operation Madad by Indian Navy in Kerala relief

The Indian Navy rescued thousands of people from flood-ravaged Kerala in combined efforts under Operation *Madad*, which was launched on 9 August to assist the Kerala state administration to undertake disaster relief operations. The Indian Navy rescued



nearly 17,000 people, of which 1,173 were airlifted while 15,670 were rescued by teams using Gemini boats after Kerala experienced unprecedented rainfall, which resulted in widespread flooding. “A robust and efficient Command, Control and Logistics Organisation of the Southern Naval Command (SNC), coordinated by the Joint Operation Centre (JOC), ensured naval personnel deployed in the worst-hit areas were utilised efficiently to rescue maximum number of people. SNC headquarters also coordinated with the Air Force headquarters for airlift of personnel and equipment from Mumbai and Visakhapatnam to Kochi,” according to the spokesperson.

Rostec in modernisation of the INS Vikramaditya



Technodinamika holding company (part of Rostec State Corporation) is executing installation supervision of marine hydraulic systems on the aircraft carrier INS *Vikramaditya*. “Within the project, installation supervision, commissioning and sea trials of *Vikramaditya* are planned. Installation supervision of marine hydraulic systems at *Vikramaditya* is an important step in the upgrade of what is currently the most powerful warship of the Indian Navy,” said CEO of Technodinamika, Igor Nasenkov. “The *Vikramaditya* project is extremely promising taking into account the long-term development of the Indian aircraft carrier programme, under which by 2027 it will acquire two more such ships.” The GS-1MF and GS-3 marine hydraulic systems are used for refueling, cleaning and pressurisation of hydraulic systems of aircraft and helicopters which form part of the air wing of the INS *Vikramaditya*.

India orders '2+2' frigates from Russia

The governments of India and Russia “have prepared protocols” for procurement of four new warships for the Navy, in a \$2.2-billion frigates contract to be signed during the forthcoming summit between President Vladimir Putin and Prime Minister Narendra Modi in New Delhi in October. This long-pending requirement for procuring Project 11356 or advanced *Talwar*-



class frigates, will involve building two of these ships at the Goa Shipyard, while the others will be procured directly from Russia’s Yantar shipyard. The deal is being processed as a ‘2+2’ scheme where technology will be transferred to Goa Shipyard to construct two frigates while the other two will be delivered earlier, as the hulls of these ships have already been fabricated for a Russian Navy order, which was suspended after the Ukrainian crisis. The Indian Navy presently operates six *Talwar*-class frigates and the new warships will also be fitted with the Brahmos supersonic missile system.

GSL fuel barges for Indian Navy



Goa Shipyard Ltd (GSL) have delivered all four 1000T fuel barges, ahead of contractual schedule, the 4th and last barge *Fuel Barge-13* delivered on 23 July 2018. Contract for construction of 4x1000T fuel barges was signed between GSL and Indian Navy on 4 June 2015 and within three years all four fuel barges have been delivered by GSL, the first being delivered on 17 August 2018 and last one on 23 July 2018. The barge is powered by two 1800 BHP engines, two 250KVA generators and five cargo pumps with a capacity of 100T per hour to achieve the required fuel transfer rate during fuelling operations. The barge is over 68 metres in length, 12 metres in beam and can attain a max speed of 14 knots, with an endurance of 800 nautical miles. The vessel has a novel hull design with bulbous bow and is equipped with the state of art navigational aids like radar, DGPS, echo sounder etc, making it capable to operate up to sea state 4 and survivability up to extreme sea state of 6.

Goa Shipyard and CGOPV programme

Keel of the third Coast Guard Offshore Patrol Vessel of the five CGOPVs on order for the Indian Coast Guard was laid at Goa Shipyard Ltd on 1 August 2018 by R Adm Philipose George Pynumootil, Flag Officer Commanding Goa Area and Naval Aviation. The five CG OPVs project is a follow-on of the six CG OPV Project, completed in 2017, the vessels scheduled for delivery between January 2020 and June 2021. These vessels for the Indian Coast Guard are an in-house design of GSL and will be fitted with technologically advanced machinery and computerised controls systems, making them the most advanced Patrol Vessels in service with the Indian Coast Guard. These 2400-tonnes vessels will be equipped with additional features including *Quick Response Boats* for rescue and anti-piracy, gunnery simulators and many more advanced features.

ICGS Vijaya for Coast Guard



L&T have delivered ahead of schedule the Offshore Patrol Vessel ICGS *Vijaya* (OPV-2) to the Indian Coast Guard on 30 August. The 2,160-ton vessel is second in the series of seven OPVs being designed and constructed by L&T under a March 2015 Ministry of Defence contract. The first vessel of the series ICGS *Vikram* was handed over on 11 April 2018 and 40 Interceptor Boats have also been delivered of the series of 54 Boats designed and built for the Coast Guard while the remaining 14 are also ready for delivery, the programme being about two years ahead of schedule. Floating Dock FDN-2 for the Navy, also designed and built for the first time in India, was delivered in March 2018 and is now fully operational at the Andaman & Nicobar Islands.

Seaplane services in India

The government of India is augmenting regular seaplane services, giving go-ahead for 'water aerodromes', the first of which is reported to be at Sabarmati in Gujarat, as also at the Sardar Sarovar Dam and Chilka lake in Odisha. "In-principle approval

has been given for the construction of water aerodromes in various states across the country. This move will promote tourism as well as connect places of religious importance. To start with, we have identified five states: Odisha, Gujarat, Maharashtra, Andhra Pradesh and Assam for the development of water aerodromes. For the first phase of the project, Chilka Lake (Odisha), Sabarmati River Front and Sardar Sarovar Dam (Gujarat) have been identified," stated Union Aviation Minister Suresh Prabhu.

DGCA has issued regulations prescribing the procedure and requirement for licensing of 'Water Aerodromes' and several airlines including SpiceJet have plans to acquire specific seaplanes. Mahindra Aerospace and Canada's Viking Air Ltd have recently established a JV to offer a wide variety of turboprops, including seaplanes, to players getting into regional aviation market. Viking makes the Twin Otter Series 400, 19-passenger twin-engine turboprop aircraft that is capable of operating from multiple surfaces (including water). SpiceJet is planning to launch remote area operations using small 10-14 seater aircraft, including amphibious planes (seaplanes).

INS Sahyadri in Exercise KAKADU 2018



Deployed to the South China Sea and the Pacific Ocean for over four months, which included representing Indian Navy in multinational exercises *Malabar 18* at Guam and *RIMPAC 18* at Hawaii, INS *Sahyadri* entered the Port of Darwin in Australia on 29 August 2018 to participate in Exercise *KAKADU 2018*. This is the premier multilateral regional maritime engagement exercise hosted by the Royal Australian Navy and supported by the Royal Australian Air Force (RAAF), held biennially in Darwin and the Northern Australian Exercise Areas (NAXA). *KAKADU 2018*, the 14th edition of the exercise, from 29 August–15 September 2018, had participation of 23 warships, one submarine, 45 aircraft, 250 marines from over 25 different countries.

Rescue in the Indian Ocean

In a dramatic multi-nation operation, an Indian Naval officer, Commander Abhilash Tomy, a naval aviator having considerable experience of flying Dornier 228s with INAS 318, was rescued from the Indian Ocean near Australia on 24 September three days

Flying High with HAL

Accolades to IAF on its 86th Anniversary



Light Combat Aircraft - Tejas: It is a single engined, light weight, highly agile, multi-role supersonic fighter. It has quadruplex digital fly-by-wire Flight Control System (FCS) with associated advanced flight control laws. Extensive use of advanced composites in the airframe gives it a high strength to weight ratio, long fatigue life and low radar signatures.



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after he suffered a severe injury when a powerful storm hit his boat while on a solo race around the world. A Kirti Chakra awardee, he was taking part in the Golden Globe Race (GGR), a solo sailboat race around the world and had sailed over 10,500 nautical miles in the last 84 days, since 1 July when his boat, *Thuriya*, was hit by a deadly storm about 1,900 nautical miles from Perth. The Indian Navy mounted a search mission with a Boeing P-8(I) joined by Australian maritime surveillance aircraft while a French fishing vessel was first to reach him, providing initial medical care before being transferred to an Indian Naval frigate.

Naval Group complete a decade in India



On 18 September 2018, the Naval Group announced completion of their decade in India, from a modest start in 2008 as DCNS India with 10 employees. Naval Group in India is now have a team of over 50 professionals “specialised in engineering, supply chain and project management while building a sound industrial ecosystem to support the Indian defence industry and Indian Navy.” A long-lasting industrial cooperation between Naval Group and India Naval Group in India was created in 2008 as a 100% owned subsidiary, with the P75 programme an important example of the indigenisation process. The first submarine of the

class, *INS Kalvari*, built by Mazagon Dock and Shipbuilders Limited (MDL) was commissioned on 14 December 2017 and the second submarine *Khanderi* launched at the beginning of 2017, while remaining four submarines will be commissioned during 2022-23.

The IAF in Exercise Pitch Black 2018



Exercise *Pitch Black*, a biennial multi-national large force employment warfare exercise was hosted by the Royal Australian Air Force (RAAF) from 24 July to 18 August 2018 in Darwin, Australia in which the IAF participated (see above). On the return leg the IAF carried out bilateral exercises with both the Indonesian and Royal Malaysian Air Forces, the latter during 20-22 August 2018 at Subang Air Base, Malaysia. The exercise encompassed interactions, discussions and exchange sorties with the Royal Malaysian Air Force (RMAF). RMAF crew flew in IAF Su-30MKI while IAF pilots flew in RMAF Su-30 MKMs. The IAF contingent comprised 145 personnel, four Su-30 MKIs of No.102 Squadron, single examples of a C-130J and C-17 and these subsequently returned to India on 23 August 2018.

Exercise Aviaindra 2018

Exercise *Aviaindra 18* was conducted at Lipetsk in Russia from 17 to 28 September 2018 and will continue in Jodhpur, India from 10 to 22 December 2018. The Indian contingent to Russia comprised 30 officers from different branches and streams of the IAF including four women officers and participating aircraft included the Su-30SM, MiG-29, Su-25, MI-8 and An-26. The exercise was focused on anti-terrorist operations in a bi-lateral scenario. The first edition of Aviaindra was conducted in 2014 and has since been planned as a bi-annual exercise.

A “leaner” Army?

The Indian Army is reportedly to reduce its force level by over 150,000 troops over the next 4-5 years under an overarching cadre review that seeks to “sharpen the force’s effectiveness and prepare it for future wars”. An 11-member panel, headed by the military secretary Lt Gen JS Sandhu, has been engaged in a cadre

review and is expected to submit its final report in November. “Merging of some verticals and rationalising roles are likely to result in cutting 50,000 troops over the next two years. A reduction of 100,000 more personnel may be possible by 2022-23. But all this is in the study phase right now,” according to a knowledgeable source.

The troop reduction is likely to be achieved through revamping different verticals including Directorates at Army HQs, logistics units, communication establishments, repair facilities and some administrative and support areas. The cadre review order flagged concerns about how multiple verticals of the army had expanded over the years, despite technology infusion into the system. “The line between verticals has got blurred, resulting in duplication of charters and associated manning. There is a definite case for reviewing the number of verticals with the aim of restructuring within the vertical as also merging where necessary/possible so as to arrive at economies of scale,” as per the source.



Drawing attention to the army’s archaic equipment and critical gaps in capabilities, former Northern commander Lieutenant General BS Jaswal (retired) said downsizing of combat forces has to be offset against induction of highly sophisticated technical equipment. “As far as overlapping duties in logistics departments is concerned, there has to be a structured analysis to see if duplication in functioning can be streamlined into lesser number of modules. Theoretically, a lot of things may seem possible but you have to get into the realm of practical applications,” he observed.

Apart from downsizing, the review covers an assessment of the army’s “future needs, career progression of officers, deficiency of officers in units, career management of non-empanelled officers, provisions related to leaving service, and improving the efficiency and morale of officers.”

Revamping force levels to improve the army’s tooth-to-tail ratio has been “a work in progress”. In August 2017, the government announced an extensive restructuring of the army to redeploy 57,000 soldiers in combat roles to sharpen the force’s fighting edge. This was done following the recommendations made by the Shekatkar Committee on enhancing the army’s combat potential and trimming its revenue expenditure. The committee had listed out measures to bring down the budget for meeting day-to-day expenses and making more money available for weapons and equipment.

Meanwhile, an internal note on restructuring of the Indian Army, as reported widely in the media, has suggested changes to make the force “leaner”, including disbanding of around 20 Divisional headquarters of the present 40 headed by Major Generals.



Divisions under the three Strike Corps, the Mountain Strike Corps, 3 Corps Dimapur, 4 Corps Tezpur, 15 Corps Srinagar, 16 Corps Nagrota and those dual tasked as 10 Corps Bathinda and 11 Corps Jalandhar shall function “as usual”. In areas where the Division headquarters are abolished, their constituent brigades will report directly to the Corps and be called *Task Forces*. “The change will free them for deployment in operational areas, save on infrastructure costs and cut down red-tape, thus allowing for quicker decision-making.”

Indigenous artillery guns

It is reported that two variants of indigenous 155mm artillery guns are at final stages of being handed over to the Army. The ‘Dhanush’ is being made by the Ordnance Factory Board, while the Advance Towed Artillery Gun System (ATAGS) has been designed by the Defence Research and Development Organisation and will be manufactured by Tata and Bharat Forge.



Six of the OFB-produced Dhanush are now undergoing “battery fire tests”—all guns firing collectively—the plan so far being to get 18 guns by March 2019. The MoD is “positive” on the ATAGS and very soon will place an order for 12 guns. Meanwhile, 145 of the M777 ultra light howitzers will be inducted from September 2019.

SpyLite Mini UAS for Indian Army

Cyient Solutions & Systems Pvt. Ltd. (CSS), a joint venture between Cyient Ltd. and BlueBird Aero Systems, of Israel has received orders from the Indian Army for SpyLite Mini UAV systems for high altitude aerial surveillance. SpyLite is an advanced, combat-proven, electric, mini unmanned aerial system, optimised for covert, extended range real-time visual intelligence. Fully autonomous, from launch to accurate parachute recovery, “the system delivers enhanced reliability even in severe weather conditions, assuring long endurance, high operational availability”.

Anti-runway bombs and anti-tank missiles

On 20 August, the MoD announced two major new weapon systems developed by the Defence R&D Organisation (DRDO), being a precision-guided bomb, launched from fighter aircraft with a range of 100 km, second an anti-tank missile, fired from helicopters. The indigenously designed and developed guided bombs named, the Smart Anti-Airfield Weapon (SAAW) has been tested at Chandan Range, in Rajasthan.

“Three tests with different release conditions were conducted 16-18 August and all mission objectives have been achieved, being the eighth round of developmental trials SAAW has undergone. The Dhruv helicopter launched a HELINA anti-tank guided missile at a tank target seven kilometres away, successfully striking and destroying it.” HELINA is the acronym for ‘helicopter launched Nag’ missile, a heavier and longer-range version of the vehicle-mounted Nag missile having a 4-km range.

Supersonic interceptor missile tested

On 2 August 2018, DRDO test-fired the indigenously developed supersonic interceptor missile, “capable of destroying incoming hostile ballistic missiles”. Chief of the Air Staff, Air Chief Marshal BS Dhanoa, witnessed the flight test. The endo-atmospheric missile, capable of intercepting incoming targets at an altitude of 15 to 25 km, was launched against multiple simulated ballistic missiles. “One target among simultaneously incoming multiple targets was selected real time, the weapon system radars tracked the target the missile locked on to it and intercepted the target with a high degree of accuracy. The complete event, including the engagement and interception was tracked by



a number of electro-optical tracking systems, radars and telemetry stations”.

The interceptor missile is a 7.5-metre long single-stage solid-rocket propelled guided missile equipped with a navigation system, a hi-tech computer and an electro-mechanical activator. The interceptor missile had its own mobile launcher, secure data link for interception, independent tracking and homing capabilities and sophisticated radars.

Godrej Aerospace delivers Brahmos air-launched version

On 31 August 2018, Godrej Aerospace handed over first airframe assembly of the air launched version of the BrahMos missile to Defence Research Development Laboratories (DRDL). Godrej is poised to deliver the next set of airframe assemblies by December 2018 and also aim to produce the first indigenous missile booster. In December 2017, Godrej Aerospace had won an order for 100 sets of airframe assemblies for the air launched version, production of which started soon after. Till date Godrej have also supplied over 100 sets of the land version of the missile to BrahMos Aerospace Pvt. Ltd.



As Jamshyd Godrej, Chairman and Managing Director, Godrej & Boyce said, “Godrej takes great pride in contributing towards building India’s defence capabilities. It is a matter of immense pride that today we have handed over the first airframe assembly of the prestigious Air Launched version of the BrahMos missile. The partnership between BrahMos, DRDL and Godrej Aerospace is unique and unmatched since it brings together the planning of defence PSUs and the innovation of private enterprise to robustly achieve the strategic goal of securing the nation.”

Lockheed Martin, Tata to build F-16 wings in India

Lockheed Martin Corp are to commence production of F-16 fighter aircraft wings in India at the facilities of Tata Advanced Systems Limited’s (TASL), Lockheed Martin’s strategic industry partners in India. According to the Company, the planned F-16 wing production move to India is not contingent on the Government selecting the F-16 for the Indian Air Force. “Building F-16 wings in India is a natural next step that builds on our



successful partnerships with Tata on the C-130J [airlifter] and S-92 [helicopter],” said Dr Vivek Lall, Vice President of Strategy and Business Development for Lockheed Martin Aeronautics. “This is a strategic business decision that reflects the value of our partnerships with India and the confidence we have in Tata to perform advanced defence manufacturing work and deliver world-class products.”

Alongside Lockheed Martin’s proposed F-16 partnership with India to produce F-16s exclusively for the Indian Air Force, the company has recently submitted a comprehensive, fully compliant 600-plus page Request for Information (RFI) response to the Indian Air Force. Lockheed Martin and TASL had announced last year that the two companies intend to produce the F-16 Block 70 in India “if the aircraft is selected by the Indian Air Force. The F-16 Block 70 features advanced avionics, a proven Active Electronically Scanned Array (AESA) radar, a modernised cockpit, advanced weapons and conformal fuel tanks. Till date, 4,604 F-16s have been operated by 28 air arms around the world and some 3,000 operational F-16s continue flying with 25 air forces, including the US Air Force”.

Tata Motors’ Safari Storme for Indian Army

Tata Motors has rolled out the 1500th GS800 (General Service 800) Safari Storme 4x4 for the Indian Armed Forces, with a ceremonial flag off by Dr. Subhash Bhamre, MoS, Defence, along with Mr. Vernon Noronha, Vice President, Defence & Government Business, Tata Motors, at its Pune facility. The company received orders to supply 3192 units of Safari Storme to India’s Armed forces and have already delivered 1300+ vehicles. The Safari Storme GS800 is indigenously designed “to meet the requirements of the Indian Army with a contemporary, highly reliable and sturdy Diesel SUV with robust features, and a minimum payload capacity



of 800 kgs”. The Tata GS800 Safari Storme is a fully loaded vehicle having special features such as ABS, recovery hooks, and fog lamps to suit army requirements. Being a low maintenance vehicle, it comes with bucket seats, mobile charging point, air conditioning (AC), heating, demisting, power windows and ample space inside the cabin to accommodate six crew members.

Ashok Leyland and CVRDE in collaboration



Ashok Leyland, flagship of the Hinduja Group and largest supplier of wheeled military vehicles to the Indian Army has collaborated with Combat Vehicles Research and Development Establishment (CVRDE), Chennai for manufacture, assembly and testing of light weight clutch for weight-optimised 1500 hp Automatic Transmission for Main Battle Tanks. As Amandeep Singh, Head-Defence, Ashok Leyland, said, “For over three decades, Ashok Leyland has been a vital part of our Defence forces through our mobility solutions. As part of our strategy to enhance our contribution to our Defence Forces and to expand our business scope within our focus area of *Solutions for Mobility on Land*, we have also been working on Tracked Vehicles.”

Godrej Aerospace partners with GKN Aerospace

Godrej Aerospace has signed an agreement with UK-based GKN Aerospace, one of the world’s leading multi-technology tier 1 aerospace suppliers, for the manufacture of specialised helicopter fuel tanks. Godrej will be setting up a cutting-edge manufacturing facility for the production of these specialised fuel tanks and will be partnering with GKN Aerospace, “a world-leader in this technology”. The rubber fuel tanks are an important consideration in the design and safety of helicopters providing crash resistance and puncture tolerance as well as overall weight reduction. The tanks follow stringent product requirements in terms of weight, material used, processes and manufacturing skills.

BEL receives 4 PSE Excellence Awards



Bharat Electronics Ltd won four PSE Excellence Awards (2017), instituted by the Indian Chamber of Commerce including: 'Company of The Year', 'Human Resource Management Excellence', 'R&D, Technology Development & Innovation' and 'Operational Performance Excellence'. The awards were received by MM Joshi, Executive Director (National Marketing), BEL, from Dr Ajay Dua, former Secretary, Ministry of Commerce, Government of India, at the awards ceremony held on 29 August 2018, at New Delhi. Seen in the picture are M M Joshi receiving the Indian Chamber of Commerce PSE Excellence Awards for BEL from Dr Ajay Dua.

BEL, CSIR-NAL sign TCA

Bharat Electronics Ltd (BEL) has signed a Technical Collaboration Agreement (TCA) with CSIR-NAL for the design, engineering, production and commercialisation of Electronic Target System (ETS), a modern training aid meant for enhancing marksmanship of Defence and Paramilitary forces during live firing exercises on the field. This was signed by Gowtama MV, Chairman & Managing Director, BEL. Designed by CSIR-NAL, the ETS is a technically superior and cost-effective solution for Police, Paramilitary and Defence personnel looking at acquiring sharp shooting skills in small fire arms as well as honing their proficiency in tactical field firing.

CSIR-NAL has developed two technologies for Electronic Target System : Detection and Hit Visualisation using Acoustic N-wave Identification (DHVANI) and Acoustic Based Hit Identification and Analysis System (ABHIAS), using which the shooter can instantly see the result on an electronic display placed nearby. This enables the shooter to constantly self-monitor his progress and take remedial steps to improve his accuracy.

BEL's record turnover

The recent Rs 9,200 crore order for supply of seven Long Range Surface-to-Air Missile (LRSAM) systems has resulted in Bharat Electronics Ltd's (BEL) turnover exceeding Rs 50,000 crore for the first time. The Company has contracts worth about Rs 9,200 crore with Mazagon Dock Limited (MDL) and Garden Reach Shipbuilders and Engineers (GRSE) to supply LRSAM systems to be fitted onboard seven ships to be built by these two shipbuilders, the highest-ever single value order received by BEL.



Anandi Ramalingam, Director (Mktg), BEL, signed the contracts on behalf of BEL with MDL and GRSE. As the lead integrator of Akash Missile systems, BEL has a proven record and is now preparing for futuristic programmes such as the Quick Response Surface to Air Missile (QRSAM) for the Army, Medium Range Surface to Air Missile (MRSAM) for the Indian Air Force and Long Range Surface to Air Missile (LRSAM) for the Indian Navy. BEL is the lead integrator of LRSAM systems for the Navy's P-17A stealth frigates.

Boeing H-47 Chinook aerostructures made by Dynamatic Technologies

Dynamatic Technologies have delivered the 75th aft pylon and cargo ramp components for Boeing's H-47 Chinook heavy-lift



helicopter, the aerostructures to be integrated at Boeing's facility in Philadelphia. Dynamatic manufactures critical components for the CH-47 Chinook, heavy-lift transport helicopter.. "This delivery marks a significant milestone in the success of the 'Make in India' programme and our commitment towards building indigenous manufacturing capabilities," stated Pratyush Kumar, president, Boeing India. Dynamatic Technologies had delivered the first set of aft pylon and cargo ramp assemblies for the Chinook in February 2015.

Mahindra Airvan 10 for Botswana's Major Blue Air



On 30 August 2018, Mahindra Aerospace Private Limited signed Botswana's Major Blue Air Ltd as first international customer for its 10-seater turboprop aircraft, the Airvan 10. SP Shukla, Group President- Aerospace, Defence and Steel, Mahindra Group and Chairman, Mahindra Aerospace stated, "Tourism companies in Botswana reposed their faith in the Mahindra Group when they introduced Airvan 8 in their aircraft fleet. Eventually Airvan proved to be the most suitable aircraft for their tourism operations and scenic flights across the country. We are delighted that Botswana is among Airvan's top markets. It is a matter of immense pride to see the first Airvan 10 being introduced in this important market." Arvind Mehra, Executive Director & CEO, Mahindra Aerospace said, "Over last few years, we have enhanced our focus and attention to this very important market. With increasing traffic and 2018 being one of the highest in terms of tourism growth, this market needed a bigger and turbine aircraft. I compliment Major Blue for becoming the first customer of Airvan 10 which well complements the existing flying fleet of Airvan 8. We look forward to many more of both Airvan 8 and Airvan 10 flying."

ST Engineering's Aerospace maintenance agreement with Jet Airways

Singapore Technologies Engineering Ltd has signed an agreement to provide CFM56-7B engine maintenance, repair and overhaul (MRO) services for Boeing 737NGs of Jet Airways and its subsidiary, JetLite, which initially covered a portion of the



airlines' 737NG fleet. With the latest agreement, Jet Airways' and JetLite's entire fleet of 80 737NGs will be covered, increasing the contract value from the initial US\$350m (approximately S\$478m) to a total of about US\$700m (approximately S\$957m). As part of the contract, ST Engineering will provide an integrated suite of engine MRO solutions, including off-wing engine maintenance support, on-wing services as well as technical support. These services will be provided over a period of 6 years starting from 2019 at ST Engineering's engine MRO facilities located in Singapore and Xiamen, China.

"Greater autonomy" for Air India

The Ministry of Civil Aviation has proposed greater autonomy for Air India's management, as part of its strategic turnaround plan for the financially challenged national carrier. The plan is part of efforts to bring about organisational and financial restructuring at Air India and seek a cash infusion of nearly Rs10,000 crore. As a senior official of the Ministry of Civil Aviation said, "We have sought more autonomy for Air India's Board so that they don't have to come to the government for approvals... (but) this is only a proposal



and nothing has been finalised yet”. Another Ministry official said that Rs 1,630 crore equity had been released and Rs 3,000 crore of government-guaranteed loans approved since the disinvestment process for Air India was put on hold. A supplementary provision of Rs 980 crore was approved for the airline in August.

Civil Aviation Secretary RN Choubey had earlier stated that these measures would ensure that there was no further value erosion of Air India “until circumstances became favourable for its disinvestment”. Air India had a debt of Rs 48,000 crore until March 2018 and the government’s attempt to privatise the airline earlier this year did not yield any bids and it was forced to put the process on hold. Still, the government maintains that “it is committed to the strategic disinvestment of the national carrier and will wait for global economic factors to improve to resume the process.”

Air France-KLM alliance with Jet Airways

On 6 September, KLM’s president and chief executive officer Pieter Elbers stated that Air France-KLM wants to deepen its alliance with Jet Airways to exploit an expected double-digit growth in the air travel markets of India and North America. “First we put connections and code-share in place on each other’s network. Now we are taking it [the alliance with Jet Airways] to the next level in terms of customer interface,” Elbers stated and added that the two airlines are also working towards aligning their frequent flyer programmes.



The previous pact had given India’s second-largest airline wider access to Europe and North America, while boosting the European airline’s access to the Indian market, the world’s fastest-growing aviation market. The idea was to connect India to a vast Trans-Atlantic network via the Paris-Charles de Gaulle and Amsterdam-Schiphol hubs. “Everyone knows that there is a huge flow of passengers from India and the USA. Using our hubs in Amsterdam and CDG, which are two of the strongest hubs in Europe and connecting them directly to the network of Jet Airways is helping us,” said Elbers, adding that the airline now boasts a “strong position” in the Europe, US and Indian markets.

UDAN to extend services to Southeast Asia?

India’s northeastern states may soon have direct air connections to destinations in Southeast Asia, according to a draft policy which extends the subsidised air travel programme *Ude Desh ke Aam Naagrik* (UDAN) to international destinations, with state governments funding and identifying the routes for operation. “The objective of the UDAN (International) scheme is to enhance international air connectivity between Indian states and select international destinations through the provision of financial support to airlines. It is the next step after the positive domestic impact of UDAN,” according to aviation minister Suresh Prabhu. “Under the scheme, the state governments will be responsible for funding the financial benefits. The scheme envisages providing monetary support, in the form of a subsidy per seat, from the number of seats as bid by the airline to make operations viable,” India is trying to make flying to international destinations more accessible to our citizens, the minister said. “This will help improve overall connectivity and spur trade, tourism and economic growth in the country,” Prabhu added. Under the scheme, the Assam government has committed to fund a subsidy amount of Rs 100 crore per annum for three years.

IndiGo and SpiceJet air cargo transportation

IndiGo and SpiceJet are considering transporting cargo to augment their operations, with passenger revenue of airlines remaining “stressed”. SpiceJet is adding freighter aircraft to tap the market, while IndiGo plans to ferry perishable cargo. “To start with, we are looking at perishable cargo like crabs from Chennai, fish from Kerala and betel nuts from Kolkata and air transport them to other parts of the country,” said an IndiGo executive. “After filling the cargo hold with luggage, we are left with about 1.5 to 2 tonnes of capacity, which can be used to transport these perishable goods,” the executive added. SpiceJet’s first freighter aircraft is already in India and slots for freighter aircraft would not be a problem even at busy airports. “If there is a requirement, the airline would provide a current passenger aircraft slot, as freighter operations would be a high-yield business.”



SpiceJet delays long-haul budget international flights

SpiceJet Ltd has delayed plans to start long-haul budget international flights as “a falling rupee and high fuel prices have increased operating costs.” The airline will wait for costs to moderate before it starts the service, which will aim to offer fares at much cheaper rates than those of foreign carriers, as per SpiceJet chairman Ajay Singh. “We expect to fly to many more countries in the future. (But) we will do long-haul international destinations only when it is commercially feasible,” Singh said. “SpiceJet would wait”



for a somewhat improved environment in terms of ATF (aviation turbine fuel) and taxation”. Ajay Singh said SpiceJet will also start procuring wide-body aircraft, “which consume more fuel, as well as higher airport landing and parking charges.” SpiceJet currently operates short-haul international destinations to Dubai, Colombo, Bangkok and Kabul with a narrow body fleet of Boeing 737-800 and Boeing 737-900 ERs .

SpiceJet operates biojet fuel flight

On 27 August 2018, SpiceJet’s first ever biojet fuel flight was flagged off by Trivendra Singh Rawat, Chief Minister of Uttarakhand from Jolly Grant airport in Dehra Dun to Delhi in



presence of Nitin Jairam Gadkari, Suresh Prabhu, Dharmendra Pradhan, Dr. Harsh Vardhan, Jayant Sinha and Ajay Singh, CMD SpiceJet.

“SpiceJet is the first and only airline in India to explore aerial operations powered by BioJet fuel and intends to undertake operations using a blend of 75% of aviation turbine fuel (ATF) and 25% of BioJet fuel, which has the potential of reducing carbon footprint by 15%”. Made from Jatropha crop, the fuel has been developed by the CSIR-Indian Institute of Petroleum (IIP), one of the constituent laboratories of the Council for Scientific and Industrial Research based in Dehra Dun. The BioJet fuel has been recognised by American Standard Testing Method (ASTM) and meets the specification standards of Pratt & Whitney and Bombardier for commercial application in aircraft.

“SpiceJet is delighted to operate the first BioJet fuel flight in India. This fuel is low cost and helps in significantly reducing carbon emissions. It has the potential to reduce our dependence on traditional Aviation Fuel by up to 50% on every flight and bring down fares. India is the fastest growing aviation market in the world today and it is our responsibility to grow using clean and sustainable technologies,” said Ajay Singh.

Pakyong in Sikkim is India’s 100th airport



Prime Minister Narendra Modi inaugurated an airport at Pakyong in Sikkim on 24 September. At a height of 4,500 feet ASL this is the first greenfield airport in Northeast India, being 33 km from Gangtok, the nearest other airport being Bagdogra in north Bengal, Sikkim itself being flanked by Nepal, Tibet and Bhutan with Bangladesh close by to the south. The first commercial flight from Pakyong would be from 4 October, with SpiceJet operating the Bombardier Q400 to and from Delhi, Kolkata and Guwahati. The airport has a 1750 metre runway and a 3,000 sq metre terminal building, with security being responsibility of the Sikkim police.

Vistara selects GENx for its Boeing 787-9 Dreamliners



GE Aviation's GENx-1B engine has been selected by Vistara to power its newly ordered fleet of six firm and four purchase rights of Boeing 787 wide-bodied aircraft. Vistara intends to use the Boeing 787-9 Dreamliners on medium-haul and long-haul international routes. The firm engine order valued at more than US\$ 340 million is Vistara's first order for GENx-powered aircraft, with deliveries expected between 2020 and 2021. Vikram Rai, Country Head, GE Aviation said, "We are honoured that Vistara has selected GE to power its growth journey. GENx engines offer impressive economics pertaining to fuel efficiency, reliability and utilisation making them most suited for Vistara's plans to strengthen its fleet for international routes."

Domestic air passenger traffic grows by 21 %

Continuing to register double-digit growth, India's domestic airlines carried 11.58 million passengers in July 2018, nearly 21 per cent higher compared to 2017 when some 9.57 million people flew, according to official data. IndiGo has continued to be the largest player with a market share of 42.1 per cent while that of Air India stood at 12.4 per cent. Latest figures compiled by aviation regulator DGCA showed that there was an increase of 20.82 per cent in the number of passengers flown by local carriers.

"The market share of SpiceJet and GoAir stood at 12.3 per cent and 8.9 per cent, respectively. Jet Airways garnered a market share of 13.6 per cent in July," according to the Directorate General of Civil Aviation (DGCA).

Aero India remains at Yelahanka

After some months of uncertainty and major concerns by both organisers and potential participants, the Aero India show 2019 will, as henceforth, continue to be held at Air Force Station Yelahanka, the dates being 20-24 February. For some time, UP's Chief Minister had lobbied hard with the Union Defence Minister for the Aero India Show to not only be shifted to Uttar Pradesh



but brought four months forward to late October-early November 2018 at a non-descript location close to Lucknow. The Air Force Station Bakshi-ka-Talaab was to be the venue but there was strong resistance by both the organisers and industry as there is virtually no infrastructure in this rural area and bringing the show forward by four months could well have resulted in some fiasco.

PSLV-C42 launches 2 foreign satellites

ISRO's Polar Satellite Launch Vehicle (PSLV-C42) launched two satellites -- NovaSAR and S1-4 -- from the Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota on 16 September 2018. S1-4 is a high resolution earth observation satellite meant for surveying resources, environment monitoring, urban management and disaster monitoring. The satellites were from UK-based Surrey Satellite Technology Limited (SSTL), which has a contract with Antrix Corporation Ltd, the commercial arm of ISRO. NovaSAR carries S-band Synthetic Aperture Radar (SAR) and an Automatic Identification Receiver payloads. The satellite applications include forestry mapping, land use and ice cover monitoring, flood and disaster monitoring and maritime missions and will be operated from SSTL's Spacecraft Operations Centre in Guildford, UK.



This was 44th flight of the PSLV and 12th flight of the Core Alone version of the vehicle. Core Alone is its lightest version without the six strap-on motors, used for launching smaller payloads. As on date, ISRO has launched 239 foreign satellites of 28 countries.

India and France MoU on Gaganyaan

With the government of India declaring its intention to send three humans to space by 2022, it reported that India and France will collaborate on Gaganyaan, ISRO's first human space mission and have formed a working group for the project. The Indian Space Research Organisation's mission is significant as it would make India one of the four countries in the world after Russia, US and China to launch a manned space flight. "The ambit of the cooperation includes giving ISRO access to space hospital facilities in France and combining expertise of the two space agencies in fields of space medicine, astronaut health monitoring, life support, radiation protection, space debris protection and personal hygiene systems," stated Jean-Yves Le Gall, President of the French space agency.

"The first step under the MoU is to exchange specialists to work on (space) medicine. We are going to send our specialists to identify exactly what we are going to do together. We have facilities like space hospital in France, and so we are doing exchange notes on the topic," Gall stated. Engineering teams have begun discussions and it is envisioned that infrastructure such as CADMOS centre for development of microgravity applications and space operations or the MEDES space clinic will be used for training of future Indian astronauts, as well as exchange of specialist personnel. ISRO plans to conduct experiments on microgravity through its astronauts.

Change in Chandrayaan-2 mission to the moon



After some years of preparation, the Indian Space Research Organisation (ISRO) have changed the Chandrayaan-2 mission, which will now have the Lander, which was initially to soft land on the surface and discharge the Rover, but instead now go around the Moon in an elliptical orbit before descending on the dusty terrain for a series of tests. This mission, unlike Chandrayaan-1 which only orbited the Moon, involves Lander soft-landing on the lunar surface and unloading a Rover to study and take measurements from the Moon, while the orbiter will go around. Initially, the project was to be a joint mission with Russia, whose space agency Roscomos was to supply the lander, but ISRO has decided to go alone.

"Energising Indian Aerospace Industry"



The 13th International Conference on this subject ("Mapping the Change") was organised by the Centre for Air Power Studies (CAPS) and CII at New Delhi on 5-6 September 2018. Various sessions included a significant briefing by the DCAS, Indian Air Force on "Capital Procurement" followed by sessions on "Make in India", addressed by the Air Officer in-charge Maintenance and "MSMEs: The Real Movers of Aerospace Industry".

Highlight of the second day was a panel discussion on the aerospace industry, in which senior executives from Lockheed Martin, BAE Systems, Boeing, Rosoboronexport and Thales participated. In the picture are seen Air Chief Marshal BS Dhanoa with Dr Vivek Lal, Vice President Strategy & Business Development with Lockheed Martin.

F-16 Supplier Conference in India

On 9 October 2018, Lockheed Martin and the Tata Advanced Systems Limited (TASL) organised the 'F-16 Supplier Conference in India' at Bangalore, with the theme of Industry Partnership on the F-16 programme.

Present were Mr Randy Howard, Director, F-16 Business Development of Lockheed Martin, as also Mr Abhay Paranjape, Chief Operating Officer, Tata Lockheed Martin Aerostructures, Mr Phil Shaw, Chief Executive, Lockheed Martin India, Mr Sukaran Singh, CEO & Managing Director, Tata Advanced Systems and Mr Masood Hussainy, Head Aerostructures, Tata Advanced Systems.

Appointments

Vice Admiral Anil Kumar Chawla assumes command of SNC



Vice Admiral Anil Kumar Chawla took over as FOC-in-C Southern Naval Command (SNC) on 31 July 2018 succeeding Vice Admiral AR Karve who retired after 38 years of service. V Adm AK Chawla was previously Chief of Personnel at the Integrated Headquarters of Ministry of Defence, Navy at New Delhi.

R Madhavan takes over as CMD of HAL

On 1 September 2018, R Madhavan took over as Chairman and Managing Director of HAL from T Suvarna Raju. Prior to this, he was heading the Accessories Division of HAL at Lucknow as an Executive Director. Born in 1962, Madhavan is a Mechanical Engineer from NIT, Raipur and a post graduate in M. Tech. from IIT Madras. He joined HAL as a management trainee in July 1982 “and has comprehensive management and engineering experience”. He was involved with production of Su-30 airframe and engine accessories from raw material phase at HAL’s Accessories Division, Lucknow.



Ananthkrishnan is Director (Finance) at HAL

CB Ananthkrishnan has taken over as Director (Finance) at the Hindustan Aeronautics Limited. Born in 1964, he is a Cost Accountant with MBA (Finance) from University of Madras

and joined HAL in March 2004 as Chief Manager (Finance) at Helicopter Division, Bengaluru. He has over three decades of experience in private and public sectors with stints in merchant banking, pharmaceuticals and fertilisers before joining HAL. He is also HAL nominee Director in the Board of three joint ventures of HAL.

He played an active role in HAL’s Initial Public Offer (IPO) during March 2018 and was involved with formalising major helicopter contracts including supply of 159 HAL Dhruv ALHs for the Armed Forces.



Dr G. Satheesh Reddy appointed Secretary, Department of Defence R&D and Chairman, DRDO

Dr G. Satheesh Reddy, Scientific Adviser to Defence Minister (SA to RM) has been appointed as Secretary, Department of Defence Research and Development (DDR&D) and Chairman, Defence Research and Development Organisation (DRDO). Dr Satheesh Reddy is well known for his significant contributions towards indigenous design, development, deployment of diversified Missiles & Strategic Systems, Guided Weapons, Avionics technologies and for sustained efforts in advancement of Aerospace technologies & Industries in India.

As SA to RM, he contributed significantly towards the formulation of many national policies and pivotal in evolving roadmap for self-sufficiency in Missiles. As Director General, Missiles and Strategic Systems (DG, MSS), he spearheaded various laboratories including the ASL, DRDL and RCI, ITR, TBRL and other technical facilities and led the design and development of a wide range of tactical and strategic missile systems to attain complete self-sufficiency in missiles.



Saab appoints Ola Rignell as India Head

Saab has appointed former Gripen Stest pilot and Head of Saab Malaysia, Ola Rignell, as the new Chairman & Managing Director of Saab India Technology Pvt Ltd (SITPL). “Ola has the experience and the expertise which will enable Saab to further strengthen our work in the



country and take forward our unbroken relationship of over 40 years. We are committed to building next-generation defence and security capabilities in India. Together with Indian government and industry, we would like to develop new ways to meet the challenges of tomorrow,” stated Dean Rosenfield, Head of Saab Market Area Asia Pacific. A former fighter pilot with the Swedish Air Force, Ola has been deeply involved in Sweden’s Gripen programme, with responsibility for testing weapons, avionics, engine performance and human/machine interfaces. Ola has logged more than 2500 flight hours on different Swedish fighters including the Draken, Viggen and Gripen, and on other combat aircraft such as the F-16, Tornado, Hawk and Harrier. Ola Rignell is a member and fellow of the Society of Experimental Test Pilots and was Saab project pilot in the US/Swedish Ground Collision Avoidance System (GCAS) endeavour, working with the Swedish Air Force, FMV, USAF, NASA and Lockheed Martin.

Anand Stanley is new President and MD of Airbus India

Airbus has appointed Anand E. Stanley to succeed Pierre de Bausset as President and Managing Director of Airbus India. He had earlier served as Global Executive Vice President, Strategy, at The Linde Group prior to joining Airbus and had started his aerospace career with Pratt & Whitney before holding multiple leadership roles within UTC and Lockheed Martin, including Head of Sikorsky’s Europe, Middle East and Africa region.



Indian Air Force Appointments

Air Marshal Anil Khosla is Vice Chief of Air Staff

Air Marshal Anil Khosla took over as Vice Chief of the Air Staff on 1 October 2018 with over 4000 hours of accident free flying, mainly on different variants of the MiG-21 and Jaguar, apart from the Kiran aircraft. The Air Officer has been Directing Staff at institutions including the Tactics and Combat Development Establishment (TACDE) and Flying Instructor School (FIS). He has commanded No.6 Squadron with Jaguars in the maritime role and two frontline bases of the IAF, at Jaisalmer and Ambala. As Air Marshal, he has held the appointments of SASO, Central Air Command, Director General Air (Operations) at Air HQ and Director General (Inspection & Safety). His last appointment was as AOC-in-C EAC.



Air Marshal Balakrishnan Suresh is AOC-in-C Southern Air Command

Air Marshal Balakrishnan Suresh took over as the AOC-in-C Southern Air Command at Thiruvanthapuram on 1 August 2018. The Air Marshal, who hails from Thiruvananthapuram, is a graduate of the RIMC Dehra Dun and the NDA at Kharakvasla. He has held a number of important staff appointments which include Joint Director and Director (Air Staff Inspection), Director Operations (Joint Planning), and ACAS-Operations (Air Defence).



Air Marshal Harjit Singh Arora is AOC-in-C, South Western Air Command

Air Marshal Harjit Singh Arora took over as Air Officer Commanding-in-Chief, South Western Air Command at Gandhinagar on 1 October, 2018 succeeding Air Marshal RK Dhir. The Air Marshal has considerable and diverse experience of accident-free operational flying which includes on the MiG-21, MiG-29 and other aircraft types, including helicopters. He is a meritorious graduate of the Tactics and Air Combat Development Establishment, Defence



Services Staff College and National Defence College. He was also Defence Attache at Bangkok, Thailand.

The Air Officer commanded a MiG-21 Bis squadron and was later Commander Air Defence Direction Centre in the same sector. He later commanded a major MiG-29 base in the western sector and as an Air Vice Marshal was Air Defence Commander at Headquarters of Western Air Command, and later the Eastern Air Command. As an Air Marshal he has held appointments as Director General (Inspection and Safety) and was Director General Air (Operations) at Air HQ before taking over as the AOC-in-C, SWAC.

Air Marshal Raghunath Nambiar is AOC-in-C, Eastern Air Command

Air Marshal R Nambiar is an Experimental Test Pilot, having logged over 5100 flight hours. He has flown 42 types of aircraft, having the singular distinction of the highest number of flying hours on the Mirage 2000. He is an experimental test pilot and was also Project Test Pilot for the Tejas Light Combat Aircraft.

He commanded No. 1 Squadron with Mirage 2000s which type he flew in combat during the Kargil conflict, including 25 operational missions. He was Director of Space Applications at Air HQ and Chief Operations Officer of Air Force Stn Gwalior. He was Defence Attaché in Israel and later Principal Director of Offensive Operations at Air HQ. The Air Officer has also held the appointments as AOC Air Force Station Jamnagar, Commandant ASTE, was Air Defence Commander Western Air Commander, Senior Air Staff Officer (SASO) of Southern Air Command, Training Command and EAC. Before taking over as the AOC-in-C of EAC, he was Deputy Chief of the Air Staff.



Air Marshal VR Chaudhari takes over as Deputy Chief of the Air Staff

Taking over as the DCAS on 1 October 2018, Air Marshal VR Chaudhari has had extensive flying experience on various aircraft types including the MiG-21, MiG-23MF, MiG-29 and Su-30MKI, with over 3800 flight hrs. He has considerable operational flying experience, including numerous air defence missions during *Op-Meghdoot* and *Op-Safed Sagar*. He is a Cat A Qualified Flying Instructor, a graduate of the Defence Services



Staff College and has Instrument Rating as an Instructor and Examiner.

The Air Officer commanded No.28 Squadron ('First Supersonics' with MiG-29s) and later served as the Chief Operations Officer at Air Force Station Srinagar. He commanded a forward base before taking over as Air I at HQ CAC IAF, was later Instructor at DSSC Wellington and Defence Attache in Zambia. Before taking over as Deputy Chief of the Air Staff, he was ACAS Ops (Air Defence) and later Assistant Chief of Air Staff (Personnel Officers).

Air Marshal Amit Dev is new Director General Air (Ops)

Air Marshal Amit Dev has flown various types of fighter and trainer aircraft and has some 2500 hours of flying experience. An alumnus of the Tactics and Air Combat Development Establishment, Defence Services Staff College, College of Air Warfare and National Defence College, he has held important field and staff appointments which include command of a fighter squadron, Air Defence Direction Centre, an operational fighter base and Advance HQ, South Western Air Command. He also served as Joint Director Tactical Operations, Director Air Staff Inspection, Principal Director Air Staff Inspection and Assistant Chief of Air Staff (Inspection), at Air HQ.

STOP PRESS !

On 5 October 2018, the Governments of India and Russia formalised the long awaited deal for the purchase of S-400 Triumf air defence systems. This was signed in New Delhi during the state visit to India of Russian President Vladimir Putin and following his meetings with Prime Minister Narendra Modi.

This 'game changing' missile system integrates a multifunction radar, autonomous detection and targeting systems, anti-aircraft missile systems, launchers, and command and a control centre and provides a multilayered defence given that is capable of firing three types of missiles. The S-400 is also expected to be deployed along the nearly 4,000-km-long India-China border.

Correction: The article titled "MBDA's Meteor BVRAAM" in Vayu's issue IV/2018, there was a line stating that the 'Malaysian Air Force Sukhoi Su-30MKMs are armed with MBDA MICA BVRAAMs': we would like to correct that by stating 'MICAs are not integrated on Su-30MKM of the Malaysian Air Force'.

(Air) Defence of the Realm (Rafale)



Air Chief Marshal BS Dhanoa during a break at the Seminar

Vayu Aerospace & Defence Review was invited to attend a special seminar on ‘IAF Force Structure 2035’ hosted by the Centre for Air Power Studies at New Delhi on 12 September 2018. The CAS Air Chief Marshal BS Dhanoa gave a special address on the rationale behind the Rafale acquisition programme as also on the IAF’s modernisation roadmap.

Detailed briefings were thereafter given by Air Marshal SBP Sinha, AOC-in-C Central Air Command (and former Deputy Chief of the Air Staff during the MMRCA negotiations) and he was followed by the present DCAS, Air Marshal Raghu Nambiar, who gave an overview on the IAF’s envisaged force structure.

As reported in various media, with controversy swirling around the procurement of 36 Rafale fighters from France, Air Chief Marshal BS Dhanoa referred to the “two front threat” from China and Pakistan to emphasise that the Rafale is urgently needed. “Pakistan has over 20 fighter squadrons, with upgraded F-16s and is inducting JF-17s from China in quantity. Meanwhile, China has 1,700 fighters, including 800 4th generation fighters...but we do not have the numbers, with fighter squadrons down to 31 from the sanctioned 42”. The Indian Air Chief flagged the situation “across India’s northern and western

frontiers” stating that Pakistan and China “are not sitting idle”.

The Air Chief dwelled on the cancellation of the original MMRCA requirement for 126 aircraft, stating that the plan to build 108 of them in India had “reached an impasse owing to irresolvable differences between Dassault Aviation and HAL.” Senior IAF officers at the Seminar clarified that the price paid for the Rafale included “most modern sensors, best in class weapons, state-of-the-art EW (electronic warfare) and enhanced survivability, India-specific

enhancements, better price terms, better overall delivery terms and timeline, better maintenance terms, longer industrial support commitment, additional warranty and longer PBL (performance based logistics) commitment.”

References were repeatedly made to such historical “emergency purchases” of fighters for the IAF, including procurement of two MiG-23MF squadrons in 1983 to counter Pakistan’s new F-16s, two squadrons of Mirage 2000s in 1985 and then two squadrons of MiG-29s.

The Air Marshals also stressed on the plan to procure large numbers of the Tejas light combat aircraft, 40 of the present Mk.Is on order to be followed by 83 Mk.IAs and thereafter by the considerably developed Mk.II which in fact will be a substantially different aircraft, “with twice the payload of the Mk.I, and powered by the GE F.414 engine.” Air Marshal Nambiar indicated that the IAF envisages inducting about 200 LCA Mk.IIs from the 2030s to replace the present legacy Jaguars, Mirage 2000s and MiG-29s. The 5th generation AMCA will meanwhile be developed to supplement the force in the decades that follow.



Air Marshals SBP Sinha and R Nambiar

VAYU Interview with

Air Chief Marshal BS Dhanoa, Chief of the Air Staff, IAF



VAYU: *The IAF has issued a new RFI for some 110 fighters and received responses by 6 July 2018, presumably from known OEMs. These are apparently being studied and selected companies would be asked to submit formal proposals for evaluation.*

Can you kindly indicate as to how long this next step could take?

CAS: The case for 114 fighters is through the Strategic Partnership route and the process as per Chapter VII of DPP-16 will be followed.

VAYU: *The IAF is very short of 'force multipliers', such as AWACS and mid-air refuellers (MRA). Kindly give us a road map as to when this vital gap in the IAF's inventory is to be filled.*

CAS: The Flight Refuelling Aircraft (FRA) is an important combat support platform and the RFI for six FRA has already been issued. Presently, a SoC is under formulation and the case will be progressed as per DPP. One AEW&C aircraft has been inducted in Initial Operational Clearance (IOC) configuration. The DRDO is carrying out the development trials on the second AEW&C aircraft towards the Final Operational Clearance (FOC). The procurement case of the two additional AWACS is under consideration. Further, DRDO is planning development of two AWACS India on the Airbus A330 platform.

VAYU: *There are persistent rumours that HAL has suggested that the IAF order another batch of Sukhoi Su-30MKIs, as follow on to the 222 already contracted, the last of which are currently being manufactured at Nasik. Would these be considered as a "stop gap" to stem the erosion of fighter squadron numbers or*



The Tejas LCA (photo: HAL)

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earmarked for special operations, for instance as carriers of BrahMos supersonic missiles?

CAS : The IAF has already inducted a major portion of the contracted Su-30 MKI and delivery of the balance aircraft is ongoing. Procurement of 83 x LCA Mk 1A has been initiated to arrest the drawdown of fighter squadrons. Further, proposal to procure 114 fighter aircraft through the 'Strategic Partnership' model is being

progressed and other suitable options are also being considered to ensure that the IAF attains the authorised strength of fighter squadrons.

VAYU : *The IAF has projected a requirement for some 180 basic turbo prop trainers, but only 75 Pilatus PC-7s are presently in service. How is this shortfall being addressed and will the indigenous HAL HTT-40 be considered to fulfill the comprehensive needs ?Also,*

with HAL's Intermediate Jet Trainer (IJT) project stalled, could the Service consider a two-stage flying training pattern, with more hours on the BTA before transition to the Hawk AJT ?

CAS : The IAF is processing the procurement of additional Pilatus PC-7 Mk II under the 'Option Clause' to meet the training requirements. As far as the IJT is concerned, it had encountered design problems in the Stall and Spin testing. In view of this the IAF has, after due study, initiated 'Two Aircraft Type Flying Training' pattern. The HTT-40 is a Basic Trainer Aircraft which is still under development and the critical phase of flight test i.e Stall and Spin, is yet to begin.

VAYU : *The air transport element of the IAF is seemingly well served by various types, ranging from the heavy-lift Boeing C-17 Globemaster III to HAL-Do228 LTA. However, the Avro replacement programme seems to have stalled: could you please let our readers know whether this will be revived in the near future? As a corollary, should not the selected type be required more as an An-32 replacement?*

CAS : The Avro replacement programme is well under progress and is at the contract negotiations stage. As far as replacement of An-32 is concerned, the IAF will take a decision at an appropriate time.



Sukhoi Su-30MKI (photo: Simon Watson)

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Su-57

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THE INDIAN AIR FORCE AT 86

Sanjay Badri-Maharaj reviews the IAF's declining squadron strength



Options and Challenges

At a meeting of the Parliamentary Consultative Committee of Defence on 27 October 2017, senior officers of the Indian Air Force, including then Vice Chief of the Air Staff, Air Marshal SB Deo, were reportedly rebuked by Defence Minister Nirmala Sitharaman for “inappropriate responses” to the issue of declining squadron strength. It has been reported that the Indian Air Force virtually rehashed long standing issues of its depleting combat strength without offering any credible options. Besides being somewhat tiresome for the aforementioned Committee – having undoubtedly heard the same refrain for some time – the lack of solutions being offered is somewhat surprising considering that a number of steps are currently being considered to address the declining force levels. What is perhaps more serious is that some of these

steps are being pursued in somewhat half-hearted manner, which is not attributable to lack of budgetary support.

The IAF has recently issued another RFI for multi-role combat aircraft and the same six companies have responded with offering of the MiG-35, the Rafale, the Typhoon, the Gripen, the Lockheed-Martin F-16 and the Boeing F/A-18. Each parent company has reportedly tied-up with a local partner for the 114 aircraft in contention. Given the dreary history of fighter procurement in India, it is an open question as to whether this project too will produce any desired results.

The Current Situation

The Indian Air Force has an effective strength of 31 combat squadrons, which includes eleven squadrons of the Su-30MKI, three each of the MiG-29 and Mirage 2000

(currently undergoing an upgrade), six of the Jaguar (at the initial stage of an upgrade process) and seven of the MiG-21 variants. In addition, two upgraded MiG-27 squadrons continue to serve alongside the equivalent of half a squadron with the Tactics and Air Combat Development Establishment (TACDE). It is to be noted that early in the 21st century, peak strength of the Indian Air Force was approximately 39.5 combat squadrons, with four MiG-23BN and six MiG-27ML squadrons forming core of the strike assets and some seventeen MiG-21 FL/M/MF/bis squadrons forming bulk of the air defence force. These were complemented by Jaguar, Mirage 2000 and MiG-29 squadrons, which added a high-technology cutting edge to an otherwise mediocre inventory. Since then, the MiG-21 and MiG-27 squadrons have been in decline and the MiG-23s phased out completely.



HAL-built Sukhoi Su-30MKI

left with 30 combat squadrons by 2020 – an overall deficiency of 12 squadrons when set against its desired strength. Subsequently, one Jaguar squadron is due to be retired by 2027, which would mean an overall deficiency of 13 squadrons by 2027.

Although making up this shortfall by 2027 poses significant challenges, the IAF is not without options. It had planned to acquire an additional four squadrons of Rafales and undoubtedly would still like to do so if permitted. To compensate for this shortfall and to cater for future replacements for aircraft such as the Jaguar and eventually



MiG-21bisons at an operational fighter base

The Challenge

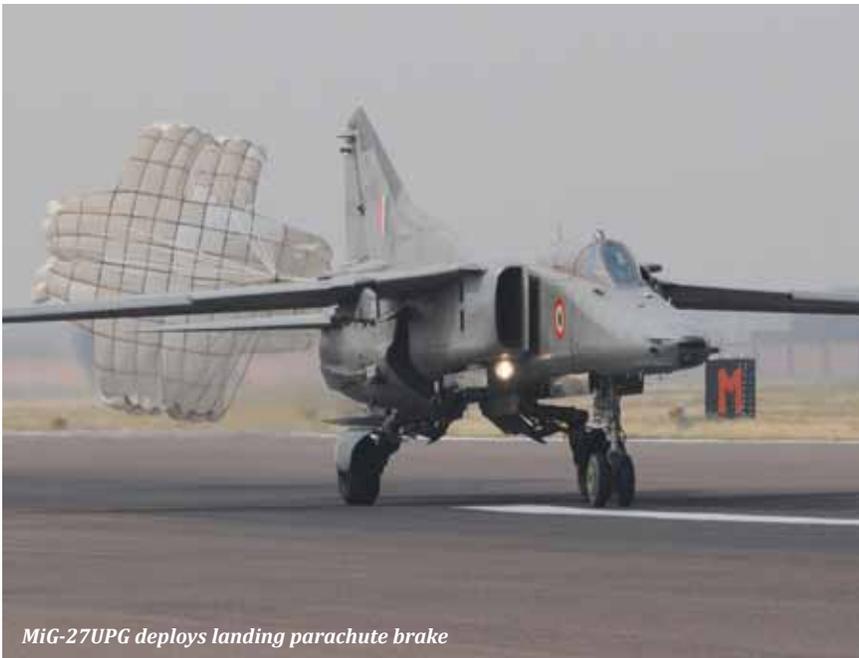
The IAF desires a strength of some 42 combat squadrons by the period 2027-32 to meet the contingencies of a two-front war. Assuming today's strength of 31 squadrons – discounting the Tejas squadron that is still to reach its desired strength – there is an immediate requirement for 11 more to meet desired force levels by 2027. Currently three more Su-30MKI and two Dassault Rafale squadrons are in the pipeline with two squadrons of Tejas Mk.1 fighters supplementing them. All these will add some seven squadrons for the IAF. However, all squadrons of MiG-21 variants and the two MiG-27UPG will be phased out by 2020. If no new aircraft are ordered, it is possible that the IAF would be

INDIAN AIR FORCE COMBAT SQUADRONS		
Type	Squadron No.	Number of squadrons
MiG-29	28, 47, 223	3
Mirage 2000H	1,7, 9	3
MiG-21Bison	3, 4, 21, 23, 51	5
MiG-21Bis	26	1
MiG-21M	35	1
MiG-27 UPG	10, 29	2
Sukhoi Su-30MKI	2, 8, 15, 20, 24, 30, 31, 102, 106, 220, 221	11 + 3 to be formed.
Jaguar	5, 6, 14, 16, 27, 224	6
Tejas LCA	45	1 (not yet fully operational)

Note: four of the above squadrons will be 'number plated' in the next year



Tejas LCA Mk.I during high altitude trials in Leh



MiG-27UPG deploys landing parachute brake

the MiG-29 and Mirage 2000, there could be two active plans to bolster force levels. One of these involves the procurement of 114 new fighters, as per the RFI. The other involves procurement of 83 LCA Mk.1A (plus 40 LCA Mk.1s).

MMRCA 2.0?

In the RFI referred to above, bulk of the fighters would be procured under the 'Make in India' programme. The F-16, the Gripen, the F/A-18 and the Rafale will sensibly compete for selection. Of note is the plan

for the aircraft to be built or assembled as part of an initiative through 'strategic partnerships' with the private sector. Lockheed-Martin has forged a partnership with Tata Advanced Systems Limited (TASL), Saab with the Adani Group, Boeing with Mahindra/HAL and Dassault with the Reliance Group. But none of these Indian partners have significant experience in manufacturing aircraft (or their avionics) to date. This may be a stumbling point as per the original MMRCA concept there was unwillingness of Dassault to be responsible for aircraft manufactured by HAL. Would it now be possible to hold OEMs responsible for aircraft manufactured by the private sector in India ?

While India's selection of new fighters will depend on capabilities offered as also technology transfer and cost-effectiveness, there is virtual equivalence of performance among the types under review. All of them are multi-role aircraft with good manoeuvrability and adequate capabilities in all aspects of air-to-air and air-to-ground combat. The choice, therefore, should be on the basis of the 'package' offered rather than individual aircraft specifications since the aircraft on offer are very similar. Yet, despite

the claims of the respective companies, establishing production lines and delivering aircraft will inevitably take their time, making quick availability of new aircraft unlikely.

The delay in decision making, now also complicated by a political row that has created much noise, but not produced proof of wrong-doing, still has the potential to stymie procurement efforts and thus preclude any timely decisions. Indeed, logically, if India is willing to eschew the 'Make in India' requirement, then the direct import of 90 additional Rafales would be the most sensible way forward. Even in terms of cost, with license-production invariably adding to unit costs, there may be advantages in this approach.

Is there a seventh contender for MMRCAs 2.0? In the shape of more Su-30MKIs? It is understood that HAL has made an offer to manufacture 40-50 more Su-30MKIs for the IAF. Given the fact that HAL has already spent vast resources and expended great efforts to indigenise the Su-30MKI and is now seeking local LRU manufacture on a large scale, the HAL-Sukhoi option may become very attractive.

The LCA : Delays and lack of focus

On 1 July 2016, No.45 Squadron inducted the first two series production Tejas Mk.1 Light Combat Aircraft. Nearly 18 months have elapsed since these first aircraft were inducted and they have since now been joined by some half dozen more. Built to IOC (Initial Operational Clearance) standards, these aircraft are the first of twenty destined for No. 45 Squadron, while

an additional 20 will be built to FOC standard, where steady but somewhat slow progress is being made.

On 12 May 2017, the Tejas Mk.1 crossed a major milestone when aircraft LSP-4 successfully fired a Derby Beyond Visual Range (BVR) air-to-air missile and this has now been cleared for integration. While gun trials were scheduled to commence last year, they have now been delayed owing to some shift in priorities. In-flight refuelling trials are currently being conducted and the FOC subsequently delayed to 2019. Meanwhile, performance of the six Tejas aircraft during Exercise *Gaganshakti* in 2018 was "most impressive" according to IAF sources.

However, of great concern is the continuing slow rate of production by Hindustan Aeronautics Limited (HAL). HAL is not yet able to meet the target of eight aircraft per year, much less the enhanced production target of 16 aircraft per year. Despite establishing a second production line using HAL's erstwhile BAE Hawk production facility, there has been very slow rate of progress in increasing production rate of the Tejas. These delays on the part of HAL have adversely impacted on unit establishment of No.45 Squadron as a viable operational entity which continues to operate with only nine aircraft.

Still, even with its limited IOC configuration, the Tejas Mk.1 offers considerable capability. Air defence is taken care of by the R-73 and Derby missiles and the aircraft is also cleared for delivery of guided and unguided air-to-ground ordnance. An armament exercise was successfully conducted by No. 45

Squadron in September-October 2017, apparently with good results, which augurs well for acceptance of the Tejas as a front-line aircraft, its performance proven during Exercise *Gaganshakti*.

On 8 November 2016, the Defence Acquisition Council (DAC) had cleared the production of 83 Tejas Mk.1A aircraft, designed to correct many of the existing shortcomings in the Mk.1 (FOC) aircraft. The Tejas Mk.1A is to be equipped with an active electronically scanned array (AESA) radar and electronic warfare systems, not integrated in the earlier LCA Mk.1s. However, DAC clearance is not the same as a contract – hardly surprising since the avionics fit still awaits decisions from HAL despite a tender being floated for AESA radars and jamming pods. On 5 October 2017, Air Chief Marshal BS Dhanoa spoke of shortly "issuing the RFP for 83 more LCAs", indicating a disconnect or at the very least poor communications between HAL and the IAF. The high cost of the Tejas Mk.1A has attracted adverse attention, some reports having it that this aircraft costs more than the twin-engined fighter, which is more than twice its size and weight!

Despite HAL being lead agency for the Tejas Mk.1A, it has not accorded this project sufficient priority despite it offering HAL the opportunity to be part of the design and development of an indigenous aircraft. The proposed LCA Mk.II, with a new GE.414 engine, is a projected development of the type, but, to date, work has been minimal. To be fair, it has been suggested that the reason for the failure to select the radar/ electronic warfare package for the Mk.1A may well be due to the preferred supplier escalating costs to an unacceptable level.

Still, the Tejas, especially its Mk.1A variant, offers an opportunity for the IAF to reduce its squadron strength shortfall. Unlike the proposed fighter procurement projects, this is an endeavour that, despite very long delays, has borne some fruit and is at the cusp of making a viable, relatively low-cost, replacement for the MiG-21 available to the Indian Air Force. If HAL were to treat the Mk.1A as priority and the IAF and ADA take the necessary steps to complete the FOC of the basic Mk.1 without further delays and shifting priorities, then there is a possibility of two Tejas Mk.1 and four Tejas Mk.1A squadrons being in service by 2025, thus filling the gap left by the



A handful of Tejas LCA Mk.1s are with No.45 Squadron

retirement of the remaining seven MiG-21 squadrons. If the LCA Mk.II is sanctioned and developed with alacrity, then the prospect for additional squadrons is in the offing, also for replacing aircraft such as the upgraded MiG-29 and some Jaguars and Mirage 2000s by 2032.

The Options

Future procurement invariably has to contend with the none-too-generous capital budget allocated to the IAF. It is public knowledge that the IAF needs to induct no fewer than 12 combat squadrons to meet its targeted strength by 2027-32. As the very first step, it is suggested that full support for the Tejas Mk.1A project be given by all stakeholders : Government, ADA, HAL and the IAF. This would make available four new squadrons to the IAF



Indian Air Force operates three squadrons of Mirage 2000s, its only true multi-role combat aircraft at present



LCA in flight display during an Aero India Show

by 2025, with the prospect of additional aircraft if the LCA Mk.II is funded and developed through necessary redesign of the airframe. Lack of focus and priority has been bane of the LCAs project in recent years rather than technical shortcomings in the aircraft or technological hurdles. HAL's somewhat lackadaisical approach on the production of Tejas Mk.1 has to end. Indeed, while the Mk.1A takes shape, more rapid manufacture by HAL could encourage the production of an additional 20 FOC Mk.1s to keep production lines going until the Mk.1A emerges. This would be a low-risk option that offers significant advantages for the IAF.



HAL-built Sukhoi Su-30MKI



The second option that needs to be considered – and with alacrity – is HAL’s offer of 40 or more Su-30MKIs. Indeed, one might wish to consider as many as 80 new aircraft plus 8 additional aircraft to compensate for attrition losses to date. As there are also plans for an upgrade of the Su-30MKI, a combination of 80 new aircraft plus upgrades would go a long way to meeting the IAF’s fighter needs well beyond 2032.

As for meeting the requirement for single-engine multi-role aircraft, the IAF and GOI may well wish to consider the procurement of second-hand Mirage 2000s from Qatar and France. This is obviously not ideal but the Mirage 2000 has served the IAF exceedingly well and in its upgraded form may serve for decades. It therefore behoves the IAF to put aside false pride and examine this option of obtaining such Mirage 2000s. This option has the

advantage of inducting aircraft familiar to IAF pilots and which already use compatible ordnance.

Above everything else, the GOI must show some courage. The current Rafale ructions appear to be bereft of sense, factual basis or logic. Timidity is the worst path to follow and runs the risk of crippling the entire arms procurement procedures. Either the GOI makes a decision quickly on a ‘Make in India’ fighter project or it abandons the entire thing and opts for the most sensible way forward : the direct import of 90 more Rafales.

The IAF is, therefore, not without options, all of which are currently at some stage of realisation. What is lacking is a sense of urgency on part of all the parties concerned. The IAF is faced with severe shortfall in its combat squadron strength by 2022. The path to avoiding this situation is open to various solutions. It is up to the Government and the IAF to take necessary decisions in timely manner and ensure that existing projects are taken to their conclusion and simultaneously new procurement endeavours are supported in expeditious manner.

Images courtesy Rafale International, Simon Watson, ADA, Angad Singh, IAF



The largest number by aircraft type serving with the IAF is the Sukhoi Su-30MKI, with 272 on order, bulk of which have been manufactured under licence by HAL at its Nasik facility

Air Vice Marshal Manmohan Bahadur on the IAF's urgent need for **AIR COMBAT ENABLERS**



Inflight refueling of an IAF A.50 AWACS

Lost in the din of public discourse about the depleting (fighter) squadron strength of the Indian Air Force, is the equally dire need of combat enablers, without which the IAF would be severely handicapped in bringing force to bear in an optimal manner.

While a Flight Refuelling Aircraft (FRA) enhances strike ranges of fighters, an Airborne Warning and Control System (AWACS) platform creates a composite air picture by fusing the radar pictures from all ground—and air—based radars with its own. This composite air picture, along with feeds from onboard communication and

electronic sensors, is used by the AWACS to direct own strikes against the adversary as also control own fighters to intercept his incoming raids.

India's indigenous AWACS programme started in the 1980s, when an Avro transport aircraft was used as a technology demonstrator test bed for development of home-grown system. After many flight tests, spread agonisingly over a decade, the prototype crashed on 11 January 1999, tragically killing all eight on board; with this ended India's brief tryst with an indigenous early warning system till the phased array balance beam Embraer145-mounted AEW&C

programme started at the beginning of this century. In the interim, the Israeli-built Phalcon system on an Il-76 (known as the A-50) was procured with the three contracted aircraft arriving between 2009 and 2011.

The Embraer AEW&C aircraft has also been inducted with an Initial Operational Clearance certificate only — implying that certain operational parameters are yet to be achieved.

The IAF, thus, still has only three Phalcon AWACS and one AEW&C system (with the second due to be delivered this year). This is inadequate considering the security threat from Pakistan and China,



Embraer 145-based AEW&C aircraft of the IAF

the latter developing its own Il-76-based KJ-2000 AWACS, of which it reportedly has four. Additionally, it has developed the KJ-200 (around 11) and KJ-500 AEW systems (around 15, including those with PLAN) based on Y-8 and Y-9 transport airframes respectively (*see separate article*). The KJ-500 uses the Y-9 turbo-prop that is bigger and has greater range than the Y-8 based ZDK-03 exported to Pakistan. The Pakistan Air Force currently operation four ZDK-03 and four Saab Erieye 2000 balance beam AEW&C aircraft.

How do the capabilities of the AWACS of the three air forces measure up? The Indian Phalcon radar system is assuredly superior in performance to the Chinese KJ-2000. The aircraft platform is also better since the IAF's Il-76 is powered by PS-90 turbo fan engines that are more powerful and fuel-efficient than PLAAF's D-30 powered Il-76-based KJ-2000.

Since both are AWACS, they are capable of data fusion from different airborne and ground-based sensors to form a composite picture of the airspace being scanned. Pakistan does not have any comparable system, though availability of limited data fusion may be inherent in its holdings.

The performance of AEW&C aircraft is speculative, but considering that turbo-prop aircraft generally cruise between 20,000 and 25,000 feet, the use of KJ-200 and KJ-500 by PLAAF over the Tibetan plateau would be sub-optimal; however, one was reportedly seen in satellite photos at Lhasa during the Doklam crisis. Thus, it would be the Il-76-based platforms of the IAF and PLAAF that would be directing the air battle, if it comes to war.

On the India-Pakistan frontier, the basing of the Saab Erieye system at Kamra in the north and the ZDK-03 at Karachi in the south perhaps are indicative of the relative quality of their capabilities : up north, the hilly terrain would require more sophisticated processing (of the Erieye?) to eliminate ground clutter while detecting low flying aircraft than in the flat desert and maritime Rajasthan and Gujarat borders.

This is so at the present, but what does the future hold? The IAF has long required two more Phalcon-equipped Il-76 AWACS, but high costs have not seen the programme go through for many years.

Then, following on to the present programme, DRDO has projected that its 'definitive' AWACS would be based on the

Airbus A330 wide-bodied aircraft, mounting its new, but underdevelopment, active phased array radar. However, this too is on hold for want of governmental clearance.

Meanwhile, China's lack of Il-76 airframes for more AWACS would soon be overcome as its Y-20 very heavy transport aircraft has entered squadron service; with the more powerful WS-20 indigenous engine soon to be certified, the Y-20 could become the mount for its AWACS which should start entering PLAAF in a decade's time. Pakistan, on the other hand, would continue to bank on its "all weather" friend and fulfil its requirements from China.

There thus is a window of around 10 years within which urgent decisions need to be taken to procure more AWACS and AEW&C aircraft for the IAF, as beyond a decade, the operational advantages that the IAF currently has could well be compromised. Air assets do not come cheap but this is a price that the nation must be willing to pay for safeguarding its sovereignty. Combat enablers are ungainly in appearance and do not have the *oomph* of fast jets but without sufficient number of the lumbering AWACS, the nation's air defence remains incomplete.

Indian Women (Air) Power

Indian military history was created on 18 June 2016 when the first three women pilots of the Indian Air Force were selected to join the fighter stream of the Service, proudly brandishing their stripes and wings at the Combined Graduation Parade at Air Force Academy, Dundigal on the outskirts of Hyderabad. With their induction into the fighter stream, India has joined a select few nations in the world that have women fighter pilots in their Air Forces. These young women, Flying Officer Avani Chaturvedi, Flying Officer Bhawana Kanth and Flying Officer Mohana Singh are India's first women jet fighter pilots.

Although women pilots have, for over 20 years, been flying fixed wing transport aircraft and helicopters of the IAF, the clearance for Indian women to fly supersonic fighter aircraft was cleared only in October 2015 by the government headed by then Defence Minister Manohar Parrikar and Air Chief Marshal Arup Raha, Chief of the Air Staff. This decision to include women in the fighter stream of the Indian Air Force was on an experimental basis. Just over two years later, on 19 February 2018, Flying Officer Avani Chaturvedi became the first woman pilot to fly a solo 30-minute sortie on a MiG-21 Bison at Air Force Station Jamnagar.

The IAF had in fact begun inducting women pilots into the flying branch in 1994 with the first batch of nine women pilots commissioned in the IAF at the Air Force



As flight cadets, they fly in HAL Kiran basic jet trainers during Stage III

Academy on 16 December 1995. Pilot Officers Priya Nalgundwar, Harita Kaur Deol, Pamela Rodrigues, Anisha Shanh, Archana Kapoor, Bindu Sebastian and Priya Paul then joined the transport (fixed wing) stream while Pilot Officers Cherly Dutta and Simran Sodhi became helicopter pilots. Till now, more than 180 women officers have been inducted as pilots in the transport and helicopter streams, even as there are around 1600 women serving in various branches of the IAF. In the Ground Duty Branches - administrative, Logistics, Accounts and Education - women have been inducted since July 1993 when the first batch of 12 cadets passed out of the AFA. While the first batch of women Aeronautical Engineers consisted of 25 (23 Electronic



Thereafter, Stage III involves flying Hawk Mk.132 advanced jet trainers

Vidyapith near Jaipur in Rajasthan. “My college had a flying club where I learnt to fly the Cessna 152. It was so thrilling! That’s when I realised I wanted to become a pilot.” What was considered as the male-only field has now been opened to women who are all geared up to fly fighter aircraft. Describing her feelings and emotions when she was preparing herself for undertaking that monumental first solo sortie, she said, “It’s a peculiar feeling when you are in the cockpit all alone and the canopy is closed. Everything else disappears. It is important to leave everything else, our worries, our joys on the ground, before flying, as I need to focus on handling the machine with safety.” Avani was also inspired by the life of Army officers in her family and was always very keen to take this legacy forward. After

and 2 Mechanical Engineers), there are increasing numbers of women engineers serving in IAF maintenance complexes across the country.

Over the past two decades and more, women pilots have certainly proved their mettle and have performed at par with their male colleagues. Although flying a fighter is far more strenuous and demanding in nature, after completing their initial flying training as cadets, these women pilots have competed with their male counterparts and were selected solely on the basis of their capability and potential.

Since it costs around Rs 15 crore to train every fighter pilot, the IAF had for long “resisted” inducting women into the combat stream. It was also felt that it would disrupt “tight fighter-flying schedules” if and when they got married and had children. Women were finally given the go ahead for the fighter jet stream after much deliberation on the pros and cons of occupational hazards, both physical and emotional that the profession entails, along with implications of surviving in war zones.

Flying Officer Avani Chaturvedi who comes from Satna in Madhya Pradesh has already become a role model for many girls across the nation. When the IAF released Chaturvedi’s photograph stepping out of her MiG, it instantly went viral on social media with a hashtag called #AvaniChaturvedi. Reacting to this trend, she opined, “It’s a privilege to be considered an inspiration!” Her fascination with flying started when she was studying for B Tech in computer sciences at Banasthali



Then Defence Minister Manohar Parrikar taking the salute at Air Force Academy Dundigal



Pilot Officer Avani Chaturvedi with her MiG-21bison



Flying Officer Mohana Singh and the MiG-21bison

she first got to fly a Cessna 152 while at college, her ambition to become an IAF pilot became steadfast.

Echoing similar emotions, her course mate Flying Officer Bhawana Kanth stated, "Being a happy-go-lucky bike riding Flying Officer, I am now also flying the MiG-21! Once I cleared the Type 69 (MiG-21 operational conversion trainer), I knew that I would soon move to the MiG-21 Bison and my solo sortie." On 16 March 2018, she became the second woman pilot to fly this fighter type solo at Air Force Station Ambala.

Flying Officer Bhawana Kanth grew up in Rajasthan and during the initial stage of her career, she was undecided between joining TATA Consultancy Services (since

she had graduated in medical electronic engineering at BMS College of Engineering, Bengaluru) or make it through the vigorous medical tests required for joining the IAF. "A big risk at the time, and an even bigger transition...I know," she smiled. "Our training was all about rewiring our brains to think like a cadet and act like a soldier." Did she always want to be a fighter pilot? "I never overthink. To me, it was just a fantasy. As a child, I remember seeing an aircraft and then just wanted to fly it. And here I am," she said.

Flying Officer Mohana Singh, the third woman fighter pilot of the IAF, comes from a flying family background with both her father and grandfather having served in the IAF. Mohana who grew up in

various IAF stations including Jamnagar, Amritsar, Gwalior and Delhi was always eager to wear the IAF's uniform, "I have always been fascinated by the uniform," she recalls. Being a graduate in electronics while communications, she started working with Cognizant in Pune while concurrently preparing herself for the AFCAT, the common entrance exam to enter the IAF. Although she cleared the written test five times, she could not clear the SSB (Service Selection Board) interview. Finally, a month before her 23rd birthday (also the age-limit to enlist in the flying branch of the IAF). So she took time off from her day job, applied once again through a fast-track selection drive in Pune - and made it! "When we do a sortie, we are essentially signing up for the aircraft. It's my responsibility to land it back safely," said Mohana Singh. "When I am up in the sky, all I am thinking about is doing my best for the country." Has her grandfather seen her in uniform? "Oh yes," she beams. "It was a proud moment for him."

Hailing from relatively small towns, these three girls have scripted history and set an example for others to follow. They chased their dreams and made sure that these were realised. "When we joined the academy, the option to join the fighter stream just wasn't available. It was only when we were in our first stage of flight training that the decision for women to apply for the fighter stream came about. After becoming a combat pilot in the Indian Air Force and flying supersonic aircraft, I realise there is nothing which a woman cannot do. Those who possess physical and mental fitness, be they men or women, they can take up combat roles. So the best thing is that we have started somewhere," reflects Avani Chaturvedi.

On 16 December 2017, two more women officers, Pratibha and Shivangi Singh were commissioned into the fighter stream of the Indian Air Force. These two officers were among the 15 women officers who had joined the cadre of Air Force Officers at the Combined Graduation Parade of Pilots and Ground Duty Officers held at Air Force Academy (AFA), Dundigal. Recently, Meghana Shanbough became yet another woman to be inducted as a fighter pilot. Amongst the 113 flight cadets, who graduated as Flying Officers of the Indian Air Force on 16 June 2018, Shanbough has become the first woman fighter pilot from South India.

The flying training

Recounting her training days, Flying Officer Bhawana Kanth recalled, "Having cleared my spin solo check in the Kiran, it was now time for me to enter the aircraft into a spin and recover it by myself. At 20,000 feet, some doubts started creeping in: what if the aircraft doesn't recover? I then told myself that if I don't do it now, I will always be afraid of it. So I spun the

more due to a number of solos ahead of me in the taxi sequence. With the sun beating down on us, finally, I reached the take off point and took permission for the same. As I started rolling for take-off, nearing the first marker, I heard the canopy warning audio coming on."

At first, Chaturvedi was confused at the emerging situation. However, the training which she had undergone helped her reach

Diwali). This was what I used to gaze from the ground with joy when I was a child."

Though night flying looks scintillating, it requires several skills to overcome some demons. On her first night flying experience, Flying Officer Mohana Singh recalled "I was on my first sector solo sortie by night on the Kiran trainer. During the sortie, there was some lightning close to me which alarmed me for a moment. I immediately initiated



Strapping in to fly the Kiran Mk.II

aircraft and to my surprise, the spin was more vicious or so it seemed. But the fighter pilot in me took over and I told myself: come what may I will recover. And all the recovery actions grilled in us during the training came out correctly and promptly the aircraft recovered from the spin - as did my confidence."

Being selected for the flying stream and subsequently for fighter flying, Flying Officer Avani Chaturvedi got the opportunity to fly two different aircraft types, one very modern and advanced, and the other a stalwart trainer, with the best of instructors. Recollecting how this high quality training helped her to avoid a ruinous accident, she stated, "I was proceeding for my second solo sortie for the day. The time spent on ground was

the right decision almost immediately. She aborted the take-off and took all necessary actions to stop the aircraft safely while on the runway. "Later, when I was having lunch that afternoon, I reflected back on the incident. That day I realised how a split second decision can get the situation under control - or out of it. Had I delayed my actions that day of aborting the take-off or got airborne with the canopy open, the results could have been catastrophic."

Recalling her night flying experience, Flying Officer Mohana Singh, recalled "Night flying was a new experience but was the best thing that ever happened after flying the Kiran trainer. I remember the small puffs of beautiful fire crackers bursting 1000 feet below me on my first take off in the night flying phase (it was

rejoin and during the descent, encountered clouds. I faced difficulty in differentiating between the stars in the dark sky above and the small clusters of light on the dark ground below."

Mohana had realised that she was not able to maintain connection between the instruments and visual indications of aircraft attitude. In this tricky situation, she trusted her training skills and the instructions of her instructor, "No unnecessary head movements, switch over to instruments, trust your instruments". These words echoed in her head and she disregarded all visual indications, continued descent to a lower altitude relying totally on her instruments. Once she had visual with the ground became oriented and recovered the aircraft safely.

Nitin Konde



The first three IAF women fighter pilots with MiG-21bis as backdrop

It is interesting to quote from Vayu’s issue VI 1996 in the article ‘Women in Blue’.

While chivalry is very much alive in the IAF, we are informed that no concessions and lowering of testing standards are permitted at Selection Boards. At the Academy, women cadets have to undergo all the rigours of training to which their male colleagues are subjected in order to achieve the desired degree of physical endurance, toughness and intellectual sturdiness, qualities that stand them in good stead in their career.

*In terms of fleet strength and man power, the IAF ranks high among the Air Forces in the world. By deciding to induct women, it has taken another lead amongst the Asian air arms and follows the example of the USAF and RAF and a few other European air forces. At IAF operational bases today, one comes across women pilots carrying out pre-dawn and after-dusk sorties in their transport aircraft and helicopters, engineering officers engaged in the onerous task of prompt turn rounds, and administrators, logistic officers and other women officers in the beehive of incessant activity. But perhaps, one will have to wait longer to meet a gum-chewing, sure-footed women fighter pilot, helmet in hands, rushing with the sense of urgency towards her Mirage 2000H or MiG-29 for an operational sortie. Fighter flying continues to be a male domain and one cannot, at the moment, foresee a female Air Chief Marshal commanding the Indian Air Force in the near Future! **[All changed now!]***

The attitude of the IAF towards women inducted into the force was succinctly summed up by Air Marshal TRJ Usman, Vice Chief of the Air Staff, who told Vayu in 1996 that “Women in the IAF are not to be employed for adornment at the Command and Air Headquarters. They should be posted at operational bases. That is where they belong.”

Women in Indian Armed Forces	The World Over
Women allowed to join armed forces as officers from the early 1990s	Combat roles open for women in many countries. But most do not allow in direct/close combat roles
Overall there are 64,770 officers in India’s 1.4 million strong armed forces	
There are 1610 women in the IAF, 1,561 in the Army and 489 in the Navy	No combat exclusion policies for women in several countries including Canada, Denmark, Norway and Portugal
Women can serve only for 14/15 years as short service commission officers. Permanent commission being considered	Women fighter pilots serve in many countries including the US, UK, Russia, Israel, China, Turkey and Pakistan
“Allowed” to fly fighters on an experimental basis. 6 inducted so far	
Not allowed on warships or submarines as well as in combat arms such as infantry, armoured corps and artillery	Malaysia, Sri Lanka and Bangladesh deploy women on warships
The IAF has around 100 women helicopter and transport aircraft pilots	
The Coast Guard and Navy have women flying in MR aircraft and helicopters as pilots and observers	Women in the US also serve on board front line warships

Women fighter pilots in India's neighbourhood



The Pakistan Air Force has inducted women fighter pilots into service since 2006, and has gradually increased the number to some 19. The senior most is Flight Lieutenant Ayesha Farooq from Hasilpur, Bahawalpur District (*in picture*), the first to be cleared for frontline service in 2013. She has served with No.20 Squadron equipped with the Chinese-made Chengdu J-7 fighter.

Sadly, one of the first PAF's women pilots, Flying Officer Marium Mukhtar met with a fatal accident near Mianwali while in a two-seat FT-7PG operational conversion trainer.

The Chinese PLA Air Force had introduced fighter flying for women in 2005, receiving an overwhelming number of applications, a total of 35 being selected from 200,000 applications of which 16 graduated to become fighter pilots. There are an increasing number of women fighter pilots now in the PLA Air Force, some of them serving with J-10 multirole fighter squadrons.

Boeing : “Partnering the Indian Air Force’s modernisation drive”

For over 75 years of its 100-year legacy, Boeing has been a strong partner of the Indian armed forces. Boeing’s relationship with India on the defence front goes back to the 1940s, when the Indian Air Force inducted two Boeing aircraft: the T-6 Texan, or Harvard made by North American Aviation, and the C-47 Skytrain military transport, a military variant of the DC-3, made by McDonnell Douglas.

Boeing has been steadily building upon this foundation and has been continuously supporting the mission readiness and modernisation of India’s defence forces.

The pace and depth of our engagement through products, services and partnerships have increased in recent years. We have expanded our global supply-chain footprint through collaboration; grown our partnerships in research, technology and academia to leverage India’s strengths and we consistently demonstrated our commitment to the success of ‘Make in India.’

Boeing has been providing robust services and support packages to the Indian Air Force’s C-17 Globemaster III fleet and the Indian Navy’s P-8I force. The GISP “virtual fleet” arrangement ensures mission readiness by providing all C-17 customers access to an extensive support network for worldwide parts availability and economies of scale. The C-17 GISP is a system-level partnership, where the customer pays for readiness, rather than specific parts or services.

Boeing also offers fully integrated training systems for C-17 aircrews in India at the C-17 Training Centre, which was inaugurated in July 2016, in collaboration with Mahindra Defence Systems (MDS). The C-17 training facility, is a full-service location offering instruction to aircrews that operate the 10 C-17 airlifters that Boeing delivered to India in 2014. The centre features a complete training solution for C-17 pilots and loadmasters with advanced simulation, courseware and computer-based training to practice the complete range of tasks required for military airlift operations and humanitarian missions, along with other scenarios such as aerial refueling and emergency procedures. The Centre has completed over 1700 hours of training and has maintained a serviceability state of 100 percent.



Boeing’s C-17 Globemaster III in IAF service

In June 2017, Boeing was also awarded a \$131 million interim support agreement contract in support of the Indian Navy’s fleet of P-8I aircraft. In January this year, the Defence Acquisitions Council cleared the procurement of a training solution from Boeing to support the Indian Navy’s P-8I crews. The training solution is customised for the Indian Navy and will offer an integrated learning approach that will combine classroom education with simulation. Dedicated support will be provided to maintain the simulators and courseware, ensuring maximum availability.

The indigenous, ground-based training system for P-8I will allow Indian Navy crews to increase proficiency in a shorter time, without using finite fatigue life or putting the aircraft at risk during a training scenario.

The approximately 60,000 sq. ft. large Training Support & Data Handling (TSDH) Centre will be setup at INS *Rajali* to provide training to aircrew and maintenance technicians. The TSDH at INS *Rajali* will comprise of an Operational Flight Trainer, a Weapons Tactics Trainer, an Ordnance Load Trainer, a Virtual Maintenance Trainer, a Data Management & Training Console, five Electronic Aircrew Classroom and an Electronic Maintenance Classroom.

In addition to continued support to present aircraft, Boeing sees a significant opportunity in the future

to support the Apache and Chinook helicopters in the coming years. We have been providing simulation based training solutions to the US Army and other international customers who operate the AH-64 Apache and CH-47 Chinook worldwide.

A future blueprint for partnership

Boeing has had a presence in India for more than seven decades and is committed to expanding that partnership. Our F/A-18 *Super Hornet India* proposal envisages the production of Super Hornets in India, in partnership with MDS and Hindustan Aeronautics Limited, further developing India’s aerospace ecosystem.

With designed-in stealth and robust capability growth plan, the Super Hornet is the best aircraft to function as a roadmap to get to India’s Advanced Medium Combat Aircraft (AMCA) programme. Boeing proposes to work closely with Indian aerospace industry to ensure they have the very latest technologies, applying lessons

learned from the current Super Hornet production line and bringing in its global scale and expertise to Indian aerospace.

The advanced technologies and combat tested multi-role capabilities of the Super Hornet, make it a perfect fit for the needs of the Indian armed forces, outpacing threats that will emerge, even decades from now.



Pratyush Kumar, President, Boeing India

Thales : “Supporting India’s ambitions”



India is one of the fastest growing economies in the world and has extraordinary potential across sectors, providing plenty of opportunities for business partnerships and growth. The country has the potential to emerge as a global platform for the defence sector in the research, manufacturing and supply chain ecosystems. Being one of the world’s largest defence spenders with an estimated spend of over two percent share of its GDP, the country is increasing its efforts to boost indigenous research, development and manufacturing along with facilitating global defence players to invest in India.

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

Since 1953, Thales has been helping India achieve its ambitions. Being a long-standing partner for over 65 years, the company has contributed in building the nation and solidifying its foundations by sharing its niche technologies and expertise in Defence, Transport and Aerospace markets.

Thales has built up a reputation of being a trusted partner to all three branches of the Indian armed forces

by providing them with its flagship solutions ranging from combat aircraft, air defence systems, sensors (ground, ship-borne and airborne), tactical communication and military avionics, among others.

For instance, the Indian Air Force (IAF) has relied on Thales for enhancing the technical-operational capabilities of its Mirage 2000 fleet. In July 2011, Thales and Dassault Aviation signed a contract for the upgrade of this fleet. The teams from Thales and Dassault Aviation have been supporting Hindustan Aeronautics Limited in upgrading the Mirage 2000 inventory as per the contract. Another milestone for Thales is selection of the Rafale by the IAF as it provides a number of state-of-the-art equipment and systems on-board this omnirole combat aircraft.

Thales touches the lives of billions of Indians each day by sharing its technological expertise with indigenous partners. The organisation’s local partnerships and joint ventures (JVs) reinforce the company’s commitment to the country.

We have been working closely with Hindustan Aeronautics Limited (HAL) for over five decades and have Joint Ventures (JVs) with Bharat Electronics Ltd, Samtel, L&T Technology Services and formed one recently with Reliance Aerostructure. We have also signed an MoU with Bharat Dynamics Limited to explore the transfer of technology of the STARStreak missile capability to India.

India is rich in engineering, human talent and certainly a source of competitiveness for our Group to grow. We have strong workforce of over 1,500 people working both directly as well as indirectly through the supply chain partnerships built with Indian companies. Our plan is to triple this number in the next two-three years as we are looking forward to developing capabilities for local engineering, procuring from India and strengthening our local partnerships.

Our objective is to make in India as well as export from India. We will continue to support the Indian defence sector including the Indian Air Force to realise the ‘Make in India’ initiative and its aim of self-reliance.



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



MBDA's Muscles for the Indian Air Force

That MBDA has been delivering “battle-winning capabilities” to the Indian Air Force and collaborating with Indian industry for over 50 years is well known. Throughout this period, there have been two guiding principles, which are to provide the very best technologies to the Indian Air Force and to work in true partnership in support of the Indian Defence Industry.

The Indian Air Force is on the cusp of receiving the ramjet-powered and network-enabled Meteor beyond visual range air-to-air missile from MBDA (*image above*). This next generation missile is widely recognised as a game changer for air combat and will provide the Indian Air Force with unrivalled air dominance capability. Key to this is Meteor’s throttleable ramjet engine, active radar seeker and datalink that combine to provide unmatched end-game speed and manoeuvrability at greatly extended ranges, resulting in its all-important ‘No-Escape Zone’ being more than three times greater than any other existing or planned BVR weapons.

The Indian Air Force’s inventory also includes the MICA and ASRAAM within visual range (or close air combat) missiles. MICA is arguably the only missile in the world featuring two interoperable seekers (active radar and imaging infrared) to cover

the spectrum from close-in dogfight to long beyond visual range. Its ability to fly out to BVR in passive mode before the seeker locks on in the final stages of the end game has earned it the nickname ‘silent killer’ as the target has little time to react or to deploy effective counter-measures. Possessing both infrared and radar-guided versions also makes MICA highly countermeasure resistant and therefore highly effective.

Selected by the IAF to equip its Jaguar strike aircraft is the ASRAAM, which provides a step-change in air combat performance. With its large rocket motor and clean aerodynamic design, ASRAAM gives high kinematic capability that delivers superior end-game performance for within visual range air combat. MBDA’s ASRAAM missiles have significantly enhanced battle capability of the IAF’s Jaguar giving them unrivalled combat ability.

Of equal importance is industrial partnership. As an example, MBDA has been assisting the development of sovereign Indian missile industry, both public and private, for over 50 years. MBDA has formed partnership with Indian industry to produce over 40,000



missiles of the MILAN family, a noteworthy and on-going programme. MBDA continues to deepen its relationship with Indian industry, as seen by the recent formation of a joint venture with long-standing partner Larsen & Toubro to deliver a series of important missile programmes under the ‘Make in India’ initiatives.

Then, the Mistral ATAM system which has been successfully integrated on HAL’s Advanced Light Helicopter (ALH) and final integration is being done on the Light Combat Helicopter (LCH). Utilisation of the Mistral missile on India’s helicopter platforms also provides a key for their use in a ground based VSHORAD role, wherein the missile is fully compliant with India’s requirements.

MBDA has an excellent track record providing both operational and industrial capabilities in partnership with the Indian Air Force and India’s defence industry. The strength of these two pillars make it a long-term true partnership, and one that should only continue to get stronger.

Loïc Piedevache, Country Head, India, MBDA Group

“FAR VISION” FOR THE DRAGON



China's Indigenous AWACS Projects

In modern air warfare, the monitoring of real time enemy air activity is vital. The AWACS (Airborne Warning and Control System) provides the air force commander an ability to monitor enemy air activity from low to high levels, deep inside hostile territory. This is essentially having an ADDC (Air Defence Direction Centre) in the air with a clear view of what is happening at long distances, thus meeting the age old requirement of commanders to know what is happening on “other side of the hill”. Such early warning from an AWACS gives definite advantage to the commander in air battle management and guiding of friendly fighters to intercept enemy aircraft well in time before the weapon release line. The AWACS has changed the way war is conducted. As a force multiplier, AWACS aircraft have become so critical in modern war that the side which does not have

them will suffer from huge asymmetry right from the preparatory stage to start of a shooting war.

The Chinese realised the importance of such platforms and started work on their own AWACS in 1969, and after long years of effort, developed their own indigenous fleet of AWACS/AEW aircraft consisting of four Kong Jing-2000 (KJ-2000), four KJ-200 and two KJ-500 with the PLAAF (People's Liberation Army Air Force). The PLA Navy (PLAN) has its own fleet of 14 AEW&C aircraft on the Y-8/y-9 platform. In addition, China has inducted a new indigenous heavy transport aircraft, Y-20, and while it has not yet been announced, it can be speculated that this will become the platform for future AWACS to replace the KJ-2000. This article traces the history and development of China's AWACS/AEW projects and briefly discusses AWACS limitations for PLAAF against the IAF.

First attempts

China's first attempt to develop an indigenous AWACS goes back to 1969. This project, called the Kong Jing-1 (KJ-1), was undertaken on a 1950s-designed Soviet Tu-4 piston-engined bomber (B-29 copy). The project was not successful since China did not have the technology, at that time, to overcome ground clutter problems. In airborne radar, the signal return from ground echoes is stronger than the target signal and the radar system must be designed to identify targets through such clutter. The Chinese were unable to do this and consequently the project was abandoned.

Since then, China had been, trying to purchase—or develop—an airborne warning and control capability. In the 1970s, relations between China and USA improved with the express intention of jointly opposing the then Soviet Union as their common enemy. Taking advantage of



The KJ-1 was China's first attempt to make an AWACS, based on the Soviet Tu-4 platform, in 1969

this situation, China began exploring the purchase of E-3A Sentry AWACS from USA which subject was taken up by the Chinese during President Reagan's visit to China in 1984 but nothing came of it. The Chinese having failed in their attempts to get E-3A, looked for AWACS from Russia, UK and Israel. The Russian system with an Il-76 airframe was rejected as its radar performance did not meet their requirements.

The Chinese also negotiated with a number of Western firms to jointly produce an indigenous AWACS. These were Westinghouse (USA), Marconi (UK), Thorn-EMI (UK), and Dornier GmbH (the latter being the main integrator for the then NATO AWACS programme) but there was no fruitful outcome. There was limited success with the development of a maritime AEW by China's Harbin Aircraft Corporation which developed an AEW prototype by installing the Thorn-EMI Skymaster radar on the Y-12 Turbo Panda. A small number of these aircraft were used for maritime surveillance, but did not qualify as an AWACS. The Chinese wanted to purchase the Nimrod AEW from Britain but this project was cancelled. Thus, being left with little choice, the Chinese decided to develop an AWACS in collaboration with Israel.

In 1992, China and Israel signed an initial agreement for joint development of such an AWACS. After four years, in 1996, both sides signed an official contract which defined cooperation in development of an AWACS based on the Il-76 platform. Initially, Israel provided modified Phalcon radar with antennas mounted on the

aircraft fuselage and nose dome. However, this configuration could only provide 260° coverage which was not acceptable to the Chinese. The Chinese wanted full 360° coverage and suggested stationary radome on top of the fuselage with phased array planar antenna technology. At this time, the Israeli plan to sell such AWACS technology ran into rough weather in 2000 when the Americans forced the Israelis to cancel the programme. The Americans did not want AWACS technology to fall in the hands of the Chinese, and saw this deal as a threat to Taiwan and to US interests in the region.

The Chinese were obviously angered with this development but even more determined to have an AWACS. The cancellation of the deal speeded up China's

indigenous efforts. Although the Israelis had removed all the Phalcon radar components, the Chinese still managed to get some of the technology, including the T/R (transmit/receive) module and secondly the production process for manufacturing the composite material radome with proper specifications to control the quality. Israel certainly helped China to design the radar structure, which knowledge, it seems, enabled the Chinese to have developed the AWACS in short time frame. According to Wang Xiaomo, Executive Vice President of China Academy of Electronics and Information Technology and a leading designer of China's AWACS project, it was "only five years to manufacture China's own AEW&C system." The Chinese also overcame other technological challenges in the development phase like design of electromagnetic compatibility to avoid radio interference with other systems in the aircraft, data link with ground stations and target pick up in dense clutter environment over mountainous-terrain.

The Kong Jing KJ-2000

In November 2003, China produced their first AWACS radar on the Il-76 platform, the aircraft called the Kong Jing-2000 (KJ-2000) which entered service with PLAAF in 2007. The Chinese AWACS uses active electronically scanned array (AESA) technology which is more advanced than America's and Russia's AWACS. The radar on the American E-3C and Russian Beriev A-50U carry out 360 degree azimuth scanning using older technology



The KJ-2000, with F-7 as tail chase aircraft



China's KJ-2000 AWACS, on an Il-76 platform. Note the triangle drawn on the lower side of the rotodome indicating the three sided planar array antenna inside. (Photo: Chinamil.com.cn)

by mechanically rotating the antenna. On the other hand, in the KJ-2000 there is no rotating antenna. The scanning in azimuth and elevation is done electronically. Three flat aerials are mounted in the radome on top of the fuselage in an equilateral triangle. Each aerial electronically scans 120 degrees, thus covering full 360 degrees in azimuth. While not many details of the KJ-2000 are available, the radar can be expected to have a maximum detection range of 400 km.

The Il-76 platform was chosen because Western countries were not willing to provide any platform and no comparable indigenous aircraft was available. As per Dr Wang Xiaomo, procuring additional Il-76 platforms also became a problem and, in an interview said, "Russia doesn't want to sell China Il-76 after the birth of KJ-2000." Thus the KJ-2000 programme ran into delays and at present only four have entered service in PLAAF. To overcome these problems, Chinese developed another smaller version of the AWACS called KJ-200, based on the Y-8 (Chinese copy of Russian An-12) platform.

The KJ-200

The KJ-200 with its balance beam-like radar on the dorsal fully of the Yun-8 airframe is a smaller AEW system which supplements the larger AWACS. The planar antenna on the fuselage is dual side linear-shape active electronically scanned array (AESA) radar similar to the Swedish Ericsson PS-890 Erieye. This shape of the antenna cannot provide coverage in front over the nose or in the rear, but will provide broadside 120° coverage on each side. The limitation of 120° coverage is because the highest value, which can be achieved for the Field of View (FOV) of a planar phased array antenna, is 120°, which limitation is with the Erieye as well.

The KJ-200 project was started in 2005 but received a major setback in 2006 when it crashed in Guande County, in Anhui province of China, killing all 40 personnel, on board. One of the worst disasters in the history of PLAAF but this did not deter the Chinese from continuing development work in this field. The KJ-200 finally made its debut in 2009 and was then inducted in the PLAAF and PLAN.



China's KJ-200 AEW based on the Y-8 platform

The KJ-500

The KJ-500 is based on China's Y-9 transport aircraft, manufactured by Shaanxi Aircraft Company. The Y-9, which is an improved version of the Y-8, is a four engined turboprop powered by improved Chinese WJ-6C turboprop engines with

There is no rotating antenna in the KJ-500, however the Chinese have claimed that KJ-500 has a phased array antenna with AESA technology similar to the KJ-2000 AWACS. The scanning in azimuth and elevation is done electronically as in the KJ-2000. Since the Y-9 is a turboprop

AEW&C aircraft which China exported to Pakistan Air Force in 2011. The Chinese have not revealed much about the KJ-500 but its maximum detection range can be estimated to be around 300 km.

The ZDK-03 Karakoram Eagle

The ZDK-03 Karakoram Eagle is based on a Y-8F600 airframe and built by Shaanxi Aircraft Corporation. The radar and on board systems were developed by China Electronics Technology Corporation (CETC).

In 2008, the Pakistan Air Force signed a contract with China for four ZDK-03 AEW&C systems to be built as per specifications and requirements of the PAF. The first aircraft was rolled out for testing in November 2010 and delivery of the first aircraft was in October 2011. The ZDK-03 radar has an electronically steered antenna based on the KJ-2000 radar which electronically scans the airspace 360 degrees in azimuth. The radar antenna is installed in a radome mounted on the dorsal side of the airframe. The ZDK-03's radar performance is expected to be better than that on the KJ-200, but since both the ZDK-03 and KJ-200 are mounted on turboprop aircraft, are likely to operate at lower altitudes.



China has developed another AWACS, the KJ-500, intended to replace the KJ-200 AEW

a maximum level speed of 660 kmph and cruising speed of 550 kmph. It has more advanced avionics and has a glass cockpit.

aircraft, its cruising altitude is lower than the jet engined KJ-2000. The KJ-500 looks similar to the ZDK-03 Karakoram Eagle



Pakistan Air Force Shaanxi ZDK-03 (Y-8) in flight over Manora, near Karachi

An analysis

Against the PLAAF's ten AWACS/AEW aircraft, the IAF has three A.50 ('Phalcon') AWACS with two more on order. In addition the IAF inducted one Embraer EMB-145 AEW&C in February 2017 and has two more in the offing. The rectangular dual side airborne radar on this aircraft has been developed indigenously by the DRDO and is similar to China's KJ-200.

Like the Chinese KJ-2000, IAF AWACS are also based on the Il-76/A-50EI airframe but the Phalcon radar is from Israel. The airborne radar in IAF and Chinese AWACS is of similar design both being active electronically scanned array (AESA) radars.

Both the PLAAF and IAF will face AWACS performance limitations in the high mountains since undulations in the terrain will create detection problems for aircraft masked behind hills. The laws of physics are universally applicable and requirement of line-of-sight conditions has to be met for radar pick up.

In this scenario, the PLAAF AWACS aircraft will have to get airborne from air bases at lower heights, which are far from the India-China border, which will reduce their time on station. The AWACS will operate at least 150 km from the border in own territory for safety so that it can slide

back and safely when under threat from IAF fighters. Another limitation of deploying the AWACS in the mountains is that because of terrain masking, AWACS would not pick up any attackers heading towards it. The attackers can thus easily plan for a sneak attack taking advantage of hill shadows in the area.

China's future AWACS plans

China certainly has major long term plans for its future AWACS, which are going to be cost competitive since major development work has already been done. Dr Wang states that the "KJ-2000 costs billions of RMB and some new systems will require even more..." Being a large country, China will need more AEW&C systems. We can develop lots of variants or upgraded version from present systems." With such competitive pricing, China will surely also capture the export market for an AWACS. Many countries which are deterred by the high costs and political strings attached to an American or European AWACS – indeed or a Russian or Israeli system – may find the competitive Chinese option.

China's other plans are to develop conformal phased array airborne radar, which will be a major leap forward in advanced technologies for this ambitious nation.

China now has a new heavy transport aircraft, the immensely more capable Y-20, recently inducted in the PLAAF in June 2016. Once these aircraft are available in sufficient numbers, they could certainly also be developed as an AWACS platform. Designed and built by Xian Aircraft Corporation (XAC), the Y-20 first flew in January 2013 and was on public display during the Zhuhai Air Show in-2014.

Y-20 is powered by four Russian Saturn D-30KP2 turbofan engines (same engine as on the Il-76), and has a maximum payload capacity of 66 which places it between the larger Boeing C-17 Globemaster (77t) and the Il-76 (40t). Wen Wei Po, a Chinese military analyst, has said "China's air force needs at least 100 large transport aircraft of the Y-20 class to enhance its global power projection ability. Another 90 are expected to be modified into tanker aircraft, electronic warfare aircraft and early warning and control aircraft." Another report by China's NDU (National Defence University) has recommended a massive fleet of 400 Y-20s for the PLAAF which will include variants for various roles. In the coming years, the Y-20 will certainly give a major boost for the PLAAF's strategic and early warning capabilities.

Gp Capt Ravinder Singh Chhatwal (retd.)



China's Y-20 heavy transport aircraft during the flying display at Zhuhai Air Show in November 2014

Boeing-Saab T-X selected by USAF



On 27 September 2018, the US Air Force awarded Boeing US\$ 9.2 billion for the development of a new advanced pilot training system for future generations of fighter and bomber pilots. Boeing is the designated prime contractor for the *Advanced Pilot Training Programme* (T-X) with Saab as a risk-sharing partner in development of the aircraft. The initial US\$ 813 million contract to Boeing covers the engineering and manufacturing development (EMD) of the first five aircraft and seven simulators.

“This selection allows our two companies to deliver on a commitment we jointly made nearly five years ago,” stated Håkan Buskhe, President and CEO of Saab. “It is a major accomplishment for our partnership with Boeing and our joint team, and I look forward to delivering the first trainer aircraft to the US Air Force.”

Leanne Caret, President and CEO, Boeing Defence, Space & Security, said, “This announcement is the culmination of years of unwavering focus by the Boeing and Saab team...It is a direct result of our joint investment in developing a system centered on the unique requirements of the US Air Force. We expect T-X to be a franchise programme for much of this century.”

The United States Air Force T-X programme was established in 2003 to select a successor for lead-in fighter training (LIFT) to the Northrop T-38 Talon, which was completing a half century of USAF service. Some 350 aircraft are to be ordered, but further purchases could push the overall purchase to over 1,000 numbers. The original in-service date for the T-X was slated as 2017, one of the driving requirements for the new trainer (T-X) being to prepare pilots for increased complexity in some areas, particularly information management, which are a part of fifth generation jet fighters like the F-22 Raptor and the F-35 Lightning II.



The USAF's Air Education and Training Command (AETC) had developed requirements for the T-38 replacement, which trainer was originally expected to enter service around 2020. However, constraints on budgets and the need to fund higher priority modernisation projects pushed IOC of the T-X to “fiscal year 2023 or 2024”, the T-X being pushed back to support “higher Air Force priorities”.

The new aircraft (and its simulation system) was required to fulfill several training roles: basic aircraft control, airmanship, formation, instrument and navigation, advanced air-to-air, advanced air-to-ground, and advanced crew/cockpit resource management. Initially, the T-X was expected to fulfill five advanced training roles: sustained

high-G operations at 6.5–7.5g, aerial refueling, night vision imaging systems operations, air-to-air intercepts, and data-link operations. The 2009 Request for Information (RFI) had included that some tasks, such as aerial refueling, would be performed in the simulator and not on the aircraft itself. Aircraft availability was to be 80%, “but not higher, as that would drive costs much higher, and the programme focussed on life-cycle costs rather than just initial purchase price.”

Several competitors submitted existing aircraft types, while others proposed all new designs including Leonardo S.p.A. with the M-346-based T-100, Korea Aerospace Industries/Lockheed Martin with the T-50 Golden Eagle, Sierra Nevada Corporation/ Turkish Aerospace Industries with a new design, apart from the Boeing and Saab's clean sheet T-X.

On 6 December 2013, Boeing and Saab Group had announced they would team up to offer a new aircraft for the T-X programme. On 22 August 2016, first pictures of the T-X concept were revealed as a single-engine, twin-tail aircraft and maiden flight of the prototype took place on 20 December 2016.

Russia re-orders Su-30SMs



President of United Aircraft Corporation and Irkut Corporation Yury Slyusar has announced imminent new contracts with the Russian Ministry of Defence for supply of more Su-30SM fighters. “This year, we plan to sign a new contract, which will ensure the loading of the Irkutsk Aviation Plant in the coming years at the level of 12-14 aircraft per year,” stated Y Slyusar and noted that the Su-30 family has good prospects in the foreign market as well: “the aircraft have been sold to a large number of countries and, we hope, will be sold again.” The Su-30SM multirole fighter is the further development of Su-30MKI and Su-30MKM combat aircraft, operating with the Air Forces of India, Algeria and Malaysia. The Su-30SM fighter itself is operated by the Russian Aerospace Forces and Navy, as well as by Kazakhstan.

Initial batch of Su-57s



As reported in *Vayu Issue IV/2018*, United Aircraft Corporation (UAC) and the Russian defence ministry are to shortly formalise contracts for a production batch of Su-57 fighters. “Regular supplies will start next year,” stated UAC President Yuri Slyusar. The Russian fifth-generation Su-57 fighter features stealth technology with the broad use of composite materials, is capable

of maintaining supersonic cruising speed and is furnished with the most advanced onboard radio-electronic equipment, including a powerful onboard computer (the so-called electronic second pilot) and some other innovations, including conformal ordnance. This batch will comprise 12 Su-57 aircraft.

‘Mass Production’ of J-20 stealth fighter



There are reports that, with installation of a new and improved engine, China’s J-20 stealth fighter will go into series production by end 2018. The WS-15 engine features cutting-edge single-crystal turbine blades and has been in development for several years, but the Chinese have struggled to get this into series production. Problems, which largely related to blades overheating at extreme speeds, have reportedly been resolved during ground tests and trial flights. “The WS-15 is expected to be ready for widespread installation in the series J-20s by the end of this year. Although some minor problems remained, these should be resolved once the engine had been more extensively run in the aircraft”, according to sources.

Azerbaijan interest in JF-17 Thunder fighters

Co-operation between Azerbaijan and Pakistan in the defence Carea has steadily been strengthened with secondment of the latter’s personnel for training and maintenance of Azerbaijani



helicopters (*also see article in this Issue*). However, the most significant interest is in Pakistani-built JF-17 Thunders, which was first officially expressed in 2016 and followed up the following year during the IDEAS exhibition in Karachi. It is understood that the JF-17 is regarded as a most cost-effective supplement to the MiG-29s in service in Azerbaijan, which is one of the several countries seriously considering procurement of the JF-17. Others include Myanmar and Nigeria, which are the first export customers, the others reportedly being Algeria, Azerbaijan, Bangladesh, Egypt, Iran, Lebanon, Malaysia, Morocco, Sri Lanka and Sudan.

Bahraini F-16s from South Carolina



Bahrain has awarded Lockheed Martin a \$1.12bn contract to build 16 F-16 Block 70 fighters for Bahrain, which marks debut sale of the latest F-16 Block 70 variant and represents the initial F-16 production programme in Greenville, South Carolina. The F-16 Block 70 (also referred to as the F-16V) features advanced avionics, including a Northrop Grumman AN/APG-83 active electronically scanned array (AESA) radar, a modernised cockpit, advanced weapons, conformal fuel tanks, an automatic ground collision avoidance system, an advanced engine and an extended structural service life of 12,000 hours. In September 2017, the US State Department approved *Foreign Military Sale* to Bahrain of 19 new-build F-16Vs, plus upgrades to its existing 20 F-16C/D Block 40 aircraft to bring them up to the same configuration.

Saab to upgrade Thai Air Command and Control System



Saab is to upgrade Thailand's National Air Command and Control System which is based on Saab's 9AIR C4I. The system is a core part of Thailand's network centric air defence capability which also includes Saab's Gripen fighter, Erieye airborne early warning system and tactical data links. 9AIR C4I is Saab's tactical air operations command and control system, which provides situational awareness and complete control of weapons, sensors and communications.

Final Omani Typhoons



BAE Systems has completed delivery of the final pair of Royal Air Force of Oman (RAFO) Typhoons, the last two aircraft having been flown from Warton in Lancashire on 4 June on their delivery in flight. The RAFO have ordered 12 Typhoons – nine single-seat and three twin-seat aircraft, deliveries beginning on 19 June 2017.

Sniper pods for Qatari Rafales



The Qatar Emiri Air Force (QEAF) has selected the Lockheed Martin AN/AAQ-33 Sniper Advanced Targeting Pod (ATP) to equip its forthcoming Rafale fighters, 36 of which are on order. It is contracted to provide the QEAF with pods, spares and deployment support for the Rafale, the tenth type to fly with the Sniper ATP. Integration efforts are ongoing, with flight tests of the pod on the Rafale in progress.

Bangladesh orders more K-8Ws



It is reported that the Bangladesh Air Force (BAF, *Bangladesh Biman Bahini*) has ordered an additional batch of K-8W Karakoram jet trainers from China's Hongdu Aviation Industrial Group. The exact number of aircraft involved in the new deal was not revealed, but government sources said that the country planned to buy seven more of the type in two batches, in fiscal years 2017-18 and 2018-19. The BAF currently has eight of the type in service, the first four having been delivered in September 2014, operated by No.15 Squadron at Jessore.

Philippines to acquire more FA-50PHs



The Philippine government reportedly wants to acquire additional FA-50PH light combat/trainers from Korea Aerospace Industries (KAI). Philippines Secretary of National Defence Lorenzana stated that there are plans to acquire around 12 more jets after their deployment on anti-militant operations last year. In March 2014, the Philippines signed a \$417.95m contract for 12 FA-50PHs, delivered between December 2015 and May 2017.

A400M refuels Rafale

The Rafale has been "successfully" mid-air refueled by an A400M. The flight test campaign was conducted by the DGA's *Essais en Vol* (DGA EV) flight test centre with the support of the



French Air Force. During the tests, the Rafale was refueled by an A400M from Escadron de Transport 1/61 'Touraine' throughout its flight envelope, the tests conducted day and night, including with night-vision goggles.

Iran's indigenous fighters



On 22 August, Iran unveiled its indigenously developed fighter called *Kowsar*, meaning 'a river in paradise'. The aircraft has marked resemblance to the US-origin Northrop F-5F Tiger, which the Iranian Air Force have operated for several decades. Local media however stated that this "fourth-generation fighter jet had been designed and manufactured solely by Iranian military experts." The Kowsar has the same twin-seat cockpit and is single engine with a single tail fin unlike the experimental Qaher F-313 rolled out in Iran some years back (*see image below*).



ASRAAM-armed F-35B Lightning in maiden flight



An F-35 Lightning of No.17 Squadron, Royal Air Force has recently flown from Edwards Air Force base in southern California, the first with ASRAAM air-to-air missiles.

Saab system for RAF Typhoons



Saab has received an order from BAE Systems for development of a new pyrotechnic smart self-protection system for the Eurofighter Typhoon aircraft “to defeat radar–and IR–guided threats.” The order is part of a framework agreement with BAE Systems consisting of development, production, support and future sales of the Smart Dispenser System (SDS), a pyrotechnic smart self-protection system for the Royal Air Force’s (RAF) Typhoons. SDS is the latest generation in Saab’s BOP family of pyrotechnic countermeasure dispensers. BOP is in-service on fighters and other combat aircraft types, and has been proven over several decades including on active operations.

First A330 MRTT for Singapore

Airbus has delivered the first A330 Multi Role Tanker Transport (MRTT) to the Republic of Singapore Air Force, the aircraft making its first official public appearance on 1 September 2018 at the RSAF’s 50th anniversary parade. “The new-generation A330 MRTT extends the endurance of the RSAF’s fighter aircraft and ensures the service’s continued capability to provide air-to-air refuelling support. It also provides the RSAF with greater cargo



and passenger transport capabilities, and enhances its ability to contribute to international humanitarian assistance and disaster relief (HADR) and peace support operations,” as per a RSAF spokesperson.

Indonesia to buy five C-130Js

The Government of Indonesia intends to buy five new C-130J tactical transports. The *Tentara Nasional Indonesia Angkatan Udara* (TNI-AU, Indonesian Air Force) currently operates a diverse fleet of C-130B/H models and earlier this year, the service announced it would acquire two A400Ms to support the civil government in transporting supplies between the western and eastern regions of the archipelago.

Third E-2D for JASDF

The US Department of Defence has awarded Northrop Grumman Systems a contract to supply a third E-2D Advanced Hawkeye for the Japan Air Self-Defence Force (JASDF). The \$153.2m modification to a previous Foreign Military Sales deal involves that construction of the aircraft be completed by March 2020. In November 2015, Northrop was awarded a \$151.3m contract for the first JASDF E-2D, due for completion in March this year. A second order was placed for a single aircraft in August 2016.

Additional TC-90s for Philippines

The Japanese Government has offered to supply additional Beech TC-90 King Air patrol aircraft to the Philippine Navy. The JMSDF has to date provided five TC-90s to the Philippine



Navy, the first two of which arrived in March 2017, followed by the remaining three on 26 March 2018. After modification and repainting, the first two were inducted into service in November 2017 and March 2018. The third TC-90 was formally inducted into the Naval Air Group (NAG) during a ceremony on 29 May at the NAG headquarters at Naval Base Heracleo Alano, Sangley Point, Cavite City.

NC-212i deliveries to Vietnam



Two NC-212i transports have been recently delivered to the Vietnam People's Air Force's (VPAF's) 918th Transport Regiment 'Hong Ha' at Gia Lam air base, Hanoi after a ferry flight from the factory in Bandung, Indonesia. It is not known when Vietnam ordered these two aircraft, as there has been no official contract announcement. Three of the earlier Airbus Military C212-400s are also in service with the Vietnamese Maritime Police, and a third NC-212i was reportedly delivered in June.

Nigerian Dornier 228s refurbished

The Nigerian Air Force (NAF) has extensively refurbished three Dornier 228s acquired from the Nigerian Immigration Service (NIS) Air Border Patrol Unit. The aircraft were earlier deemed "repairable" by NAF engineers at 431 Engineering Group, NAF Base Kaduna. The two aircraft being made operational are awaiting spares and other equipment so mandatory outstanding scheduled inspections can be completed before they re-enter service.



Pakistan orders 30 T129 ATAKs



The Pakistan Government has signed a contract with Turkish Aerospace Industries to buy 30 T129 ATAK helicopters, including a comprehensive package for logistics, ammunition, spares, ground support equipment and training reportedly valued at around US\$1.5 billion. The T129 ATAK, has "unique survivability features, new generation engine, state-of-the-art avionics and asymmetric weapon delivery capability, which provides highly mobile and lethal attack capability against personnel, ground and air targets." This is regarded as the largest single export success in the history of the Turkish defence industry.

Morocco evaluates Turkish T129

The Government of Morocco are possibly also procuring Turkish Aerospace Industries (TAI) T129 ATAK helicopters. It is reported that a Moroccan military delegation recently visited TAI to begin negotiations about the possible acquisition, but it is as yet unknown how many T129s Morocco is planning to purchase.

IAI Heron TP for Germany

Airbus Defence and Space and the German *Bundesamt für Ausrüstung, Informationstechnik und Nutzung der Bundeswehr* have signed an €895m (\$1.05bn) contract to provide the



Bundeswehr with Israel Aerospace Industries (IAI) Heron TP unmanned aerial systems (UAS). This comprises five Heron TP air vehicles, four sets of ground segments, training, and all system operational services – under a leasing arrangement. The new drones will be equipped for reconnaissance, but are capable of carrying weapons. The project requires two years to set up, followed by an operational phase lasting a further seven years, after which, the Heron TP is due to be replaced by a new European UAS.

German rotary wing training

In mid-June 2018, Airbus Helicopters handed over the fifth and final H135 for the Bundeswehr (German Armed Forces), who are leasing the helicopters for pilot conversion training. The five H135s join the 14 EC135T1s, in service for training with the Bundeswehr's *Internationales Hubschrauberausbildungszentrum* (International Helicopter Training Centre) at Bückeburg since 2000.

'Modernised' Mi-26T2V in flight



Prototype of the newly developed Mi-26T2V helicopter recently made its maiden flight at the flight-test centre of Rostvertol company of Russian Helicopters Holding (part of Rostec State Corporation). "The State Armament Programme for 2018-2027 envisages providing the armed forces with this version of heavy-lift helicopters. I am convinced that the Mi-26T2 helicopter will be a sought-after machine in Russia and in Asia, Africa and the Middle East," stated Anatoly Serdyukov, Industrial Director, Aviation Cluster of Rostec State Corporation.

Mi-28NE Night Hunter unveiled



Russian Helicopters has unveiled a new version of its Mi-28NE attack helicopter, the 'Night Hunter' with the new Khryzantema-M anti-tank missile and a dual guidance system. Using this missile will increase the tank-type target engagement range to 10 km. The helicopter is also fitted with the Ataka guided missiles with laser guidance, apart from 500 kg bombs.

Chinese amphibian AG600 tests



China's indigenously-developed massive amphibious aircraft, the CAG600, has completed trial ground flights and entered a new test phase with operations on water. The AG600, named 'Kunlong,' made a trial flight from Zhuhai, in southern China's Guangdong Province to Jingmen, a city in central China's Hubei Province. The aircraft has carried out a series of tests since its maiden flight last December and will now conduct such tests and trial flights in Jingmen. The AG600's main role is maritime rescue, fighting forest fires and marine monitoring.

CMV-22B for US Navy

Bell Boeing has been awarded a \$1.4bn order for CMV-22B carrier on-board delivery (COD) aircraft for the US Navy. The contract includes a total of 58 tiltrotors for the US Navy, US Marine Corps, US Air Force and for Japan, and modifies a previous advance acquisition contract. This includes manufacture and delivery of 39 CMV-22Bs for the US Navy, 14 MV-22Bs for the USMC, one CV-22B for the USAF and four MV-22Bs for Japan. The US Navy will use its new CMV-22Bs to transport personnel and cargo from shore to aircraft carriers, eventually replacing the C-2 Greyhound.



Turkey's STM to supply corvettes to Pakistan



Defence engineering firm *Savunma Teknolojileri Mühendislik ve Ticaret* (STM) and other Turkish companies have won a tender to provide four *Ada* (MILGEM)-class corvettes to the Pakistan Navy. “This will be largest single export [deal] in the history of the Turkish defence industry,” stated Defence Minister Nurettin Canikli on 5 July. The main contractor is the Military Plants and Shipyard Management Joint Stock Company (ASFAT AS), which is part of the Turkish Ministry of National Defence. Canikli said that Ankara and Islamabad have agreed to build two of the warships at Turkey’s Istanbul Shipyard while the remaining two will be constructed in Pakistan’s port city of Karachi.

The *Ada*-class has a fully-loaded displacement of 2,032 tonnes, a draught of 3.6 m, and a beam of 14.4 m. Armament on the 99 m-long platforms includes a 76mm naval gun, four (two twin) 324 mm torpedo tubes, two quadruple launchers for anti-ship missiles, and one RIM-116 close-in weapon system. Each corvette can accommodate 93 crew, with spare berths for 13, and an S-70B Seahawk sized helicopter on the flight deck.

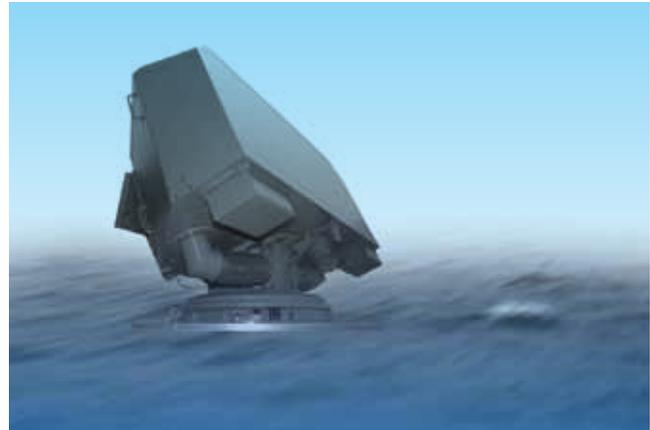
SEA 5000 Future Frigates for Royal Australian Navy

Australia is to acquire nine high-end anti-submarine warfare frigates from end of the next decade under a deal with BAE Systems worth US \$26 billion. Referred to as the *Global Combat Ship–Australia*, or GCS-A, the new ships will be known as the *Hunter*-class in Royal Australian Navy service and will replace



the Navy’s existing *Anzac*-class frigates and will be built in South Australia. A version of BAE Systems’ *City*-class Type 26 ASW frigate, now under construction for the British Royal Navy, will also be acquired under Australia’s SEA 5000 Phase 1 project, known as the *Future Frigate Project*.

Saab Sea Giraffe Naval Radars



Saab has recently signed a contract for delivery of the multi-role naval radar Sea Giraffe AMB and associated equipment including spare parts, the work for the initial phase of the contract to be carried out during the period of 2018-2019. The contract also includes options for 10 additional Sea Giraffe AMBs.

Saab’s NG anti-ship missile system RBS15 Gungnir

The RBS15 missile family is evolving a design “that unlocks a new level of future growth potential.” The option to engage targets from the air, as well as from land and sea gives the ability to perform coordinated attacks, with multiple missiles, against a wide range of naval and land-based targets thereby increasing mission flexibility. “Whilst RBS15 Mk3 delivers the capabilities that forces require today, the RBS15 Gungnir also integrates with pre-existing RBS15 infrastructure to fulfil tomorrow’s defence requirements. The system is backwards compatible, so an investment in the Mk3 opens a smooth path to transition into Gungnir in the future.”



RBS15 German Navy's K130

Saab has received an order from its German partner Diehl Defence for the Anti-Ship Missile RBS15 Mk3 ship system, with deliveries to take place during 2019-2024. The German Navy will buy additional K130 class ships and this order comprises onboard ship systems for these.

Black Shark advanced torpedo



Leonardo will supply Black Shark Advanced (BSA) torpedoes and associated logistic support services to equip the Italian Navy's U212A 2nd Series submarines. The Black Shark Advanced is an evolution of the Black Shark heavy torpedo, already acquired by many countries including Chile, Indonesia, Malaysia, Portugal and Singapore. This latest version integrates an innovative energy production section that can be optimised, according to the use of the system, for training or operational purposes. In the operational configuration, the BSA is equipped with an innovative battery that ensures an increase in capabilities and performance.

Safran electro optic sensors for the SEA1180

Safran Electronics & Defense Australasia will provide electro optic sensors as part of the situational awareness system for the 12 Offshore Patrol Vessels (OPVs) SEA1180 Project. Developed and produced by Safran Electronics & Defense, Vigy Engage is a light, panoramic, multi-sensor shipboard electro optic system, including a cooled infrared imager, video channels and a laser rangefinder. Employing advanced stabilisation techniques, it provides clear images day or night, including in rough seas and at high speed.



S-400s for Turkey



The first S-400 strategic surface-to-air missile systems will be delivered to Turkey in 2019, according to Viktor Kladov, spokesman for Rostec. Requests have been made by the Turkish government to speed up production and delivery of the S-400 systems even as US State Department's spokesperson Heather Nauert warned that Washington "was against its allies purchasing Russian S-400 air defence systems" and that the White House would "potentially impose sanctions in the likelihood that such transactions occur".

Meanwhile, Almaz-Antey has delivered additional S-400 Triumph air defence missile systems to the Russian forces "ahead of schedule". The S-400 can engage targets at a distance of 400 km and at an altitude of up to 30 km. Turkey and China have acquired S-400 air defence missile systems, aside from Russia while a contract on the delivery of S-400 systems to India "is expected shortly".

Carl-Gustaf M4 for Australian Army

Saab has received an order from the Australian Army for its new Carl-Gustaf M4 multi-role weapon system, being the sixth customer for the system since its launch in late 2014. "The new version retains all the effectiveness and versatility of the proven Carl-Gustaf system while introducing a range of major enhancements." The Carl-Gustaf has seen extensive operational service with the Australian Army and inducting the M4 weapon represents the continued modernisation of this weapon.



US Government order Carl-Gustaf ammunition

Saab has received an ammunition order from the Department of Defence for the Carl-Gustaf man-portable weapon system valued at approximately \$16 million, the 84-mm recoilless rifle system known in the US as M3 MAAWS (multi-role, anti-armour, anti-personnel weapon system). In addition to the munition types already in service with operators of the system, DoD has also placed their first order for the MT 756 (Multi Target) round, designed for combat in urban areas and for incapacitating an enemy under cover inside a building.

TROPHY Active Protection Systems for US Army



Leonardo DRS, Inc. will provide the US Army with TROPHY active protection systems for its Abrams tanks in support of immediate operational requirements. Developed by long-time partner Rafael Advanced Defense Systems Ltd. of Israel and currently fielding some 1,000 systems to all major Israeli ground combat platforms, TROPHY provides combat-proven protection against anti-armour rocket and missile threats.

KMW and Nexter's Main Ground Combat System

The French and the German governments have announced joint development of a new Main Ground Combat System and a new Common Indirect Fire System by KMW and Nexter. "This is a significant step forward in the defence cooperation between the two countries and in Europe." This close cooperation was the key motivation for the foundation of KNDS in 2015, wherein Nexter and KMW cooperate as national system houses for land systems.

Controp's EO/IR systems

Controp has won a \$31 million contract to supply EO/IR systems and services for an "Asian defence customer" over a 20-month period. Hagay Azani, CEO & President of Controp, stated: "This

contract positions Controp as a leading supplier of Electro-optical InfraRed systems in Asia, proving that our systems are advanced in their field and provide innovative, comprehensive solutions for important defence programmes."

RADA's MHR radars selected for US Army IM-SHORAD



RADA's Multi-mission Hemispheric Radar (MHR) has been down-selected as part of the Leonardo DRS mission equipment package (MEP) solution for the US Army's Initial Maneuver-Short Range Air Defence (IM-SHORAD) capability. DRS is in negotiations with the US Army for this prototype contract. The MHR radar, when integrated on the Stryker A1 platform, meets the Army's on-board sensor requirements and provides 360 degree aerial surveillance to detect and track UAS, rotary wing and fixed wing threats at desired ranges. Each IM-SHORAD MEP includes four MHR radars to provide persistent surveillance, execute at short-halts and operate on-the-move. This accelerated IM-SHORAD prototype effort requires systems be delivered in early 2019. Nine prototype systems will inform a future production decision for more than 140 systems beginning in 2020.

Oshkosh JLTVs for US Army

The US Army has placed a \$484 million order for 1,574 Joint Light Tactical Vehicles (JLTV) and associated installed and packaged kits from Oshkosh Defence. "This latest order follows



completion of the Multiservice Operational Test and Evaluation (MOT&E) conducted by the US Army and Marine Corps and further demonstrates that the JLTV programme continues to be a top modernisation priority for our armed services,” said George Mansfield, Vice President and General Manager of Joint Programs at Oshkosh Defence. “The JLTV is ready to support our troops, and we look forward to getting more soldiers and Marines into this extremely mobile, protected, and proven next-generation light tactical vehicle.”

Raytheon developing US Army Laser



Raytheon is developing a 100 kW class laser weapon system preliminary design for integration onboard the Family of Medium Tactical Vehicles as part of the US Army’s High Energy Laser Tactical Vehicle Demonstration programme contract. HEL TVD, a US Army science and technology demonstration programme, is part of the Army’s Indirect Fire Protection Capability Increment 2 initiative. “Multi-spectral targeting sensors, fiber-combined lasers, power and thermal sub-systems are incorporated in a single package. This system is being designed to knock out rockets, artillery or mortar fire, or small drones,” stated Roy Azevedo, vice president of Intelligence, Reconnaissance and Surveillance Systems at Raytheon’s Space and Airborne Systems business unit

LM’s JAGM achieves Milestone C



Lockheed Martin’s Joint Air-to-Ground Missile (JAGM) system has passed its Defence Acquisition Board review and achieved *Milestone C*. The signed Acquisition Decision Memorandum approves the JAGM system to enter into Low-Rate Initial Production (LRIP). JAGM is a multi-sensor air-to-ground missile that is the successor to the combat proven HELLFIRE Romeo and HELLFIRE Longbow missiles. Backward compatible with all rotary wing and fixed wing platforms that fire the HELLFIRE family of missiles, JAGM employs a multi-mode guidance section that offers enhanced performance on the battlefield. The multimode seeker combines improved Semi-Active Laser and millimeter wave radar sensors providing precision strike and fire-and-forget capability against stationary and moving land and maritime targets in adverse weather and obscured battlefield conditions.

Rolls-Royce engines for Boeing MQ-25s



Rolls-Royce engines have been selected by Boeing to power the US Navy’s new MQ-25 Stingray aircraft, which will provide unmanned, carrier-based air-to-air refuelling. The US Navy has awarded the MQ-25A engineering and manufacturing contract to Boeing to provide four aircraft. The MQ-25 is designed to provide the US Navy with a much-needed refuelling capability and extend the range of combat aircraft from carriers. Each MQ-25 aircraft will be powered by a single Rolls-Royce AE 3007N engine, manufactured in Indianapolis, US. The AE 3007N, the latest variant of the Rolls-Royce AE family of engines, will provide excess of 10,000 lbs of thrust and additional electrical power to the aircraft.

Israel’s Rampage missile

Israeli Military Industries Systems (IMI Systems) and Israel Aerospace Industries (IAI) have unveiled their jointly developed air-to-surface missile known as Rampage, a “long-range assault missile.” The supersonic weapon is an air-launched derivative of the IMI systems ground-launched Extended Range Artillery (EXTRA) guided artillery rocket and is intended for use against heavily defended targets including command centres, airfields, maintenance centres, infrastructure and high-value field targets. The Rampage has been tested to clear it for air launch and while there are still more operational employment tests to be undertaken, the weapon is considered ready for production for an “undisclosed customer.”

Airbus Perlan Mission II glider breaks record



The Airbus Perlan Mission II glider has set a new world altitude record for a glider, soaring the engineless Perlan 2 to 76,124 feet and in the process collecting vital data on flight performance, weather and the atmosphere. This particular flight by pilots Jim Payne and Tim Gardner surpasses even the maximum recorded altitude in level flight of the US Air Force's iconic U-2 Dragon Lady reconnaissance aircraft: 73,737 feet, flown by pilot Jerry Hoyt on 17 April 1989.

First ANA Airbus A380



The first Airbus A380 for All Nippon Airways (ANA) has rolled out of the final assembly line (FAL) in Toulouse, the aircraft moved to an outside station for various ground tests. It will then be transferred to the Airbus facilities in Hamburg for cabin installation and painting. ANA placed a firm order of three A380s in 2016, becoming the first customer for the 'superjumbo' in Japan. The first delivery is scheduled early in 2019, and the A380 will initially be operated on the popular Tokyo-Honolulu route. Airbus has so far delivered 229 A380s, with the aircraft now in service with 14 airlines worldwide.

First Boeing 777X revealed



On 9 September 2018, Boeing "rolled out" the first Boeing 777X-9 aircraft which is to be used for static testing, this non-flying 777X will be used to verify design strength. The second airframe is well-advanced on the production line, to be ready for first flight in March 2019. There are two versions of the Boeing 777X family: the -9 and longer range -8. The 777-9X offers seating for more than 400 passengers and has a range of more than 8,200 nautical miles (15,185 km), will have the lowest operating cost per seat of any commercial aircraft. The 777-8X will seat 350 passengers and offer a range capability of more than 9,300 nautical miles (17,220 km).

Bamboo Airways to acquire 20 Boeing 787s



Bamboo Airways have announced a commitment for 20 Boeing 787-9 Dreamliners worth \$5.6 billion. As part of the agreement, Bamboo Airways completed the deposit requirement in mid-June to reserve the 20 airliners, which are tentatively scheduled for delivering from April 2020 through 2021.

Bombardier CRJ900s for Uganda



After 15 years without having “a national airline,” Uganda is reviving its ‘flag bearer’ by ordering four new CRJ900 aircraft from Bombardier Commercial Aircraft and has signed a firm contract for four new CRJ900 regional jets. Uganda Airlines will operate the CRJ900 in dual-class configuration with 76 seats, including 12 in first class configuration.

IndiGo receives the 1,000th built ATR 72



ATR has delivered its 1,000th ATR 72 to Indian domestic carrier, IndiGo, the ATR 72 programme having been launched in January 1986 with first delivery to the Finnish carrier Finnair in October 1989. The programme began with the ATR 72-200 (187 deliveries) before introduction of the ATR 72-500 (365 deliveries) in 1997 with American Eagle. The most recent model, the ATR 72-600 (448 deliveries), was launched in 2009 and entered into service with Royal Air Maroc in 2011.

Second MC-21 aircraft in new colours

On 11 July 2018, the second MC-21-300 test aircraft flew from the airfield of the Irkutsk Aviation Plant, painted in a new livery, in a flight lasting 3 hours 7 minutes. The flight tasks



included checking of aircraft systems and taking aerodynamic corrections for the air-speed parameters measurement system. The white colour was selected to demonstrate high quality of airframe surface and precision of joints of fuselage sections. Development and manufacturing of MC-21 aircraft relies on the integrated employment of digital technologies, manufacturing of airframe’s units and its assembly performed at the new automated assembly line. Laser measurement systems and computer-controlled positioners (movable supports to ensure 3-D moves of units) provide minimal errors in joining airframe parts.

Arresting Hook and HDD for MQ-25

General Atomics Aeronautical Systems have concluded performance testing of the arresting hook *Hold Down Damper* (HDD) for its proposed MQ-25 unmanned aerial refueling



aircraft intended for the US Navy, GA-ASI collaborating with GKN Aerospace's Fokker business unit in Helmond, Netherlands. The test simulated dynamic conditions providing performance characteristics of the HDD, such as damping, spring rate and pressure control functionality. The test results validate modeling tools that provide quick reaction capability for completing the design and manufacturing during the Engineering and Manufacturing Development (EMD) contract.

GA-ASI Guardian demonstration flights



According to General Atomics Aeronautical Systems, the Guardian Remotely Piloted Aircraft (RPA) has concluded the first large-scale demonstration flights in Japan, which are intended "to promote the civil and scientific applications of the RPA". The Guardian RPA configuration has an endurance of more than 20 hours and has been operated by the United States Department of Customs and Border Protection since 2008. The aircraft's sensors included a long-range maritime surface-search radar, stabilised optical and infrared video cameras, plus an active collision-avoidance system, including a short range air-to-air radar.

Mission payloads on GA-ASI's MQ-25



General Atomics Aeronautical Systems, have test flown the MQ-25A surrogate aircraft – a Predator C Avenger – outfitted with a representative set of mission payloads, including Electro-optical/Infrared (EO/IR), Electronic Support Measures (ESM), Automatic Identification System (AIS) and Mission Processing. MQ-25 is the US Navy's unmanned aerial refueling aircraft programme. During the flight, the MQ-25A surrogate's payloads were remotely commanded by GA-ASI's extensible payload command and control (C2) system. The team will leverage this software to enhance the Navy's Unmanned Carrier Aviation Mission Control System (UMCS).

Leonardo and General Atomics in sensor cooperation

Leonardo and General Atomics Aeronautical Systems have signed an agreement to integrate the former's electronic warfare surveillance system onto the GA-ASI MQ-9B, without the need for external pod(s). SAGE, which will be available in 2019, is to be offered off-the-shelf and integrated into the airframe as an available baseline configuration for MQ-9B operators of the Sky Guardian and maritime surveillance Sea Guardian. SAGE is a digital ELINT (Electronic Intelligence) sensor with a built-in 360° RWR (radar-warning receiver) capability. It is used to detect, identify and geo-locate Radio Frequency (RF) signals, such as radar fire-control systems, and can alert operators to potential threats to the aircraft.

BAE Electronic Warfare Systems

BAE Systems is integrating its advanced Compass Call electronic warfare (EW) systems with modern aircraft to significantly improve mission effectiveness. Work is beginning for transition of its advanced Compass Call electronic warfare system from aging EC-130H aircraft to a more modern and capable platform that will significantly improve mission effectiveness. As mission system integrator for the programme, BAE Systems is working with L3 Technologies to transition the Compass Call capabilities onto an EC-37B aircraft, a special-mission Gulfstream G550 that meets Air Force requirements. "This new platform will provide combatant commanders with improved stand-off jamming capability and flexibility to counter sophisticated communications and radar threats."



Boeing's Low-Cost Smart Bomb

The game-changing JDAM

This year marks 20th anniversary of the day in 1998 when Boeing delivered the first production model of the satellite-guided Joint Direct Attack Munition to the US Air Force. JDAM ('j-dam') destined to transform the way in which the Air Force, Navy and Marine Corps conducted air strikes against ground targets, because it delivered pinpoint accuracy regardless of weather conditions.

Precision bombing had been a dream of aviators since the first bombers were built. If pilots could accurately attack key bottlenecks in an enemy's military apparatus and war economy, the adversary would be crippled and likely defeated. Unintended damage of civilian targets would be minimised. Precision bombing thus had the potential to be decisive, efficient and even humane compared to previous ways of waging war.

But hitting targets accurately turned out to be much harder in the early days than planners had expected. In one particularly disappointing episode during World

War Two, 835 bomber sorties against a single Japanese factory produced only 4% damage while sacrificing 40 bombers. The inability to hit point targets in Europe and Japan led the US Air Force, which was then part of the Army, to turn to indiscriminate area bombing of cities.

The advent of nuclear weapons made the newly independent Air Force (in 1948) first among equals in military councils after the war, but its leaders never gave up their dream of pinpoint accuracy that could minimise "collateral damage" in wartime. During the 1970s and 1980s, the necessary technology finally became available in the form of missile seekers that enabled munitions to home in on the image of a target or laser light reflected from an illuminator.

The first generation of precision-guided munitions, popularly known as smart bombs, were highly accurate – if atmospheric conditions permitted them

to be. However, as the US Air Force and Navy discovered in *Operation Desert Storm* in 1991, when there was rain or dust or smoke around a target, seekers had trouble finding it. A smart bomb that could work regardless of weather conditions or local obscurants like smoke was needed.

That was the genesis of JDAM. Designers at Boeing devised an inexpensive way of providing free-fall gravity bombs with guidance from Global Positioning System satellites. Employing simple control surfaces and "strakes" along the side of the bombs that permitted them to glide, the Boeing technology converted 'dumb' weapons into smart munitions. As long as the location of a target was known, JDAM could hit within a few yards of it even in a sandstorm.



A US Navy F/A-18 Super Hornet equipped with multiple JDAMs. Each of the weapons shown can be used to destroy a different target with high accuracy and at low cost

The new system debuted in the Balkan air war of 1999, with stealthy B-2 bombers delivering 650 JDAMs against targets in Serbia during long flights from their home base in Missouri – as chance would have it, the same state where Boeing manufactures the JDAM guidance package. Having already trained for years on a precursor to JDAM, Air Force pilots were able to hit 87% of intended targets in that initial air campaign.

That's remarkable performance in a place where poor weather conditions can degrade the performance of other types of smart weapons. JDAM quickly became the weapon of choice for US pilots, and warfighters in two dozen allied countries. Boeing would go on to produce hundreds of thousands of JDAM guidance packages for 500-pound, 1000-pound and 2000-pound bombs. Its plant in St. Charles, Mo. currently produces over a hundred per day in two shifts.

Today, all of the heavy bombers and strike fighters in America's joint force are equipped to deliver JDAMs, including the tri-service F-35. It's a safe bet the next-generation B-21 bomber will be too. Expectations for what strike warfare can accomplish have been genuinely transformed. Rather than sending half a dozen fighters to destroy one target, the military services can dispatch one fighter to destroy half a dozen targets – in a single sortie, and at low cost.

Even with the price of the bomb itself included, a JDAM guidance system costs barely \$30,000, whereas the value of the target it destroys with pinpoint accuracy may be over a hundred times that amount (or more). JDAM thus delivers an unusually favorable 'cost-exchange' ratio to US warfighters, compared with weapons like cruise missiles that might cost the better part of a million dollars.

And because glide weapons can be released miles from their targets, pilots are safer.

Smart weapons have been in the news lately, and not in a good way. Dozens of civilians in Yemen may have been killed by forces using a different type of American-supplied smart bomb. However, neither the makers of smart bombs nor their products are responsible for this tragedy. Precision-guided munitions enable pilots to tailor their strike tactics in order to minimise unnecessary damage, so in principle they can greatly reduce the number of innocent deaths in wartime.

It is up to the militaries employing them to use the technology in responsible manner. War will never be a humane undertaking, but thousands of noncombatants are alive today in places like Afghanistan, Iraq and Serbia who might have been sacrificed if war had been waged the old way. Weapons like Boeing's Joint Direct Attack Munition have opened a new chapter in the history of strike warfare – a chapter in which warring nations have fewer excuses for being inhumane.

Loren Thompson

Eurofighter and the Future Concept ‘Tempest’



Artists' impression of the Eurofighter and Tempest in close formation

Eurofighter Typhoons from various European air forces stood alongside the UK's future combat air strategy concept model 'Tempest' during the *2018 Belgian Air Force Days* at Kleine-Brogel. A Eurofighter 'show of force' formed a static display line-up on September 8-9, in addition to a spectacular air display from the Royal Air Force's Eurofighter Display Pilot, Flt Lt Jim Peterson, demonstrating the power, speed and impressive agility of this multi-role combat aircraft. Displayed there was a full scale model of the 'Tempest' the future combat aircraft system concept developed by the UK Ministry of Defence with industrial partners.

First revealed at the 2018 Farnborough International Air Show, Tempest illustrates some of the concepts and capabilities the UK expects to see on a future system, concepts which will continue to evolve. The UK's Combat Air Strategy, launched alongside the Tempest model at the Farnborough show, stresses a clear and critical role for Eurofighter as the primary route to developing the next generation of world-leading capabilities and technologies.

The Eurofighter, which is being considered as part of the Belgian F-16 replacement programme, is "the true European solution." With 500 aircraft already operating amongst Belgium's immediate neighbours, it is the backbone

of European combat air power, and will remain the continent's dominant combat aircraft for decades to come and will provide the technology development path through to European next generation programmes.

As Alison Rose, UK's Ambassador to Belgium, stated: "We are delighted that both the Tempest model and Eurofighter aircraft were here at Kleine-Brogel as part of this year's Belgian Air Force Days event. Eurofighter is the European aircraft defending skies across the continent. It is 100% designed, manufactured and assembled across Europe and will provide the technology bridge to future programmes. It is therefore fitting that so many aircraft, including the spectacular Royal Air Force air display, were part of this celebration here in the heart of Europe."

Anthony Gregory, Eurofighter campaign director for BAE Systems, stated, "We are delighted to return with our European partners at this year's Belgian Air Force Days. As part of the F-16 replacement programme, we and our partners believe Eurofighter is the solution which will meet all of Belgium's operational, security and industrial requirements today and for decades to come, including the development of collaborative relationships which are critical for future programmes. The presence of Eurofighters from across the core nations

reinforce our commitment to the future of the programme and highlight our countries' close and enduring defence and security links with Belgium."

Ivan Gonzalez, Airbus Defence & Space Head of Combat Aircraft Campaigns, stated "The presence of Eurofighters from across Europe is a further demonstration that Eurofighter is the true European proposal for Belgium, building on a long history of partnership. Our company has proud track record of successful collaboration with Belgian industry and the Armed Forces on military platforms including the A400M, the NH90 and the MRTT. Eurofighter for Belgium would build further on that and we are delighted so many Eurofighters are here at Kleine-Brogel."

Andrea Nappi, Head of Eurofighter Export at Leonardo Aircraft, stated, "The Eurofighter programme represents a successful and strategic example of European collaboration in the defence sector. Through this programme, partner nations and industry have not only grown together but the result is a world-beating product, fully matured and capable to address developing threats for decades ahead. Participation into the programme is the building block to ensure continuous technology growth and the opportunity to play a significant role into any future development programme throughout Europe."

The MC-21 and its virtual avatar: Industry 4.0 concept

According to the Industry 4.0 concept, every product has its corresponding digital description or virtual avatar. It turns into a strategic tool for ensuring long-term success throughout the entire life cycle of the product. The new MC-21 medium airliner, whose flight testing has been continuing by Irkut Corporation since May 2017, is no exception. Earlier, the company had mastered the integrated use of digital technologies in development of the Yak-130 supersonic trainer and serial production of components for the Airbus A320 family.

As Andrey Belov, deputy chief designer of Irkut Corporation for managing the electronic layout and configuration, opines, "In the interests of all stages of the life cycle of the MC-21 aircraft, a digital description of the product in the form of an electronic model and a calculation model are designed. This approach is an important element of the Industry 4.0 concept, which is now followed by the world's leading aircraft manufacturers".

"Initially, the electronic layout was intended to replace the wooden layout with the primary linkage of the structure," added Andrei Belov, "however, the mathematical description gives incomparably more opportunities. Now we have digital technologies deployed for the design, production and operation of aviation equipment."

Meanwhile, aerodynamic and strength calculations, as well as the technological requirements for the production of each part is taking place simultaneously. "This approach allows one to quickly sort through various options and choose from them the most optimal, corresponding to the specified characteristics," explained Andrey Belov. "We significantly narrow the search area, analysing the gas dynamic characteristics of the aircraft, as well as



MC-21 airliner in flight

its strength characteristics. The entire refined, therefore it is impossible to provide of iterations in the traditional way. We provide a dynamic exchange of data between all the participants of the programme. This allows you to quickly respond to changing economic conditions, new customer requirements and regulatory documents".

Within the framework of the MC-21 programme, digital models have been created that include hundreds of thousands of components and describe more than 30 different aircraft configurations. The corporation does not have any single level or process that does not use digital technologies.

Among the components of the digital description, along with the electronic layout, there are numerous models describing aerodynamics and gas dynamics, loads, production technology, as well as maintenance operations. Irkut Corp. applies various information systems of vendors from around the world like Siemens, IBM, Ansys, and so on, leading Russian IT enterprises, as well as its own systems. The comprehensive level of introduction of information technologies allows solving complex problems of system engineering, strength, technology and support of airline operators.

Irkut's strides in avenues of development of production, the precise docking of the airframe assemblies, the rapid introduction of changes in the design of the aircraft based on the results of the first test flights has become possible owing to the introduction of digital technologies.

Currently, the efforts of engineers are focused on development of the electronic layout in order to support the operations of MC-21. The digital description of the MC-21 has become the basis for the development of the method of its maintenance in the process of designing the aircraft. The 3D geometry of the structure is being formed for all units and the ergonomics of personnel access for maintenance and repair operations is being studied. These procedures are being finalised in the course of testing the first MC-21 aircraft, which will allow development of interactive operational documentation for the commencement of commercial operation of the aircraft.

The design team at Irkut Corporation works on augmenting the functionality of the electronic layout. As Andrey Belov says: "We will use the digital twin of the aircraft to obtain the characteristics of products in service."

The next stage of development will be removal of the dynamic characteristics of a real aircraft in the process of its operation, their modeling on a digital model and forecasting the behaviour of a real aircraft. The task is to conduct constant monitoring of the state of all systems of the aircraft, analyse their development and possible future problems.

"The real exploitation of digital counterparts has not started yet," says Andrey Belov, "but all leading aircraft manufacturers have focused their efforts in this direction. We are also working to implement this approach within the framework of the MC-21 programme. "

Alexei Sinitsky

The Army 2018 International Military Technical Forum Developments at Rosoboronexport



Tor-E2 SAM system launched

JSC Rosoboronexport, part of the Rostec State Corporation, has started promoting the newest Tor-E2 SAM system developed and produced by the Almaz-Antey Air and Space Defence Concern. The Tor-E2 fits into short-range air defence segment, retaining the best qualities inherent in the Tor family “to become an even more formidable weapon against any current air threats.” With its unique capabilities and performance, the system is “superior to most of its counterparts in the world market and second to none in mobility and survivability. Rosoboronexport is considering its sale from its partners for the supply of these systems,” stated Alexander Mikheev, Director General of Rosoboronexport.

The system provides air defence for army units in combat and on the move, as well as to protect military and other critical facilities from attacks by manned and unmanned aerial vehicles. The Tor-E2 can engage aircraft and helicopters, cruise, anti-radar and various guided missiles. It effectively destroys precision guided munitions, such as glide and guided air bombs, as well as UAVs within its engagement envelope. The

system is capable of operating in intense jamming and counter-fire environments, in any weather, by day or night.

The Tor-E2 combat vehicle is an independent, mobile, all-terrain fighting unit that provides detection and identification of air targets on the move and at the halt, target lock-on and engagement at the halt, and on the move. A high level of automation and unique algorithms of the SAM system minimise crew involvement in the engagement process. A battery of

the four-channel Tor-E2 SAM systems, consisting of four combat vehicles, can simultaneously engage up to 16 targets flying from any direction at a range of at least 15 km and an altitude of up to 12 km. Each vehicle carries 16 missiles, which are twice as many as the previous version of the Tor system.

The Tor-E2 is a unique weapon, one combat vehicle incorporating all which is necessary for anti-air warfare, from target detection to its destruction. The system



far exceeds its counterparts in combat survivability: “to knock out a Tor battery, you need to destroy all of its combat vehicles. For most of its counterparts, disabling a command post or a battery radar would be sufficient.” In addition, two Tor-E2 combat vehicles can operate in the ‘link’ mode, which enables them to exchange information about the air situation at different altitude ranges and coordinate joint engagement operations. In this mode, one of the combat vehicles, receives information from the other and does not reveal itself until the launch of the missile.

The possibility of integrating the Tor-E2 SAM system into any existing air defence system is available including compatibility with NATO standards, considerably expands its export potential. A command post can be attached to a battery of four Tor-E2 combat vehicles to control and coordinate them and interact with the air defence control system.

“Rosoboronexport is ready to provide exhaustive information on the Tor-E2 SAM system and we expect much attention for our other new air defence weapons being promoted by our company – the Viking SAM system and the Gibka-S MANPADS squad combat vehicle,” added Alexander Mikheev.

Sprut-SDM1 light amphibious tank

Rosoboronexport has launched the Sprut-SDM1 light amphibious tank built by the Tractor Plants Concern. “This is a unique armament unrivaled throughout the world. The Sprut-SDM1 is the only light amphibious fighting vehicle in its class that possesses the firepower of the main battle tank, capable of disembarking from a ship and operating day or night in difficult terrain. “Rosoboronexport expects interest

in this vehicle from countries which have difficult terrain, such as water obstacles, marshes and mountains. A number of South-East Asian countries have already shown great interest in the Sprut-SDM1,” stated Rosoboronexport’s Director General Alexander Mikheev.

The Sprut-SDM1 will provide fire support to infantry, engage armoured targets, destroy enemy strong points and fortifications, and conduct battlefield reconnaissance and security. It is intended for marine troops as also armoured forces. The Sprut-SDM1 has a ‘powerful’ armament suite, similar to a main battle tank, and includes a 125-mm gun, a 7.62-mm remote-controlled machine gun and a 7.62-mm coaxial machine gun. The vehicle is equipped with a guided missile weapon system designed to engage armoured targets, including ERA-equipped ones, at ranges up to 5 km. Its automated digital fire control system enables target detection, recognition and destruction on the move and at the halt, in poor visibility conditions, day or night, using different types of gunner’s and commander’s sights. The amphibious tank offers a high level of protection for vehicles in the class. Its low weight and capability to cross water obstacles afloat ensures high level of terrain passability, began capable of operation in mountains and hot tropical climate.

Contracts worth over 20.3 billion rubles

Rosoboronexport has signed 15 different contracts with foreign customers at the recently concluded Army 2018 International Military Technical Forum in Kubinka, Moscow region. Export contracts signed



Rosoboronexport equipment on display

exceeded 20.3 billion rubles and includes sale of unmanned aerial vehicles, electronic warfare systems, close combat weapons and others. “The Company’s portfolio has been replenished with firm orders from Asian and African countries, as well as from member states of the Commonwealth of Independent States,” stated company officials. Several agreements on cooperation between Rosoboronexport and Russian firms in military-technical cooperation were also signed at the forum.

Rosoboronexport conducted negotiations and consultations with delegations from 45 countries from the Asia-Pacific region, the Middle East, Africa, Latin America and Europe during the first few days of the *Army 2018 Forum*, specialists making presentations and demonstrations on over 150 items of modern Russian weaponry and military equipment exported by the Company. “Despite ongoing anti-Russian propaganda, Rosoboronexport held a series of successful negotiations with delegations from a number of European countries which visited the Army Forum. Many countries including in Europe, are fairly outraged by actions of the US, which is trying to prevent other countries from developing military-technical cooperation with Russia. Rosoboronexport is engaged in dialogue with foreign customers at all levels and the export deals are approved by either presidents or at a high government level in the G2G format. That is, sanctions have the effect of a boomerang: the partners actually regard them as interference in the internal affairs of the state. As a result, we are consistently moving away from the US dollar in mutual settlements in favour of national currencies, especially since Rosoboronexport has accumulated a lot of experience of successful cooperation in various foreign economic circumstances,” the head of Rosoboronexport stressed.



The Sprut-SDM1 light amphibious tank

Vostok 2018



Russia's largest military exercise

To counter what it called the “aggressive and unfriendly” attitude towards it, Russia has carried out the biggest war games during peace time in its history, involving 300,000 troops who were joined by 3500 Chinese and some Mongolian troops. Known as *Vostok 2018*, the drills were predictably criticised by NATO which organisation termed this as “rehearsal for large-scale conflict”. The Russian ministry of defence said that almost a third of its active military personnel took part in the week-long exercises in Siberia and the Russian Far East.

The week long exercise, held from 11 to 15 September 2018 was spread across five army training grounds, four airbases and three seas: the Sea of Japan, the Bering Sea and the Sea of Okhotsk. Up to 80

naval vessels took part, from two Russian fleets. However, drills were not held near the disputed Kuril islands north of Japan.

During the event, Russian army showcased its latest and lethal arsenal right from *Iskander* missiles that can carry nuclear



Sukhoi Su-35s and Su-34s took part in the exercises



Russian President Vladimir Putin attended the war games after hosting an economic forum in Russia's far eastern city of Vladivostok where his Chinese counterpart Xi Jinping was one of the prominent guests. The Russian army compared this show of force to the USSR's 1981 war games that saw between 100,000 and 150,000 Warsaw Pact soldiers take part in *Zapad-81* (West-81) – the largest military exercises of the Soviet era. Sergey Shoygu, Minister of Defence of the Russian Federation said these exercises are even larger. "Imagine 36,000 military vehicles

warheads to T-80 and T-90 tanks and its next generation Su-34 and Su-35 fighters. At sea, the Russian fleet deployed several frigates equipped with *Kalibr* missiles that have been used in Syria. The main focus of the exercise was to practise the rapid deployment of thousands of troops, as well as aircraft and vehicles, from western Russia to eastern regions, across thousands of miles.

Russian Defence Ministry thereafter released images of columns of tanks, armoured vehicles and warships on the move and combat helicopters and fighter aircraft taking off. In one clip, marines from Russia's Northern Fleet and a motorised Arctic Brigade were shown disembarking from a large landing ship on a shore opposite Alaska.

tanks, armoured personnel carriers, infantry fighting vehicles -- and all of this, of course, in conditions as close to a combat situation as possible."

Russia's military exercises come at a time of escalating tensions between Moscow and the West over accusations of Russian interference in western affairs and conflicts in the Ukraine and Syria.



“Passion for Precision”

Nammo's .338 Lapua Magnum Story

The .338 Lapua Magnum (Lapua for short) has now been around for a while in the sniper community, but it does have the distinction of being the first cartridge designed specifically for sniping. The .338 Lapua was developed back in 1983 but it was not until the later 1990s that it gained in popularity and started to become more widely used. The cartridge was designed to reach at 1000 metres with enough energy to penetrate five layers of military body armour and still make the kill. The effective range of this cartridge is over a mile (1609 meters) in the right shooting conditions as has been demonstrated in recent conflicts with confirmed kills in excess of 2000 metres.

In fact, of the top ten longest recorded sniper kills in history, three of them used



the .338 Lapua Magnum.

This includes Corporal of Horse (CoH) Craig Harrison, Household Cavalry of the British Army, who has two confirmed kills using the .338 Lapua Magnum Lock Base B408 bullets at a distance of 2,475 meters.

Realistically, 1500 metres is within the range of a trained sniper. This cartridge is based off the .416 Rigby Case, necked down to .338 caliber, and is designed primarily as a military extreme range anti-personnel round and there is really no

Law Enforcement applications, unless one need a super penetrating round for either armoured vehicles or barricaded suspects. There are not a lot of rifles chambered for the .338 Lapua but the list continues to grow. The availability of match ammo has also grown to where there are a handful of manufacturers making good match grade ammo. The recoil of these heavier extreme range cartridges, such as the 338 Lapua, can be high so a good muzzle brake is required.

For military extreme long range anti-personnel purposes the .338 Lapua is an excellent choice, however this cartridge is not recommended for close range Law Enforcement use.

Genesis of the .338 Lapua Magnum

Originally developed as a military cartridge, the .338 Lapua Magnum may well be seen by small-arms historians as one of the most important cartridges developed in the latter part of the 20th century. The .338 fills an important but previously unfilled tactical niche between 7.62mm and .50 caliber sniper rifles, since it is capable of delivering reliable hits to 1,500 metres. Owing to innovative bullet designs developed at Lapua, the .338 Lapua Magnum also makes a compelling cartridge for long-range target shooting, hostage situations or providing accurate fire in support of ground forces.

The .338 Lapua Magnum, also known as the 8.6 x 70mm, was originally developed

in 1983 as a long-range sniper cartridge for the US Navy designed to push a 250 grain (16.2 gram) bullet at about 3,000 fps (914 mps). After a series of experiments, the Research Armament Company in the United States designed a round based on a slightly shortened and necked-down .416 Rigby case, building rifles for the Navy that used Hornady bullets and cases from Brass Extrusion Labs. The cartridge went from wildcat to production status when Lapua Ltd. in Finland refined the design at the Navy's request. The standard .416 case was not robust enough to support the average pressures generated by this cartridge, so Lapua kept the outside dimensions the same but strengthened web area of the case. It should be noted that average pressures for this cartridge run a bit less than 60,915 psi or 420 MPa, and no single round will exceed 70,052 psi or 483 MPa. Muzzle velocity of production ammunition is a wee bit slower than the original concept, running about 2,950 fps (900 mps) out of the average rifle. This round will still be supersonic at 1,300 yards (1,200 metres), however, while 7.62x51mm M80 ball commonly goes subsonic around 704 metres.

Accuracy and velocity at long range are greatly facilitated by design of the Lapua projectiles, which have had a reputation for extraordinary long-range performance since the 1930s, when Lapua developed a special bullet with rebated boat tail designed to give Maxim belt-fed machine guns



.338 Lapua Magnum improved for King of 2 Miles Match

unprecedented accuracy at ranges of 1,500 meters and beyond, while minimising barrel erosion commonly associated with boat tail bullets of conventional design. The resulting precision D46 and D47 bullets delivered a lot of gold medals in national, world, and Olympic championships. The new .338 Lapua Magnum ball round features a novel bullet design based upon that heritage. The B408 Lock Base bullet features much more robust construction and a conspicuously shorter rebated boat tail, which is also distinguished by a slightly pointed base. The B408 Lock Base provides superior accuracy at long range while delivering a flat trajectory. Lapua offers a broad range of tactical and sporting rounds for the .338 Lapua Magnum, and it would be useful to take a brief look at each of these different rounds.

The .338 Lapua Magnum is an important cartridge for military snipers because it significantly outperforms the 7.62x51mm (.308 Winchester) round, which is the most common cartridge used in the sniper rifles of NATO and other Western countries. Rifles chambered in 7.62x51mm tend to be reasonably light and maneuverable while providing a good mix of accuracy and penetration out to about 600 meters with conventional ammo and to about 900 meters with VLD (Very Low Drag) ammo. The .300 Winchester Magnum, which is increasingly being fielded in sniper rifles, provides good performance out to about

1,000 meters. That's a long shot, but serious problems in the real world can need solving at greater ranges.

In the military environment, whether conducting conventional operations, so-called peace-keeping missions, or special operations, it is not uncommon to come under heavy weapons fire originating a kilometre or more away. There has been considerable interest in fielding precision rifles chambered for the massive .50 BMG (12.7x99mm) machine gun round to counter such long-range threats, since this round has a maximum effective range of about 2,000 metres.

The .338 Lapua Magnum is capable of placing reliable hits well beyond a kilometre, yet the typical .338 rifle only weighs about one kilogramme more than a comparable .308 rifle. The weapon is much more comfortable to shoot with than a .50 BMG rifle, its muzzle blast and flash are considerable less, and both the rifles and the ammunition provide a more cost-effective option for long-range military sniping.

The adoption of the Lapua Magnum has been gradual, but with an ever widening circle of end-users. For example the British Ministry of Defence recently adopted the Accuracy International Model AW Super Magnum chambered in .338 Lapua Magnum to meet its requirement for a long-range sniper rifle. The Netherlands has adopted .338 rifles as their standard sniping weapon, and

the Finnish Army have purchased 400 Sako TRG-41 sniper rifles chambered for the .338 Lapua Magnum round. Several European countries are evaluating .338 rifles as well. Not to be left behind, the US Army is also exploring new ammo options to enhance the lethality of snipers equipped with the latest model sniper rifle. According to an announcement made by the Army's Office of Project Manager a year ago, *Soldier Weapons* is seeking information and attempting to identify qualified sources to produce .338 Lapua Magnum (LM) Armour Piercing (AP) ammunition.

The announcement explains that "Snipers are required to execute combat, combat support and combat service support missions across the range of military operations that include conducting and supporting joint land operations, operational movement and manoeuvre, reconnaissance, anti-terrorism, force protection, direct action, unconventional warfare and special operations. In addition, warfighters often conduct collateral activities such as law enforcement, protective service, resource protection, civil affairs, peacekeeping/peace enforcement operations, foreign and domestic humanitarian assistance and counter-terrorism operations." Further, that the new .338 LM AP ammunition would provide snipers with the ability "to effectively achieve the above mentioned mission out to 1,500 metres."

Identifying what it described as "current limitations" in its long-range ammo, the gaps list stated that Army special operations forces currently use "100+ year old bullet technology for their standard precision projectiles in sniper applications," further identifying that technology as "a lead core with a copper or gilding metal jacket that is formed/pulled around the core." The announcement adds that "This technique works well but there are limitations to achieving a high Ballistic Coefficient (BC), balance, and weight consistency."

That "gaps list" went on to identify possible materiel solutions and future / long term technical approaches, including: solid copper turned bullets (bearing copper for lubricity / hardness); sub-caliber, sabot type projectiles; smooth bore capable projectiles either rifled or finned; and exploration of other nonabrasive/non-smearing metal or alloys for solutions.



Raptors on a roll



Summer tour in Europe

During three weeks 8-28 August 2018, 12 Lockheed F-22 Raptors made a deployment to the United States Air Force Europe (USAFE) airbase of Spangdahlem in Germany. On this deployment to Europe, came the F-22s of the 95th Fighter Squadron, 325th Fighter Wing, home based at Tyndall Air Force Base, Florida, USA.

As part of this 'Flying Training Deployment', the F-22 fighters also made visits to Norway, Greece, Spain, Romania and Poland. Some visits were for just one day, taking-off in the early morning and returning late in the afternoon, while others lasted for several days.

During their visits in Europe, the F-22s were accompanied by Boeing KC-135 tanker aircraft for air-air refueling during flight to the destination, while aircraft maintainers flew onboard for ground maintenance during debriefing of the pilots after morning missions.

Besides these visits, there were many air-air battles ('dogfights') fought overhead western Europe with and against the Spangdahlem-based USAFE F-16s, the European NATO partners Germany (Eurofighters), France (Mirages), Belgium

(F-16s) and the Netherlands (F-16s) in order to maximise training opportunities while "strengthening the NATO alliance and deterring regional aggression."

In Europe, aim of the aircraft and airman was to train with allies and other US Air Force aircraft as well as forward deploy to European NATO bases. As part of the

European Deterrence Initiative, these training deployments are to assure allies and further demonstrate the commitment to regional security and stability. In addition, these training deployments help demonstrate and exercise the capabilities of the aircraft in various environments, enhancing integration between the US and its allies.





It is also an important objective to exercise fourth and fifth, or fifth and sixth generation aircraft capabilities, especially since allies and partners within Europe are operating the F-35 Lightning II such as the Norwegian Air Force, “a perfect opportunity for aircraft to train alongside other types of Air Force aircraft in a realistic training environment.”

Both the F-22 and F-35 bring complementary capabilities to the 21st Century warfighters, “the F-22 being a vital component in our air force that projects air dominance rapidly and at great distances to defeat any possible threats.”

Organisation

A lot of planning is done with each participating country, hosting and participating however, with the USAFE being the lead for F-22s operations. Invitations are sent out early and selection made of the learning objectives. These are planned for the duration of the deployment following which baseline instructions, the rules of engagements and the airspace reservation are sent out to all participants of the mission. This is daily practice for NATO aircraft but the F-22’s presence this time made it very attractive for European participants.



Today's shapes, into the future



Earlier deployments

This 2018 deployment was not the first one in Europe, but certainly it was the longest. In August 2015, the US Air Force deployed F-22 Raptors to Spangdahlem Air Base, Germany, to train and exercise with other allied militaries and US forces, the F-22s coming from the 95th FS at Tyndall AFB. In April 2016, the US Air Force deployed F-22s Raptors to RAF Lakenheath for training exercises with other Europe-based aircraft, to conduct critical Global Response Force (GRF) training and to bolster NATO



Raptors and Fighting Falcons, from the same team



allies' capabilities. These F-22s too were deployed from the 95th FS at Tyndall Air Force Base, Florida. Most recently, F-22s were deployed to RAF Lakenheath, England, in October 2017. These F-22s were from the 27th Fighter Squadron will pilots and maintainers from the 94th Fighter Squadron of the 1st Fighter Wing, at Joint Base Langley-Eustis, Virginia.

The F-22 Raptors have also participated in European airshows, such as the Royal International Air Tattoo and the Farnborough Air Show, as well making a flypast during the 100th Anniversary celebration of the *Lafayette Escadrille* in Paris, France.

Text and photos by Alex van Noye & Joris van Boven



The ‘Land of Flames’ marks Centennial of the Azerbaijani Air Force

This year marks the 100th Anniversary of both the Azerbaijani Air Force (*Azərbaycan Harbi Hava Qüvvələrinin*) and the Azerbaijan Democratic Republic, the Air Force itself established on the 26 June 1918.

Azerbaijan, known as the ‘Land of Flames’, regained its independence after breakup of the Soviet Union in 1991. The Azerbaijan Armed Forces were re-established on 9 October 1992 and today the Azerbaijan Air and Air Defence Forces are the largest in the Caucasus region with the Air Force having about 8,000 personnel of a total of some 70,000 personnel in the total Armed Forces.

The main fighter base of the Azerbaijan Air Force is at Tagiyev (also known as

Nasosnaya) a former Russian Air Base which is currently undergoing modernisation. Tagiyev houses the sole squadron of MiG-29Cs and MiG-29UBs which have been in service since 2007. The airbase is located north-west of the Capital Baku, near the town of Sumqayit. Before operations started here with the MiG-29s, the unit was operating a mixture of MiG-25PD/PU/RBs which were withdrawn from service in 2006. The resident Su-24 fleet was withdrawn during 2010 with three derelict airframes now remaining on base. The specialised Repair Factory for MiG-25s, part of Tagiyev Airbase, has had aircraft from Iraq, Libya, and Algeria come for maintenance, till the last decade. Recently Tagiyev Air Base has undergone extensive upgrade to both the

HQ facilities and the runway. With support of the United States, new runway lighting has been installed, plus ILS/DME and VOR to support operations.

“The sole MiG-29 unit has no specific designation or name within our Air Force, we are just known as the Fulcrum unit” according to Base Commander Col. Rustamov Zaur. “We have the MiG-29s in service since 2007 when they were procured from the Ukraine and were overhauled in the Ukraine before delivery”. Some 17 MiG-29s are believed to be in service, fifteen MiG-29Cs and two MiG-29UBs of which three are currently undergoing a 3000-hour check at the Lviv Repair Plant in Ukraine. Some twenty-six pilots fly approximately 60 hours a year, but “our way of counting



A MiG-29 on landing



Two MiG-29s in flight



Pilots of the MiG-29 squadron



MiG-29 on the threshold

flight hours is bit different as we only note down actual time in the air without mission preparation, taxiing and landing” according to the Lt. Col.Ibrahim Haziyeu, the MiG-29 Squadron Commander.

“Student pilots who are in their third year at the Air Force Academy in Baku start with flight training, approximately 10 to 20 hours at Baku Kala Air Base. After graduation, selected MiG-29 pilots will join the Air Force Training School which is located at Kurdamir Air Base for fixed wing training. The Training School shares facilities with the small Su-25 fleet. Student pilots fly around 150 hours on the L-39” according to Lt Col Ibrahim Haziyeu. When the training is finalised at Kurdamir, new pilots (at rank of captain) will either join the local Su-25 unit or join the MiG-29 unit at Tagiyev. “New pilots will complete a forty-five

day Academic Training as preparation for their first MiG-29 flight” explains Lt. Col. Haziyev. “After this, there will be some additional training and a test to check capabilities. When we are satisfied, the new pilots will have around 10 to 15 hours on the MiG-29 simulator which was acquired some years ago. Presently two simulators are available, one for MiG-29 pilots and one for Su-25 pilots training. All MiG and Sukhoi pilots are required to log a number of simulator hours a year. In parallel with the simulator training, about ten to twenty sorties are flown on the MiG-29UB before the new MiG pilot makes his first solo flight on the MiG-29” concludes the Lt. Colonel. Training for night flying and ground missions will take an additional two



Three Mi-35Ms were seen at Quala in May 2018



Mi-24V and Mi-35M pilots at Quala Air Base

international cooperation has become more important over the last few years” concluded Commander Col. Rustamov.

Turkey and Azerbaijan have strong cooperation, dating back to 1992 when an agreement was signed. The Azerbaijan and Turkish Armed Forces conduct regular exercises, best known being the annual exercise “TurAz Şahini” (*TurAZ*) in which Azerbaijan MiG-29s, Su-25s and Mi-17-1s operate with Turkish Air Force units from Konya Air Base in Central Turkey. The latest edition took place in September 2017 at Tagiyev in Azerbaijan.

The *TurAz* exercise improves interoperability and exchange of experience between the Azerbaijan and the Turkish Air Forces. Through years of joint exercises with Turkey, Azerbaijan has been updating

years of training. Currently conversion and operational training is conducted within the MiG-29 unit. “It puts a lot of pressure on the squadron to have training in parallel with operational missions” according to one of the Instructor pilots. This situation will change in the near future with opening a new dedicated Air Force Training School.

“Air Defence and Ground Support are the most important tasks for our unit” continues the Base Commander. “We mostly train for air interception and have up to three MiG-29s on scramble alert. As an example in 2016 we had sixteen actual scrambles, mostly in the conflict region. We have the MiG-29” airborne within six minutes when required. We can also work together with the Su-25s, when tasked for Combat Air Patrol. As most of the training exercises are held within our own Air Force,



The Mi-24P fleet consists of just two airframes, a legacy left behind by the Soviets



For search and rescue duties, three Ka-27Ss are with 4 Squadron, a mixed unit. The Kamovs were left behind by the Russians when they vacated Qala air base in the early 1990s and are currently operated by the Azeri Army on behalf of the Navy

its combat readiness tactics improving airfield operations. Azerbaijan pilots are mainly trained at the Azerbaijan High Military Aviation School, but some also attend courses at the Air Force Academy in Turkey and have had initial flight training at Cigli Air Base. “The ultimate goal is to prepare and join the international exercise *Anatolian Eagle* which is held yearly in Turkey” Col Rustamov explains.

JF-17s as the new induction

Currently two MiG-29 pilots are training with the Pakistan Air Force to gain experience on the JF-17 fighter. “First results are that the JF-17 is comparable to our MiG-29C and therefore we are reviewing the next steps to acquire this new fighter aircraft,” confirmed the Base Commander.

The largest number of aviation assets are at Kala (Qala) Air Base, which has undergone some modifications with a new large hangar area for maintenance and storage of helicopters. This new facility was officially opened in March 2018 as part of further modernisation of the Azerbaijan Air Force. Bulk of the helicopter force consists of ‘Hind’ variants: Mi-24V/P, Mi-35M and Mi-24G ‘Super Hinds’. The fleet of Mi-17-1V ‘Hip-H’ doubles up as light attack and assault platforms besides the usual task of troop transport. For this purpose the Mi-17-1Vs can be equipped with a variety of weapon systems: the IAI ‘Lahat’ (Skybow) an advanced light weight laser homing missile which is highly effective against a variety of target types, including ground targets, ships and helicopters at ranges up to



Line up of Mi-24Vs part of 2-CI Eskadrilya/ 2 Squadron ‘Griffins’



During March 2018, a fifth squadron (Special Operations) became operational with the AB-412. Three of this type were acquired in 2016. Pilots and mechanics from the Pakistan Army have trained Azeri pilots

8 km. This is manufactured by IAI and the Azerbaijan Air Force was supported by Elbit during its introduction, Azerbaijan being the first export customer for this system. Along with the 'Lahat', the long range missile system 'Spike' ER was introduced in the Azerbaijan Armed Forces, the weapon system used on the Mi-17-1.

Recently, in March 2018, a fifth squadron (Special Operations) became operational with Bell 412 helicopters, some three of this type acquired in 2016 from Canada. Besides the three Bell 412s a Bell 407 and MD-530 were acquired, all sporting black colour. "Both types are currently not operational as pilots have not yet been trained," according to Major Zaur Agayev of the Special Operations Squadron. Major Agayev graduated from the Turkish Air Force Academy and is one of the

instructor pilots with the fifth squadron. "Currently one pilot is in Pakistan to become an Instructor Pilot for the Bell 412."

The Mi-24V fleet was upgraded in the second quarter of 2003 and nine Mi-24Vs are operational. An additional nine were upgraded in 2013 to Mi-24G 'Super Hind' standards (Gecə) which stands for 'night', the upgrade programme carried out between South African Company Advanced Technologies and Engineering (ATE) with Ukrainian companies Aviakon and Luch design bureau from Kiev. The Azerbaijani Mi-24G is based on the ATE's Super Hind Mk4, the core avionics similar to the Mk4 version. The equipment kit (based on the Denel Rooivalk) comprises an ATE developed mission computer, navigation system, NVG rangefinder as well as the Kentron Cumulus Argos 550 gyro stabilised

multisensor targeting and surveillance system integration TV plus IR sensors and a laser rangefinder. Most striking differences are the redesigned nose and cockpit which reduces weight and improves sight from the cockpit. The mission equipment is lighter in weight and offers NVG capabilities. Cockpit equipment includes two multifunction 6x8 inch flight control and data displays, a Doppler GPS system.

Mainstay of the attack helicopter force is the Mi-35M of which twenty-four were acquired in 2010, deliveries completed by January 2014. The Mi-35s are equipped with night vision goggles, a turret-mounted IRTV-445MGH infrared TV thermal imaging system and new countermeasures equipment. The weapons package comprises 9K114 'Shturm'-V (AT-6 'Spiral') anti-tank missiles, 80 mm S-8 and 240 mm S-24 unguided rockets, as well as either a single 12.7 mm 9-A-629 machine gun or two 7.62 mm 9-A-622 machine guns or one 30 mm 9-A-800 grenade launcher. In addition, they can operate with 50 kg (110 lb.) or 500 kg (1,100 lb.) bombs.

The Kala Base Commander stated, "Our focus is to have two Mi-17-1s compatible with the NATO Operational Capabilities Concept (OCC). We hope to join a NATO initiated exercise in 2019 in order to have the opportunity to gain experience, see what we are worth and share our knowledge".

***Carlo Kuit & Paul
Kievit/Bronco Aviation***



The MD530 and Bell 407 are currently not operational



Aviadarts 2018

Eastern Approaches: Exotic aircraft in exotic locales

Four Su-34s fly in close formation while dropping their bombs on the Dubrovichi range

This year's *Aviadarts* competition took place from 29 July to 11 August at Dyagilevo air base, situated just west of the city of Ryazan, 180 kilometres south-east of Moscow. This was the sixth *Aviadarts* competition and four nations competed in seven different categories. The first edition, in 2013, took place at Lipetsk air base further in the south of Russia, with use of the Pogonovo range (Voronezh). The advantage of using Dyagilevo air base is that the Dubrovichi range is just 30 kilometres from the base, enabling pilots to focus on the competition itself for maximum results.



The PLAAF's J-10A made its debut at Aviadarts: also seen is a Belarus Yak-130 and a Russian Mi-26



Two PLAAF JH-7As participated in 2018, including this aircraft landing back after a mission. Note one of the judges recording accuracy of the landing

Aviadarts is part of the International Army Games, being the 2018 edition, which is also referred to as the *Military Olympics*, consisted of 28 "games" taking place in seven countries. These *Military Olympics* included competitions such as the tank biathlon, sea cup and gunsmith master. A total of 33 countries mainly from Asia, the Middle East and Africa participated in the events, making it a truly international competition. Each "game" attracted different countries which sent in their best teams to compete for the trophies.



Russian Mi-8AMTsh-1 takes off from the Dubrovichi range after an assault mission



The gigantic Mi-26 lands at the Dubrovichi range to deliver military vehicles and troops

Participating crews of the *Aviadarts* 2018 contest started with a physical training tests during the first weekend of the competition. During the next two days that followed, all participants were given an opportunity for practice. The foreign participants were given the possibility to get familiar with the layout of the airfield and the layout of the ranges used. With the diverse selection of aircraft types and helicopters, this meant that the fighters and attack aircraft would operate for the first time on one day, while the heavy bombers and transport planes would fly their initial missions on the next day. Helicopters flew their missions during both days, providing almost constant flying activity.

Over next two days, skills of the pilots were actually put to test with competitive flights, which followed the same manner of operations, with fighters and light bombers flying on the Thursday followed by heavy bombers and transport aircraft on Friday. These competition days meant a far stricter regime, with aircraft taking off in 15 minute intervals.

The Results

The competition's main trophy, the *Aviadarts* Cup, went to the VVS who won four out of

The Competition

Aviadarts 2018 attracted participants from three foreign nations, besides the host nation Russia. A diverse selection of aircraft landed at Dyagilevo air base in the week leading up to start of the competition. Over sixty crew from the People's Republic of China, Republic of Belarus, Republic of Kazakhstan and Russian Federation competed in the contest.

There were seven categories to determine "best pilots of fighters bombers, assault, long-range military transport, and army aviation the latter including transport and combat helicopters."

The pilots themselves competed in physical training, aerial reconnaissance, piloting technique and combat employment against ground targets. In addition, fighters were involved in penetration of simulated enemy air defences and several air-combat situations. At each stage during the competition, pilots dropping bombs, launched guided and non-guided missiles, fired front guns, carried out airborne operations in cooperation with ground forces.



Republic of Belarus Mi-24V departs for another mission



PLAAF Y-9 takes off for another mission



Chinese PLAAF H-6K taxis out for a morning mission



Su-25SM taxis back after a mission, nine of which aircraft type participated at this year's Aviadarts



The Armed Forces of the Republic of Kazakhstan participated with their new assets, including Su-30SMs



Su-30SM comes into land

seven categories, while the People's Liberation Army Air Force took second place and scored most points in two categories. The final spot went to the Armed Forces of the Republic of Kazakhstan, who scored most points in one category. The Deputy Commander-in-Chief of the Russian Aerospace Forces, Lieutenant General Andrey Yudin presented trophies to the team leader Colonel Vasily Yakimovich during the closing ceremony at Dyagilevo air base on 11 August.

This year's edition of *Aviadarts*, attracting more aircraft from in foreign participants, proved that the competition is seen as a valuable manner to train pilots and various aircrew. With recent participation of Russian pilots in the Syria conflict, this was also a very good way to measure up against pilots who had had real combat experience. *Aviadarts* is not a "common exercise," such as *Red Flag*, *Maple Flag* or *Frisian Flag* as in the West, but is a growing

competition that will surely attract more participants from various Asian countries in the future.

Text and photos: Erik Bruijns



VVS Tu-22M-3 takes off, with Aviadarts flightline in the backdrop

Even more on APROC 2018

The Netherlands hosts the 12th Edition



Local Dutch AH-64D providing air cover during a rescue operation

The twelfth edition of the *Air-Centric Personnel Recovery Operatives Course* (APROC) was held in The Netherlands for the first time during May and June 2018. Airbase Gilze-Rijen hosted helicopters and aircraft from seven countries including the Netherlands, France, Italy, Poland, Spain, Sweden and the United Kingdom; all sent one or more helicopters, along with the participation of some Dutch F-16s, two Italian EF2000s and two E-550A Gulfstreams. Belgium, Canada, Denmark, Germany and the USA took part with their ground forces only.

The exercise is organised annually by the European Personnel Recovery Centre (EPRC) and is aimed at rescuing downed aircrew or other trapped soldiers from hostile areas, so-called personnel recovery. The fighter aircraft provided fixed wing RESCORT (rescue escort), with Mi-24, AH-64 and AS.555 helicopters acting as rotary RESCORT. The other participating helicopters (CH-47D, NH.90, AS.332, Merlin, H-101 and UH-60) were used for actual extraction of the aircrew. Most

notably, however, was the participation of an Italian E-550A Gulfstream, a brand new and unique Conformal Airborne Early Warning and Control (CAEW) aircraft.

The E-550A is based on the Gulfstream 550. To serve in the CAEW role, Israeli Aircraft Industries built in an active electronically scanned array (AESA) four-dimensional radar providing 360° detection, identification and tracking of both airborne and surface targets. Integrated is an electronic support measures system, which measures emitters at a wide range of frequencies also with 360° coverage. Furthermore, the aircraft is fitted with a self-protection system (SPS) that includes active and passive sensors and countermeasures against incoming missiles, plus a NATO-compatible communications system that has been jointly developed by Elta and Leonardo. Its 10 hours endurance and 12,000 km range makes the E-550 a valuable asset for surveillance. With the first aircraft delivered to the Italian Air Force at the end of 2016 and the other one only beginning of 2018, this exercise

was a serious test for the heavily modified Gulfstreams. And, they lived up to their task of Airborne Mission Coordinator (AMC), which was extra useful because the planned participation of NATO and French E-3 AWACS as AMC had been cancelled owing to lack of available aircraft.

During the exercise, 26 missions were flown in nine days, which totalled to over 140 sorties and 300 flying hours of the participating aircraft and helicopters. Multiple exercise areas were conducted both in the Netherlands and Belgium, with changing groups of around five helicopters flying their own daily mission and participants were able to train the personnel in a realistic and international environment. The exercise was deemed a success with all 190 participants graduating. Interestingly, the relatively new integration of both fixed wing and rotary assets in APROC scenarios will be a point of focus during the next edition, which will be held in 2019 at Zaragoza airbase in Spain.

*Patrick Dirksen & Frank Mink
Tristar Aviation*



Spanish AS.332 taking off after picking up a 'wounded' soldier, with the door-gun for self-protection clearly visible



Italian Eurofighter from 4 Stormo at Grosseto airbase provided fixed wing air cover



Italian HH-101A Caesar leaving for another mission, its aerial refuelling tube a notable feature



French NH.90 coming in to pick up downed aircrew



Brand new Italian E-550A returning from an AMC mission, with CH-47 in the background

First to the Last

Captain Peter Weger's 50-year flying career culminates with the Dornier 328



Once a Luftwaffe fighter pilot, then test pilot on both the Eurofighter 2000 and Dornier 328 programmes, Captain Peter Weger rounded off a stellar 50 years of uninterrupted flying with a positioning flight of Dornier 328 turboprop (D-CSNC) back from Farnborough UK to Oberpfaffenhofen in southern Germany in late July 2018.



Water salute arrival at Oberpfaffenhofen for Peter's final landing in the Dornier 328

As one of Germany's most experienced test pilots, type-rated on 50 aircraft types and with a total of 13,000 hours logged, Peter has enjoyed a varied career since graduating from the Empire Test Pilot School at Boscombe Down, UK. Peter flew the F-104 and F-4 Phantom with the German Air Force, obtained an aeronautical engineering degree from the *Hochschule der BW*, at Neubiberg and later served as Chief Test Pilot with Messerschmitt Bölkow-Blohm in Manching, where he was engaged mainly on Tornado and Eurofighter development and a variety of experimental aircraft testing.

He is credited with flying the very first Eurofighter 2000 on 27 March 1994 in Manching, Germany and made the first flight in the Dornier 328JET at Oberpfaffenhofen, Germany in 1997.



Captain Peter Weger with long-time Dornier 328 flight test pilot colleague Captain Conny Cornelius

Peter became involved with the Dornier programme originally with Fairchild Dornier as Deputy Chief Test Pilot when the futuristic 728 JET was under development. He joined Cirrus Airlines flying the 328 in commercial service for several years, then became involved with the Grob Aerospace SPn G180 flight programme. When that programme was shelved in 2006, he joined 328 Support Services as lead test pilot. Peter was awarded the prestigious *Kincheloe Award* for outstanding achievement from the Society of Experimental Test Pilots in 1994, becoming the first German to accept the accolade.

At Farnborough 2018, Peter Weger, Conny Cornelius and Klaus Deiter Hose flew the Dornier 328, from which several parachutists made spectacular descents including that by Erich Jelitko, formerly with the German special forces and now Managing Director of the Company ATASS Advanced Tactical Airborne Systems and Services [see images on the right].

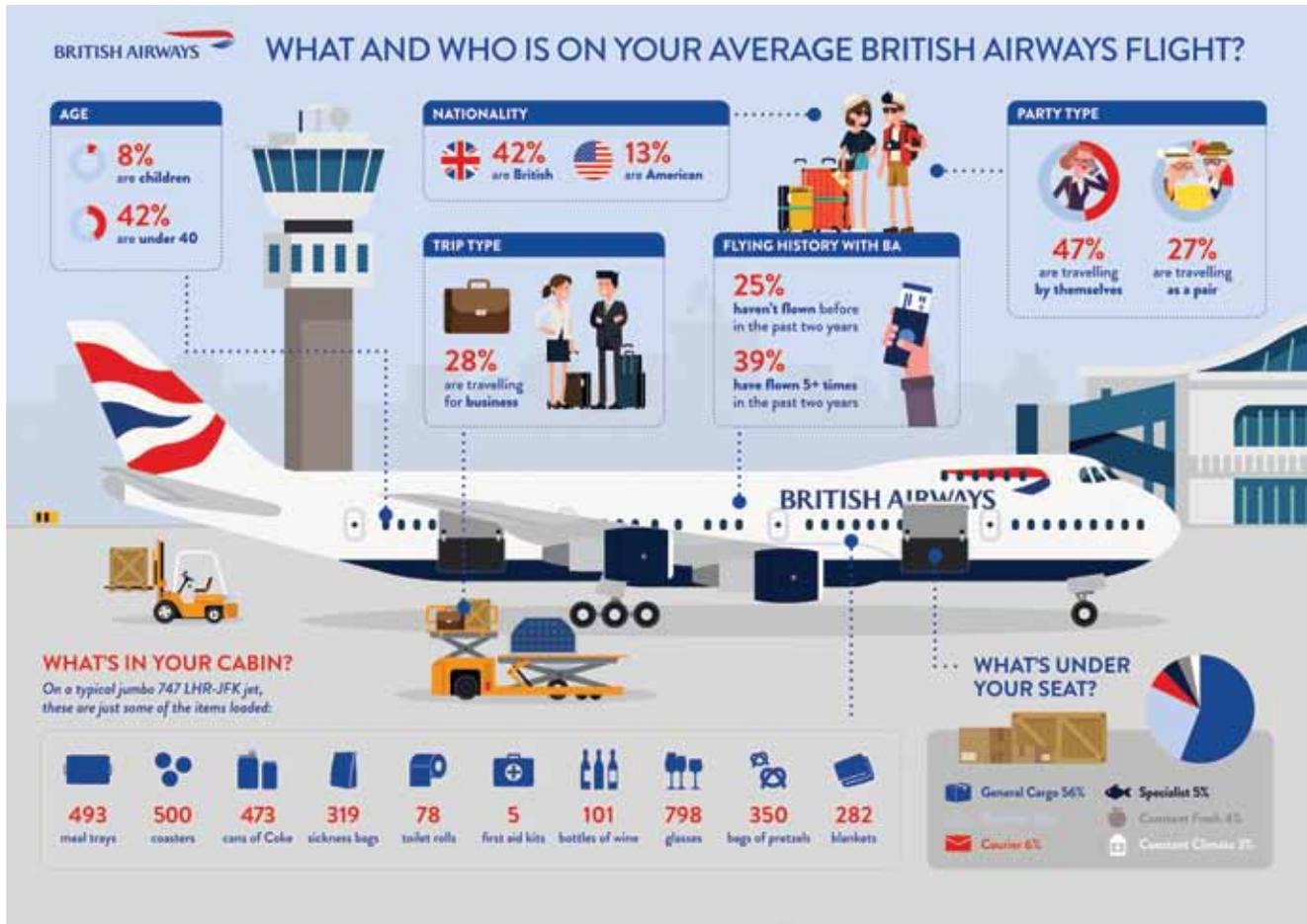
“We would like to thank Peter for his outstanding accomplishments - not just on the 328 programmes, but for his significant contribution to flying in Germany. We wish Peter and his family a very happy retirement,” stated 328 Support Services CEO Dave Jackson.



328 SSG is a subsidiary of Sierra Nevada Corporation, specialising in Space and Defence, and with over 3,000 employees offering a broad spectrum of services to the aircraft industry. 328 SSG employs over 160 aviation experts and supports more than 200 Dornier 328 aircraft globally.

All what you wanted to know, but ... !

Interesting data reveals exactly what, and who, is on one of British Airways' 850 flights a day !



As the summer holidays reach full swing, British Airways has released data revealing exactly what, and who, is on one of the airline's 850 flights a day. A Boeing 747 is loaded with over 7,000 items - many of which have to be unloaded and re-loaded before each flight. Included in the inventory are 1,737 items of cutlery, 798 glasses, 101 full bottles and 388 quarter bottles of wine, 350 bags of pretzels, 78 toilet rolls, five first aid kits and up to around 800 items of bedding, including the new Club World White Company bedding, which has been introduced as part of British Airways' £600m investment in its long-haul business class.

The study also looked at how people fly. In an average year one in two (47 per cent) are solo travellers, while 27 percent travel as a pair. Around 70 per cent are travelling for leisure, while 28 per cent are flying for business.

For those who've ever wondered what's flying in the hold beneath them besides their suitcases, our sister company IAG Cargo can shed some light on this. So far in 2018, 26 per cent of cargo flying in the hold has been made up of priority goods such as fashion products, the latest smartphones, or tablets. While five per cent of the cargo was specialist cargo like live animals or high value artwork, four per cent has been perishable produce such as raspberries from Kenya or lettuces from the US and three percent of the cargo was temperature controlled pharmaceuticals and lifesaving vaccines. Some of the year's most interesting shipments includes Cognac from Bordeaux to Kuala Lumpur, emergency lettuce from Los Angeles in response to the UK's heatwave vegetable shortage and royal wedding special magazines from the UK to the US. Carolina Martinoli, British

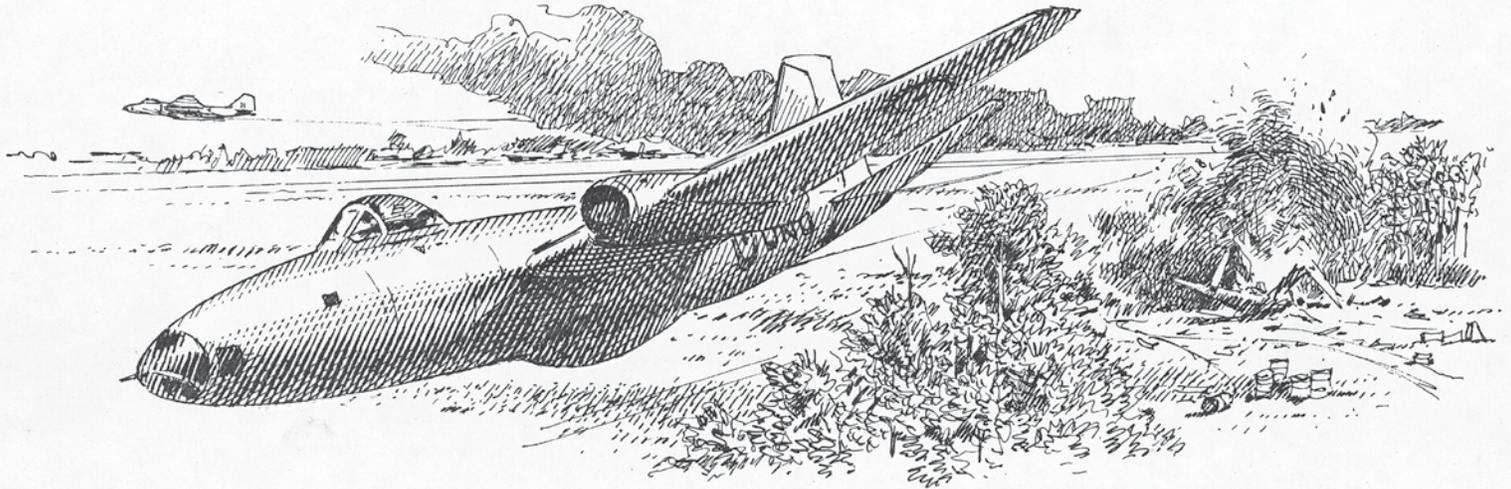
Airways' Director of Brand and Customer Experience, said: "Many of our customers are curious about flying and want to know who or what else is on their aircraft. With more than 800 flights each day all over the world it takes a lot of planning, from loading cargo to wine, to toilet rolls, and first aid kits."

New champagnes and English sparkling wines for customers travelling in First Class and Club World have also been added to the list of items onboard, as part of the airline's £4.5 billion investment for customers over the next five years. The investment is also driving the installation of the best quality WiFi and power in every seat, the fitting of 128 long-haul aircraft with new interiors and the delivery of 72 new aircraft.

Happy landing !

Courtesy: BA

Out of Africa



IAF Canberras in the Congo

An unusual commitment of the Indian Air Force during the early 1960s was to support the United Nations in the Congo in Central Africa. Following the secession of Katanga, masterminded by commercial interests in Belgium, the UN had appealed for both ground troops and combat aircraft to restore law and order and peace. Six Canberra B(I)Mk.58s of No. 5 Squadron ('Tuskers') of the IAF, were thereafter deployed from their home base in Agra to the heart of Africa. Operating from Leopoldville and Kamina, the Canberras were to systematically obliterate the mercenary air force, destroy Katangan targets and generally provide UN ground forces with effective air support.



The geo-political cauldron

In 1959, Belgium had declared its intent to grant independence to its colony in Africa, Belgium Congo, this being cynically regarded as a hasty response of a minor European country wanting to disassociate itself from the growing post-colonial world. The Congo was soon afflicted with political and tribal violence. The post-independence political vacuum attracted private capitalists, who greedily sought to carve out their financial fiefs.

A day after their independence on 30 June 1960, troops of the newly formed National Congolese Army (*ANC-Armee Nationale Congolaise*) mutinied in Leopoldville (now Kinshasa), capital of the new nation, against continued appointment of Belgians in political positions. To protect their interests in southern Congo, the Belgians then reinforced forces still deployed in the country. This military element was called *Force Publique* (FP) which also had a small air element consisting of two Sikorsky S-55 and three Aerospatiale Alouette II helicopters, a De Havilland Heron and ten De Havilland Doves, based at Leopoldville International Airport and at Kamina. In addition, the Belgian Air Force (*FAB-Force Aérienne Belge*) operated 16 North American T-6G Harvards and four



Prior to the induction of Indian Air Force Canberras, a task team of IAF officers headed by Air Vice Marshal Erlic W. Pinto, then AOC-in-C Operational Command (in picture above), was sent to the strife-ravaged country to assess the prevailing situation, check on availability of operational airfields for operations, navigation aids and general infrastructure. The team included then Group Captain Hassan Shamsi and Squadron Leader (later Air Marshal) SC Lal while the Army sent several senior officers including Brigadier (later Lt Gen) Sartaj Singh.

Fouga CM 170 Magisters from their Flying School at Kamina. The FAB's No.15 Wing in the Congo also had flights equipped with Douglas C-47 Dakotas, C-54 (DC-6) Skymasters, as well as some Fairchild C-119F Packet tactical transport aircraft.

In July 1960, under Tshombe's leadership, Katanga dramatically seceded from the Congo and declared itself an independent state, charging President Lumumba with treason by selling out the country to the Soviets, even as he appointed

himself as 'President'. Another development led to creation of the 'Autonomous Mining State of South Kasai', with Bakwanga as its capital.

Such utter chaos in post-independence Congo called for palliative measures to be provided by the UNO and Lumumba requested the world organisation "to intervene". Thus the ONUC (*Force de l'Organisation des Nations Unies au Congo*) was formed with 3500 ground troops from Tunisia, Morocco, Ghana, Ethiopia, Ireland

and Sweden, whose expeditious deployment frustrated any possible Soviet intervention. However, because of Lumumba's appeal to the Soviet Union for aid against Belgium, Nikita Khrushchev issued a "hands off" warning to the West, vowing resolute measures to curb any 'aggression'. In fact, Khrushchev had simply taken advantage of the chaos to establish a Soviet presence in Central Africa. His protégé, Lumumba, soon employed nine Soviet-crewed Ilyushin Il-14 transport aircraft to ferry loyal ANC troops to the secessionist areas.

The UN Secretary General Dag Hammarskjöld soon appointed Conor Cruise O'Brien as his special representative in the Congo. However, Dag Hammarskjöld was not fated to see his directions fulfilled. He was enroute to negotiate a ceasefire between the 'non-combatant' UN troops and Katangese forces of Moise Tshombe on 18 September 1960 when his Douglas DC-6 airliner (Swedish registered SE-BDY) crashed near Ndola in Northern Rhodesia (now Zambia). Hammarskjöld and 15 others perished in the crash which cause has never been officially determined but there were rumours that a Katangese Fouga-Magister flown by a mercenary pilot had actually shot it down.

The FAB had, meanwhile flown a number of Fouga Magister jet trainers back to Belgium, yet the *Force Aérienne Kantanguise* (FAK) continued with a nucleus of five Doves, eight T-6s, a Heron, an Alouette II, a Piper L-18C and a single S-55 helicopter.



Remains of the Swedish DC-6 in which was travelling UN Secretary General Dag Hammarskjöld



Incapacitated Belgian Fouga Magister at Kamina airfield

and Orientale (some 7000 troops), the Kasai Balubas (3000 troops) and the Katangese gendarmerie (5000 strong, including 500 white mercenaries).

Tshombe quickly reinforced his military capabilities. His 'air arm' was called KAT (also known as 'Avikat'), based at Luano airfield and consisted of nine French-origin Fouga CM.170 Magisters and five German-origin Dornier Do28As. The Fouga Magisters were armed and in addition to machine guns, could fire 68mm unguided rockets and drop 50 kg bombs which played havoc with constant attacks on opposing forces including those of the United Nations.

The 'UN Air Force'

The arrival of Indian Air Force Canberra bombers in the Congo came at a time when the country was a virtual cauldron of conflict, diverse forces ferociously trying to dominate the

The Soviet 'presence' was short lived and the UN soon occupied - and closed - Congolese airports to all except UN flights. At this stage, Mobutu seized control on 14 September 1960, expelled all Czech and Soviet Army 'advisors' and closed their embassies in Leopoldville. ANC troops loyal to Mobutu captured Lumumba and imprisoned him but Lumumba's supporters threatened in retaliation to decapitate Europeans in Stanleyville unless he was freed. Antoine Gizenga, Lumumba's closest associate, proclaimed a new, pro-communist government in Stanleyville on 13 December 1960, again backed by the Soviet Union.

In January 1961, ANC units loyal to Lumumba invaded northern Katanga to support rebellion of Baluba tribesmen against Tshombe's secessionist regime. Lumumba was flown to Bakwanga (where his aircraft could not land) and then continued to Elisabethville where he was promptly shot dead on arrival.

The murder of Lumumba was announced only on 12 February 1961, causing revulsion internationally. Belgian embassies were attacked in many countries and Belgian property confiscated. At this juncture, the Governments of Egypt, Soviet Union, Ghana and Yugoslavia "recognised" the Lumumba government. The world was getting very concerned indeed. In February 1961, Gizenga's troops controlled three out of the country's six provinces and he engineered expulsion of all Europeans and other foreigners. Gizenga soon agreed to join a central cabinet under Cyrille Adoula and to participate in a parliament with 'Lumumbists' holding key posts. But the conflict worsened. The armed forces had remained under the UN, including the ANC (some 7500 troops) Gizengas Kivu



Katangan troops along with mercenaries fighting UN forces



Various aircraft types of the United Nations peacekeeping Air Forces are at Kamina including F-86 Sabres from the Philippines, Iran, and Ethiopia along with J-29s from Sweden. Also in the picture are S-55 helicopters and a lone C-47 Dakota



Canberra B(1) Mk.58 interdictor bomber of No.5 Squadron IAF, in UN colours, prior to take off from Air Force Station Agra



Indian troops arrive in the Congo, marching past UN C-119 and C-47 transport aircraft

with aircrew drawn from different Air Forces. The UN's air assets were based at Kamina and were given a massive boost on 9 October 1961, when six Canberra B (I). Mk 58s of the IAF arrived, under command of Wg Cdr AK Soares. IAF ground support personnel had been transported from Agra in four USAF C-124 Globemasters.

Sometime earlier, India's Prime Minister Jawaharlal Nehru had been quick to respond to the UN's appeal for help, and had immediately released Major General Inderjit Rikhye for the command appointment. In August 1960, Dag Hammarskjold, the UN's secretary-general, made a personal plea for the secondment of Rajeshwar Dayal to head the entire UN operation. Following the loan of these and other key personnel, a later request for assistance by armed troops and military aircraft was received by the Government of India and help was again immediately granted. An Indian Army Brigade Group proceeded to the Congo and requests made to the Indian Air Force for ground support aircraft were agreed to.

balkanised region. The main objective was to neutralise the Katangese Air Force (KAT), which was to be destroyed at the soonest by the unified UN Air Force under command of Air Commodore Morrison of the Royal Canadian Air Force.

The 'UN Air Force' in the Congo consisted of Ethiopian Air Force F-86F Sabres, augmented by those from the Philippines and Iran plus three Swedish Air Force Saab J-29B Tunnan fighters and two S-29C reconnaissance fighters plus a squadron of 16 Italian AF C-119s and a combined UN Dakota Squadron, commanded by an IAF Wing Commander



Indian Air Force personnel with Canberra of No.5 Squadron at Leopoldville in the Congo



Indian troops with their vehicles on arrival in the Congo

Initially, the Hunter fighter ground attack aircraft was considered for the task but choice was changed to the Canberra interdictor-bomber, despite the fact that the UN had decreed that no bombs would be carried or dropped. This decision was made for three main reasons: firstly, the Canberra was formidably armed with four 20-mm cannon in a ventral pack; second, it had long endurance and great operational range, and third, a navigator and airborne navigation aids such as the 'Green Satin' were considered essential for the task in view of the poor weather and virtual absence of ground aids in central Africa.

No.5 Squadron (*Tuskers*) equipped with the Canberra B (I) Mk.58 interdictor bomber was to provide six aircraft, aircrew and ground support personnel. Led by the CO, Wg Cdr AIK Soares, the initial four Canberras left their base at Agra on 17 October 1961 for the Congo, flying by way

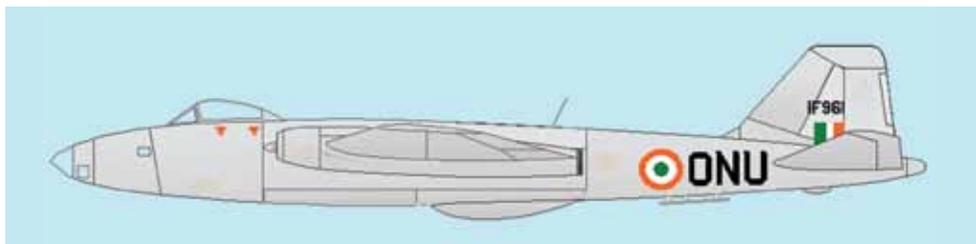
of Jamnagar, Aden and Nairobi; four USAF C-124 Globemasters transported the 150 NCOs and airmen of the ground party, plus support equipment. Amongst the aircrew were two of the IAF's finest bomber pilots, Flt Lts 'Pete' Gautam and Charanjit Singh whose actions in future major wars in the sub-continent were to become legendary.

On arrival at Leopoldville, Wg Cdr Soares reported to the United Nations Air Commander, Air Commodore Morrison (seconded from the Royal Canadian Air Force), who had by this time an odd assortment of aircraft under his command, including, among others, those F-86 Sabre fighters from various Air Forces and Saab J-29s of the Swedish Air Force. Then there was this squadron of sixteen Fairchild C-119 Packet transports of the Italian Air Force, plus a combined UN Dakota squadron crewed by members of various air forces, including those of Argentina and Brazil, being commanded by Wg Cdr GB Singh of the Indian Air Force.



The hunted: Katangan Air Force Air Fouga Magister (image by Robert Craig Johnson)

Accommodation was provided for the Canberra party some miles away at Limite and the IAF quickly settled into the new environment and, most importantly, got familiar with the area from the air. The intensive flying programme covered low-level sorties at 500 ft and often lower, formation flying, night flying and in general 'showing the flag' for making their presence felt. The Indian Independent Brigade Group had, earlier in August, launched *Operation Rumpunch* to take into UN custody the many foreign mercenaries serving with the Katanga Gendarmerie.



The hunter: Indian Air Force Canberra B(1) 58 (image by Robert Craig Johnson)



Remains of a 'Seven Seas' Company DC-4

This was followed, in September, by the attempt to seize Katangese airfields and communication networks, but primarily for the protection of refugees.

Towards the end of November came news of a massive build-up by the Katangese Army in Kolwezi, 130 miles NW of Elizabethville, then held by a battalion of the Indian Brigade. Indian Army personnel were being ambushed, and air strikes were being made by this lone Fouga Magister thought to be flown by a French mercenary named Jacques Delen. This aircraft would fly over Kamina, and bomb hangars and the transport aircraft which regularly flew in from Leopoldville on supply missions. These aircraft, incidentally, came from a remarkable airline called the *Seven Seas Company*, with aircrews made up of Americans, Swedes and Britons. Their main task was to fly in full fuel drums abroad DC-4s and other aircraft types.

By early December, the United Nations Air Commander was ordered to take action and the Canberra crews from No.5 Squadron were summoned for briefing. Within hours, six Canberras took off, in three waves of two aircraft each, led by Wg

Cdr Soares. The first pair were to attack and destroy the airfield at Kolwezi while the second and third waves were each given a series of grid map references for areas where Katangese troop concentrations and convoys had been reported.

It was a formidable task, since the targets were over 800 miles (1,290 km) distant and route to the target was blanketed in cloud. The plan of action was to find a lake which lay to the west of Kolwezi and then map-read over the final leg to the airfield, using the 'Green Satin' airborne navigation aid. The moment of truth came even as Wg Cdr Soares dived, keeping a wary eye on his altimeter, to break cloud just 400 ft above surface of the lake: a quick check of lakeside features and he turned in to the airfield – and what a target!

A light transport aircraft had just taken off and had disappeared into the clouds hanging low above the runway. Two large transport aircraft were refuelling by the control tower and, parked behind the main runway, were some six or seven light transport and communications aircraft. Well off to one side in a jungle of clearing was that dreaded Fouga Magister which had 'terrorised' Elizabethville and Kamina.

As Soares later recalled, *I took out all the light aircraft with my 20 mm cannon on the first low level pass attack whilst Flt Lt Gautam, flying the second Canberra, destroyed the Fouga Magister. We made a rapid turn and, on the second pass, I concentrated on the heavy transports and control tower. During the second run in I saw that we had stirred up a hornet's nest of activity. Katangese soldiers were running about everywhere, and scores of*

muzzle flashes told me that we were flying through a curtain of bullets. On the third and last pass I saw that all the parked aircraft and the control tower were ablaze, so we both hammered away at the stacked fuel barrels, the adjacent hangars and the buildings.

The Canberras then set course for Kamina airfield, which was to be their new base. On arrival they learned that the raid had been an outstanding success. The other Canberras had all homed in on the lake, found their targets and dealt with them to great effect. After rapid refuelling and re-arming, the Canberras returned to the fray, knowing that they enjoyed complete air superiority, all the Katangese aircraft at Kolwezi and Jadotville having now been destroyed.

Wg Cdr Soares led his Canberras back to Kolwezi for their second strike. *On my first pass I flew low over the bulk petrol stores without firing, and was relieved to see people scurrying out of the way before I turned around for a second pass, firing a one-second burst. Since our cannon shells were loaded alternately with high explosive and incendiary heads, only one hit was needed to 'whoosh' off the entire line of storage tanks. On the third pass I concentrated on anything that had survived the previous attacks. As before, we were flying through an angry hail of small arms fire and as I pulled up I heard an ominous bang as my aircraft was hit in the nose area. My navigator, Flt Lt MM Takle was struck in the upper thigh. I pulled up through cloud and set course for Kamina, set the controls to automatic and climbed down and forward to render first aid. He was in great pain, and I had to apply a tourniquet above the gaping wound before returning to the controls. On landing he was rushed to the UN hospital and subsequently recovered.*

Other Canberras sustained anti-aircraft fire hits as well, but thanks to the excellent work by ground technicians, none were grounded for more than an overnight. For the next week, the Indian Canberras made numerous armed reconnaissance sorties. The war was hotting up, and on 9 December Wg Cdr Soares was summoned to Elizabethville for briefing. *Again, I hitched a lift in a transport aircraft into the middle of the battlefield area, where I met Brig KAS Raja, commander of the Indian Brigade. He was in the thick of the battle and there were shells howling over our heads as he pointed out on the map areas he wanted neutralised, and then took me forward to point out the exact*

targets on the ground return to base, I briefed Sqn Ldr PPS Madan, Flt Lt Dushyant Singh, Flt Lt SC Singh and Flt Lt Peter Gautam for the operation.

The Canberras once more carried out immaculate raids, with Flt Lt Charanjit Singh, despite heavy and accurate anti-aircraft fire, "posting his cannon shells



IAF Canberras at Kamina



Katangan and foreign mercenaries scatter during aerial attack at Elizabethville

straight into the post office" with devastating effect. This building housed the main communication Centre for the Katanga capital and its destruction was to have far-reaching effects. The other aircraft in the raid strafed road convoys, ammunition dumps and various strong points, much to the subsequent delight of Brig Raja. The transmitter was destroyed and with it, Katanga's communication with their European mentors was snapped.

Over the next days, IAF Canberras continued to fly operational sorties around Elizabethville, often in direct contact with Forward Observation Officers who guided them on to their various targets, which were expertly camouflaged, often almost invisible from the air. The Katangan troops and foreign mercenaries fell back and Gorkha units followed up their attacks with other

infantry troops from the Indian Brigade. The fire support given by the Canberra squadron was rated as the major factor in the battle for Elizabethville.

The following weeks, into January 1962, found the IAF Canberras flying a heavy programme of armed reconnaissance sorties, looking for targets of opportunity and striking at convoys wending their way along the enemy lines of communication. The weather was, as ever, unpredictable, from a few hundred feet clouds building up rapidly into a solid wall towering to some 40,000 ft, vicious electrical storms were encountered and visibility in the driving rain was appalling.

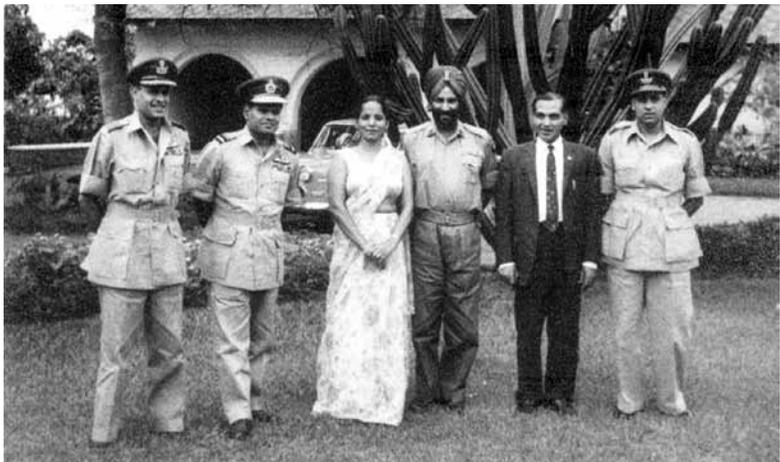
The combat pressures gradually died down hereafter but operational photographic reconnaissance missions still had to be flown, and visual confirmation on the state of vital targets such as bridges, troop

movements and concentrations reported back to commanders of the land battle.

The main air actions had taken place from late November 1961 until early January 1962; soon after Wg Cdr (later Air Commodore) Soares handed over command to Wg Cdr (later Air Marshal) S Jena, to return to Agra and resume command of the main component of No.5 Squadron. He was later to receive a bar to the VrC he already had from a previous campaign. The Vayu Sena medal was won by Flt Lt P Gautam and five officers and NCOs of the ground party in the action in which the Indian Canberras provided the UN with their real force multipliers.

[With extracts from 'Himalayan Eagles' Volume II, History of the Indian Air Force by Pushpinder Singh].

A senior Indian team was led by Air Vice Marshal Erlic Pinto, which included Gp Captain Hassan Shamsi, Sqn Ldr SC Lal, Brigadier Sartaj Singh and other officers, to the Congo prior to induction of the Indian Air Force Canberras.



These rare images, taken in the Congo over 57 years ago are courtesy Air Marshal SC Lal (retd)

The Dakota returns 'Home'

A Red Letter Day, Worthy of Five Stars



Air Marshal GD Sharma &
Dakota VP 905

Fourth May 2018 will go down as a red letter day in history of the IAF even as a venerable C-47/DC-3 Dakota “returned home”, to its old family fold, the Indian Air Force. Being from amongst the fighter aircraft fraternity, I have no pretences of having experienced the challenges that faced the Dakota and its gallant crew members when operating in the challenging Himalayan environment. But starting with the Kashmir Operations of 1947 and thereafter, in the treacherous hills of the north east, it was the Dakota and its indomitable crew members that contributed immensely to safeguarding our national frontiers [see allied article].

In my view, these are the five stars that made 4 May 2018 a red-letter day: On this day, this Douglas DC-3 Dakota, given the tail number VP 905 and christened

as *Parashurama*, joined the IAF’s Vintage Flight at IAF Station Hindan.

Having been its primary transport aircraft and solid workhorse for several decades, the Dakota served with the IAF from 1947 onwards, playing a crucial role both in the Kashmir 1947-48 and 1971 Indo-Pak conflicts, and in many counter-insurgency operations in between. Pioneered by the legendary Air Commodore (then Wing Commander) Mehar Singh (‘Baba’), the Dakota had made the first ever landing of a transport aircraft at the high airfield of Leh at an altitude of 10,700 ft. Earlier, RIAF Dakotas flew in troops and supplies during the siege of Poonch in 1947-48. According to aviation historian Pushpinder Singh “The Dakota is the reason why Poonch is still with us”. What better tribute can

we pay to this aircraft which had made history during the Second World War and for several decades after? Inevitably, as time (and airframe life) took their toll, the faithful Dakota was retired some decades later, to give way to the Avro (HS 748) in Indian Air Force service, followed by other types.

This particular example of the Dakota had been identified and bought from scrap, refurbished in the UK and ferried to India by a combined and determined British/IAF team. The tail number VP 905 was appropriately chosen, being that of the Dakota piloted by Wing Commander KL Bhatia of No.12 Squadron which transported the first batch of troops (1st Bn, the Sikh Regiment under command of Lt Col Dewan Ranjit Rai) to Srinagar on 27 October 1947 and commencement

of IAF operations in the 1947-48 war. By the end of that first, fateful, day in October 1947, three Dakotas of the RIAF along with six civil Dakotas, had made 28 vital sorties from Palam (and Willingdon, now Safdarjung airports) in New Delhi, ferrying troops and their small arms to Srinagar and defence of the Kashmir valley.

70 years later

Over 70 years later, this Dakota (VP 905) was accepted by Chief of the Air Staff, Air Chief Marshal BS Dhanoa from the Rajya Sabha MP Rajeev Chandrasekhar, when a Gift Deed was signed on 13 February 2018 but it was later on 4 May 2018 that the CAS formally received papers of the Dakota from the MP's father, Air Commodore (ret'd) MK Chandrasekhar.

This Dakota has now joined the IAF's Vintage Flight at Hindan in the company of two other treasures, the Tiger Moth and Harvard. Since maintaining, flying and preserving vintage aircraft is well beyond the required skills of today's "techno-logistic air warriors", there has emerged yet another specialist breed who restore and maintain such vintage aircraft. The IAF, in keeping these aircraft airworthy and show casing them on special occasions will, hopefully, stir nostalgic memories amongst IAF veterans whilst inspiring air warriors of today and those of the future.

Air Commodore MK Chandrasekhar, a veteran Dakota pilot himself, with nearly 13,000 flying hours in the IAF, said at this memorable event that "this aircraft is dedicated to all air warriors and their families who served and flew the Dakota in various IAF operations in the remotest parts of India from 1947 till its retirement." His son Rajeev Chandrasekhar MP, had in an interview two years ago, said that because of his upbringing, had always been deeply interested in military history and being a pilot himself, also knew about aircraft. He was horrified to learn in 2010 that the last remaining Dakota at IAF Station Sullur had been sold as scrap. He later located one in Ireland, which needed to be refurbished and then bought it. But his proposal, in 2011, to gift this to the IAF met with a blank from the highest levels of government since he was informed that the IAF had no policy of receiving such gifts! Fortunately, his perseverance paid off and in 2016 the government changed its stand.

After this initial rejection, he reflected, "in many ways, the rejection of my proposal is emblematic of the way we treat our military, its history, traditions and sacrifices. Britain still celebrates the sacrifices its airmen made, and *The Battle of Britain Memorial Flights* reminds people of Britain's finest hour." In his view, true patriotism was not about slogans, "but recognition and honouring of those Indians who have protected our country and the military traditions that made those men".

He concluded that "India requires its political leadership to take an interest in its military history" and he personally did so by the example he set on this memorable day.



Air Marshal Gian Dev Sharma with family and friends at Hindan

Air Marshal Gian Dev Sharma

There were a galaxy of Air Force veterans at Hindan, amongst whom were many who had spent a lifetime with the Dakota, so it would be unfair to single any one for special mention, except that much like VP 905 making history, there was one amongst them doing so as well.

It can be said with certainty that not only was Air Marshal Gian Dev Sharma the eldest Dakota pilot present that day, but in all probability also the oldest living Dakota pilot in the world. At 96 years of age, his family had made every effort to see that he did not miss this historic event. He came all the way from his home in Dehra Dun to be present on the occasion, to be with his faithful aircraft in which he had flown thousands of missions for so many decades.

Commissioned on 10 November 1941, GD Sharma spent the first few years in service with fighter squadrons such as Nos.1, 8 and 10, flying the Wapiti, Vengeance, Hawker Audax, Lysander, Hawker Hart, Hurricane, Tempest and Spitfire, amongst other types. His tryst with the Dakota commenced with No.12 Squadron on 23 November 1947 with Dakota (MA 963) and he signed off his last Dakota mission on 4 December 1977 on HJ 910. He had commanded No.12 Squadron from July 1958 to April 1960. In his years with the Dakota, in which he clocked over 2600 hours of flying, these of course were operational missions but also VIP flying of the Prime Minister on 20 November 1948 in Dakota HJ 205 from Palam to Srinagar and an early UK courier commencing from Palam on 5 February 1952 and returning on 3 March 1952. On that courier the outbound route followed was from Palam to Jamnagar, Sharjah, Baghdad, Nicosia, Eladem, Luqa, Istres, Geneva, Zurich, Paris and destination Abingdon. The inbound route was from Abingdon, Istres, Tunis, Castle Benito, Eladem, Nicosia, Baghdad, Bahrein, Sharjah, Jamnagar and Palam.

Air Marshal GD Sharma retired as AOC-in-C Central Air Command, 40 years ago, in December 1978. Undoubtedly, the greatest honour that Air Marshal Sharma could have accorded his Dakota Group colleagues was to continue displaying the leadership, courage and comradeship which marked his presence on this historic day.

As for me, I can only say with nostalgia that I did not miss the thrill of flying the Dakota in the course of my testing career, my first such experience being in Dakota (IJ820) only on 4 December 1964!

Air Marshal Brijesh D Jayal (ret'd)

*Photographs from Air Marshal
GD Sharma's family.*

Indian Air Force History

The Douglas C-47 Dakota in IAF service



The world's most widely used general-purpose military transport, the Douglas C-47 was military transport version of the commercial DC-3 airliner which first flew on 22nd December 1935 and entered service with the United States Army Air Force in 1941. Hundreds of C-47s entered a fourth decade of service in the 1970s and a total of 10,926 C-47s (Dakotas in RAF service) were manufactured in the USA, while licence production was also undertaken in the USSR and Japan. The C-47 could accommodate 28 troops or carry 7,500 lb. (3,406 kg.) of cargo and was powered by two 1200 h.p. Pratt and Whitney R-1830-90c radial engines.

More than any other type, the Dakota dominated in its service with the Indian Air Force, quite appropriately with its glorious place assured in the history of aviation. The establishment of a transport unit in the Royal Indian Air Force was considered soon after the Second World War and No.12 Squadron was earmarked for eventual conversion to the C-47 Dakota general purpose transport. In fact No. 12 had initially been raised with Spitfires in December 1945 at Kohat and was to have re-equipped with twin-engined fighter-bomber aircraft but as these were not available, the transport role was allotted to this formation which received ten C-47s at Panagarh towards the end of 1946. An inauspicious beginning, for most of these aircraft were badly damaged and written off in wake of a cyclonic storm which hit the sprawling airfield and replacement aircraft were only available some months thereafter.

The Squadron briefly trained on twin-engined Oxfords at Bhopal and then moved to Mauripur for final conversion to Dakotas,

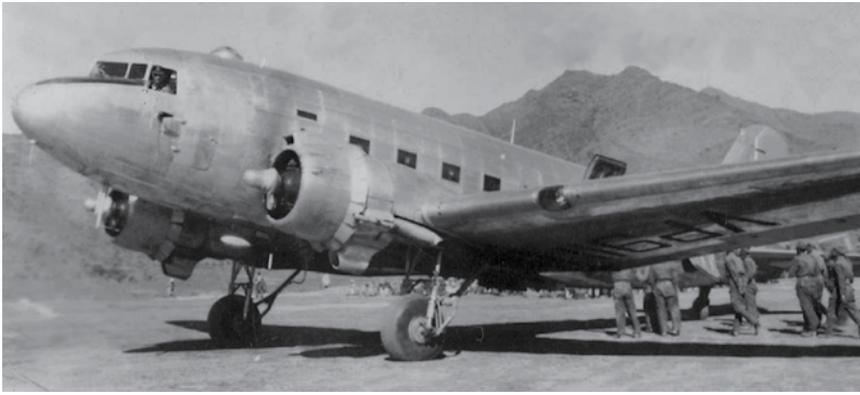
RAF instructors being provided by Nos.10 and 31 Squadrons RAF. During their training period, No.12 Squadron's Dakotas flew passenger and freight runs from Karachi to Poona and Jiwani, carrying urgently needed water supplies to that drought-stricken area.

The Squadron then moved to Chaklala (Rawalpindi) in mid-1947 with a flight detached at Drigh Road and was involved with the Paratrooper Training School which was expected to function under a joint India-Pakistan command for three years. In the event, No.12 was allotted to India and Pakistan was to instead receive Dakotas assigned to No. 6 Squadron which was converting to the transport role from fighters at Drigh Road. In August 1947, No.12 Squadron with ten Dakotas (VP series) was rapidly transferred to Agra which became its permanent base in independent India.

The Dakotas very soon demonstrated their worth dramatically in the turbulent times, one of the first operational tasks facing

the RIAF on partition being evacuation of almost 30,000 refugees from a newly born Pakistan. In October 1947, large bands of raiders poured across the border into Jammu and Kashmir; on the 25th the Maharaja sent an SOS, signing the instrument of accession leading to the momentous decision to send Indian military aid to Srinagar. By midnight on 26-27 October, 329 men of the 1st Battalion, The Sikh Regiment had assembled at Palam airfield and three Dakotas of No.12 Squadron were airborne with the battalion headquarters at dawn, one company following' in civilian Dakotas from Willingdon airport, the aircraft being landed at Srinagar unsure if the airfield remained in friendly hands.

As recorded, "in the whole story nothing is more astonishing than the airlift of 27 October which changed the course of history". Lord Louis Mountbatten has said that in all his experience of SEAC and over-the-hump flights to China, he had never known of such an airlift being effected at such short notice. In less than 48 hours over



Dakota (in civilian registration) at Srinagar airfield, 1987

a hundred civilian and RIAF Dakotas had been assembled to fly troops, equipment and supplies to Srinagar. RIAF and civilian pilots and ground crew worked by day and night. 704 sorties were flown unabated from Delhi, staging through Jammu, till the 17 November.

No.12 Squadron distinguished itself through all phases of the fourteen-month campaign in Jammu and Kashmir. With one aircraft damaged in the first critical month, the strength was nine Dakotas, supplemented by another eight aircraft in 1948. The Dakotas played a valuable part in the recapture of Jhangar in March 1948, conveying tons of army requirements from barbed wire to rations and ammunition right up to the ground troops forward lines. Meanwhile the garrison at Poonch held out against repeated assaults and to facilitate regular flow of air supplies, 6000 refugees volunteered to work day and night in completing a rough airstrip in one week.

On 12 December 1947, the first Dakota of No.12 Squadron landed initiating operation 'Punching' which signified flying in the vital stores and flying out refugees

and casualties. Although in December the RIAF had landed a section of 4th (Hazara) Mountain Battery, hostile guns still had to be neutralised by 25-pounders. On 21 March 1948, seven Dakotas landed the artillery and equipment both in day and by moonlight while the airstrip was being shelled. No.12 had a large share in the successful defence of Poonch, carrying out 73 sorties in six days, flying in 421,000 lbs. (191,200 kg) of supplies and evacuating 35,000 refugees. In September, with the airstrip again damaged, the Dakotas free-dropped stores flying low over the airstrip. Dakotas not only operated from the difficult Poonch airstrip but from small semi-prepared Auster fields, particularly Potha, for evacuation of serious casualties.

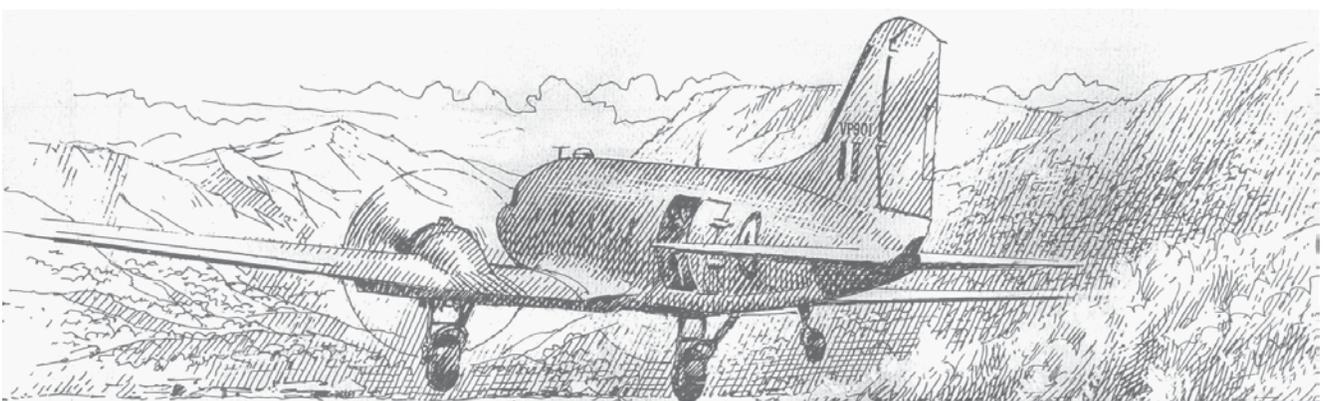
The Dakotas now pioneered the air route to Ladakh. As the raiders' threat to Leh became imminent, Air Commodore Mehar Singh undertook a flight to Leh on 24 May 1948, along an uncharted route at 25,000 feet (7,620 m.) and over the world's highest mountain ranges, landing at an improvised strip at Leh, 11,554 feet (3520 m.) a.s.l. In June, two companies of the

2/4 Gurkha Rifles were flown to Leh from Srinagar in six Dakotas of No.12 Squadron fitted with improvised oxygen apparatus, the aircraft keeping their engines running while unloading and reloading and so building up the Leh garrison energetically.

Dakotas also lent a hand in offensive action and some aircraft were fitted with bombs. In March 1948, RIAF Dakotas loaded with 500 lb. (227 kg) and 1000 lb. (454 kg) bombs, to be rolled out by hand, bombed hostile positions in the Rungad Nullah area of Poonch, this unnerving the hostiles.

In the Hyderabad police action, as part of 'Caterpillar' Air Task Force, two Dakotas of No.12 Squadron were moved from Agra to Poona and, carrying 500 lb. bombs, scored two direct hits on Bidar airfield runway on 13 September 1948, despite machine gun and small arms fire. On the 13-14 September night, Dakotas flew over Hakimpet and Begumpet airfields dropping leaflets with the 'call-to-surrender'.

Meanwhile, more Dakotas were being made available to the Air Force. The end of the Second World War had hundreds of aircraft formerly with the 3rd Tactical Air Force and US 10th Air Force and lacer surplus to requirement scattered at a number of maintenance depots. HAL at Bangalore was involved with overhauling and refurbishing of over one hundred of these Dakotas for the IAF during the period 1949-51 (HJ, BJ, LI series.) In later years, about 12 aircraft were fitted with Wright Cyclone engines, and known as *Hyper Dakotas*, continued in service till 1967. Some other Dakotas were procured from the civil airlines and state royal flights and No.11 Squadron was subsequently formed in September 1951 as the IAF's second



*Evocative drawing of IAF Dakota taking off from Poonch, during the seige of 1947-48
[Collection of The Society for Aerospace Studies]*

transport unit. In 1954, No.12 Squadron was to receive C-119G Packets, becoming a composite unit as the C-47s were retained for some years till they were passed on to the newly-formed No. 43 Squadron. The third C-47 transport formation was No. 49 Squadron, flying Dakotas in Eastern India.

On 5 October 1947, the IAF had procured a Dakota of standard 21-seat configuration from Tata Airways and this aircraft (HJ 205) became the first of many in the HQ Communication Squadron, additional Dakotas, fitted out in the VIP configuration, forming part of this unit; other Command communication flights were to receive numbers of the Dakota as well. Dakotas transported VIPs and delegations far and wide. In December 1952 the retiring air chief was flown to the UK in an IAF Dakota escorted for some distance by six Spitfire PR Mk.XIXs and in September 1956, a Military Goodwill mission flew in a Dakota from Palam to Peking via Barrackpore, Hanoi, Canton and Hankow.

In 1948, coastal flight training was conducted on Dakotas and many a crew on maritime patrol duties in the B-24 recalled their orientation on the versatile and ubiquitous Dakota. Yellow-painted Dakotas were given to the Conversion and Training Squadron at Agra which moved to Begumpet during December 1956, subsequently expanding into the Transport Training Wing and being split between Begumpet (as No.1) and Yelahanka (as No.2) TTW. In 1949, the Navigators Training School was established at Jodhpur as part of the AFFC, the Dakotas being fitted-out with six navigational-signal consoles for the purpose. The Paratroop

Training School at Agra had its complement of Dakotas while traditionally black-and-yellow striped Dakotas served with Nos.1 and 2 Target Towing Units at Cochin and Palam, towing sleeves for army and naval anti-aircraft gunners. The Dakota has also been engaged in photographic and other surveys of India with No. 106 (Strategic Reconnaissance) Squadron.

Dakotas employed for aid-to-civil authority tasks for years and missions of mercy carried out from Rajasthan to Assam. In 1950-52, Dakotas dropped food and supplies at areas devastated by floods in Assam and Manipur, urgent medical supplies were dropped over Gyantse in 1954, food and material airdropped in Orissa, Gurdaspur, the Palwal area, Chamba, Lahoul valley and Nepal in 1955, food supplies rushed to Pangi valley and flood relief in Ceylon in 1956 and so on into the sixties, with airdropping of rice in Mizo hills, flood relief in UP and North Bengal, the Dakota has been the common factor.

The main function however, remained tactical transport support to troops and para-military forces in the difficult jungle and mountain terrain of NEFA and the Naga Hills. With formations concentrated in Assam and detachments based at a number of airfields, the Dakotas airdropped ammunition and supplies, flying low in valleys and between hill tops, often facing hostile fire when flying in assistance to beleaguered posts in Nagaland. A Dakota was shot down while supply dropping onto a beleaguered Assam Rifles post at Purr on 26th August 1960, and the crew kept in captivity for some years thence.

In the 1962 operations against the Chinese, IAF Dakotas, augmented by some from Indian Airlines, flew in troops and supplies to forward airstrips and evacuated casualties, a note-worthy effort being free-dropping of supplies at Walong even as Chinese artillery straddled that airstrip. In March 1962, a Dakota 'freighter' (VT-CGP) was bought from Air India and in March 1963, six ex-RCAF. Dakotas were received as part of the aid from Canada making up some attrition.

And so into the seventies, it was difficult to select a replacement aircraft to fulfil the same requirements. Although spares gradually become more difficult to procure, the venerable Dakota continued to serve as a tactical transport, VIP communication aircraft and a multi-engine trainer. The Transport Training Wing, combined at Yelahanka in 1970, was however to be discontinued from 1973 and the Navigation and Signal School at Begumpet supplanted the Dakota with the HAL-built (Avro) HS 748.

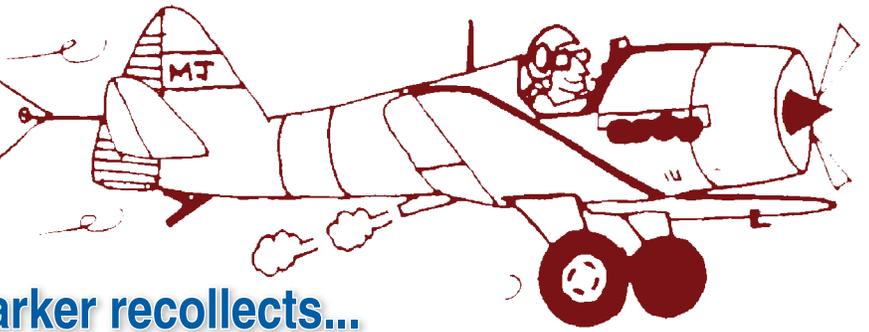
In December 1971, Dakotas formed Part of the fleet which airdropped paratroopers and stores in Bangladesh while in the West, an Air Delivery Flight using Dakotas flew 207 sorties conveying vital spares and stores from Equipment Depots to operational units, this ensuring a high rate of serviceability amongst combat squadrons. The Dakota thereafter continued to make its contribution for some three decades of service with the Indian Air Force. *[The Dakota was finally retired from IAF service in 1979]*

[Extracted from 'Aircraft of the Indian Air Force, 1933-73' by Pushpindar Singh]



IAF Dakota at an Eastern airfield

Ancient Aviator Anecdotes



Air Vice Marshal Cecil Parker recollects...

TENNIS ANYONE?

The two outdoor activities I enjoyed most in my life were flying—and tennis! The former was of course my essential profession for 35 years whereas the latter was my preferred game for 65 years. As a school boy in the 1930/40s I was introduced to tennis by my father who took me along to his club and, after playing, handed his racquet over for me to pick up the basics from the club markers. In college we were fortunate to have a court alongside our hostel and, with regular practice with some talented and experienced fellow students, I was able to make it to the college team by 1949-50. On joining the air force in 1951, a fellow flight cadet and I were invited to play tennis at a local club by our Chief Ground Instructor (CGI). My more experienced partner (he had represented BHU) and I were just able to get the better of the CGI (a future Services player) and his partner (a future CAS); both of them were to be my mentors in the years to come.

In the early 1950s, few fighter air bases had any courts in their Officers Messes or in nearby clubs, hence tennis was sporadic. However, three tenures at Defence Services Staff College (DSSC) in the 1960s, 70s, and 80s provided, not only joint services professional knowledge in the class room, but much tennis at the Wellington Gymkhana Club. In fact, while on the faculty in 1973-75, I was fortunate to have some keen and talented players who did the college proud in tournaments at various Planters clubs in the Nilgiris.

One special game is remembered. My son, then a teenager in boarding school and a good tennis player, was on holiday and we were playing together at the Coonoor club when the legendary Krishnan and his teenage son (up from Madras/Chennai for the weekend) joined us. On discovering that we too were father and son, he invited



us to play a friendly doubles; no prizes for guessing who won!

In 1980, while attending the course at the RCDS London, we were very fortunate to have the President of RAFTA (Royal Air Force Tennis Association) as a member. Thanks to his links, four of us from three different countries played regularly at the courts in Belgrave Square but where I had to learn to pick up tennis balls myself! He also helped us to attend the Wimbledon Championships that year. On the first day of the Championship my wife and I joined all the other Indians present at Court No 17 to cheer young Vijay Amritraj. We were indeed lucky to see the top players of the day, but the best was yet to come. Thanks again to RAFTA, the four of us were invited to play a practice game at Wimbledon two weeks after the Championships closed, (“Tell your grandchildren you played here”) and were allotted Court No 17 ! (Since three of my grandchildren grew up within a kilometre of Wimbledon, they were not that impressed!).

Post retirement we settled in Secunderabad and were again fortunate to have tennis facilities at both the club and the RSI. On one occasion Nasiruddin Shah (whose brother was the then local Division commander) visited and I was invited to

form up a foursome for tennis. His touch on the court was as effective as on stage/screen and provided a great deal of excitement to our ball boys at the RSI who were thrilled that the thespian celebrity was on their tennis courts.

On one of our many trips to the UAE I accompanied my teenage grandson to his club in Dubai where he was being trained by a professional coach from the Philippines. On learning that I was an old tennis player from India (I was then in my late 70s), he came over, introduced himself, invited me to play and mentioned that he had played against “your Amritraj”. I explained that I was an ordinary club level player but was delighted to see a fourth generation member of my family demonstrate excellent tennis potential under his training.

In my early 80s, I perceived that my tennis partners/opponents seemed to get younger and younger every day! After a fall on court (which fortunately broke no bones) my wife ruled out any more tennis and restricted my outdoor activities to the swimming pool. My tennis is now confined to the TV where I marvel at the power and precision of today’s top players. At this point I am tempted to draw some analogies between flying and tennis, but will leave that for another day...

25 Years Back

From Vayu Aerospace Review Issue V/1993

Wanted : an Advanced Jet Trainer

In a recent interview with the *Vayu Aerospace Review*, Chief of the Air Staff described the logic of the IAF's need for an advanced jet trainer. With the obsolescence of all its trainer aircraft and the consequent need to induct new aircraft types, the IAF has been planning to take the opportunity to switch to the more modern two-phase system (basic and advanced), which streamlines the flying training, economises on the variety of trainer aircraft in service and the number of flying hours needed thus reducing the training period overall. "It is, therefore, necessary that the IAF adopts such a new training system as early as possible."

Déjà vu

Forty years ago, in 1953, the motley collection of private airlines which then operated in Indian skies were nationalised and, under the Air Corporations Act, Indian Airlines Corporation (IAC) was created to provide scheduled air services throughout India, and to some regional countries. Now, in 1993, there is a déjà vu situation in reverse, with a motley collection of private airlines operating in Indian skies, but with the difference that they now challenge and compete with that very Indian Airlines Corporation.

40% Foreign Equity in Private Airlines

The Government of India have reportedly cleared the proposal for foreign equity investment in Indian aviation companies, up to a maximum of 40%. This will thus pave the way for direct foreign investment in some of the Indian air taxi companies by international airlines. Jetair, one of the more successful of the air taxi companies, had applied to the Government for permission to allow two international airlines to have an equity stake in the Indian company. The resultant Jet Airways has proposed that Gulf Air and Kuwait Airways should each be permitted to acquire 20% stake in the overseas parent body of this new airline.

RMAF requests IAF's support

A delegation of the Royal Malaysian Air Force visited India during the last week of August for detailed discussions with the Indian Air Force on vital training and maintenance aspects of the MiG-29 air defence fighter. As per an agreement signed earlier this year, the Indian Air Force will provide servicing and overhauling facilities for the RMAF's MiG-29s. IAF instructors will convert RMAF

pilots onto this advanced fighter, both in Malaysia and India, while the IAF's No.11 Base Repair Depot (BRD) at Ozar, will assume responsibility for maintenance support also seconding personnel to Malaysia for on-line maintenance training while major overhauls will take place in India.

IAF in earthquake relief operations

Following the devastating earthquake in the southern Maharashtra region, the Indian Air Force have flown hundreds of sorties to transport para-medical teams, food, medicines, tenting, construction equipment and personnel to the area. Nine Antonov An-32s plus Mi-8s and Chetak helicopters were deployed for the massive relief operations which were carried out from airfields as far apart as Palam, Hakimpet, Yelahanka and Poona.

Air India introduces B-747 Dash 400

The first four Boeing 747-400s ordered by Air India have joined its fleet, reaffirming Air India's commitment to stay in the forefront of international aviation. Air India's choice of the Boeing 747-400 was determined by the need to provide higher standards of comfort to its passengers, making the long haul flights a pleasure. The enhanced seat pitch and the additional leg room enables passengers to retract and recline the seat.

Indian Air Force Museum

On 12 October 1993, in an informal but impressive event, the Air Force Museum at Palam was inaugurated as part of the 61st Air Force Day celebrations. The proceedings were inaugurated by Air Chief Marshal SK Kaul while Air Marshal Pratap Rao, AOC-in-C Western Air Command and Air Commodore VG Kumar AOC, Air Force Station, Palam gave brief presentations before taking the invitees for a voyage "down memory lane," through the two exhibition galleries and the main hangar. The invitees were mostly serving and retired senior officers of the Air Force with their wives and included four former Chiefs of Air Staff, including Air Chief Marshals Arjan Singh, OP Mehra, SK Mehra and NC Suri.

Agro-Aviation Wing

The Ministry of Agriculture has decided to reform the agricultural aviation wing to handle locust control operations, cloud seeding for artificial rain and other aerial plant protection operations. Minister Baram Jakhar has said that cloud seeding was a viable proposition despite the failure of similar attempts in the past. This would be taken up on an experimental basis to begin with and if successful would be expanded. The aviation wing once it was set up, would utilise the existing aircraft obtained from Vayudoot as also new purchases with aid given by USAID, the EEG and New Zealand.

Tale Spin

Above and Beyond



Although the first Rafale MRCAs for the Indian Air Force will only be handed over a year from now, the recruitment branch are wasting no time in attracting young men and women to join the Service, with catchy advertisements showing the fine lines of this next gen aircraft to advantage. However, the tail numbers and identification markings have been airbrushed to hide their unit, which seems to be standard procedure today wherein images of all IAF aircraft receive such treatment.

Alors! But these are Armée de l'Air Rafales which always proudly display their squadron insignia!

Have a heart !



Revealing his great heart is Rajya Sabha MP Rajiv Chandrasekhar who located, restored and then presented a vintage C-47 Dakota to the Indian Air Force Vintage Flight in May 2018. Delving through history he had the aircraft given the tail number 'VP 905' to honour that very aircraft that flew Indian Army troops into Srinagar on the fateful date of 27 October 1947...

... but the ever vigilant censors ensured that this tail number too was obliterated!

Force multipliers

IAF examiners were stunned when they found that tech-savvy fraudsters had hacked into their online exam to recruit non-commissioned officers in Rohtak. The fraudsters had gained remote

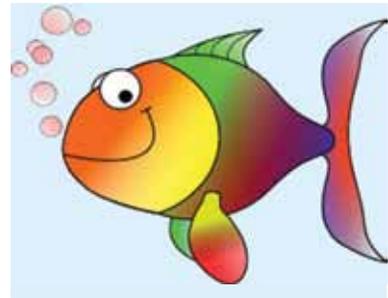
access to computers used in the exam by setting up a parallel network. They were giving answers to the questions with the help of experts even as the candidates were sitting idle in front of their computers. The exam was being conducted by Centre for Development of Advanced Computing (C-DAC) which had outsourced it to another agency.

Fly by Wire ?!



A Fishy Tale

The travails of Air India get fishier day by day. In the latest chapter of this never-ending story, an AI Dhaka-Kolkata flight was delayed as security officials stopped the pilot of the aircraft from smuggling on board a 2.5 kg hilsa fish, a much-prized delicacy on both sides of the Bangla border. Foiled in his nefarious attempt to infiltrate a doubly illegal Bangladeshi immigrant into India, the errant pilot had to leave behind his Piscean prize.



Would-be buyers of the Airline could well tell the Maharaja to go fish, much to the satisfaction of jet-setting *netas* and *babus* who can continue to make free use of the carrier to give themselves a whale of a time.

From The Economic Times

Vintage Times



The two iconic shapes on Indian roads and Indian skies in the early 1960s are exemplified by the Fiat 1100 Millecento car from Italy, built by Premier Automobiles in India and the MiG-21 fighter built by Hindustan Aeronautics Ltd in India. The former has long disappeared while the latter (in later variants) continues in the skies above the country. Is there a moral to the story?

Old is Gold but keep Fishbed in the Bowl!

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