

VAYU

IV/2018

Aerospace & Defence Review



Farnborough Air Show 2018

Riddle of the RFI

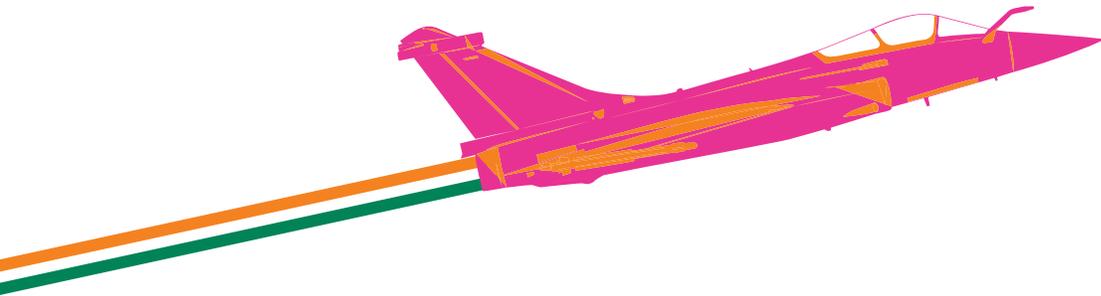
Navantia's 'Juan Carlos I'

The S-400 for India

World of Airbus

The Boeing Interview

happy independence day



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Capturing the scene at Farnborough 2018, RAF Hawk comes into land as Airbus A350-1000 prepares to take off (image courtesy : Airbus)

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Dr Nick Evesenkin (Russia)

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ADVERTISING & MARKETING MANAGER

Husnal Kaur

BUSINESS DEVELOPMENT MANAGER

Premjit Singh

PUBLISHED BY

Vayu Aerospace Pvt. Ltd.

E-52, Sujan Singh Park,

New Delhi 110 003 India

Tel: +91 11 24617234

Fax: +91 11 24628615

e-mail: vayuaerospace@lycos.com

e-mail: vayu@vayuaerospace.in

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27 Riddle of the RFI



The Indian Air Force reportedly received responses to its Request For Information (RFI) for 110 fighters by 6 July 2018. In his incisive review of the RFI document itself, Professor Prodyut Das is unsparing in his analysis that the 73-page long document seems to be “an amalgam of pilot’s notes, vague questions and a lack of connectedness”. He feels that this document could well reflect “the malaise in the organisation of our overall defence planning”, but readers can make their own judgment.

36 Navantia’s ‘Juan Carlos I’: an on-the-spot report



Vayu’s Nitin Konde went on board the Spanish Navy warship L-61 *Juan Carlos I* at Mumbai harbour, this special visit reflecting the Spanish Company’s endeavour to offer the Indian Navy similar ships to meet its requirements for LPDs. As per *Indian Maritime Military Strategy*, the IN requires a number of LPDs to augment its ‘out-of-area’ or expeditionary capabilities.

41 The S-400 for formidable air defence



This strategic air defence system has been subject of prolonged negotiations between the Governments of India and Russia, but formalisation of contract delayed as this has remained under

shadow of the United States CAATS Act. However, Sayan Majumdar feels that India could well opt for integration of the S-400 system with the Israeli-origin Green Pine radar systems.

44 “The Game Changer”



In another article, Sayan Majumdar considers MBDA’s Meteor BVRAAM as the ‘Game Changer’, this beyond visual range air-to-air missile being vital armament not for only the IAF’s new Rafales but possibly for the present fleet of Su-30MKIs and Tejas LCAs.

47 Farnborough Air Show 2018



Vayu’s Editorial team covered the Farnborough International Air Show 2018 at the hallowed site in Hampshire, ‘Footloose at Farnborough’, somewhat rambling is Indian-oriented, including expression of some despair at the manner of promoting Indian-built aircraft and helicopters to the world market.

Several headlines are highlighted, including those massive orders for airliners, from both Airbus and Boeing stables, these mega companies having recently taken Bombardier and Embraer regional jets under their respective wings. On the Show’s opening day, the British unveiled their ‘future fighter concept’, naming this as the Tempest and predictably, there were reactions from the Airbus Group.

51 Conversation with President of Boeing International



In this Vayu exclusive, the Managing Editor spent time with Bertrand-Marc Allen, President of Boeing International who freely discussed various topics, highlights of which are shared with readers. Boeing International’s President was candid about the Company’s commercial market outlook, its 80% stake in Embraer, the tariff threats and was enthusiastic about India, which country today not only flies hundreds of Boeing-built airliners, but its armed forces are increasingly operating Boeing aircraft and helicopter types.

Stop Press : Included are first images of Apaches and Chinooks making their maiden-flights in Indian colours, most timely indeed !

57 The Expanding World of Airbus



This mega company has forecast a \$ 4.6 trillion worldwide market over the next 20 years, but not only are its range of airliners being continuously ordered by the world’s carriers but its helicopters, military aircraft and special purpose vehicles are notching many successes.

Technology developments; Second MC-21-300 in flight; ‘When Tigers Gather’; Dassault’s Mirage 2000N retired; APROC 2018; Exercise Iniochos 2018

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Farnborough 2018 in retrospect

With the Singapore Air Show earlier this year being (seen as) a sales flop, Brexit storm clouds, the world on the brink of a global trade war and the UK MoD's mini-defence MDP review being delayed, expectations were low going into the 2018 Farnborough Air Show that this year's exhibition would end up being a damp squib.

While it is true, and more than one visitor remarked on the sparse flying display, by end of the week it had been a bumper show with over 1,400 orders (firm, options and MoUs) signed, worth \$190bn and only beaten by the 2014 show. Indeed, the first day's order total was double that achieved at the 2016 show. Boeing was the eventual leader with 673 commitments announced (145 of these, however, were already in the order book), overtaking Airbus' 431 sales tally.

Although Farnborough is a global exhibition, this year had a more British theme to it, coming hard on the heels of RAF 100 celebrations in London and UK aerospace, aviation and space sectors pulled out all the stops. Dominating the military front was the reveal of a full-size mock-up from UK's *Team Tempest* of a sixth-generation fighter concept, aimed at being in service by 2035. Part of Britain's *Combat Air Strategy*, also launched at Farnborough week, the concept was unnamed until UK Defence Secretary Gavin Williamson referred to it in his speech as the 'Tempest' jet, an appropriate moniker that has stuck and also makes it stand out from the myriad other FCAS-named projects.

Though the Tempest that enters service will arguably end up looking different from the concept shown at Farnborough, the UK's vision and capabilities for a next-gen combat system, that will be affordable, flexible and incorporate cutting-edge tech have undoubtedly sparked lots of interest around the world, especially with its overriding message that Britain is looking for partners to turn this into reality.

The significance of this goes beyond the UK military aerospace sector itself, in that it (along with the Franco-German FCAS) establishes that the US F-35 is no longer the 'only game in town' for a stealth fighter programme in the 2040s. Indeed, this sees the UK leap-ahead of the US in inviting others to join its sixth-generation combat programme, something that the US has yet to do for its comparable F/A-XX/PCA projects. Although this is still early days and 'Tempest' represents a R&D programme rather than a final design; this unveiling has been a wake-up call to those that have written the UK military aerospace off as in being in gradual decline.

Meanwhile, over at Airbus, there were also last-minute announcements with an order from AirAsia X for 34 Airbus A330neos plus an MoU from another unidentified customer for ten A320neos. At its wrap-up conference, Airbus said that it had received new business for 431 commercial aircraft (93 firm orders and 338 MoUs) at Farnborough 2018, which comprised 60 A220-300s, 304 A320 Family aircraft, 42 A330neos and 25 A350 XWBs.

From 'Aerospace', *Royal Aeronautical Society*

The Quest Continues

India's quest for procuring 110 fighter aircraft for its air force is progressing with six global aviation majors having responded to the Request for Information for the programme. The aircraft makers which responded to the RFI would have mentioned the operational and technical parameters of their military platforms. They have also indicated fly-away price of the aircraft. The IAF will now draft its technical requirements for the tenders that can be issued within the next three to six months. The competition to give India's new fighter jet will start after the global players respond to these tenders. As per current plans, Indian private sector manufacturers are expected to tie up with the winning global player to manufacture these aircraft in India.

The six firms had competed in an earlier attempt to provide 126 fighter aircraft to the IAF, known as the Medium Multi Role Combat Aircraft (MMRCA) programme which was scrapped after Prime Minister Narendra Modi in April 2015 had announced that India would instead procure 36 Rafale jets from France in a government-to-government deal.

Later, the defence ministry had another plan of procuring 114 single engine fighters with foreign collaboration at an estimated cost of Rs 1.15 lakh crore. This plan was also scrapped earlier this year. In April, the defence ministry issued a RFI to procure 110 fighter jets, which project includes both single and twin engine fighter aircraft. Two of the competitors in this contest are single engine fighter (the F-16 and the Gripen), while the remaining four are twin-engined.

According to the RFI, the procurement of the 110 aircraft should have 15 per cent aircraft in fly away condition and the remaining 85 per cent to be made in India by a 'Strategic Partner'. The programme is a crucial requirement of the IAF, which currently has a reduced strength of 31 fighter squadrons, when it actually requires 42 to tackle the collusive threat of Pakistan and China.

But the IAF is separately making efforts to further strengthen its combat capabilities with induction of the Tejas Light Combat Aircraft. Defence PSU, Hindustan Aeronautics Limited (HAL), is currently working on manufacturing 123 Tejas LCAs for the IAF, of these 40 are Mark 1s and the remaining 83 are the Mark 1A version.

From *Economic Times*

Case for lateral moves in MoD

The government's announcement of lateral absorption of experts in 10 government departments at the level of joint secretary shows that fresh talent, from a pool other than that of the Indian Administrative Service, is being given a chance at nation building. Its success depends on two factors. First, with how much zeal the bureaucrats will oppose the proposal

and put a spanner in the works; second, whether qualified middle-aged professionals are willing to give up their well paying jobs that come with decision-making and financial powers that exceed what a joint secretary has. However, the ministry of defence (MoD) has been left out from the list of ministries that require fresh talent from outside. Unless of course the IAS officers in MoD are experts in matters military. Could uniformed personnel, who are military experts in the real sense, be good lateral inductees into MoD at a decision-making level?

After the China debacle in 1962, there was a virtual emergency in the recruitment in the officer cadre of the armed forces. Some of them left the Services early, entered the civil services through their regular entrance exams and rose to head ministries as secretaries in Delhi. This was the last that time there was a true systematic lateral absorption from the Forces. Subsequently, to keep a younger age profile in the military, many committees recommended lateral moves into the civil services and central police forces. The ethos of discipline, diligence and military professionalism would enrich these entities no end, these committees felt. But, nothing like that has happened due to vested interests and petty politics, with the expertise going waste.

To give an example, the first test pilot on the LCA Tejas fighter programme left the project since, for lateral absorption into the Defence Research and Development Organisation (DRDO), he was given only equivalent status of a Wing Commander and not one that recognised his unique expertise. But, we are willing to pay millions to foreigners as technical consultants. In 2011, two serving Air Vice Marshals, one looking after IAF helicopter operations and the other in charge of their technical maintenance, applied for lateral induction as CEO of Pawan Hans Helicopters. These two had spent the better part of 35 years each in IAF's helicopter stream but were not even called for an interview.

Would it not be better to have a military man advising the defence secretary? It is time that the scholarly attributes of uniformed personnel got their due like Gen McMaster, a serving officer, who was America's National Security Advisor. To quote Niti Aayog Chairman Amitabh Kant, who rightly argues for a reverse lateral movement of civil servants into private sector saying "... cross mobility will provide the ultimate synergy;" a move of IAS officers to field formations and the headquarters of the armed forces will make them ideal candidates for a return to the MoD and form the spine of a permanent sub-cadre in this crucial ministry. Only then will one see the MoD and Service headquarters functioning as a well-oiled team. Lateral induction from the Services at the joint and additional secretary level to the MoD must be part of this laudable government move.

AVM Manmohan Bahadur in *The Hindustan Times*

Spare the taxpayer

The government's failed attempt to privatise the airline it owns, Air India (AI), is already bearing bitter fruit. The airline is behind on its payments to several of its creditors. These include both banks that extended loans as well as corporate entities that leased aircraft, including top-of-the-line Dreamliners. Debts have been piling up for at least two months in both cases. The aircraft lessors have declared that an "event of default" has occurred, which may mean that they begin proceedings to take back the aircraft; this would leave AI with a giant hole in its schedule and place it in even more trouble. The banks' actions will be even more closely watched. The Reserve Bank of India (RBI) has been quite firm on the subject of not concealing bad loans any further; if AI misses payments for three months, then the banks might be entitled to declare its account a non-per-forming asset.

Naturally, the question that could be asked in this respect is: What is the precise status of the government-owned airline, whose debt, many assume, has an implicit sovereign guarantee? In fact, in the last financial year (2017-18), the government committed to releasing Rs 18 billion to allow the airline to deal with its accumulated losses. But only Rs 6.5 billion of that amount was released. AI is reportedly assuring its creditors that more is on the way. However, there are good reasons for the government to, in fact, not release any more of money. Indeed, there may be a silver lining to this entire mat-ter. The banks, concerned about NPAs, might be able to subject the AI account to the process outlined by the new Insolvency and Bankruptcy Code, or IBC. If so, the privatisation of AI might move forward purely through the application of law. The principles of the IBC should be allowed to operate in this case just as in any other. The operational creditors, such as aircraft lessors, and financial creditors, such as banks, should move the AI case to the National Company Law Tribunal.

Indeed, this might allow the government to wash its hands of the privatisation process and claim that the natural course of law is being followed. The criteria that had been set for the privatisation of AI were unnecessarily stringent but perhaps that was a reflection of the political constraints on the government. There is, after all, less than a year to go for the general elections and it would have been concerned about the eventual price at which the air-line would have been sold as well as the terms of the sale. If it appears that they favoured a buyer, then it might have had significant electoral costs for the ruling party. If AI is subjected to the IBC process, however, the committee of creditors, mandated by the IBC process, could take the decisions that the government, as primary owner, is unwilling to take. From the taxpayer's point of view, this would be a victory. After all, each additional day that the airline is on the government's books is another day that taxpayers are on the hook for its losses.

From *Business Standard*

Better civil-military relations (CMR)

Only a diehard optimist would expect that India's elected representatives would find the time to reflect on national security. But, with Parliament currently in session, should the improbable come to pass, here are some suggestions.

Each threat and challenge to India's national security in the past 70 years has arisen not just due to the continued indifference of its political leadership but also their inability to learn from past mistakes. While the downward spiral of the defence budget (in real terms) and galloping asymmetry *vis-à-vis* China are causes for alarm, far more worrisome is the absence of a vision that could trigger remedial processes. Slogans are great for national morale, but someone must convert them into actionable strategies; so patently lacking in context of India's military-industrial complex, defence modernisation or national security reform.

A possible reason for this 'holiday' from long-term planning or strategising by ministers seems to be a shift, of the onus of politics, from party apparatchiks to their shoulders. The demands of Parliament, constituency, party politics and election campaigning, in most cases, leaves them little time for their portfolios. In case of the Ministry of Defence (MoD), since the military has been deliberately excluded, crucial defence matters are, by default, left to personnel of the administrative, accounts and other civilian cadres who run the ministry. This uniquely Indian concatenation is definitely not the best way of managing national defence.

Material and organisational shortcomings in our national security, periodically highlighted by the CAG or Parliamentary Committees, attract fleeting public and media attention, which dissipates after rhetorical government responses. However, an area with grave but hidden implications for national security is civil-military relations (CMR) whose crucial significance seems to have eluded India's post-independence rulers. A key feature of the current CMR in India, is the huge perceptual gap that exists between the two sides. While the political and bureaucratic establishments see nothing amiss and have remained staunch upholders of the 'status quo', the military and veterans seethe with dissatisfaction at an increasingly asymmetric and deliberately contrived civil-military equation.

The most worrisome impact of this dissonance is on the MoD's functioning. By stubbornly resisting integration of the Army, Navy and Air HQs with MoD, the bureaucracy has denied itself readily-available professional advice and the ministry, some badly-needed decision-making ability. Proof of the system's ineptitude is to be found in the languid manner it discharges its primary function of equipping the forces. Procurement of simple but urgently needed items, like modern rifles, helmets and bullet-proof jackets for jawans takes 8-10 years, while major weapon-systems can take anything from 15-30 years. Hardware acquisition programmes from abroad, as well as indigenous projects like the Tejas fighter, Arjun tank and Kaveri jet engine have remained in limbo for decades, for want of decision-making. The government may downplay this dysfunctionality, but voids in our military capability are obvious and have visibly eroded our credibility as a significant power.

While some aspects of CMR impinge directly on India's national security, there are many consequences of this discord that have implications elsewhere. Among these are the military's push-back after every pay-commission award and the acrimonious negotiations that follow, the protracted veterans' public agitation for 'one-rank-one-pension' and frequent tussles about rank-equations with civilian cadres. Controversies related to opening of cantonments to the public, and politicisation of 'surgical strikes' have further muddied the waters. In the furor surrounding these debates, few have reflected on the roots of the persistent malady that afflicts CMR.

The division of India's armed forces, in 1947, was accompanied by a hurried reorganisation of the imperial defence structure to suit the new republic's needs. During this turmoil, the military leadership remained ignorant of a significant development that originated from the civil side. The armed forces HQs, instead of being merged with the MoD, or being designated 'department(s)' of MoD, were reduced to 'attached offices' and made subaltern to the Department of Defence (DoD). This automatically placed a layer of bureaucracy between the military and the politician and replaced 'civilian (political) control' by de facto 'bureaucratic control'.

This 'act of commission', a fatal flaw in our national security matrix, was followed by an equally damaging 'act of omission': the failure of the new Indian State to accord recognition to the functions and status of its armed forces. The IAS and IPS (to be joined, later, by the Indian Forest Service) were created as All India Services by Article 312 of the new Constitution. Another category known as the Central Civil Services, consisting of 89 Groups A and B services, that provide the huge government bureaucracy, was inherited from the Empire. However, the functions, responsibilities and status of the armed forces, their chiefs and senior functionaries, found no mention in the Constitution, any Act of Parliament or even the Government of India (GoI) Rules of Business, created in 1961.

This absence of recognition and lack of defined status has worked to the detriment of India's military. Successive Pay Commissions, using whimsical equivalences, have depressed the armed forces, in terms of emoluments (and consequently status), relative to the All India Services as well as the Central Civil Services. Since eight of the latter were created to render support to the military, this has led to severe hierarchal problems. The chiefs receive perfunctory attention from politicians and bureaucrats because they have no *locus standi* in the edifice of the GoI. It is the Secretary MoD who, by Rules of Business, represents the three Services. This iniquity has stimulated a steady deterioration in CMR over the past decades.

It is incongruous that the standing of the armed forces of the Union should remain indeterminate, and open to repeated misinterpretation, *vis-a-vis* civilian and police organisations. It is, similarly, inappropriate that the Service Chiefs, responsible for safeguarding national sovereignty on land, at sea and in the air, should be denied recognition by the State, and remain 'invisible' in the MoD.

A part of the remedy for this acute anomaly lies in amending the Rules of Business. But the real answer lies in legislation that clearly defines the status of the armed forces, as well as role and functions of the military hierarchy. Since this issue impinges not only on our military's morale, but also on CMR and, ultimately, on India's national security, it should merit discussion in the ongoing session of Parliament – other pressing business notwithstanding.



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“Articulate a clear stand on Iran !”

Indian Prime Minister Narendra Modi met Chinese President Xi Jinping on sidelines of the Shanghai Cooperation Organization (SCO) summit held in June. India’s proposal to host an informal summit in India in 2019, along the lines of the Wuhan summit (in April 2018) was accepted by the Chinese. Both countries also signed agreements to share hydrological data on the Brahmaputra river and for export of non-Basmati varieties of rice from India. Another issue discussed during the Modi-Xi meeting was collaboration on a joint development project in Afghanistan, first proposed during the Wuhan Summit.

After his meeting with Xi, PM Modi tweeted, “We had detailed discussions on bilateral and global issues. Our talks will add further vigour to the India-China friendship.” Speaking of the presence of leaders from India and Pakistan and the entry of both countries into the SCO, Xi said, “The entry of India and Pakistan into the Shanghai Cooperation Organisation would bolster its strength.”

During his address at the SCO plenary PM Modi referred to two vital issues; connectivity and terrorism. “We have again reached a stage where physical and digital connectivity is changing the definition of geography. Therefore, connectivity with our neighbourhood and in the SCO region is our priority,” he said.

PM Modi then referred to India’s participation in the Chabahar project and the International North South Transport Corridor (INSTC) as clear instances of India’s firm commitment to *connectivity*. India, however, refused to endorse the Belt and Road Initiative (BRI) Project, sending a clear message to China that it was not comfortable with Beijing’s initiative. A declaration issued after the Summit stated that Russia, Pakistan, Kazakhstan, Uzbekistan, Kyrgyzstan and Tajikistan have “reaffirmed their support for the Belt and Road Initiative (BRI)”—of China.

However, in recent months, India’s approach towards both China and USSR has been driven by pragmatism and self-interest. During the Wuhan Summit, as well as during Modi’s visit to Sochi, the changing economic order (especially US president Donald Trump’s isolationist approach) and geo-political developments in South Asia and outside were discussed.

New Delhi’s decision to work on a development project with Beijing in Afghanistan was of special interest. Through both these ‘informal’ summits and New Delhi’s overall attempt to reboot ties with Beijing and Moscow, a clear message would have gone to Washington DC.

India’s stand on the US withdrawal from JCPOA (Joint Comprehensive Plan of Action), and Washington’s continuous threat to impose sanctions against even allies doing business with Iran has been criticized as “being muted”. Only External Affairs Minister Sushma Swaraj, in a press conference, firmly outlined the status of India’s ties with Iran, saying, “We only recognise UN sanctions. We do not recognise any country-specific sanctions. We don’t make our foreign policy under pressure from other countries.”

During Iranian Foreign Minister Javad Zarif’s visit to New Delhi (in May 2018), the possibility of reviving the rupee-rial payment method through the UCO bank was discussed. During the SCO Summit, while speaking about connectivity projects linked to Iran, PM Modi did not speak about the relevance of the Iran Nuclear Agreement.

Given India’s economic and strategic interests in Iran (which happens to be the third largest supplier of oil to India), some mention of the Iran Agreement and support for Tehran on the issue would surely have been appropriate. India could have used this opportunity to send a tougher message to US on Iran. The timing was apt, given two recent developments.

First, US allies like France, Germany had approached the US seeking exemption

from sanctions. “As allies, we expect that the United States will refrain from taking action to harm Europe’s security interests.”

Both US National Security Advisor John Bolton and US Ambassador to Germany advised European countries to reconsider business ties with Iran. Second, at the G7 Summit, Trump had not really minced any words in the context of tariffs. Trump had accused countries of “robbing” the US and commented on India saying, “This isn’t just G7. I mean, we have India, where some of the tariffs are 100 per cent. And we charge nothing. We can’t do that.”

While Russian and China’s ties with the US are of a very different nature, both countries seized the opportunity and extended their support to Iran. President Xi, while praising the nuclear agreement, said the deal was “Conducive to safeguarding peace and stability in West Asia and the international non-proliferation regime, and should continue to be implemented earnestly.”

During his meeting with Russian President Vladimir Putin, Iranian President Hassan Rouhani spoke of the need for greater cooperation between both countries after the US withdrawal from JCPOA.

India needs to use the SCO to its advantage. The organisation does provide an opportunity to reach out to China, Russia, Central Asian countries and even Pakistan. India needs to make its voice heard on the Iran issue and cannot insulate itself. While it is okay not to comment on every geo-political issue, playing it safe on Iran will not really benefit New Delhi.

India should have been more categorical in its support for Iran at the SCO Summit, given its interests in that state. Taking a stand similar to China and Russia may not have been possible, because of the Indo-US strategic relationship, but more subtle messaging, that India would follow an independent course, was certainly possible.

Tridivesh Singh Maini
[in South Asia Monitor]

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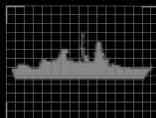
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RFI responses submitted to IAF



Described by many as 'Competition MMRCA 2.0', contenders for the Indian Air Force's requirement for 110 new fighters, as per the RFI issued by the service on 6 April 2018 (see *Vayu III/2018*), have reportedly submitted their responses at Air Headquarters before the deadline of 6 July 2018. The six OEMs are assuredly Airbus (Eurofighter Typhoon), Boeing (F/A-18 Super Hornet), Dassault (Rafale), Lockheed Martin (F-16), RAC (MiG-35) and Saab (Gripen). What is only speculated for present is the interest of Sukhoi in offering its new Su-35, while there have been reports of HAL's proposal for more Su-30MKIs (in addition to the 222 being built at its Nasik Division). After scrutiny, formalisation of the next step (issue of the RFP to shortlisted candidates) would take place but there is no present estimate as to how long this could take as national elections are also slated for early 2019.

It is understood that the IAF has underlined the commitment of OEMs to participate in development of the indigenous Advanced Medium Combat Aircraft (AMCA), which is strongly supported by the Service as this futuristic fighter is billed as successor to the legacy Jaguar/Mirage 2000/MiG-29, twelve squadrons of these types to be phased out by the mid-2030s.

India proceeds with S-400 deal

In spite of various sanction threats from the US, the Government of India is reportedly proceeding with procurement of the Russian S-400 Triumf strategic air defence systems which it considers vital for the country. The Indian and Russian Governments reportedly have concluded price negotiations with signing of the final contract expected during a summit meeting in between October 2018. The total contract value is estimated at around \$5.5 billion for five regiments, the standard S-400 battery consisting of four transporter erector launchers (TELs), four launch tubes per TEL, in addition to target acquisition and engagement (fire control) radar systems and a command post. (See article in this Issue).



Eleventh C-17A for IAF



The last Boeing C-17A Globemaster III at the production facility in California has been purchased by the government of India, making this the eleventh such aircraft for the Indian Air Force. Boeing was awarded a \$262m Foreign Military Sales contract to provide this final unsold C-17A Globemaster III to India, with work expected to be completed by August 2019. India had placed an initial order for ten C-17As in January 2010 and the last of these was delivered to the IAF's No. 81 Squadron in December 2014.

India test-fires nuclear capable Agni-5 ballistic missile

On 3 June 2018, India's nuclear capable long range ballistic missile Agni-5 was test fired off the Odisha coast, launched from a mobile launcher, being the sixth trial of the Agni-5 ballistic missile. "The flight performance of the missile was tracked and monitored by radars, tracking instruments and observation stations all through the mission," according to an official statement. The three-stage, 17-metre tall, two-metre wide Agni-5 missile is capable of carrying a nuclear warhead of about 1.5 tonnes. The Agni-5 incorporates advanced new technologies in terms of navigation and guidance, warhead, and its engine. Agni-5's navigation systems, "very high accuracy Ring Laser Gyro based Inertial Navigation System or RINS and the most modern and accurate Micro Navigation System or MINS" ensured that the missile impacted its target with precision.





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India, USA and CAATSA

Indian Defence Minister Nirmala Sitharaman has in a recent statement emphasised the close defense ties between India and Russia. “In all our engagements with the USA., we have clearly explained how India and Russia’s defense cooperation has been going on for a long time and that it is a time-tested relationship ... we have mentioned that CAATSA cannot impact the India-Russia defense cooperation.” The United States had passed the ‘Countering America’s Adversaries Through Sanctions Act’ (CAATSA) against Russia in August 2017 for reportedly influencing and manipulating the 2016 US presidential election process.

However, the imposition of sanctions by the United States on India is seen “as highly unlikely” but nonetheless, India’s decision to move ahead with the S-400 acquisition could impact future U.S.-India defence deals, including the possible procurement of armed US-made Predator drones or the establishment of joint aircraft production facilities.

Major defence deals with USA



Although the planned 2+2 dialogue between Indian and US Government functionaries has again been postponed, there are major defence deals in the pipeline. The US has emerged as a major supplier of defence equipment to India, with contracts for over \$ 12 billion in the past decade, including those for Boeing P-8I long range maritime patrol aircraft, C-17A strategic transport aircraft, C-130J tactical transport aircraft, Chinook heavy lift helicopters and Apache attack helicopters. In the pipeline is a possible \$ 2 billion contract for 24 Naval Multi Role Helicopters as also that for 22 Guardian Unmanned Aerial Systems for the Service.

Kamov Ka-226T joint venture “near finalisation”

According to various reports, the government of India is likely to formalise the long-planned joint venture programme for production of the Kamov Ka-226T light helicopter by Hindustan



Aeronautics Ltd in collaboration with Russian Helicopters. An inter-governmental agreement between India and Russia was signed for the project during Prime Minister Narendra Modi’s visit to Moscow in December 2015, followed by a general agreement signed in October 2016. In May 2018, the Indian MoD issued a Request for Proposal (RFP) for supply of these helicopters, 60 of which are to be delivered from Russia and the balance 140 built in India. The Ka-226T is to supplant the HAL-built Chetak and Cheetahs in service with the Indian Army, Air Force and Navy.

Tejas deployed at Sullur



The IAF’s first Tejas LCA squadron (No. 45) has moved to its “permanent” air station, Sullur near Coimbatore, in June 2018. Following its raising at HAL Bangalore Airport on 1 July 2016 (see *Vayu Issue IV/2016*), No. 45 squadron has received half-a-dozen HAL-built Tejas LCA Mk.1s, the unit gradually getting operational, also being deployed during the massive exercise *Gagan Shakti* during April 2018. Although the squadron unit establishment (u/e) is 16 fighters plus two operational conversion trainers, No. 45 is well short of numbers even as HAL gears up to produce more LCAs at its Bangalore Complex.

MoD concerns on LCA price



The Ministry of Defence has reportedly formed a multi-disciplinary committee to examine the standard costing of HAL-built Tejas Light Combat Aircraft. Forty LCA Mk.1s, including four twin-seat operational conversion trainers, have been ordered for the Indian Air Force even as production of 83 of the follow-on Mk.1A, with specific upgradations identified, have been cleared. According to reports, the LCA Mk.1 unit price to the IAF is quoted at Rs 463 crore, which is substantially higher than contemporary aircraft types such as the Lockheed Martin F-16 (at Rs 380 crore) and Saab Gripen E (Rs 455 crore). Even HAL's licence-built Sukhoi Su-30MKI twin-engined heavy fighter is priced at Rs 415 crore (ex-Russian price Rs 330 crore) and this has resulted in the detailed examination by the committee headed by Principal Advisor (Cost).

Rafale in routine CAG audit



The Comptroller and Auditor General of India (CAG) will also audit the procurement of 36 Dassault Rafale fighters contracted from France for \$8.7 billion, "as it does for all such deals", but only after the contract is fully executed and the payment is fully completed. In this context, Defence Minister Nirmala Sitharaman has assured the nation that "there is no scandal in Rafale...we are very clear on that part." She added that comparing a price for the Rafale that was never paid (by the previous UPA regime), with what had been reached by the NDA government was a "non-starter".

Six AH-64E Apaches for Indian Army



Following the earlier contract for 22 Apache attack and 15 Chinook heavy lift helicopters for the Indian Air Force signed in 2015, the US State Department approved the FMS sale of six AH-64E Apache helicopters for the Indian Army at an estimated cost of \$930 million on 12 June 2018. In support of the same, the Government of India has requested the provision of: fourteen T700-GE-701D engines; four AN/APG-78 Fire Control Radars; four Radar Electronic Units (REU) Block III; four AN/APR-48B Modernised Radar Frequency Interferometers (M-RFIs); one hundred eighty AGM-114L-3 Hellfire Longbow missiles; ninety AGM-114R-3 Hellfire II missiles; two hundred Stinger Block I-92H missiles; seven Modernised Target Acquisition Designation Sight/Pilot Night Vision Sensors (MTADS-PNVS) and fourteen Embedded GPS Inertial Navigation Systems (EGI). Also included are rockets, training and dummy missiles, 30mm cannon and ammunition, transponders, simulators, communication equipment, spare and repair parts, tools and test equipment, support equipment, repair and return support, personnel training and training equipment, publications and technical documentation, US Government and contractor engineering and logistics support services, and other related elements of logistic and programme support.

Tata Boeing Aerospace delivers AH-64 Apache fuselage

Tata Boeing Aerospace Limited have delivered their first AH-64 Apache combat helicopter fuselage ahead of schedule from its facility in Hyderabad, for onward transportation to Boeing's AH-64



Apache manufacturing facility in Mesa, Arizona, and integration into the final assembly line. This delivery was made within a year of the aerospace joint venture facility becoming operational, which will be the sole global producer of fuselages for AH-64 Apache helicopter delivered by Boeing to its global customers including the US Army. This will also produce secondary structures and vertical spar boxes for the multi-role combat helicopter, “a major step forward in Boeing and Tata Advanced Systems’ continued commitment to make advanced, high quality aerostructures in India,” said Pratyush Kumar, president Boeing India.

India gifts HAL Do-228 to Seychelles



On 26 June, the External Affairs Minister Sushma Swaraj handed over a HAL-Dornier 228 maritime patrol aircraft to the President, Republic of Seychelles, Danny Faure at a ceremony in New Delhi. Mr Faure described the “momentous occasion” as historical day” and that “inclusion of this aircraft would bolster the coastal surveillance of Seychelles and provide strategic depth to policing its extensive Exclusive Economic Zone (EEZ)”. The aircraft joins an earlier HAL-Dornier 228 in operation with the Seychelles Government and was slated to carry out a flypast at the 42nd Independence Day of Seychelles on 29 June.

T Suvarna Raju, CMD, HAL in his welcome address hailed the event as “proud moment” for HAL as the aircraft has been delivered ahead of schedule and accepted by the Seychelles Air Force. “We have provided hands-on training to the pilots and technical staff from Seychelles. We are committed to extend full-fledged support to the teams involved with its maintenance and operations of the aircraft”, he added.

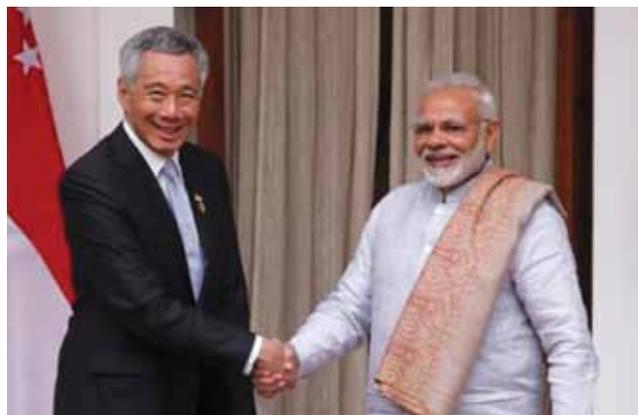
“Performance based logistics” support for Coast Guard ALH

A new Dhruv Advanced Light Helicopter for the Indian Coast Guard (ICG) began its ground run on 28 June 2018, at HAL’s Rotary Wing R&D Centre “for integration and certification of 19



new systems”. Director General Rajendra Singh of the ICG received the contract documents from T. Suvarna Raju, CMD-HAL, the latter stating, “For the first time, HAL has entered into a contract with ICG that includes performance based logistics (PBL) support after the delivery of helicopters, for five years. HAL’s ALH Dhruv helicopters are extensively deployed by ICG for various roles such as Search and Rescue (SAR), casualty evacuation, armed patrol, coastal surveillance, VIP movement and the night SAR.” HAL had signed a contract worth around Rs. 5126 crore for supply of 16 ALHs to Indian Coast Guard over five year timeframe in March 2017 for Low Intensity Maritime Operations (LIMO) and Coastal Security.

PM Modi at Shangri-La Dialogue



Visiting Singapore to address the Shangri-La Dialogue in early June, Prime Minister Narendra Modi also met with his counterpart Lee Hsien Loong, as well as signing a pact with Singapore for providing logistic support to Indian naval ships, submarines and naval aircraft. Mr Modi was on a tri-nation visit to Singapore, Malaysia and Indonesia, perceived as countering China’s dominance in economic and military areas. “India and Singapore are cooperating not only on land but also in the seas! At the Changi Naval Base, I got an opportunity to witness the deep-rooted naval cooperation between our two nations,” the PM tweeted. While delivering his keynote address, Modi stated, “An Asia of rivalry will hold the region back while an Asia of cooperation will shape the current century.”

PM Modi at Indonesia



Earlier, Prime Minister Narendra Modi visited Indonesia in end-May 2018 and held “productive discussions” with President Joko Widodo, when the two countries signed 15 agreements, including those to augment cooperation in defence, space, science and technology, railways and health sectors, and called for freedom of navigation in the strategic Indo-Pacific region. PM Modi stated that “India’s Act East Policy and the vision of SAGAR (Security and Growth for all in the Region) matched Widodo’s Maritime Fulcrum Vision.” Both leaders reiterated the importance of achieving a peaceful and prosperous Indo-Pacific region where sovereignty, international law, freedom of navigation and overflight, sustainable development and an open and fair trade and investment system were respected, amidst China’s flexing of its military muscles in the East and South China seas.

(The image has IAF Su-30MKIs along with an Il-78 MKI aerial refueller over the seas, which symbolically connect both India and Indonesia).

US Pacific Command is now US Indo-Pacific Command

In a move seen as strengthening US-India defence ties, the United States of America has renamed its ‘Pacific Command’ to become ‘Indo-Pacific Command’. According to reports, this command, responsible for all US military activity in the greater Pacific region, currently has about 375,000 civilian and military personnel assigned to its area of responsibility, which includes India. “Relationships with our Pacific and Indian Ocean allies and partners have proven critical to maintaining regional stability,” stated US Defence Secretary Jim Mattis. The Indo-Pacific Command is one of the six US geographical combatant commands (there are three functional commands that include Special Forces and the strategic weapons) and its area of responsibility spans 38 countries including India, China, Australia, Japan, the ASEAN countries and the two Koreas.



Exercise Malabar 2018



The 22nd edition of the annually held naval exercise *Malabar* took place 7-16 June 2018 off Guam island in the Western Pacific and was divided up into two phases, the first harbour phase at Naval Base Guam followed by the sea phase.

In the earlier editions, these naval exercises took place in the Indian Ocean region, including the Bay of Bengal but the exercise has grown in scope and complexity over the years with Japan’s Maritime Self Defense Force (JMSDF) taking part for the first time along with the US Navy. According to US naval spokesman, “training focussed on high-end warfighting skillsets, subject matter expert and professional exchanges, combined carrier strike group operations, maritime patrol and reconnaissance operations, surface and anti-submarine warfare, medical operations, damage control, helicopter operations and visit, board, search and seizure operations.”

The Indian Navy deployed its INS *Kamorta*, the first of four anti-submarine *Kamorta*-class stealth corvettes; the INS *Sahyadri*, a *Shivalik*-class stealth multi-role frigate; and the *Deepak*-class fleet tanker INS *Shakti*, as well as a Boeing P-8I advanced maritime patrol/anti-submarine warfare aircraft. It is learnt that Philippine military personnel were also invited as observers on board the IN aircraft.

US Navy ships included the USS *Ronald Reagan*, the only forward-deployed *Nimitz*-class supercarrier, the *Ticonderoga*-class guided-missile cruisers USS *Antietam* and USS *Chancellorsville*; the *Arleigh Burke*-class guided-missile destroyers USS *Mustin* and USS *Benfold*; a *Los-Angeles*-class nuclear-powered attack submarine, as well as one P-8A Poseidon maritime surveillance/anti-submarine warfare (ASW) aircraft. The JMSDF participated with the 19,000-ton JS *Hyuga*, lead ship of the *Hyuga*-class of helicopter carriers; the *Takanami*-class guided-missile/ASW destroyer JS *Suzunami*; the *Akizuki*-class guided-missile destroyer JS *Fuyuzuki*; and a diesel-electric attack submarine, as well as a Kawasaki P-1 maritime patrol aircraft.



IAF in Exercise Pitch Black



The Indian Air Force is participating in its first ever exercise in Australia, Exercise *Pitch Black*, which will involve over 100 aircraft from nine nations. This biennial three week multi-national large force employment exercise is conducted from RAAF Base Darwin and RAAF Base Tindal, and was held 27 July - 17 August 2018. The Exercise features a range of realistic, simulated threats which can be found in a modern battle-space environment and as per the RAAF, “is an opportunity to test and improve our force integration, utilising one of the largest training airspace areas in the world.” Recent participants include those from the air forces of hosts Australia as also Canada, France, Germany, Indonesia, Netherlands, New Zealand, Singapore, Thailand and the United States (generic image above). The Indian Air Force contingent included four Su-30 MKIs, a C-130 J and a heavylift C-17A.

In addition to Exercise *Pitch Black* in Australia, the IAF carried out bilateral exercises with both Indonesia and Malaysia, the aircraft staging through these south east Asian countries enroute Australia.

IAF Commanders' Conference

The biannual IAF Commanders' Conference took place at Air Headquarters in New Delhi on 31 May 2018 when Chief of the Air Staff, Air Chief Marshal BS Dhanoa, briefed the Defence Minister on current status of the IAF and on Exercise *Gagan Shakti*, which was conducted in April 2018.

Addressing the IAF Commanders, Nirmala Sitharaman praised the exemplary conduct of IAF's biggest exercise in recent times and complimented all personnel for sustaining round the clock operations in most professional manner. While laying down her vision for contribution of the IAF towards indigenisation, she emphasised that being a tech intensive service the IAF should pioneer in laying the roadmap for absorption and production of high end



aviation technology products in India and propel India's growth in these sectors as envisaged in Government of India's 'Make in India' policy over the next 15 years.

Indian Air Chief visits Israel, Brazil and the UK



Air Chief Marshal Birender Singh Dhanoa Chief of the Air Staff made a four day visit to Israel from 21 to 24 May 2018 and attended a conference themed 'Air Superiority as a Bridge to Regional Stability', as part of 70th anniversary of the Israeli Air Force. The CAS also visited some air bases and establishments of the Israeli Air Force. The Indian Air Chief was later on a four day official visit to Brazil from 4 to 7 June 2018, visiting various operational and training units and interacting with senior officers of the Brazilian Air Force.

Air Chief Marshal Birender Singh Dhanoa was thereafter in the UK from 9-15 July 2018 to attend the Royal Air Force Annual Air Power Conference and Royal International Air Tattoo marking the 100th Anniversary of the RAF [see image].

Indian Coast Guard and Pakistan Maritime Security Agency meet

Director General Rajendra Singh of the Indian Coast Guard hosted a four-member delegation of the Pakistan Maritime Security Agency (PMSA) led by Rear Admiral Zaka Ur Rehman, Director General PMSA in India from 27-30 May 2018. This annual



meeting is a significant link between the two maritime agencies for addressing issues pertaining to maritime boundary violations by fishermen and enhancing cooperation in the domain of maritime search and rescue and marine environment pollution. During the meeting, the need for instituting Standard Operating Procedures (SOPs) for immediate release and repatriation of fishermen who inadvertently cross the International Maritime Boundary Line (IMBL) was re-iterated. It was also agreed to conduct search and rescue communications exercises between the Rescue Coordination Centres to validate the SOPs for efficient conduct of rescue of distressed vessels/crew at sea.

BEL Representative Office in Vietnam



On 13 June 2018, Defence Minister Nirmala Sitharaman inaugurated the first Representative Office of Bharat Electronics Limited (BEL) in Vietnam, handing over the symbolic key to Gowtama M V, Chairman & Managing Director, BEL, during a recent Vietnam-India Defence Industry Business Meeting. BEL has set up its first Representative Office at Vietnam for addressing export business opportunities and to provide product support and services to users in the region. “The Representative Office will aim to promote BEL’s exports in areas such as Weapon Systems, Radar Systems, Naval Systems, Military Communication Systems, Electronic Warfare Systems, Combat Management System and Coastal Surveillance System.”

DAC clears acquisition of radars and hovercraft

The MoD’s Defence Acquisition Committee (DAC), headed by Defence Minister Nirmala Sitharaman, has cleared the procurement of 12 high power radars for the Indian Air Force as also, hovercraft for the Army and Coast Guard. Both programmes will cost Rs 5500 crore and will be executed “through the indigenous route.”

BSF Mi-17s in major overhaul

The Border Security Force’s air wing of six Mi-17 helicopters have returned from Russia following major overhaul. The BSF’s air wing commitments include logistic air support to Central Armed



Police Forces (CAPFs) under the Home Ministry, anti-Naxal and counter-insurgency operations, air maintenance of remote border outposts, casualty evacuation, disaster relief operations as well as VVIP transportation.

The BSF, the only CAPF to have an air wing, has a mixed fleet of fixed-wing and rotary-wing aircraft comprising one Embraer 135 business jet, two ageing HS-748 aircraft, a Cheetah, six Mi-17 1V, eight Mi-17 V5 and six HAL Dhruv helicopters.

Indigenous FDRs for IAF Mi-25/35s

The Indian Air Force is to upgrade its fleet of Mi-25/35 attack helicopters with indigenously-developed digital flight data recorders and video recorders. The present analog systems will be replaced by digital equivalents, this upgradation to be done by No. 3 Base Repair Depot, Chandigarh. The Soviet-origin Mi-35s are projected to continue in service for at least another 15 years, even as the Service is receiving HAL Rudra light attack helicopters and preparing for induction of the US-origin AH-64E Apache.

Russia offers comprehensive submarine designs

Indications from Moscow are that Russian shipbuilders have made a comprehensive proposal for joint design and construction of the Indian Navy’s next-generation submarines. This matter



was discussed at high-level meetings during the Sochi summit in May and offers an alternative to the much awaited tender for six new diesel electric submarines under the P75I programme, also incorporating Air Independent Propulsion (AIP) systems. The submarines would also be modified for launching Brahmos supersonic missiles.

While the current plan is to go in for a global competitive process that will involve companies from Russia, France, Germany and Sweden, the official proposal from Moscow is for a government-to-government deal for joint design also involving the Advanced Technology Vessel Project (ATVP). This ATVP is euphemism for the nuclear-powered submarine, the first such (INS *Arihant*) being constructed at Vishakhapatnam “with considerable assistance from Russia.”

Life extension of IN's Kilo-class submarines

Decisions on the medium refit and life extension of two of the Navy's *Kilo*-class submarines are expected from the MoD which is to decide whether this Rs 2,400 crore project would be carried out in Indian or Russian shipyards. The first of these is INS *Sindhuratna*, already dry-docked and ready for moving to the selected shipyard, either to Russia where the boats were originally built or in India, with Hindustan Shipyard Limited (HSL) and L&T being the contenders. According to Rear Admiral LV Sarat Babu, CMD HSL, “We have the capability of undertaking this project in India. We have been carrying out regular refits for *Kilo*-class submarines at the yard and this would require much more work but we are confident that it can be done on time.”

L&T accelerates production of warships

Larsen & Toubro is building a series of in-house designed seven New Generation Offshore Patrol Vessels (OPVs) for the Indian Coast Guard against a 2015 contract with deliveries from 2018 to 2021. The first OPV was delivered in April 2018, ahead of schedule. The second OPV launched in January 2018 is presently being readied for sea trials and is planned to be delivered ahead of schedule shortly, while system integration is in progress in the 3rd and 4th OPVs, which are slated for launch later this year. The keels of 5th and 6th OPVs were laid by Inspector General TP Sadanandan, Deputy Director General (Materiel & Maintenance) Indian Coast Guard at L&T's Defence Shipyard at Kattupalli near Chennai on 3 July 2018.

BHEL JV with Ukraine's Zorya

Bharat Heavy Electricals Ltd. (BHEL) are to set up a joint venture with Ukrainian Zorya Mashproekt to overhaul warship turbines in India, powering the Indian Navy increasingly its dependent on Ukrainian gas turbines, powering some 34 warships at present including on five *Rajput*-class destroyers, three

Delhi-class destroyers and 16 fast missile corvettes of the 1241RE class. These turbines require overhaul after 30,000 hours and are sent back to the Ukraine, both costly and time consuming. The proposed joint venture would substantially reduce the downtime. The onsite repair and maintenance of Zorya turbines are currently being done at the Marine Gas Turbine Overhaul Centre (MGTOC) at INS *Eksila*, Vishakhapatnam. The BHEL-Zorya JV would plan to indigenise maintenance and service support to Zorya Turbines.

The Defence Cyber Agency (DCA)

Reliable reports have it that the government has cleared Reestablishment of the Defence Cyber Agency (DCA) “mandated with the defensive, deterrence and offensive aspects of cyber warfare.” To be operational before the year end, the DCA will initially be manned by 1000 personnel from the three services and be a precursor to the setting up of a full-fledged Cyber Command in the near future. Responsibility for establishing the DCA is with the Integrated Defence Staff (IDS), this requirement being viewed as “urgent” in view of the dynamics of warfare which demand cyber expertise and integration.

More financial powers for DRDO

The MoD has delegated greater financial powers to the Defence Research and Development Organization (DRDO) so as to “enhance its efficiency and effectiveness”, but the body requires a drastic overhaul to ensure India develops a robust defence-industrial base in the years ahead. Such delegation of financial powers to DRDO has been given by defence minister Nirmala Sitharaman and is “intended to neutralise the ill-effects of over-centralisation and facilitate quicker decision-making” in the organisation. The move comes at a time when the government is yet to appoint a successor to S Christopher, who retired as the DRDO chief in May 2018, with defence secretary Sanjay Mitra holding additional charge of the organisation. The powers of the DRDO chief (secretary, defence R&D) to sanction projects and procurements have now been enhanced from Rs 75 crore to Rs 150 crore. The powers of the seven director generals or DRDO cluster heads (aeronautics, missiles & strategic systems, electronics, armaments, life sciences, naval systems and computational & cyber systems), in turn, have gone up from Rs 50 crore to 75 crore.

L&T Defence to produce Quad Launcher and Canister for BrahMos Missiles

In May 2018, L&T Defence completed design and prototype manufacture of the ‘Quadruple Canisterised Inclined Launcher’ (QCIL or Quad Launcher) for BrahMos missiles. This followed extensive trials before the prototype Quad Launcher to BAPL, designed for launching BrahMos supersonic cruise missiles in an inclined configuration on-board Indian Naval ships, was handed



over. The launcher has capability to support and launch four missiles in single or salvo mode, and is suitable for warships having limited space.

While receiving the new launcher, Dr. Sudhir Mishra Director General (BrahMos) said, “BrahMos has taken an exemplary lead in the Indian Government’s ‘Make-In-India’ drive. The BrahMos concept of ‘Mind-to-Market’ has led to technology development along with skilled manpower creation and a huge business, thus leading to in-country wealth generation.” In the picture above are (left to right) Dr. Sudhir Mishra, Director General (BrahMos) DRDO and CEO & MD, BrahMos Aerospace and Jayant Patil, Whole-time Director (Defence) and Member of L&T Board

Two months later, on 7 July 2018, L&T Defence inaugurated their new production line for BrahMos Transport Launch Canister (TLC) at Ranoli, near Vadodara for series production of the BrahMos Supersonic Cruise Missile System. The Advanced Composites Manufacturing Facility at Ranoli will support series production of BrahMos TLC.

L&T Defence deliver Akash System

L&T Defence have completed production of the 1,000th Integrated Propulsion Airframe System hardware for the Akash Missile at L&T’s Precision Manufacturing Systems Complex



(PMSC), Coimbatore with Jayant Patil, Director (Defence) and Member of L&T Board, handing over this to V Udaya Bhaskar, Chairman & Managing Director, Bharat Dynamics Limited.

Akash is an all-weather medium-range surface-to-air missile (SAM) system indigenously developed in India as part of the Integrated Guided-Missile Development Programme (IGMDP), providing multi-directional and multi-target area defence. The Akash missile can be launched from static or mobile platforms, such as battle tanks, wheeled vehicles providing deployment flexibility. The SAM system can handle multiple targets and destroy maneuvering targets such as unmanned aerial vehicles (UAV), fighter aircraft, cruise missiles and missiles launched from helicopters. The Akash SAM system defends vulnerable areas in all weather conditions against medium-range air threats from low, medium and high altitudes.

In the picture are seen (left to right) Jayant Patil, Director (Defence) L&T, V. Udaya Bhaskar, Chairman & Managing Director, Bharat Dynamics Limited and Dr S Christopher, then Head of DRDO.

Isro’s plans for manned space flight



The Indian Space Research Organisation (Isro) have been working on the design of a capsule for future manned space missions. An initial experiment on ‘Pad Abort’ or crew bailout system was conducted at a test facility in Sriharikota on 5 July, with Isro chairman K Sivan stating that “The experiment on the ‘Pad Abort’ or crew bailout system was a grand success... Simulating an astronaut was a crew model kept in a capsule which was attached to a rocket engine. When the solid engine motor was fired and launched into air, the crew capsule got detached from the engine after some time, moved away from it, a parachute deployed and the capsule landed safely at a designated spot on the sea.”

Concerning upcoming tests related to the manned mission, Sivan said, “Our next test will focus on aborting the capsule at flight mode. Like today’s test, many components needed for the country’s first manned mission will be tested in near future.” Commenting on various systems required for the manned mission, the Isro chairman said, “A human space programme focuses on taking a human to space and bringing him back to the Earth safely. For that purpose, we will have to provide a life support system to our crew within the

spacecraft. Therefore, we will make arrangements for continuous oxygen supply, controlled pressure and environment system, food supply, human waste discharge system and crew protection system involving the escape capsule.” Sivan also said, “After today’s successful test, we will now prepare a project report and submit the same to the government for approval.”

Air India privatisation “on hold”



The government’s plan to sell 76% of its holding in Air India to the private sector has been shelved owing to the absence of any bidders. This was officially announced on 20 June, the listing plan of Air India having received a setback some days earlier after the Securities and Exchange Board of India SEBI denied the state-owned carrier exemption from a rule which makes net profit for the past three years as mandatory. In his reaction, aviation minister Suresh Prabhu said, “The aviation sector globally is going through a difficult time due to high crude oil prices. So, it is not the right time to sell the stake in Air India.” Aviation analysts have however said that they are disappointed since, “Continuing government ownership with no clear roadmap will lead Air India to extreme insignificance and possible closure.”

No transfer of AI aircraft for VVIP use

As a fallout of Air India’s failed privatisation bid, the government has reportedly revised earlier plans to transfer two of the airline’s Boeing 747s to the Indian Air Force for VVIP use. AI’s inventory includes four Boeing 747s which are used by VVIPs including the president and prime minister and this manner will continue till a decision on Air India’s future is taken. The B-747s used by VVIPs



are over 25 year old and meanwhile, Air India plan to operate the next generation Boeing 777s, to be modified by Boeing with the latest security and communication systems and be ready for VVIP services in 18 months.

Air Vistara orders 19 Airbus, Boeing airliners



On 11 July 2018, Air Vistara has formally announced its orders for a total of 19 Airbus and Boeing airliners worth \$3.1 billion (approx Rs. 21,344 crore), even as the carrier embarks on ambitious expansion plans, including international operations. The letter of intent signed with Airbus is for 13 A320 neo and A321 neo aircraft as well as options for buying seven more aircraft from the A320neo family. Vistara would also lease another 37 new A320neo family aircraft from leasing companies. The airline has selected the LEAP 1-A engines from CFM International for the A320neo and A321 neo aircraft, which are to be delivered between 2019 and 2023.

The letter of intent signed with Boeing comprises that for six firm-ordered 787-9 Dreamliner and purchase rights for four more aircraft from the 787 Dreamliner family. For these aircraft, the airline has selected General Electric GENx-1B engines, and delivery is scheduled between 2020 and 2021. “The 787-9s are intended for use on medium-haul and long-haul international routes”.

First Boeing 737 MAX to Jet Airways

Boeing delivered the first 737 MAX to Jet Airways on 20 June 2018. “The new 737 MAX is a critical element to our future growth strategy and we are proud to become the first airline in India to introduce this brand new airplane to our customers,” stated



Naresh Goyal, Chairman of Jet Airways. This marks the first of 150 737 MAX airplanes ordered with Boeing, following two separate orders for 75 airliners placed in 2015 and earlier in 2018.

Increasing air connectivity in India's north east



Air connectivity to India's north east is being enhanced by the tourism ministry, along with the civil aviation ministry, having identified 16 new destinations under the regional connectivity scheme (RCS). In the first phase of the UDAN scheme, which seeks to make air travel affordable, only one north-east cluster was identified amongst 27 routes in the country. Deccan Air had bid successfully for connecting Imphal to Shillong, Silchar, Dimapur, Aizawl, Kolkata and Agartala. In the second phase, the civil aviation ministry has identified nearly 16 new routes in the north east, the routes awarded to 15 airlines and helicopter operators after the bidding process for second round of RCS. In the first round, while helicopter operators had not shown interest, four have been granted the rights to fly on select routes in the second phase. These include Pawan Hans being awarded helicopter services to parts of Imphal, Guwahati, while Zoom Air, Skyone and Spicejet have been awarded flights between Kolkata and parts of Arunachal. Flight operations have also been awarded to operators in Assam, Mizoram, Nagaland, and Tripura.

GoAir in steady expansion

With a new Chief Executive Officer at the helm, GoAir are not only streamlining their operations which have been impacted owing to engine issues with the A320neo, but are considering



international flights to regional destinations including Phuket and the Maldives. New CEO Cornelis Vrieswijk, formerly with easyJet and Transavia is reportedly building a new management team and introducing strategies for efficient operations. GoAir has 144 Airbus A320neos on order and is "looking at wide-body opportunities soon". Gains from sale and lease-back of aircraft has helped GoAir post a 36 per cent year-on-year increase in net profit during 2016-17. Net profit for 2016-17 was Rs 20.05 crore against Rs 15.00 crore in the previous year.

SpiceJet launches cargo services



In end-June 2018, SpiceJet launched scheduled air cargo operations in the country, the service initially covering eight major cities which would be expanded to all 18 destinations of the airline thereafter. With its Boeing 737 800/900ER fleet, SpiceJet plan to carry 2-3.5 tons of cargo on each of its flight. Operating 118 flights every day to 18 destinations SpiceJet can thus offer a capacity of about 350 tons per day.

GMR develops resort airport at Cebu

The Mactan Cebu International airport at Cebu in the Philippines was inaugurated by President Rodrigo Duterte on 7 June 2018 who described it as the "most beautiful airport in the country today." India's GMR Group, in partnership with Megawide Construction Corporation were responsible for the project, working closely with the local administration in Cebu and the Department of Tourism.

Harris to modernise ATM communications infrastructure

Harris Corporation has been selected to modernise India's air traffic management communications infrastructure in "support one of the world's fastest growing aviation markets, which is expected to double in size over the next 10 years". The Airports Authority of India (AAI), which owns and maintains 129 airports, has awarded Harris a 15-year, Rs 944 crore (\$141 million) contract



to serve as the prime contractor and systems integrator for AAI's Futuristic Telecommunications Infrastructure initiative, which will "upgrade network operations, enhance security, and improve the performance, reliability and quality of India's air traffic management (ATM) network, while reducing telecommunications costs."

Maldives issue IT notice on GMR

The Government of Maldives has reportedly served an income tax notice to GMR Male International Airport (P) Ltd (GMIAL), a GMR Group Company which had earlier won a \$271-million arbitration case against premature termination of their contract. GMIAL had earlier entered into an agreement in June 2010 with Maldives Airports Company Limited (MACL) and Ministry of Finance and Treasury (MoFT) Maldives, for "the rehabilitation, expansion, modernisation, operation and maintenance of Ibrahim Nasir International Airport for a period of 25 years". However, in November 2012, MACL and MoFT issued notices to GMIAL stating that the concession agreement was void ab initio and that neither MoFT nor MACL had authority under the laws of Maldives to enter into the agreement and MACL took over the possession and control of the airport effective December 2012. Meanwhile, China's Beijing Urban Construction Group was awarded a US\$400 million runway project as part of plans to upgrade Maldives' main international airport.

Analysts opine that this move by the Maldives is the latest in their "face-off" with India, the Abdullah Yameen regime also asking India to withdraw its second Dhruv ALH from Laamu atoll, whose location is significant, as this is where the Chinese are said to be building another port.

AAI controlling stake in Sri Lankan airport

The Airport Authority of India (AAI) have reportedly proposed to take the majority and controlling stake in Sri Lanka's Mattala Rajapaksa International airport in south west Sri Lanka, at a cost of Rs 1,660 crore. Analysts opine that the decision is

more strategic rather than economic and is perceived as a step to counter China influence which is constantly growing its presence in the island nation. The airport is located only 30 kilometres from the Hambantota port which has virtually been "given" to China. If the deal is finalised this would be the first time that AAI will own an airport outside India even though this airport handled only 4,772 passengers in 2016 and flyDubai ceased services to this airport last year. Amongst various schemes, AAI are expected to establish a flying school here as also attract charter air services.

Boeing's new Digital Innovation Centre

Boeing inaugurated the newest phase of the Boeing India Engineering and Technology Centre (BIETC) in Bengaluru on 15 June 2018 (see photo below). The new facility will double Boeing's existing footprint of 160,000 sq. ft. and will accommodate another 1,000 new employees, working on cutting-edge technologies to drive aerospace innovation "from India, for India and the world". While the new facility will incorporate software technologies into design, manufacturing and service offerings, Boeing will continue to scale up its aerospace, R&D and engineering activities in its existing facilities, which are also pursuing "a journey of growth."

"We see India as a hotbed for path-breaking software solutions that can redefine the way the world designs, operates and manages airplanes," said Ted Colbert, Boeing's chief information officer and senior vice president of Information Technology & Data Analytics, while inaugurating the new facility. The facility will contain an integrated lab for Internet of Things (IoT), Analytics and Mobility, a 3DX lab to develop 3D experiences, a Systems Integration Lab and a Proof of Concepts Lab. The new facility will also enable driving strategic initiatives like Digital Transformation. "The new engineering facility at BIETC reflects an agile and driven Boeing in India, one that inspires people to collaborate and accelerate step-change innovation," stated Pratyush Kumar, president, Boeing India.



G2G approach for US-2i procurement



The long-pending deal for purchase of 12 ShinMaywa US-2i Amphibious and Rescue (SAR) aircraft for \$1.65 billion is reportedly on track, with the Indian Government expected to propose a government-to-government deal (G2G) to finalise the programme before the India-Japan annual summit in September. According to a senior official : “The discussions have been going on for this aircraft for several years; there has not been much of an action so far.... recognising the advantage of selling to India, the two governments are willing to negotiate much lower price for these machines and through G2G route.”

The Government of India has reportedly been keen on acquiring the ShinMaywa US-2i amphibious aircraft from Japan as part of their expanding bilateral strategic partnership, “with both nations wary of China’s assertive behaviour in the Asia-Pacific region”. Earlier in April 2018, on side lines of DefExpo in Chennai, Mahindra Defence Systems had signed a pact with Japan-based ShinMaywa Industries for the manufacturing and assembling of ShinMaywa US-2 in India. In a statement, Mahindra said that both companies have entered into the partnership with a view to set up maintenance, repair and overhaul (MRO) services in India and also undertake manufacturing, assembling of structural parts and components for US-2 amphibian aircraft. (see *Vayu Issue III/2018*)

US, Japanese, Indian Navy in Mine Countermeasures Exercise

US Navy mine countermeasure (MCM) units, Japan Maritime Self Defense Force (JMSDF) MCM units along with Indian Navy Explosive Ordinance Disposal (EOD) units carried out the 2JA Mine Countermeasure Exercise 2018 near Ominato, Japan, on 18 July 2018. This “strengthens interoperability and increases proficiencies in mine countermeasure operations amongst regional allies and partners”. During the exercise, participating units practiced unit-level mine countermeasures tactics to include using sonar equipment to detect mines. Explosive ordnance



disposal unit personnel conducted dive operations in support of mine countermeasures efforts. The exercise culminated in a combined phase in which US Navy and JMSDF coordinated and communicated to ensure a safe route through simulated mines in one of the designated exercise areas.

Sikorsky S-76D sold to Govt of Maharashtra

Sikorsky, a Lockheed Martin company has announced the sale of an S-76D helicopter to the Government of Maharashtra which contract marks first sale of an S-76D helicopter in India, with delivery scheduled in 2019. “The S-76D helicopter introduction has been quite successful in the Indo-Pacific region, with more than 30 aircraft sold and delivered in the last five years,” said Christophe Nurit, Sikorsky’s Regional Executive for Asia.” The aircraft has been selected and proven for multiple mission requirements ranging from Naval and Coast Guard operations to Executive Transport.” S-76D helicopter VIP options include a customised interior with seating for five to eight passengers.



Indian Navy in 'Malacca deployment'



On 11 July 2018 the INS *Sumitra*, patrol vessel of the Indian Navy's Eastern Command, became the first Indian warship to operationally visit the Indonesian port of Sabang, strategically located at entrance of the Malacca Straits. This visit underlines the recent announcement by Indian Prime Minister Narendra Modi and Indonesia's President Joko Widodo that "an Indian-Indonesian joint task force would undertake projects for port related infrastructure in and around Sabang". During the Indian PM's visit to Indonesia, the two countries signed the Defence Cooperation Agreement to supplement the earlier 'Security Dialogue'.

Earlier, in late May 2018 the corvette INS *Kulish* and a Dornier 228 MPA of the Indian Navy conducted the annual *India-Indonesia Coordinated Patrol* where the two forces jointly sail along the maritime boundary between the two countries.

464 more T-90 MBTs for Army

The Cabinet Committee on Security headed by Prime Minister Narendra Modi is reportedly to meet shortly and clear the acquisition of 464 additional T-90 main battle tanks for the Indian Army. This is some 18 months after the defence acquisition council



(DAC) had cleared the proposal in November 2016. The additional T-90s will augment the Army's large armoured force inventory which includes over 1300 T-90s, acquired directly from Russia as also manufactured at the heavy vehicles factory (HVF) at Avadi near Chennai in Tamilnadu.

CSTPL add new Airbus A320 simulators

CAE Simulation Training Private Limited (CSTPL), a joint venture between InterGlobe Enterprises Pvt. Ltd. and CAE Inc., celebrated its fifth anniversary recently. With its campus in Greater Noida, this is the largest A320-approved pilot training centre in India with six simulator bays, to impart training to over 5,000 aviation professionals every year. The organisation has announced expansion plans of adding two new Airbus A320 Full Flight Simulators to its present inventory of five A320 simulators as well as a new ATR72-600 Full Flight Simulator "to meet the growing demand of its airline partners".

Tata Technologies in MoU with VDIA



Tata Technologies Ltd has signed an Memorandum of Understanding with the Vidarbha Defence Industries Association (VDIA) to establish a new state-of-the-art aerospace and defence centre in Nagpur. "This centre will help establish Maharashtra as the preferred investment destination for aerospace and defence manufacturing, promote indigenous and modernised technological capabilities and develop skilled resources to support micro, small and medium enterprises (MSMEs) to be globally competitive in the aerospace and defence sector". In the photo above are seen Chief Minister of Maharashtra, Devendra Fadnavis and Anand Bhade, President Asia-Pacific, Tata Technologies

BEL signs MoU with Saab



Bharat Electronics Ltd (BEL) has signed a Memorandum of Understanding (MoU) with Saab of Sweden, for joint marketing of the L-Band 3D Air Surveillance Radar, RAWL-03, co-developed by BEL and Saab. This Long Range Air Surveillance Radar, a cost-effective L Band three dimensional (3D) radar for early detection and tracking of air and surface targets, enables engagement of fire control systems and will be offered in both ship-borne and land-based configurations. The system is based on the state-of-the-art GaN TR Module technology and incorporates the latest Signal Processing techniques. Seen in the picture (left-right) are Urban Lennheimer, Vice President (Surface Radar Solutions), Saab; Kiran V, General Manager (International Marketing), BEL and David Kovarik, Vice President (Sales and Product Management), Saab.

L&T and BEML in MoU

BEML Ltd, a PSU under the Ministry of Defence and Larsen & Toubro, the private sector engineering, technology, and construction conglomerate have signed a Memorandum of Understanding (MoU) “to jointly capitalise on the emerging opportunities in the domestic and export markets for defence products and systems”. The cooperation between the two organisations is aimed to leverage initiatives for increased value addition within the country in development/manufacturing and long-term support for defence and export business in identified areas/projects/programmes, thus synergising their combined strengths.

Air India seeks Rs 2100 crores for immediate operational needs

According to reports from Mumbai, the national carrier Air India has requested the Government to revive its equity infusion, seeking Rs 2100 crores to address its immediate operational requirements. This is in the wake of privatisation plans being undone (see separate news item) but any such infusion will only take care of Air India’s short term capital requirements. The national carrier has plans to induct only nine more A320s, on lease, primarily for replacement rather than expansion. According to a spokesman “Air India will continue to lose domestic market share, reduced to below 10% from the 12.8% earlier”.

India and South Korea in special strategic partnership

During the official visit to India in mid-July 2018 of South Korean President Moon Jae-in and his delegation, the two countries have endeavoured “to strengthen the special strategic partnership and upgrade the comprehensive economic partnership agreement (CEPA)”. According to the joint vision statement issued after the talks, “we pledged to work together to prevent proliferation of weapons of mass destruction and delivery systems, particularly to terrorists and non-state actors.”

A total of 11 documents have been exchanged between the two sides, including an MoU on cooperation in field of biotechnology, bio-economics and telecommunications.



Appointments

Lt Gen Devraj Anbu becomes VCOAS



Lt General Devraj Anbu was appointed as Vice Chief of the Army Staff on 1 June 2018. Commissioned in the 14 Sikh Light Infantry on 7 June 1980, he has wide operational experience including serving on the Siachen Glacier, counter insurgency & counter terrorist operations in Jammu & Kashmir and North-East as well as in 'Op Pawan' in Sri Lanka. During

his 37 years' military career, the General Officer commanded his unit during 'Op Parakram', an Infantry Brigade on the LoC in the Kashmir Valley, a Mountain Division in Sikkim, the Indian Military Training Team in Bhutan and IV Corps in the East.

Lt Gen Ranbir Singh is GOC-in-C Northern Command



Lieutenant General Ranbir Singh assumed charge as General Officer Commanding-in-Chief, Northern Command on 1 June 2018. He was commissioned in the 9th Battalion Dogra Regiment in 1980 and has had varied Staff and Command appointments, having commanded a Mountain Brigade, an Armoured Division and a Strike Corps. His tenures also include

United Nations Peace Keeping assignment at Rwanda and as Chief Operations Officer in the Sudan. Besides other staff and instructional appointments, he has had multiple tenures in the Military Operations Directorate in various ranks including as Director General Military Operations, famously during the "surgical strike" of September 2016.

Arup Chatterjee is Director Engineering, R&D HAL



On 1 June 2018, Arup Chatterjee took over as Director (Engg. and R&D) of Hindustan Aeronautics Limited, prior to which he was heading the

Aircraft Research and Development Centre (ARDC) as its General Manager. He joined HAL in 1982 and has served in HAL's Korwa, Kanpur and Koraput Divisions apart from the Corporate Office at Bangalore.

Dr Tessy Thomas appointed DRDO's DG Aero



Dr Tessy Thomas has been appointed as the Director General, Aeronautical Systems (DG-Aero) of the DRDO on 1 June 2018, earlier being Director of the Advanced Systems Laboratories (ASL) at Hyderabad. Dr Tessy, celebrated as the first woman DRDO scientist to head a missile project, is DRDO's third woman DG at the technical level. The Aero cluster labs under Dr Tessy's authority include the Defence Avionics Research

Establishment (DARE), Gas Turbine Research Establishment (GTRE), Centre For Air Borne System (CABS), Aeronautical Development Establishment (ADE), Centre for Military Airworthiness & Certification (CEMILAC) and Aerial Delivery Research and Development Establishment (ADRDE). The Aeronautical Development Agency (ADA) responsible for Tejas and all future combat fighter projects, too will fall under her charge.

Ashish Saraf appointed as head of Airbus Helicopters, India



Airbus has appointed Ashish Saraf as head of the helicopter division of Airbus India to lead its initiatives across the civil, defence and parapublic rotorcraft markets, taking over from Xavier Hay who leaves India after six years. Saraf joins Airbus Helicopters at a time when the company is competing on several military helicopter projects "that would reinforce and enhance the local aerospace and defence industrial ecosystem". Since 2015, Saraf has served as Vice President – Industry Development, Strategic Partnerships and Offsets at Airbus India, focusing on 'Make in India' initiatives aimed at enhancing the company's industrial footprint.

Prof. Prodyut Das writes on

Riddle of the RFI



Symptoms of an ancient malaise?

They play 'Abide with me' at the end of *Beating of the Retreat Ceremony* on 28th January, every year at Vijay Chowk in New Delhi. It was Gandhiji's favourite hymn but truth to tell, I do not care much for Victorian Hymns. The words and the music are all right I suppose and in this case there was a tinge of tragedy : Lyte was dying of tuberculosis when he wrote it, but generally, being on the native and therefore, receiving side of *Pax Victoriana*, the humbug, hypocrisy and self righteous sanctimony of that era spoils the flavours for me. My remembrance of 'Abide with me' comes from my recollection, perhaps faulty, of the phrase "the encircling gloom" which is a pretty accurate summing up of the present situation vis-a-vis the MMRCA and the LCA and the morass that passes for a process of building up of our air strength.

The RFI

My gloom was not lightened when a friend sent me a copy of the recent RFI issued by



Vayu Bhawan for some 110 new fighters for the IAF. Seventy three pages long it seems to be an amalgam of pilot's notes, vague questions and a lack of connectedness. Coming from one of the innovative and

experienced Air Forces in the world, this does not impress.

First is the style. Clearly some of the questions are mere "padding" The location of a parking brake or the resistance of some

'Once More, with Feeling' : Contenders



Boeing F/A-18



Saab Gripen



Lockheed-Martin F-16



RAC MiG-35

in the MMRCA 2.0 Sweepstakes



Eurofighter Typhoon



Dassault Rafale

transparent material to solar radiation are hardly the questions that need to be asked, in this century, from vendors of the calibre of – in alphabetical order – Airbus, Boeing, Lockheed-Martin, RAC-MiG, Saab (images in the double-page spread) If they *are*, then specify the standards expected. In another case in the performance of a certain system : it is not sufficient to specify 45°C because 45°C, 45°C, 50% RH and 45°C, 50% RH 100mts alt, 450kts LLXC will give different answers : I don't buy aeroplanes but if you will pardon me, I found the style slightly *effete*.

It has been ages since I imbibed all those carefully taught lessons on accusative voice and passive voice, dative and nominative case but I felt that a certain more assertive style of writing would have shortened the length of the document considerably. If we are in the market for 110 fighters, we can be more firm about, for instance the technical life of the airframe should be at least 4000 hours for single-engine airframes and 7000 hours for twin-engine types when flying a profile as outlined in Fig X, if you see what I mean. Why the two different figures for life? Perhaps, for one reason or the other, the single-engine type won't last much longer than that in low level fighter missions?

I have a charitable explanation for the 73 pages of 'bumpf'. It is quite possible that someone in DASR at Air HQ got a 'rocket' for the previous RFI which I believe was just one page. *There seems to be an extremist inside*

Air HQ! Having received the said 'rocket', the receptor's reaction could well have been '*All right you so and so of uncertain parentage, if it is length you want try ploughing through this!*' In a way I rather hope that was the case because it would show that all is well with the Air Force!

Style is subjective, but it is a matter of concern when an endurance, with flight refueling, of ten hours is being called for with night - capable FR! If all this capability came for free and with no penalty in terms of performance then one could let that pass and pity the aircrew but otherwise this is serious outrage. What kind of mission are we having in mind when we are asking for this capability? Has that been requested/ approved by the cabinet? Or was it put in to favour a particular type? Only the Americans will have the need, specify or have this kind of capability. If it is only to join 'Red Flag', then it will be cheaper to route through Cairo and Paris. Cairo is, alas, no longer what it used to be but I am sure the aircrew would manfully endure the hardship of being stranded in Paris for the night!

The second objection is that this RFI does not seem to be any different for what would have been if released for heavy fighters such as the Su-30MKI or the Su-35. It seems illogical that we take on the complexity of inducting three types of combat aircraft – Heavy/MMRCA/ LWF – from three different countries and not reap the benefits. The greater effort

of keeping three types in service must be compensated by having sharply "optimised for the role" kind of capabilities. All sorties will not demand the same kind of capability and particularly for the light-weight types, the percentage of war load/MTOW load goes down sharply. Therefore equipment levels have to be carefully pared to retain performance and range-payload. We need a large air force but we cannot have it by having a series of *Bonsai* –as in Japanese gardening- aircraft.

The other idea would be to have a "stripped to essentials" airframe – *basic equipment for VFR short range strike against average "95 percentile" targets with ground based /AWACS control* – and have fairly comprehensive sets of mission packs carrying just the few sensors required for the more exotic missions. The argument is that any capability that is not required in a mission is a handicap of that mission. The example of the MiG-21s used for cratering Tezgaon in '71 can be cited. The pilots would have much appreciated if they didn't have the radar which was *never* needed but instead had more fuel and two 30mm NR revolver cannon which the MiG-21PF originally had and which were deleted in the FL, and later sorely missed.

Transfer of Technology

More than one third of the RFI, about 26 pages, covers the wish list of Technology transfers. It covers everything but the proverbial kitchen sink. My reactions:



"Heavy, medium light weight fighters, all in a row" : flight line at Yelahanka during an Aero India Show



Dassault Rafale: the odds on winner?

- TOT does not come for free. It will pad up the bills (and the commissions) but is it relevant to us? For example the technologies for Blisks and Single Crystal Blades (SCB) has been asked for. Will an engine development programme be funded keeping in mind the negligently planned Kaveri/GTX programmes? Do we have the engine test beds or people with the “right stuff”? It is premature to get “blisk”. Let’s walk before buying sprinting shoes. A Blisk is not an unmixed blessing. At the cost of more expensive FOD repairs it maybe gives a 2-3 % improvement in compressor performance, once you have reached the 80-85% (for example) compressor efficiency ranges. If we are at, say, 55% efficiency we better spend effort trying to get the efficiency up to scratch. Acquiring technology without *sanctioned* plans and trained people to use it reveals callousness with funds and an un-engineering like expectation that all we need to get a serviceable engine is to cram it with high technology stuff.
- The same applies to the SCB. This gives better sfc as well as longer TBOs. It is essential for an ‘expeditionary’ air force like the USAF even in peacetime because of their need to “transfer of assets to various theatres”. We have no ambitions to global policing. We can have a matching if not identical capability usually by degrading TBO. There are more ways of killing a cat than drowning it in cream! Why are we steeply chasing something we do not just now need? The Chinese engines DO NOT match the US engines in terms of TBO and TTL but in terms of Thrust-to-Weight, they are probably close enough to the US engines. The Chinese are not losing too much sleep with such a situation because they have designed their airframes for

quick engine change and employing more people-they can afford that sensible solution. In the meantime they beaver away, sometimes by fair means, to improve the ever narrowing menu of lacunae in their engines.

New readers may wish to read ‘The Lessons of the Kaveri’ in *Vayu III/2014* for more on our engine options. It would be cheaper and more certain if we spend a decimal fraction of the expected TOT costs and without ‘socialist’ bias, viz- the L&T versus MDL tussle for building submarines – or the BMP replacement orders – for example fund companies that are already in this approximate field and with the right spirit for blisks. Bharat Forge (not a shareholder!) comes to mind and get them to do a ‘cold’ i.e. non flying, blisk of the LP spool of the RD-33 or Kaveri compressor and measure the aerodynamic efficiencies and creep and other relevant properties as well as the problems of manufacture and heat treatment. Just that, not a ten years pie in the sky programme. We will learn, at very low cost much more than getting ‘Blisks for Dummies’ in three volumes as I suspect is the hopeful expectation.

In defence engineering, our past dismal track record has been that the taxpayer paid good money to get TOT which was then allowed to be wasted down the drain. Consider that:

- The HDW submarine programme ended and we had no follow on programme. It was only when the entire workforce at MDL had retired that people woke up to the need to replenish our submarine fleet. Of course the TOT had to be paid for *again*.
- TOT was paid for the Bofors FH 77B 155/37 technology. We then sat on those drawings for thirty years, until the artillery requirement had changed to 155/52 before suddenly waking us up

with a start. The hope was for another round of TOT? The change was in another magnitude of machining and propellant technology. In the interim what happened? Firstly we did not build *one single howitzer* to those drawings for which we had paid TOT. Whilst our people merely gazed of on the Bofors drawings, there was a separate induction of light weight howitzers, something which we could have cobbled together from the TOT if we had let our engineers loose with a brief and a little funding. An aluminum gun carriage was a *possible* solution at a fraction of the cost even if the carriages had to be remanufactured more often. Did anyone responsible even think it out? If ‘no’, why not? Even if it failed – in a *short period* experiment- we would have surely learnt.

- Why is it invariably that feasible projects are never funded but the less feasible the project, more the sustained support. Who sanctions these open ended ‘picnic’ projects and why?

The past shows that TOT is waste of money. The fact that Jubbulpore factory could get out the 155/46 calibre gun out in a commendable short time indicates that there is the ability to ‘figure things out’ at the rank and file level. If one cannot, then one should not call oneself an Engineer but an ‘Engineering degree holder’! There is a difference between the two.

Finally I have a fundamental doubt about ‘buying’ TOT. The Chinese have an embarrassing trade surplus with the US about which the US complains a lot. Why is it not that the US sells and the Chinese just buy the TOT? Perhaps the inscrutable Chinese have a natural advantage for Industrial espionage?

Cost of the horses

If wishes were horses beggars would ride! The cost of the buy *without* TOT is currently at \$ 18,000/kg x 8000kgs./aircraft x Rs 66/\$ X 110 which works out to Rs 104,540 crore upfront to buy and at least another Rs.312,632 crore to keep them in service for just the next twelve years at 225 hrs per airframe per year. This does not include the flight refuellers (see ten hrs sorties as above) and AWACS as will be required to make the BVRs work optimally. Given that sanctioning a paltry Rs. 6600 crores to *modify* pensions to OROP took a mere 42 years, it is clear that we are not going anywhere in a hurry as regards the MMRCA.

Those prices are if we buy the entire lot from abroad. If we make it in the Government factories, it will be another forty nine percent or so more! In the case of the Sukhois that HAL built, even if we accept that HAL costs should only equal and not be less than Russian costs, we have spent an additional Rs 18,700 crore. Any wonder why we don't have enough money for the Forces! Why do we continue with this farce when 'saving foreign exchange' the old explanation, holds no water today?

One small but encouraging point is that there is no 'bobbery' (*baap rey*, an exclamation of awe and shock) about AOA, that great requirement of a decade ago. If not by oversight, it is good that we are not letting the ghost of the Phantom II's spinning characteristics haunt us anymore.

To sum up. This is an RFI produced by the IAF working in isolation. It is a 'misleading' RFI because it is for an 'expeditionary' Air Force, not integrated into an overall defence strategy, perhaps because we never had one. What we need is a *Self Defence Air Force*. We certainly need a large Air Force but this is not the way we will get there.

The plan(c)e of Wails

Digressing for a moment to the LCA: its delays have actually got us to where we are and seeking a face saving solution by labeling a LCA replacement/supplement programme as the MMRCA, we see the

same encircling gloom. The LCA has been blessed with more than one IOC while the FOC is 'just around the (by now perennial) corner'. A production line has been set up and augmented to cater to produce some eleven aircraft per year. Can we expect to have two fully equipped squadrons (never mind if it is to FOC-1 standard) by September 2019 and four squadrons by September 2021? That *should* be possible but to believe that this would be akin to a second marriage, a triumph of hope over experience! My prediction is that we will perhaps get another six aircraft by the end of this financial year. If there is a seventh, it will be delivered on 29 March 2019 at 2300 hrs so that it can be said that seven were delivered in 2018-2019. One speaks from experience.

The LCA situation continues to be dismal and I will share my reasons for being gloomy about improvements in this regard, if only so that the reader will know how many grains of salt to take with my assessment.

- The aircraft will not meet its speed and energy related performance parameters. The aircraft is claimed to be supersonic at sea level but there have been reports that the aircraft is not meeting its Mach 1.6 max speed which is one of the reasons for holding up the FOC. An aircraft that does Mach 1.1-1.2 at SL *will do* Mach 1.6 at the tropopause. I have always been skeptical of the drag

of the airframe. Mind you, I would value transonic acceleration rather than the max straight line speed. Readers are referred to *Vayu I/2015* 'The LCA... beloved aircraft or lemon?' for a more complete exposition.

- During the Second World War the Russians found that they could improve speed of the Ilyushin Il-2 M3 *Shturmovik* by about 32 kmph on a top speed of 400 kmph by improving the fit and finish of hatches, covers, gaps between the control surfaces etc. I was reminded of this when I was examining the picture on the cover of *Vayu VI/2017* of an LCA. My interest was caught by the pattern of light reflecting on the upper mid fuselage /wing root area. The light pattern indicates the presence of an irregular large kidney shaped *depression*, indicating poor finish in that area. This is fatal to performance. I cannot think of any excuse for that. And this on a LSP aircraft, not from the early TD/PV series. I wonder if the LCA programme has *any* engineer in any *responsible* position, or else one would not get to see such shoddy work.
- There has been some mild cheering about the move of nine LCAs to Sullur, being hailed as proof that the programme is finally out of the woods and the aircraft is 'operational'. I too would like to believe that but it does not square up with common sense. Here



Tejas trainers line up for take off: the two-seaters are still not cleared for series production at HAL

we have the MiG-21s requiring to be carefully looked at for signs of popped rivets and cracks and no doubt spares are no longer as plentiful as they were half a century ago but here we are sending its 'red hot' replacement to the deep South, out of harm's way. There have been no reports of swarms of people invading the Coromandel Coast, intent on setting up laundries and dentist shops. Is it that the aircraft has been declared "fit for service" as a point of honour (why? whose?). Perhaps the Air Force does not want its forward bases and hardened shelters cluttered with an operationally suspect type. Sullur is a good place where the aircraft can be parked without harming themselves or the Air force. Let's base the aircraft at Halwara, Hasimara or Nal before we roll out the barrel!

- The aircraft has flown 1000 sorties with No.45 Squadron. The usage rate works out to roughly 85 hours/aircraft/year. The neighbour's JF-17 compares at 126 hours/aircraft/year while the RFI in question expects an average utilisation rate of 225hrs/ aircraft /year.
- Reports of pilots being 'delighted' with LCA's handling and cockpit interface etc are no consolation to the IAF. Even if we get 100 out of 100 in these areas, the aircraft is still a lemon. The Morane Saulnier MS 406 was a very pleasant and nice-to-handle aircraft but it simply did not match up to the Me-109.

At this point several questions nag one's mind. First is why is this periodic 'blooming' of the MMRCA requirement e.g. 2002, 2007,2016, 2018 etc and how can something so 'urgent' continue to be deferred for so long? My construct is that the MMRCA is the dog that is being wagged by the LCA tail! We are in a crisis because of the continued failure of the LCA programme to stick to *any* schedule. If we had ten squadrons of LCA in service and more in the pipeline, the MMRCA deal would not have verged on the "compelling circumstances" situation. To break this circle we need to tackle the LCA problem first. This programme is where it is because of sheer negligence in supervision at all levels.

The LCA is unlikely to ever be a top ranking aircraft but it can be made serviceable if we break with the past methods. The political leadership must hammer out a

compromise between the user's expectations and the designer's capabilities, within the restrictions imposed by the LCA's unfortunate tailless delta configuration. At the same time the design has to be tweaked. Having got that compromise, the production has to be ramped up to about forty aircraft per annum. The MiG-21 replacement is the most critical factor for the IAF's and a production line set up for thirteen airframes can also do forty. In any case we have nothing better for the present and the LCA is certainly better than the Hawk.

Continuing on this theme, the major question remains as to why we have specification which seems to be for 'an expeditionary Air Force'? Perhaps the Air Force wrote it out to cover all contingencies, including the improbable. We enjoy an enormous advantage in that *we* are not expedition minded. Our war planning for the three weeks war can go into very precise details with targets, times, sortie rates, losses, squadron cycles. Our adversaries cannot create 'Bekaa Valley' all along a 4000 km. front. So while, we should have some squadrons of 'Bekaa Capable' and many squadrons of 'Tropical VFR combat capable' squadrons, this will be a big relief in terms of budget and technology and 'do-ability'.

A Swadeshi MMRCA?

The third, and most demanding question is as to why, for such a most crucial requirement, there has not even one Indian OEM bidding? There is good money to be made and we are nothing if not enterprising. For this we have to go into the politics so batten down your hatches and I will be more concise.

Some historians hold that half way through the First World War, it became clear to financiers of the British Empire that India's independence was inevitable and the new nation's industry could become a considerable threat to their worldwide investments. To safeguard their interests, they started several processes aimed at reducing the efficiency of the yet-to-emerge Indian economy. These included fracturing of the market and long established supply chains with plans for 'Partition' and encouragement of secession. Post Independence regime changes in Pakistan (and later in Bangladesh) prevented commercial reconsolidation of the fractured

markets. India's excellent education system, once rightly vaunted to be second only to Oxford and Cambridge, was politicised and reduced to its present mediocrity. The increased funding for education sadly found its way to political parties and private pockets. Human resources, the feedstock Industrialisation such as by the Japanese, has been so degraded that a new word 'Unemployability' had to be coined.

Hobbling the Industry in particular, there was a strong movement for a 'socialist pattern of Society' in some UK Universities and their Indian acolytes. Unfortunately this received ill-considered but extraordinary support from a small minority of India's then leadership. The proposed Socialist pattern of society was a regime almost Soviet in its rigidity and central authority of a pattern *never* allowed to be applied in the country of origin.

The espousal of such a "socialist pattern of society" in the garb of welfare for the masses, allowed a relatively small number of people in power to stifle the inherent enterprise of the Indian peoples. At the same time, with its 'dog in the manger' policy the Government created big "no fly zones" where, illogically, in an era of shortage of capital and management skills, private capital was shut out. When licenses were given the permitted production rate was always and unfailingly far below the level to make the product globally competitive.

Just how crippling this policy was and what opportunity was lost can be gauged by examining the decline of Air India. Under JRD Tata it was a prized airline. It is unsaleable today. And talking of Tatas, this industrial house were set to produce fighters, fighter-bombers and transport aircraft at its facilities in Poona when World War II began, but they were not allowed to proceed, and HAL then became (and remains) the sole such entity in India.

The opposite, and very happy, example is that of India's automotive industry which pre-liberalisation, produced a very limited variety of models of unfailing bad quality. Volume wise it was nowhere. India is today the fifth largest producer in the world, exporting globally with fairly good design capabilities and in some segments, remains the largest producer in the world. We note with some pride that India was the only country where the home grown products were able to fend off the challenge of Japanese competition.

Teeth of the Elephant: 50 squadrons !

I will now begin with a scenario. We have fought our 2-front, three-week war. Our losses will be around 200 aircraft gone and another 100 or so dragged to the BRDs for repair. They will be there for the next six-twelve months before starting to trickle back. The adversary, as he licks *his* wounds, realises that thanks to our numbers, we have been able to sustain our squadrons, absorbed the losses, and re-trained our crews. He is aware that in spite of this battering and the loss of some of the cream of our crews, our critical close support and strike strength remains effective and he may well think that discretion is the better part of valour, and not have started a fight in the first place. As they say so wisely in Hindustani 'An elephant has two (sets of) teeth – one to show, and another to eat!' The timing of *Gaganshakti* to coincide with the PM's visit to China was very much serendipity but every 'show' helps!

We are now caught between a rock and a hard place as far as our air strength is concerned. We need a 45-50 combat squadron Air Force, not because that number was crystalised in 1963 but because of the above scenario. The loss of 200 machines is a given because of the single factor of increased effectiveness of SAMs and MANPADS, ever since the December

1971 war. We lost 75 aircraft in ten days then against a hamstrung Pakistan. We need those numbers *now!*

Unfortunately if we go by the RFI (what this article is really all about) we will never have that large force because no country maintains forces of this size using imported equipment. 'Making in India' will not help, as thanks to our penchant for 'socialism', we have muddied our own waters.

The magic potion?

North Korea (NK) is to me a Business School case study of how totally involved political guidance can maximise slender resources to achieve incredible results. It is a given that the NK missiles are below par and their nuclear weapons equally doubtful, but the North Koreans have succeeded in being like the proverbial Indian folk tale, an ant in the (US) elephant's ear. The magnitude of North Korea's achievement can be gauged if we remember that North Korea is in terms of size population and resources about the size of the Indian state of Chhatisgarh. (It *is* a little difficult to imagine the Chief Minister of this state keeping the US President awake at night).

That NK is a totalitarian state is irrelevant. China, under Mao, was totalitarian but Mao's obsessive preoccupation of staying on in power meant that the vast Chinese Armed Forces soon became obsolete. It was only under Deng Xiaoping's monitoring of the

weapons programme that China made rapid strides. Nevertheless in an age of body bag sensitivity, Mao never blinked when dealing with the USA. The clear lesson is that one must have large forces, with home grown equipment even if they are slightly below par. With all these widely varied perspectives to the problem, we can visualise that the only way out is with having astute political leadership. Leadership must, in the words of Shakuntala's Raja Dushyant (No.47 Squadron's motto) live up to *Karmani Byapritam Dhanuhu*, or 'My bow is bent to its task'.

Staking the elephant

In pre-colonial India, a Commander signaling his resolution would tie down forelegs of his command elephant to stakes driven into the ground. In doing so, he exposed himself to risks of being overrun. Warfare being a mind game, such an act often had the effect of unnerving the opposition – and he would go on to win the field. Political maladroitness has got us to where we are and it is now for India's political leadership to stake the elephant.

Pakistan has always applied the doctrine of 'compelling circumstances' to their political life. They do not have a political life. If we apply the doctrine of compelling circumstances to our weapons procurements, we will then neither have a weapons industry nor consequently large



Both HAL-built types: Su-30MKI from Nasik and Tejas LCA from Bangalore

armed forces. Our political leadership must reject the doctrine of 'compelling necessity'. This spectre will continue to haunt us unless firmly dismissed. Given the nuclear deterrence and our present strike capability, no one will overrun Assam or Ladakh. However, given resolute political will, we will need five to ten years to turn the tide as regards weaponry. We are at this dismal spot because our political leaders have, almost since independence, never taken a comprehensive interest in matters of defence except for lip service.

So, this RFI

This RFI could well reflect the malaise in the organisation of our overall defence planning. The approach is narrow, linear, compartmented, reactive and vulnerable. A small import lobby can disrupt and manipulate the process at will. Defence plans must definitely be made by the bureaucracy and the military under the yoke of political leadership. Once the national security scenario is clear, our war plans become simpler and more focused and the need for a technology package then gets reduced affordably reduced. A careful review of the threat may show that the S 400 and bullet-proof jackets and night vision equipment along with automatic rifles will be short period compensation for the

present weakness in our air strike strength, as they only buy us time.

Faster development of the LCA Mk1A is certainly a key to stability of the Air Force acquisition process. The present situation cannot just have happened, but perhaps degenerated because politicians of the day were too preoccupied to monitor and supervise, even to the very simplest levels of just 'keeping an eye'. If we do not get another six LCAs by December 2018, the Government must institute an internal White Paper on the entire LCA programme. If, after Rs 70,000 crores (PDV) and 35 years, all we have are nine partly operational aircraft, then it definitely requires political intervention.

The cost of manpower is the single largest cost in aircraft design and manufacture. The LCA cost should be close to that of the JF-17, but in fact is nearly double!! The quotation by HAL of a price of Rs.486 crore (*The Statesman* editorial of 2/07/18) is so out of this world, that this is either a cover up for the failure of the LCA programme or an excuse to import, both intolerable! The cost of the PSU production does not match with common sense. It is not enough that our R&D costs are 'lower' than those internationally, which can and should be about one third to one fifth.

It would be willful neglect on part of the Government if it makes the LCA Mk.II(?) the sole contender for future funding. I can fantasize about a Honeywell F.124 N-powered development of the HF-24 and the GE F 414 powered adaptation of a MiG-27 which is not only day dreaming but these aircraft with proven airframes and new power plants are far closer to the ASR for an Mk.2 than the Mk1. Their airframes have the room for all the avionics that the IAF want. The bonus will be of time scales and the ability to 'tweak' the design to perfection. No.11 BRD Nasik/ Air HQ can do the initial project studies for the MiG-27/F414. It would be an act of commendable foresight if the private sector be invited, even as observers for such studies.

If, for other reasons, we are forced to acquire the MMRCA (*Vayu II/2017*) from international OEMs, as a substitute for the LCA then go for the lowest cost and size equivalent to the LCA. Amen !

As a parting, I reiterate that every time we have come to the edge of the woods, we have turned around to go back deep into the forest. Only strong political will and clear direction can change this fate. Let them keep 'Abide with me' for ceremonies. For the Air Force and our Defence Industry, the tune must change to *Kadam Kadam Baraye Ja* "March! March! Ever Forward!"



Navantia's 'Juan Carlos I'



Visits India

Promoting its flagship amphibious assault vessel, Navantia, the Spanish state-owned shipbuilding company, brought its warship 'L-61 Juan Carlos I' to the Indian port city of Mumbai on 2 June 2018. This special visit by the Spanish warship is considered as a key step by the company to offer the Indian Navy four similar ships to upgrade its current fleet. Vayu visited the warship to be briefed on its capabilities, strengths and technologies.

Spanish shipyard Navantia sailed its 26,000 tonne amphibious assault vessel from Spain to India but before arriving at Mumbai, the Spanish vessel had docked in Kuwait where it offloaded five helicopters: three Chinooks and two Cougars that Spain has deployed in support of its current military mission in Iraq.

The *Juan Carlos I*, launched in 2008 and commissioned in 2010, is named after the King of Spain who abdicated for his son Felipe VI in 2014. The concept of the *Juan*

Carlos I is based on four different aspects: usefulness of the ski-jump ramp of Royal Navy aircraft carriers, the versatility of US Navy amphibious assault ships, the logistic capabilities of RO-RO transport ships, and the potential for humanitarian assistance of hospital ships. Its main distinguishing features are thus a combination of all these capabilities in one single platform.

The Spanish Navy intends versatility and interoperability for its naval force and the LHD *Juan Carlos I* meets both requirements.



The tiered-design of Juan Carlos I clearly seen in this picture



AV-8B Matador before launch



SH-3D and AV-8B on the flight deck

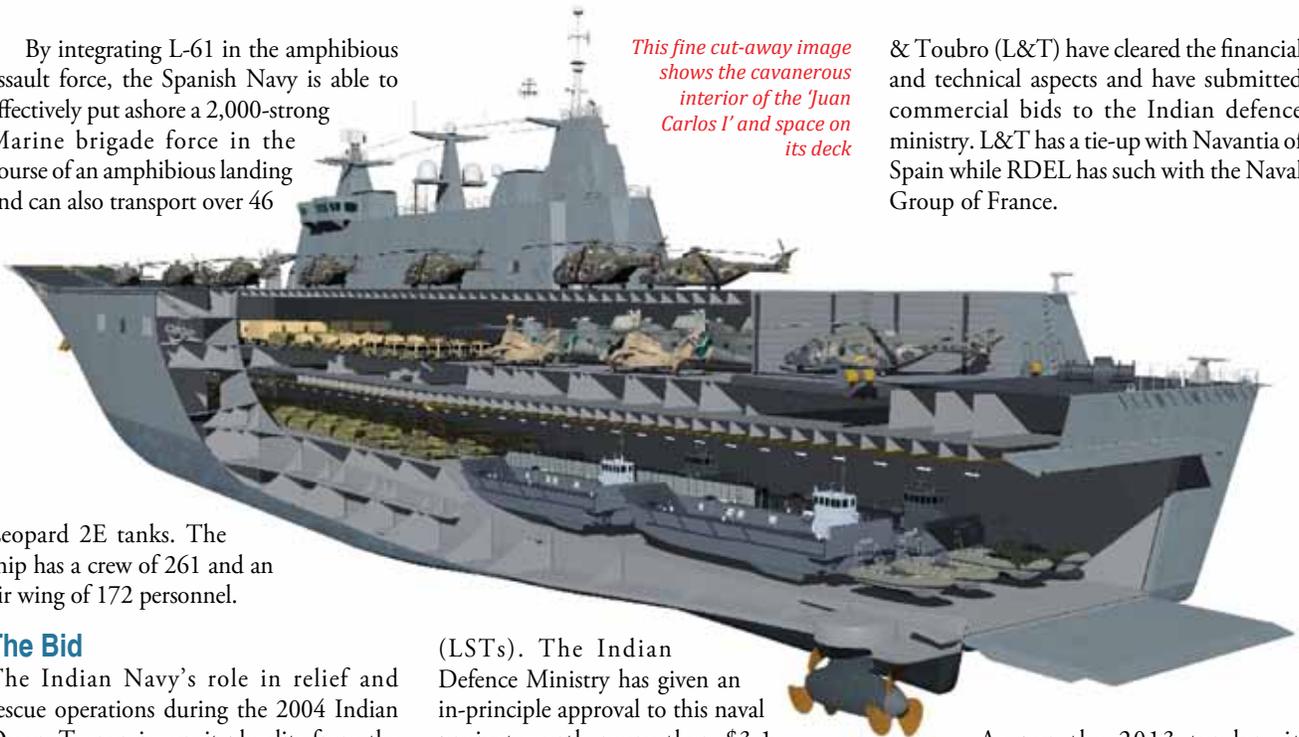
Experience at sea has confirmed the ship's versatility to perform such planned roles in effective manner: for amphibious assault, as an aircraft-carrier, strategic projection and for providing humanitarian aid.

The company claims that the level of interoperability that has been achieved by the vessel, especially regarding flight operations, is "quite satisfactory," having demonstrated its capability of operating with Spanish Army and Air Force helicopters as also with US Marine Corps tilt-rotor MV-22 Osprey aircraft.

By integrating L-61 in the amphibious assault force, the Spanish Navy is able to effectively put ashore a 2,000-strong Marine brigade force in the course of an amphibious landing and can also transport over 46

This fine cut-away image shows the cavernous interior of the 'Juan Carlos I' and space on its deck

& Toubro (L&T) have cleared the financial and technical aspects and have submitted commercial bids to the Indian defence ministry. L&T has a tie-up with Navantia of Spain while RDEL has such with the Naval Group of France.



Leopard 2E tanks. The ship has a crew of 261 and an air wing of 172 personnel.

The Bid

The Indian Navy's role in relief and rescue operations during the 2004 Indian Ocean Tsunami won it plaudits from the international community while underlining its strategic potency to Indian policy planners. For the IN however, that situation brought to attention the crucial need to augment amphibious capabilities above and beyond what is provided by its existing fleet of medium-sized landing ship tanks

(LSTs). The Indian Defence Ministry has given an in-principle approval to this naval project worth more than \$3.1 billion to provide critical support which will involve also landing platform docks (LPD).

The Indian Navy has planned four such 20,000-30,000 tonne LPDs for induction in the next decade. India's private sector companies Reliance Defence and Engineering Limited (RDEL) and Larsen

As per the 2013 tender, it was initially decided to allot the manufacturing contract of two LPDs to the domestic private sector and the remaining two to a state-owned shipyard. However, after some amendments, the entire LPD contract was assigned to private players upon acceptance of their revised bids.



AV-8B VTOL fighters on the deck



Fine profile of the amphibious assault vessel (L61) seen to good effect

The diesel-electric propulsion LPD ships will have capability to remain at sea for at least 45 days. The ship would be equipped with a point defence missile system, close-in weapon system, anti-torpedo decoy system, chaff launchers heavy and light machine guns. It is required that LPD ships be able to carry six main battle tanks, 20 infantry combat vehicles and 40 heavy trucks. Each ship is expected to carry 1,430 personnel, 470 sailors and 900 troops. The ship would have the capability of simultaneous operation by special operation helicopters.

Commenting on capability of domestic shipyards that will build the LPDs, an Indian Navy official stated, “RDEL has no past experience in building large warships, including LPDs. However, as far as L&T Limited is concerned, they have been building commercial ships of equivalent tonnage, thus have sufficient in-house capability to build ships of equivalent displacements.”

Why does the IN want LPDs?

The Indian Maritime Military Strategy (IMMS) paper released in 2007 clearly recognises “that the use of maritime power to influence operations ashore is a primary,

and not a subsidiary, role of maritime force employment”. It further outlines that “this could be undertaken through commodity denial or by directly supporting the land campaign through the delivery of ordnance by naval platforms or amphibious and/or expeditionary capabilities.” Indeed it is precisely to augment ‘out-of-area’ or expeditionary capabilities that these LPDs are being sought by the IN.

“Indian Navy requires LPDs not for only protecting its island territories and the exclusive economic zone but also to thwart growing Chinese influence in the Indian Ocean littoral region,” an Indian Navy official has stated. “The aggressive posturing of the Chinese Navy in the South China Sea and Indian Ocean Region has made it necessary to beef up strength in the Indian Ocean region.”

The Indian Navy currently operates one LPD, the former US-owned, *Austin*-class LPD *Trenton*, which was acquired by India in 1997 and renamed as *INS Jalashwa*.

Navantia’s focus

The Navantia Group has welcomed this opportunity to support its current offering for the Indian Navy LPD Programme, as the chosen designer for in partnership with Larsen and Toubro as the main contractor. The LHD *Juan Carlos I* is Navantia’s reference ship for the LDP programme.

“There remains constant effort from the Governments of Spain and India to boost their defence ties which has helped Navantia to a great extent and since 2000, the company has been actively involved in examining needs

of the IN,” stated a Company executive. Besides the LPD Programme, the Group is also involved in various other programmes such as the P-75 *Scorpene* submarines, FSS for construction of five fleet support ships, MCMV programme for the construction of 12 minesweepers and nine counter vessels and collaboration with the IN.

As Navantia’s President Esteban García Vilasánchez, stated, “For us, India is a land of opportunities; it is a country where we hope to build four amphibious ships based on the design of *Juan Carlos I*.” The president, while addressing the Indian media during their visit to the warship, further stated, “It is our privilege to be associated with L&T in this mega project. Basically, L&T are the builders and we are supporting them on the technology and design front. If we get the contract, then L&T in association with Navantia will build four similar vessels and these will be aligned with the ‘Make in India’ initiative.”

L&T officials also opined, “In our earlier programmes, what we had manufactured were way smaller ships than L-61 *Juan Carlos* so in order to build this colossal vessel, one needs to have great partnership with people who have an ample amount of experience in this domain. This is the reason we have joined hands with the Navantia Group as they have both experience and technology to build this mega-sized warship”

Describing differences between the Spanish vessel and its Indian variant, officials informed *Vayu* that “The ship will be built in the Kattupali Shipyard, Chennai with higher amount of domestic indigenous content. There will be other changes as well since the Indian Navy doesn’t want to have fixed-wing aircraft on board and we have to remove the ‘Ski-Jump’ which will lead to shortening length of the vessel. What



Ski-ramp of the ship for AV-8B launches



V-22 Osprey comes in to land

the IN is looking for is a helicopter carrier and this vessel is capable of carrying various helicopters to perform multiple tasks such as amphibious operations, ASW operations, humanitarian and disaster management operations, etc.”

Technology Transfer

The current Spanish Navy *Juan Carlos I* has a 201.9m-long and 32m-wide flight deck with a 12° ski-jump facility for VSTOL aircraft (AV-8B Plus or the future joint strike fighter). Apart from the V-22 Osprey, AV-8B Plus and JSF aircraft, six NH-90, six SH-3D and six AB 212 helicopters, four CH-47 Chinooks and one SAR helicopter can be operated from the vessel.

The ship’s hangar can accommodate 12 aircraft, while six aircraft can be parked on the flight deck. The ship has two elevators, with a capacity to lift bigger aircraft in the future.

The ship has a deck of 69.3m length with 16.8m width while its flooding deck can carry four LCM-1E/LCM-8 + 4/6 Supercat type RIBs, one LCAC and LVTs. Displacement of the LHD for amphibious operations is 27,079 tonnes, while the maximum sustained speed is 19.5 knots.

However, as per the Navantia Group, there will be several alterations in the proposed Indian variant: overall length of the Indian vessel will be 214.19 m, breadth 32.0 m, full load displacement 27,000 tonnes and maximum speed of 20 knots. This ship will be powered by four main

engines of 8,000 kw, two auxiliary engines of 3,500 kw and four electrical engines. It will be armed with CIWS, chaff launchers, SAM missile systems and 12.7 mm machine guns.

The present *Juan Carlos I* has extensive medical facilities with two operation theatres, a dentist’s room, a sick bay, a consulting room, a first-aid room, an ICU, an injury selection area, an X-ray laboratory, a lab and a chemist’s room. An elevator connects the flight deck and cargo decks with the hospital.

The vessel has satellite, data and voice communication systems in place, the crew and staff on board able to receive commands and communication from data links, sent through sensors and equipment.

The LHD is powered by a combined diesel-electric and gas turbine (CODLAG) propulsion system. The electric engines are powered by one gas turbine and two diesel generators, with an endurance of 9,000nm at 15kt. An electric propulsion system means a reduction in fuel consumption, gas emissions and noise and vibrations; lower maintenance costs; reduction of necessary space and high manoeuvrability.

It certainly seems that the *Juan Carlos I* is well suited to fulfil present requirements of the Indian Navy, but there are many nautical miles to cover before Navantia-L&T jointly receive the contract and ships of this class sail the oceans under the Indian ensign.

Nitin Konde



Launching LCM from the 'Juan Carlos I'

The S-400 for formidable air defence



Armed with three types of missiles to create a layered defence, the S-400 Triumf (NATO reporting name: SA-21 *Growler*) is an air defence missile system developed by Almaz Central Design Bureau of Russia. Essentially an upgrade of the S-300 series of Surface-to-Air Missile (SAM) systems, this replaced the S-300P

and S-200 air defence systems of the Russian Army from April 2007 onwards. Likely to enter service of in Indian Air Force, the proposed \$ 5.5 billion deal has been cleared by Defence Acquisition Council (DAC). Capable of simultaneous engagement of 36 targets, the system can engage all types of aerial targets including aircraft, Unmanned

Aerial Vehicles (UAV), and also ballistic and cruise missiles within the range of 400 km, and at an altitude of up to 30 km. The rapidly deployable system again is stand-alone and integrates a multifunction radar, autonomous detection and targeting systems, anti-aircraft missile systems, launchers, and the Command & Control (C&C) centre.





Deployment of the S-400 during exercises in Russia

The S-400 air defence missile system uses four new missile types in addition to the missiles of the S-300PMU system, the first missile inducted for the system being the 48N6DM (48N6E3). It is an improved variant of the 48N6M with powerful propulsion system to destroy airborne targets within the range of 250 km. The Active-Radar Homing (ARH) 40N6 Anti-Ballistic Missile (ABM) of the S-400 has a claimed range of 400km and in addition specifically targets hostile airborne force multipliers at great distances like Airborne Early Warning & Control (AEW&C) aircraft, Joint-Surveillance Target Attack Radar (J-STARS), and support jammer platforms. To engage fast moving targets such as fighter aircraft with high hit probability, the S-400 Triumph also launches 9M96E and 120 km ranged 9M96E2 medium range SAM systems, which can engage targets flying as low as 10 metres.

The 55K6E C&C system of the S-400 Triumph is based on the Ural-532301 mobile command post vehicle, equipped with Liquid Crystal Display (LCD) consoles to process air space surveillance data of individual batteries. It controls and monitors long-range surveillance radar, tracks airborne threats, prioritises the threats, and coordinates other batteries. The fire control and target tracking radar of the S-400 is the 92N6E (NATO Codename: *Gravestone*). The radar is based on the MZKT-7930 8x8 vehicle. The 96L6 Cheese Board 3D surveillance and tracking radar is optionally carried by the same vehicle when the S-400 battery is deployed autonomously. The 91N6E Big Bird acquisition and battle management radar of the S-400 is based on the 8x8 trailer and is capable of detecting and tracking aircraft, rotorcraft, cruise missiles, guided missiles, drones and ballistic missiles within the distance of 600km. It can simultaneously track up to 300 targets and engage 72 of them.

The Israeli Radars

India may well opt for integration of the S-400 system with IAF-operated EL/M-2080 Green Pine and Super Green Pine radar systems. The ELTA Electronics subsidiary of IAI developed the EL/M-2080 Green Pine Early Warning & Fire Control (EW & FC) radar for the Arrow Anti-Tactical Ballistic Missile (ATBM) system and the Green Pine radar has a proven track record demonstrated in over twenty successful ballistic missile intercepts. The radar includes the trailer mounted antenna array, the power generator, a cooling system and a control centre. Developed from the ELTA Music phased-array radar, Green Pine is an dual mode, electronically scanned, solid state, phased array radar operating at L-band in the range 500 MHz to 1,000 MHz, weighs 60 t and comprises of 2,000 transmit-receive modules. Green Pine is said to be capable of tracking ballistic missiles from a range of

up to 500 km and able to track targets up to speeds over 3 km/s while intercept of the attacking missile may occur 90 km away at an altitude of 10 to 50 km. The long range of Green Pine radar system ensures that a second shot can be taken at the incoming ballistic missile if the first shot fails to secure the “kill”. India placed an order and received its first Green Pine Early Warning & Fire Control (EW & FC) radar in 2001 and has since been integrated with the country’s indigenous missile defence system as the *Swordfish* radar system. The Super Green Pine, also operated by India, has an enhanced tracking range of 800 to 900 km. The S-400 SP85TE2 launchers are based on the BAZ-64022 6x6 tractor truck or MAZ-79100 series Transporter-Erector-Launcher (TEL) vehicle. The TEL vehicle can carry up to four launch tubes holding a mix of missiles.

A follow on system, the S-500, according to a CNBC report citing United States intelligence officials, has it that “the S-500 surface-to-air missile system successfully struck a target 299 miles away, which the United States assessed is 50 miles further than any known test.” The CNBC report suggests that the missile used was a version of S-300V4’s long-range heavy NPO Novator 9M82MD missile, which has a range of 250 nautical miles and a speed of about Mach 7.5. However, it is more likely that the missile in question is a derivative of the 250 nautical mile range 40N6 missile used on the S-400. In either case, the fact remains that the S-500 has demonstrated exceptional capabilities. When used against air breathing targets, the S-500 can use the 48N6 family of missiles, which weigh about two tons and have an effective range of up to 250. For longer-range targets, the system uses a version of the 40N6 with higher performance and also employ the shorter range and lighter weight 9M96 and 9M100 family missiles.

Against ballistic missile threats, and apparently with a secondary capability against air targets, the S-500 uses the 77N6-N and 77N6-N1 kinetic kill missiles. The missiles are capable of hitting their targets at 7 km per second, which the Russians expect would be sufficient to destroy any incoming aerial target including satellites. It apparently has the capability to engage targets as high as 200 km at ranges of 600 km. It can engage as many as 10 incoming ballistic missiles simultaneously and has a response of less than 4 seconds. The Russians claim that the system can engage Over-The-Horizon (OTH) and can be plugged into an air defence network to include satellites. The S-500 can reportedly analyse information about a possible missile attack obtained by early warning satellites and OTH radars, such as the RLS Voronezh-DM, and in conjunction with 1L119 Nebo SVU select targets in terms of their importance, cut off false targets at a great distance, and finally issue target designations to various systems.

Sayan Majumdar

Russian S-400 Triumph Air Defense System

S-400 Triumph air defense system is designed to intercept all types of aerial targets, including ballistic and cruise missiles

S-400

Developer: Russia's Almaz Antei Design Bureau

NATO reporting name: SA-21 Growler

2007

APRIL 23 S-400 Triumph put into service

MAY S-400 destroys two simulated targets flying at the speed of about 2,000 mph (1,600 kph) and the altitude of 16 km (about 10 miles)

AUGUST The first S-400 air defense system put on combat duty near Moscow



S-400 battalion components:

55K6E



Mobile command post on Ural-532301

91N6E



Big Net acquisition and battle management radar

Up to eight fire units, including

92N6E



Cruise Stone engagement and fire control radar

5P85TE2 / 5P85SE2



Launchers (up to 12) with 4 missiles each

Optional equipment:

96L6E



60-altitude acquisition radar

40V6MR



mobile mast system

Performance characteristics	Specifications
Target Max Speed: up to 4,000 mph	<div style="display: flex; align-items: center;"> <div style="border: 2px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 5px;">2x</div> <div>Twice as effective as previous generation air defense systems</div> </div>
Range, km: Aerodynamic targets: 250; Ballistic targets: 60	
Altitude, km: 0.01 - 27	<div style="display: flex; align-items: center;"> <div style="border: 2px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 5px;">AUTO</div> <div>Fully automated battle management cycle - from target acquisition to assessment of engagement results</div> </div>
Number of simultaneously engaged targets: 36	
Deployment time: 5	<div style="display: flex; align-items: center;"> <div style="border: 2px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 5px;">4+</div> <div>Considered a "4-generation" system by performance and combat capabilities</div> </div>
Service life, years: equipment: not less than 20; missiles: 15	

Some types of S-400 missiles

9M96E / 9M96E2 ground-to-air missiles



Range: 1-40 / 1-120 km
Altitude: up to 20 / up to 33 km

48H6E / 48H6E2



Range: 1-100 / 1-200 km
Altitude: up to 27 km

Source: RUSI

MBDA's Meteor BVRAAM



“The Game Changer”

Every pristine combat aircraft must perform modern weaponry for execution of missions. It is prudent to deduce that selection of Dassault Rafale multi-role strike aircraft for the Indian Air Force (IAF) was at least partially influenced by the platforms MBDA Meteor Active-Radar Homing (ARH) Beyond Visual Range Air-to-Air Missile (BVRAAM) with its 80+ nautical miles range to provide an ultra-long range interception capability against fighter-sized targets, critical in attaining “first look-first shoot-first kill” capability. Besides fulfilling the interceptor role for “outer-air battles”, the IAF is faced

with a proliferation of BVRAAMs in its ‘neighbourhood’ including Raytheon AIM-120C-5 variant of AMRAAM in Pakistan Air Force (PAF) service. It is opined that IAF will aspire for the Meteor BVRAAM to arm a significant proportion of its fleet additionally including the Sukhoi Su-30MKI and Tejas LCA.

A 3.65-metre long, stealthy, low drag, lightweight (185-kg) BVRAAM design from MBDA’s stable, the 80+ nautical miles ranged Meteor with a more linear velocity profile is designed as a complete unit, requiring no assembly and maintenance immediately before loading. It is designed

to be compatible with AIM-120 type rail and eject launcher systems. Born out of the multi-national Project S225X examining the future BVRAAM technologies and designed for a network-centric warfare (NCW) environment, the Meteor has a data-link capability to be guided not only by the launching aircraft but also by another fighter or even by Airborne Early Warning & Control (AEW&C) platforms. The extended range/enhanced kinematics is ensured by Meteor’s solid Boron fuelled Variable-Flow Ducted Ramrocket (VFDR) propulsion system, also referred to as Throttle-able Ducted Rocket



(TDR), supplied by Bayern-Chemie, along with a speed of more than Mach 4 and high terminal velocity. Thus even when launched from extreme stand-off ranges, the missile

will retain energy in the end game to defeat fast, manoeuvring targets.

The control system consists of four small moving tail surfaces but at inherent

high speed sufficient to perform sharp manoeuvres. The engine's two air intakes, positioned on both sides of the lower part of missile's body, are shaped to reduce the missile's Radar Cross-Section (RCS) to represent a stealthy profile. The Electronics & Propulsion Control Unit (EPCU) adjusts the rocket's air intake and duct covers based on the cruise speed and the target's altitude. The EPCU, in addition observes the distance and fuel level in the rocket and adjusts the throttle of the rocket thereby managing the fuel system.

The need for controlled airflow (by the missile's electronics) to the ramjet titanium ducts ruled out the 'skid-to-turn' manoeuvring of a conventional rocket-powered missile, as it will risk masking an intake and instead 'bank-to-turn' manoeuvring is adopted.

The Meteor is capable of autonomously engaging wide range of airborne targets, including cruise missiles with less than 1-metre square RCS. For mid-course navigation guidance, Meteor utilises Inertial Navigation System (INS) combined with update commands provided by the launch, or any friendly aircraft via the two way secure microwave data-link, to adequately





Meteor on the Typhoon

offset Identification Friend or Foe (IFF) complexities or challenges at long ranges. The two way data-link, additionally allows the launch platform to provide updates on targets or re-targeting when the missile is in flight. The data-link is capable of transmitting information such as kinematic status plus also notifies target acquisition by the seeker.

During the terminal phase, the Ku-band (NATO: X band) ARH seeker (advanced version of the MICA RF '4A') employs advanced proportional based navigation software, offering high reliability in detection, tracking and classification of targets. The missile also integrates Inertial Measurement System (IMS). However, rumours persist that the system can operate passively in the K-band given the consortiums previous research interests. The seeker is said to be more resistant to electromagnetic jamming and operate in stealthier mode than the seekers of the MICA RF and Aster. To ensure total target destruction, the missile is equipped with a combination of Saab Dynamics laser proximity and impact fuses and a

fragmentation warhead that is detonated at the optimum point to maximise lethality. The Proximity Fuse Subsystem (PFS) has four antennae, arranged symmetrically around the fore body, with the impact sensor fitted inside the PFS.

As Meteor is designed for a NCW environment, it is suitable for the futuristic concept of "Cooperative Fighter Operations" or Mixed Fighter Force Concept (MFFC) considered essential for future BVR engagements and optimum performance and results.

Conceptually in the IAF service pairs of Sukhoi Su-30MKI, Dassault Rafale and Tejas may be data-linked; as one illuminates, the other launches the missiles against the targets. In such engagements, the 'striker' fighter will be able to impart the greatest kinetic energy to the Meteor BVRAAM by accelerating up to Mach 2 and then manoeuvring out of the engagement. The illuminator with the powerful radar capable of performing like a mini-AEW&C would remain firmly subsonic keeping a decent distance from the target, providing either command-guidance updates alongside illuminating the target.

Since the Meteor represents a six-nation project, back during Aero India 2007 MBDA officials withheld any formal comment on its possible integration with IAF Sukhoi Su-30MKI fighters, yet there were sufficient hints to this *Vayu* correspondent by senior MBDA officials that integration is very much possible (contrary to news reports) in response to formal request by Indian Government and IAF. MBDA in fact, has experience in integration of missile systems with Russian platforms and Malaysian Air Force Sukhoi Su-30MKM are armed with MBDA MICA BVRAAMs.

As apparent, BVRAAM will assist the IAF Sukhoi Su-30MKI and Rafale fleet to achieve great combat potential in BVRAAM combat scenario that may prove critical in any confrontation with the Chinese People's Liberation Army Air Force especially at the opening stages of conflict, and decisive in the long run. Surprise has always been the key to successful execution in air combat, with as much as 50-percent of shot down pilots totally unaware of the fact that they were actually under attack!

Sayan Majumdar

Footloose at Farnborough 2018



Hawks of the Red Arrows 'escort' a Spitfire to mark centenary of the Royal Air Force

How time flies (as do aeroplanes)! This Journal's first foray to the hallowed airfield at Farnborough was for the 1976 Air Show, when the skies above Hampshire also witnessed an exciting new shape from America which was then subject to intense evaluation by nations of the NATO alliance, seeking a new lightweight fighter. The (then) General Dynamics F-16 was to eventually beat the competition and be ordered by Belgium, Denmark, Netherlands and Norway, in what was termed as 'contract of the century'. Early model Fighting Falcons flown by GD test pilots carried out awesome aerial displays, and four decades later, the much evolved F-16 wowed visitors again, however only on penultimate day of this edition. The F-16 has remained a contender for the IAF's MMRCA requirement now for 14 years – and counting!

But back to Day 1 of the Farnborough Air Show 2018 and there was palpable excitement in the shuttle bus from the station to the site as a bright-eyed US industry executive could barely contain

his enthusiasm as this was to be his first international air show. 42 years later, the same grounds, airfield layout, black hangers as always, but this time, fewer combat aircraft on the ground and virtually none

in the air (sans the lone F-16 as mentioned earlier).

The Main Hall has been much spruced up, the facilities truly 21st century, the air conditioning effective (very much needed

AH-64 Apache seen below the wing of an USAF Hercules

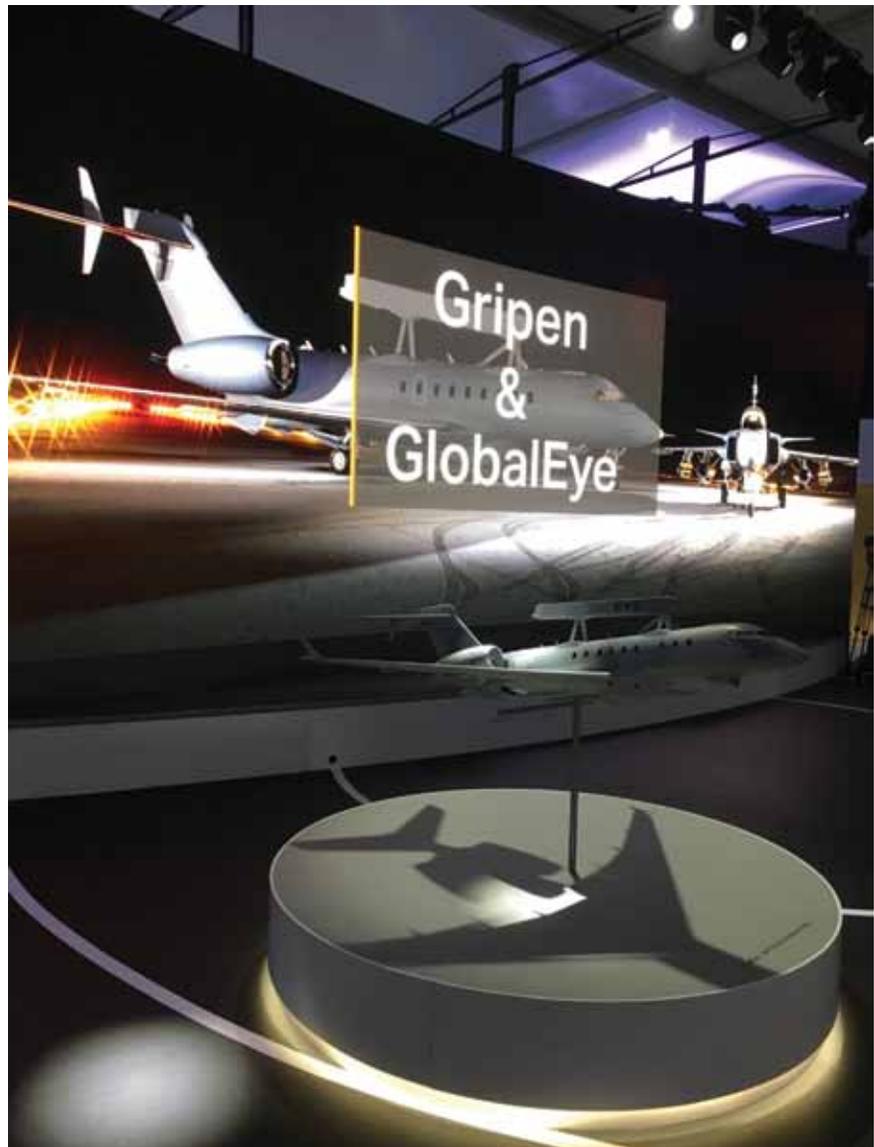


during this unusually hot summer) but one missed the thunderous air manoeuvres by fighters (and bombers) as too the formation aerobatic displays by world renowned teams. One had hoped that, 2018 being the 100th Anniversary of the RAF's foundation, there would have been terrific presence at Farnborough of the world's oldest independent air arm, but it was somewhat anti-climatic to witness only this sedate flypast by a pair of RAF Typhoon alongside the Service's first Lockheed Martin F-35 Lightning II. Hawks of the magnificent Red Arrows however had heralded start of the flypast, lovingly escorting an iconic Spitfire (just declared absolutely the most beloved fighter of the British century).

There were some 60 aircraft on static display at Farnborough, ranging from the Antonov An-124 to the Thales Watchkeeper. The American arena had a posse of aircraft types, including the F-15E, C-130J, P-8 Poseidon, AH-64 Apache, Boeing Chinook and Sikorsky S-92. Single models of the Tornado GR.4 and Eurofighter Typhoon remained on ground although visitors flocked around the full scale models of the Eurofighter Typhoon and Saab Gripen outside their respective company chalets.

However, it was model of the sixth generation Tempest in the BAE Systems Hall that startled the visitor, even if this nomenclature has been recycled, with Hawker Tempest IIs having been frontline RAF fighters in the mid-1940s (so, in its new avatar, should this not be correctly designated as Tempest III ?).

Back to the flying displays, these were decidedly civil-aircraft oriented,



The Saab display focused on their next gen Gripen E and the GlobalEye AEW&C aircraft



Shape of the future ? The sixth generation Tempest full scale model as proposed by BAE Systems

ranging from the never-say-die Dornier 328 which flew twice, once also to drop display parachutists, to the magnificent Airbus A350-1000 whose sleek shape (but very silent) flight was a show stopper. The Lockheed Martin LM-100J (Civilian Super Hercules) had visitors gawking as the pilot actually looped the loop with this magnificent aeroplane, whose prototype first flew 64 years back !

Boeing's 787-8 Dreamliner was followed in the air by a Boeing 737-700MAX but it was the cute Japanese Mitsubishi MRJ which was really adorable. The Sun is again rising from the East ! From the South (of America) came the Embraer E2 and Legacy 500 which preceded display by the military KC390 tactical transport aircraft.



EJ200 engine which powers the Eurofighter Typhoon

Bombardier's C-Series regional jet is now the Airbus A220-300 and this carried out a silent but impressive display. Not to forget the Turkish delight in shape of T129 ATAK helicopter which performed with much aplomb (and has recently also been ordered by the Pakistan Army).

And what of India's aviation prowess ? Visitors could be forgiven if they never got to see even models of HAL's products as the PSU's chalet was hard to find let alone visit, being tucked away in a corner well beyond the rows of chalets and halls to which 99.99% of show attendees would flock. The HAL stand-alone building (double storied) was virtually empty of any display apart from two models of the light combat helicopter (LCH) and Dornier 228 light transport aircraft (LTA). Whiffs of curry upstairs attracted more than these aeroplanes downstairs, the HAL chalet was more like an oasis for wandering Indians (including this writer) when he felt a little homesick.



Airbus A350-1000 takes off for its display



A350-1000 of Qatar Airways under a magnificent canopy of cloud which did not hamper the flying display



Boeing 787 of Biman Bangladesh Airlines being readied for flight display



Models of the HAL Dornier 228 and light combat helicopter (LCH) at the HAL chalet, both types having considerable export potential

only displaying the Gnat/Ajeet light fighter but Kiran Mk.II jet trainer but also a flock of Dhruv ALHs to potential customers. Alas, those were the days and hopefully actual aeroplanes in the form of HAL-built Dornier 228s, Dhruv ALHs and LCHs will be present at future Air Shows and visitors will have more than just a cup of tea !

The Dornier 328 continues to attract special attention even years after its production ceased in Germany. This 30+ seat regional airliner was subject of much Indian interest in the past and could well have been workhorse of the present regional air connectivity scheme

Last word : a great enthusiast of India and its Air Force wanted to meet with Indian aviators but found little interest even after presenting his splendid books on the IAF and HAL. Asking for a cup of *masala chai*, he was given a cup of tepid, mostly milky tea and that about sums up the impression that international visitors were given of India's aerospace endeavours !

Last last word : it wasn't always like this. HAL has put its best foot (wing ?) forward at previous Farnborough Air Shows, not



In conversation with Bertrand-Marc Allen, President, Boeing International

As President of Boeing International since 2015, Allen is responsible for the company's international strategy and corporate operations outside the US, with 18 regional offices in key global markets. His responsibilities include developing the company's growth and productivity initiatives outside the US, forming new business and industrial partnerships, overseeing international affairs, enhancing Boeing's local presence and providing global functional support. Previously, Allen served as President of Boeing Capital Corporation, a wholly owned Boeing subsidiary that arranges, structures and provides financing for Boeing's commercial airplane, space and defence products. Prior to Boeing Capital, Allen served as VP of Boeing International and was President of Boeing China, responsible for leading the company's business in China from its Beijing headquarters.



Boeing and Vistara confirmed an agreement for up to ten 787 Dreamliners at Farnborough 2018

marked an outstanding week for order capture in commercial aviation, with customers announcing 673 orders and commitments in total, reflecting a continued resurgence in demand for freighters and strong order activity for the 737 MAX and 787 passenger airplanes. We secured 48 orders and commitments for the 777F, five for the 747-8F, reflecting continued strengthening in the cargo market globally. We announced a total of \$98.4 billion in orders and commitments for commercial airplanes at list prices and \$2.1 billion in commercial and defence services orders and agreements.”



Boeing and Jet Airways announced orders for an additional 75 737 MAXs at Farnborough '18

On a bright and sunny day at the Farnborough Airshow 2018, Vayu Aerospace and Defence Review had the privilege to meet and interact with the (very) tall and affable Bertrand-Marc Allen, President, Boeing International. We touched on and discussed a wide variety of topics, highlights of which are shared with readers.

On Boeing's success at Farnborough

“We have strengthened our position as the global leader of the aerospace industry, booking historic orders and showcasing our innovation and strategy for growth here at the Farnborough International Airshow. We led the way, demonstrating value for our customers, capturing important new business in products and services, and announcing the unique strength of our strategic partnership with Embraer. Boeing

“The Future is Built Here”

During the show, Boeing announced its collaboration with artificial intelligence company Spark Cognition to deliver unmanned aircraft system traffic management (UTM) solutions. This announcement coincided with the launch of Boeing NeXt, an incubator organisation for future commercial mobility solutions that will shape the emerging world of travel and transport. Boeing NeXt will leverage the company’s research and development activities and investments in areas such as autonomous flight, smart



cities and advanced propulsion, and address transportation challenges of the future by moving people and goods with proven technology. Boeing marked the show with the launch of a new brand campaign, *The Future is Built Here*, highlighted by a dynamic exhibit that featured interactive virtual and augmented-reality displays that shows visitors Boeing’s commercial and defence products, service offerings and future innovations.

On Boeing’s Commercial Market Outlook

Revealed was Boeing’s 2018 Commercial Market Outlook, raising the 20-year forecast for commercial airplanes and services to \$15.1 trillion. The global market is forecast at almost 43,000 new airplanes, valued at \$6.3 trillion, and demand for \$8.8 trillion worth of commercial services through 2038. The strength of the cargo market was underscored by more than 50 freighter orders and commitments at the Show. According to global fleet data, there are more than 900 airliners today that are over 25 years old. By the mid 2020s, more

than 500 airliners a year will reach 25 years of age – double the current rate – adding to the retirement wave. 44 percent of the new airliners will be needed to cover replacement alone, while the rest will support future growth.

Boeing on commercial aviation

“We have around 5,800 commercial airplanes in backlog, globally distributed. In past decades, it was concentrated in the US and Europe, in hub-and-spoke traffic subject to regional economics. Today, it’s a point-to-point connected world: more than 180 new 787 city pairs have emerged just since we launched the Dreamliner. Also, we’ve been taking actions in our business: discipline on our production rates and a much more tailored R&D profile. Aerospace is perhaps the strongest industrial sector around the world right now. The combination of market strength and innovation is creating wonders. We have a very strong lineup that is positioned for a marketplace worth \$7.6 trillion over the next 10 years. Commercial

passenger traffic continues to grow at 6-7% a year, defence budget strength is returning to the US and our allies, and there is strength in the services business. We are going to produce over 800 commercial airplanes for the first time this year and go beyond 900 in the relatively near term.”

Boeing on the proposed NMA (new midmarket airplane)

“We see a market for 4,000-5,000 aircraft and are looking at various options and continuing to talk with dozens of customers. We see an opportunity that can’t be served with derivatives of today’s product lines: 220-270 seats and a range of around 5,000 nm. It is a market that needs the efficiency and comfort of a widebody airplane and the economics of a narrowbody. That’s what is fundamentally different, and that’s the business case we’re trying to close. We are doing what we can to protect a 2025 entry-into-service date. But we’re not going to be rushed to a decision. This is something we will get to during the next one-year time frame, which will be about right to support 2025.”

Boeing on the tariff threats

“We’ve always stood on the platform that free and fair trade is good and that we all need to play by the same rules. I think it is an important part of what you see happening right now. Global aerospace thrives on a healthy economy and trade. At the same time, with competitors emerging around the world, we want to make sure everybody plays by the same rules. The (Trump) administration has been very good about including business in the conversations. We have a seat at the table. We play very heavily into the \$80 billion US aerospace trade surplus. While 80% of our commercial airplane backlog is destined for customers outside the USA. 80% of our supply chain jobs and 90% of Boeing’s manufacturing jobs are in the USA. All of those factors are being considered, and we’re still very hopeful that balanced solutions will be found.”

“Dealing with the realities of trade disputes and tariffs and other concerns around the world, our job is to maintain a long-term perspective. We have to be able to see our way through these local challenges and issues. We win when we have that long-term perspective. We’re going to be a voice at the table to try to resolve these issues, but we’re always going to maintain our long-term view of the marketplace. We are concerned about the impact of possible trade tariffs on the cost of running its supply chain, but has not yet seen any impact from US-Chinese trade tensions on its business. The discussion right now is proposed tariffs, ongoing discussions. So in terms of actual implementation and things that are impacting us, we haven’t seen a material impact yet. We are concerned that it could affect supply chain costs. But note that supply chains are flowing in both directions between (these) countries as we both support existing fleets as well as build new airplanes.”

Boeing on its 80% Embraer stake

“This is a truly strategic partnership that positions us and generates significant value for customers who are pursuing a range of fleet solutions. It’s a natural evolution of our longstanding history of working together. Our two commercial families fit nicely without overlap. We also have complementary service profiles and distribution capabilities around the world. Embraer has some interesting vertical capabilities that overlap with our strategic

objectives, such as interiors and landing gear. Boeing and the joint venture would benefit from complementary cultures and engineering workforces, broader resources and scale and accelerated growth across global markets.”

And now, India !

“Boeing is well placed in the competition to supply the Indian Air Force with 110 fighters jets and are also finalists in a separate competition to supply the Indian Navy with 57 fighters. We have gotten to know Indian industry, understand the Indian process. The tender for 110 combat aircraft mandates building at least 85 percent of the order locally. The deal is likely to be at least \$15 billion. Whichever fighter India picks, industrial offsets and technology transfer will be a major factor in the decision. Assembling the aircraft in India seems to be a key component of any deal and we are willing to set up an assembly line in the country under a *make*

in India initiative. We already have many parts being built in India and have over 160 suppliers there.”

“The same factory established for Super Hornet production could be used to build India’s next generation indigenous fighter aircraft in the future. By building the Super Hornet in India, the country will then have the aerospace ecosystem that will allow them to build a next generation fighter themselves.”

“When it comes to what the Super Hornet can bring to the Indian Navy, we think that the Super Hornet is a next-gen aircraft. We continue to build them for the US Navy. We are going to bring the Block III Super Hornet online, a next gen fighter that is both networked and survivable. It has a high level of stealth and a great EW suite, it has an AESA radar that has been integrated and flying for years. We’re bringing out an infrared search and track sensor—a great package of sensors and equipment that make it a very lethal next generation fighter. It will

be operating as a front-line aircraft well into 2040. We think the aircraft speaks for itself from capabilities standpoint and that’s a huge advantage as you build a large fleet.”

“In April 2018, we announced a three-way partnership with Hindustan Aeronautics Ltd. and Mahindra Defence Systems Ltd. to manufacture the F/A-18 Super Hornet in India at a new facility, which can also be used for other requirements. Boeing and Tata Group companies have several partnerships for manufacturing equipment for both commercial and military aircraft in India. We have a Tata Boeing Aerospace (TBAL) joint venture for producing fuselages for the AH 64 Apache attack helicopters for global orders. Tata Advanced Materials delivers composite panels and other equipment for the P-8I long-range maritime surveillance and anti-submarine warfare aircraft, while TAL Manufacturing Solutions makes floor beams for the Boeing 787-9, besides ground support equipment for C-17 Globemaster III strategic airlifter.”

STOP PRESS

First Apache, Chinooks for India in Maiden flights



In IAF markings, India’s first AH-64E Apache

A significant step towards modernising the Indian Air Force’s helicopter inventory took place in early July when the IAF’s first Boeing Apache and Chinook helicopters made their maiden flights. “First flight of India’s Apache and Chinook helicopters are important milestones towards strengthening Indian armed forces capabilities,” stated Pratyush Kumar, President, Boeing India. “India will receive the most advanced versions of both the AH-64E Apache and the CH-47F Chinook. Indian industry partners such as Dynamatics is building large sections of Chinook, and the Tata Boeing joint venture in Hyderabad is building the complete fuselage of the Apache.”

The IAF is to receive 22 AH-64E Apache and 15 CH-47F(I) Chinook transport helicopters, the contract for the Indian Air Force’s 22 Apaches and 15 Chinooks being finalised in September 2015. Additionally, six Apaches have been cleared for procurement by the Indian Army in 2017, their fuselages being produced by Tata Boeing Aerospace Limited, the joint venture between Boeing and Tata Advanced Systems in Hyderabad.

The AH-64E Apache is a multi-role attack helicopter and is flown by the US Army, features enhanced performance, joint digital operability, improved survivability and cognitive decision aiding. The Chinook is a multi-role, vertical-lift platform, emphasising heavy-lift transport of troops, artillery, equipment and fuel. It is the helicopter of choice for humanitarian disaster-relief operations, in missions such as transportation of relief supplies and mass evacuation of refugees.



The CH-47F(I) Chinook in Indian colours



The F/A-18E/F is on offer to the Indian Air Force and Indian Navy



Mr. Bertrand-Marc Allen with F/A-18 Hornet in background



Indian Air Force C-17 Globemaster III

In early June, Tata Boeing Aerospace Limited delivered the first AH-64 Apache combat helicopter fuselage ahead of schedule from its state-of-the-art facility in Hyderabad. The fuselage was then transported to Boeing's AH-64 Apache manufacturing facility in Mesa, Arizona for integration into the final assembly

line. This delivery comes within a year of the aerospace joint venture facility becoming operational. The facility, which is spread over 14,000-square meters and employs 350 highly skilled workers at full production, was inaugurated by Ms. Nirmala Sitharaman, Minister of Defence, Government of India, in March this year.

The facility will be the sole global producer of fuselages for AH-64 Apache helicopters delivered by Boeing to its global customers including the US Army. The facility will also produce secondary structures and vertical spar boxes for the multi-role combat helicopter.

VSC



The Indian Navy was first service after the USN to induct the Boeing P-8 long range maritime patrol aircraft

And then there were two ! A220 vs E 195-E2



Executives of Airbus and CSALP before Farnborough

The Airbus and CSeries Aircraft Limited Partnership (CSALP)

On 1 July 2018, a fortnight before the Farnborough Air Show biennial international air show, Airbus took majority control of the CSeries Aircraft Limited Partnership (CSALP) incorporating the latter's CS100 airliner into its family, renaming it the A220-100 while the larger CS300 would be the A220-300. The new designations mean that these airliners are now part of Airbus, however of smaller capacity than the A320, but positioning them alongside, if not above, the competing Embraer E195-E2.

According to strategists, the A220-100 is being marketed by Airbus as an 'entry-level aircraft' – a growth vehicle for regional airlines and a tool for carriers requiring special performance for challenging airports, such as London City. Airbus sees the A220-300 as a hub feeder and a lower risk option for start-up carriers. The A319neo, which is the same size as the A220-300 but having significantly higher seat-mile costs, will be positioned as a "high-performance aircraft." Of the more than 6,100 firm orders for A320neo-family aircraft, only 56 are for the A319neo, which presently is still in flight-testing.

JetBlue Airways were first off the block by ordering 60 A220-300s, with deliveries to begin from 2020, plus options for 60 more aircraft which would begin delivery from 2025. According to the airline, "we are evolving our fleet for the future of JetBlue, and the A220-300's impressive range and economics offer us flexibility and support our key financial and operating priorities".

Embraer sign record deals

Not to be outdone, the next day on 17 July, Embraer announced deals for some 300 aircraft, worth a combined \$15 billion, consisting of both its E175-E1 and E2 families of airliners. The Brazilian company revealed letters of intent from Azul (21 E195-E2s) and Republic Airways Holdings (100 E175s with 100 purchase rights), and a firm order from Wataniya Airways (10 E195-E2s with 10 purchase rights). Further, Switzerland's Helvetic Airways will order 12 E190-E2s with an additional 12 on option, Helvetic presently operating seven E190-E1s and five Fokker 100s. Including these new contracts, Embraer have sold more than 520 E-175s to airlines in North America, by far the leader in the 70-75 seat category.

On 5 July, Boeing had signed a non-binding Agreement to assume an 80% stake in Embraer's commercial programmes. While management of the new company will be based in Brazil, reporting to Boeing CEO Dennis Muilenburg, the company expects the joint venture to be formalised by the end of 2019, following various shareholder and regulatory approvals.

According to Embraer's CEO and President Paulo Cesar de Souza Silva "the business combination with Boeing is expected to create a virtuous cycle for the Brazilian aerospace industry, increasing its sales potential [and] production, creating jobs and income [and] investments and exports, and, in doing so, adding more value to customers, shareholders and employees."



Executives of Boeing and Embraer at Farnborough 2018

Creating the Tempest



BAE Systems and Saab have earlier worked together on the Gripen multirole combat aircraft programme, the latter company having also co-developed the T-X advanced jet trainer with Boeing to meet the large USAF's requirement for replacement of the T-38. The UK Government has also been assisting Turkey develop its new generation fighter and Saab has made similar proposals for both the Turkish and South Korean next gen programmes.

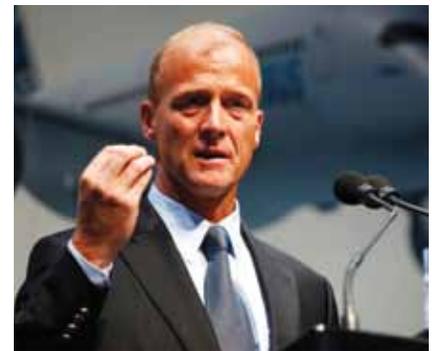
Reactions from Airbus

The first reaction from the Airbus Group which will be working with Dassault on the FCAS programme, was that it “notes the UK's announcement regarding its plans for the development of a new fighter aircraft and is encouraged to see the government's financial commitment to the project, which supports the goal of sovereign European defense capability”. Further, ‘a Future Combat Air System is of utmost importance to Europe's armed forces and therefore we look forward to continuing collaborative discussions in the area with all relevant European players”.

On 16 July 2018, opening day of the Farnborough International Air Show 2018, in presence of British Prime Minister Theresa May, the UK ‘future fighter’ concept was unveiled, seen as a major milestone in its approach to develop a 6th generation fighter through international cooperation. As an integral part of the UK's ‘Combat Air Strategy’ paper, the core ‘Tempest Team’ will comprise BAE Systems, Rolls Royce, Leonardo and MBDA along with the UK's defence equipment and support agency and the RAF rapid capability office to develop a twin-engine, delta-winged, low-observable fighter. To be known as the *Tempest*, the future fighter will eventually supplant the present Typhoon and operate alongside F-35 Lightning IIs.

An Anglo-Swedish-Italian programme ?

Even as this issue goes to press, and although not officially commented upon, this British-led future fighter programme could possibly include Sweden and Italy as participants in development and future deployment. If this unravels, the Tempest programme could well have BAE Systems and Saab working together in competition to the Franco-German Future Combat Air System (FCAS), both these involving manned and unmanned aircraft.



Thereafter, the Chief Executive of Airbus, Tom Enders, virtually opened the door suggesting a merger of the future fighter programmes, “to create a pan European military aircraft company with the might to take on America”. A former German Army paratrooper, Tom Enders said that it was time “to seriously look at consolidating and coalescing efforts eventually to one”. He elaborated saying that “there's just no room for three different programmes, not even for two the main players need to align industrial forces to create one big programme that could win a large number of jet orders in Europe and have a significant chance of winning big export orders outside Europe.”



The Expanding World of Airbus



Hi Fly, the 14th operator of the iconic double-decker wide-body airliner, displayed its A380 for the first time at Farnborough International Airshow 2018

\$4.6 trillion worldwide market forecast over the next 20 years

Airbus' new Global Services Forecast predicts a US\$4.6 trillion worldwide market for commercial aircraft services from 2018 to 2037. The new analysis is based on a three-way market segmentation, respectively focusing on the aircraft, the airline operation, and, importantly, the passenger experience.

Aircraft-focused lifecycle services represent the largest segment of growth and include maintenance, spares pool access, tooling, technical training and system upgrades which are needed to keep the airline flying. This market represents a cumulative value of \$2.2 trillion over the 20-year period, from \$76 billion in 2018 to more than \$160 billion per annum by 2037. These services are provided throughout the lifecycle from design to dismantling. In this category, aircraft manufacturers provide customers with core services which come with the aircraft, including assigned field reps and call centres for AOGs for example. The largest market by value is maintenance, increasingly characterised by outsourcing and 'paid-by-the-hour' (PBH) contracts. Moreover, as technology and new materials develop, such as composite repairs, Airbus sees a strong trend for further outsourcing.

PBH contracts allow airlines to secure and predict their maintenance costs, allowing airlines to focus on their core business of flying. Airbus also sees airlines increase their outsourcing of inventory management towards pooling, instead of investing in their own stocks.

The next largest category encompasses flight operations services, such as pilot training and flight-planning solutions will account for a \$1.5 trillion cumulative spend over 20 years. Fleets are expected to more than double to 48,000 aircraft over this period, such that Airbus estimates a need for 540,000 new pilots in the next 20 years. This trend will require 'smarter' ways of training using new digital technologies.

The third component of the global services market focusses on the passenger experience which will account for an estimated \$0.9 trillion cumulative value over the 20 year period. This encompasses the services needed to optimise the flight experience, including cabin upgrades, cabin crew training, in-flight-entertainment, connectivity and booking. This segment is expected to more than double in the next 20 years and grow from \$27bn to almost \$70bn. A notable trend is that seamless connectivity will undergo exponential growth, as more and more passengers manage their travel using a smart device, providing them all the information in real-time about the airport, connecting flights, bag collection details etc.

After an 18 percent annual growth in its services revenues for the past two years, Airbus' ambition is to triple its services revenues from more than \$3.2bn in 2017 to reach \$10bn of services revenues in commercial in the next decade. To attain this goal, Airbus will continue to develop full lifecycle integrated services for all Airbus' aircraft operators. Furthermore, these integrated services – such as Flight Hour Services (FHS) – will be even more efficient through the Skywise open data platform. Airbus will also expand its current service portfolio to non-Airbus platforms, given that 62 percent of Airbus' total fleet is operated by 'multi-fleet' operators. An example of this happening today is illustrated by Airbus' materials management subsidiary Satair, which already has 25 percent of its revenues coming from non-Airbus parts, while the Navblue flight operations subsidiary also delivers multi-fleet services. Furthermore, Airbus will extend services to a wider customer base, such as airports and air traffic control operations. Lastly, Airbus will reinforce its strategic position in the value chain. Another visible facet of Airbus' growth in its services is the increasingly local presence, ie. being closer to its customers. Airbus' developing global services footprint now spans 65 locations globally including 17 training centres.

Airbus introduces the A220-100 and A220-300

Airbus revealed its A220 at a ceremony held at its Henri-Ziegler Delivery Centre, near Toulouse. Witnessed by Airbus employees and members of the global news media, the

Aircraft, “I pay tribute to all the women and men at Bombardier and the supply chain who have strived over the past years to bring this fantastic aircraft to the world. The A220 now enters a new phase in its career with all Airbus’ resources behind it to further its commercial success worldwide.”

signing a Memorandum of Understanding for 60 firm orders for the larger A220-300 model. In addition, the airline converted 25 of its current orders for Airbus A320neo aircraft into orders for the larger A321neo. JetBlue’s A321neos and A220s will be powered by Pratt & Whitney GTF engines. “JetBlue’s selection of the A220 aircraft as a complement to its growing A320 Family fleet is a tremendous endorsement – both of the A220 itself and of the way these two aircraft can work together to provide airline network flexibility and a great passenger experience,” remarked Eric Schulz, Chief Commercial Officer for Airbus. “JetBlue will be able to leverage the unbeatable efficiency of both the A321neo and the A220-300, as well as taking advantage of the roomiest and most passenger-pleasing cabins of any aircraft in their size categories.”



A220-300 in flight

A220-300 landed wearing its new Airbus name and colours.

The A220 family comprises two models, the A220-100 and A220-300, formerly Bombardier C Series (CS100 and CS300). The aircraft are fully optimised for the 100 to 150 seat market and ‘perfectly complement Airbus’ existing best-selling A320neo family’. “Everyone at Airbus has been looking forward to this historic moment. Today, we are thrilled to welcome the A220 to the Airbus family and are honoured to see it wearing its new Airbus colours for the first time,” stated Guillaume Faury, Airbus President Commercial

Jet Blue is pioneer

JetBlue has become the first customer for the newly-rebranded Airbus A220 aircraft,

First BelugaXL

The first of five BelugaXL aircraft to fly has made its first flight lasting four hours and 11 minutes. Following this first flight, the



Nepal Airlines has taken delivery of the first of two A330s leased from Portuguese lessor Hi Fly. These will be in addition to its two existing A320neos and will be one of the largest aircraft operating out of Tribhuvan International Airport at Kathmandu, to the world

BelugaXL will undergo some 600 hours of flight test over 10 months to achieve Type Certification and entry into service later in 2019. The BelugaXL programme was launched in November 2014 to address Airbus' transport capacity requirements in view of the A350 XWB ramp-up and single-aisle production rate increases. Five aircraft will be built between 2019 and 2023 to gradually replace the five BelugaST. The aircraft will operate from 11 destinations as Airbus' method of transporting large aircraft components. Based on an A330-200 Freighter, the BelugaXL is powered by Rolls Royce Trent 700 engines, with lowered cockpit, the cargo bay structure and the rear-end and tail newly developed jointly with suppliers, now give the aircraft its distinctive look.

AEGEAN Airlines order 30 A320neos



AEGEAN Airlines of Greece have ordered 30 A320neo Family aircraft at a ceremony in Athens. The purchase agreement, comprising 10 A321neos and 20 A320neos, was signed by AEGEAN Chairman Eftichios Vassilakis and Airbus Chief Executive Officer Tom Enders. Currently, AEGEAN operates a fleet of 49 Airbus aircraft (37 A320s, 11 A321s and 1 A319).

Airbus Helicopters and Safran boost for H125 and H130 operations

Airbus H125 and H130 helicopter customers will benefit from significant reduction in direct maintenance costs for the Safran Arriel 2D engine. The two main improvements provided by Safran are the extension of 25 % of the time between overhaul (TBO) to 5,000 hours for new and in-service helicopters, and the new three year/ 2,000 hours warranty conditions

– replacing the previous two year/1,000 hours warranty for all H125 and H130 helicopters delivered in 2018. H125 and H130 customers will benefit from the removal of the calendar limitation, which till now required an engine inspection at a repair centre every 15 years, regardless of the number of hours logged. The robustness of the Arriel 2D eliminates the need for a

one million flight hours. The Arriel 2D offers extremely competitive operating costs, 10% lower in average than those of earlier variants. The Arriel 2D is also backed by a complete Safran service package, notably the *Support By the Hour* (SBH) contract and the 5Star programme, fully adapted to customers operating fewer than five helicopters.



H125 & H130 from Blue Hawaiian

calendar limit on modules 1, 2, 4 and 5, while for module 3, the engine's condition can be restored during a periodic visit performed at a maintenance centre.

More than 1,000 Arriel 2D-equipped H125 and H130 helicopters are in service worldwide and have collectively logged over

Hungary orders 20 H145Ms

The Hungarian Ministry of Defence has ordered 20 H145M military helicopters equipped with the HForce weapon management under of the military



modernisation programme *Zrinyi 2026*. Together with the helicopters, Airbus will provide an extensive training and support package. With a maximum take-off weight of 3.7 tonnes, the H145M can be used for a wide range of tasks, including troop transport, utility, surveillance, air rescue, armed reconnaissance and medical evacuation. The Hungarian fleet will be equipped with a fast roping system, high-performance camera, fire support equipment, ballistic protection as well as an electronic countermeasures system to support the most demanding of operational requirements. “The HForce system, developed by Airbus Helicopters, will enable Hungary to equip and operate their aircraft with a range of ballistic or guided air-to-ground and air-to-air weapons.”

Airbus performs world’s first A3R contact with large aircraft receiver

Airbus Defence and Space has followed on its earlier achievement in Automatic Air-to-Air (A3R) refuelling of a fighter with the same operation performed with a large receiver aircraft. In a joint operation with the Royal Australian Air Force (RAAF) which is collaborating



with Airbus in development of this technology, the Airbus’ A310 company development tanker performed seven automatic contacts with a RAAF Airbus KC-30A Multi Role Tanker Transport. The system requires no additional equipment and is intended to reduce refuelling boom operator workload, improve safety, and optimise the rate of air-to-air refuelling (AAR) in operational conditions to maximise aerial superiority. Airbus has begun work towards introducing the system on the current production A330 Multi Role Tanker Transport (A330 MRTT) aircraft.

Drukair orders new ATR 42-600

Drukair have ordered an ATR 42-600 equipped with the new ClearVision system, the first operator to benefit from the advantages of ClearVision’s Combined Vision System (CVS), incorporating the Enhanced Vision System (EVS) which improves visibility and the Synthetic Vision System (SVS) which generates images of terrain and obstacles using an extensive database. Drukair has been operating ATR 42s since 2011 and operates in challenging environments, serving small airports in the Himalayan Kingdom. Certified last year, the ATR -600’s latest Standard 3 avionics includes RNP AR 0.3/0.3, which further enhances airfield accessibility and operational performance.



File picture of Drukair ATR-42 at Paro airport in Bhutan

As Tandi Wangchuk, Chief Executive Officer of Drukair, stated, “Purchasing another ATR was a natural decision. The improvements delivered by the -600 series’ new Standard 3 avionics, along with the ClearVision CVS system add significant operational and thus economic value. We also look forward to welcoming passengers into the most modern cabin in regional aviation and offering them the most comfortable in-flight experience possible.”

Airbus and International SOS sign MOU on drone cargo delivery systems

Airbus and International SOS, the world’s leading medical and security risk services company, have signed a Memorandum of Understanding (MOU) to jointly study the viability of using aircraft or unmanned systems to deliver medical cargo and supplies. Under the agreement, Airbus will help to define and install reliable aircraft or unmanned aerial medical cargo deliveries as part of International SOS MedSupply services. MedSupply deploys medical supplies, specialist medical care and equipment to meet the requirements of preventive health programme or in support of a medical emergency in urban as well as unfamiliar and remote locations. The studies will

look into both urban to rural and ship to shore deliveries. “Airbus and International SOS will thus collaborate on safe, secure and enterprise drone delivery for hub to hub distribution of medical cargo, compliant with local regulatory bodies, as International SOS have global operations worldwide in emergency evacuation or medical resupplying.”

Ukraine order 55 Airbus helicopters

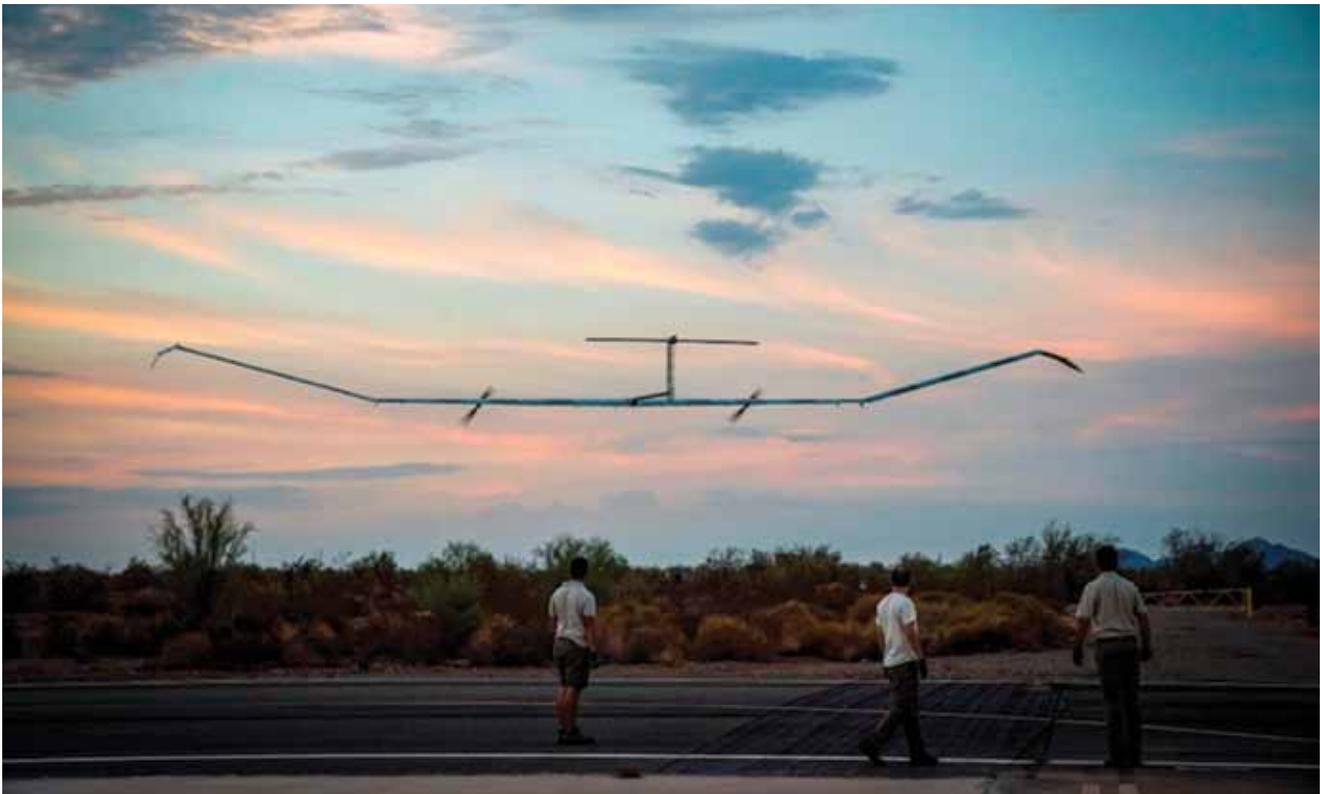
Following an Intergovernmental Agreement signed between France and Ukraine on 8 June, Airbus Helicopters have signed

Zephyr S in world endurance record

Zephyr S, Airbus’ High-Altitude-Pseudo-Satellite, has surpassed the current flight endurance record of an aircraft without refueling of 14 days, 22 minutes and 8 seconds and continues to pioneer the stratosphere. The Zephyr aircraft departed for its maiden flight from Arizona, USA on 11 July 2018. This first flight of the Zephyr S aims to prove and demonstrate the aircraft capabilities, with the final endurance record to be confirmed on landing.

RAF receives 20th A400M

Airbus has delivered the 20th Atlas A400M transport aircraft of a total order for 22 to the Royal Air Force (RAF). The newly-delivered aircraft has formally entered service with the RAF and will soon commence crew training ahead of operational deployment. The RAF is presently conducting trials to test Atlas’s ability to deliver cargo by parachute and undergo air-to-air refuelling using a RAF Voyager aircraft. The cargo delivery trial, carried out by a UK aircraft crewed by Air Warfare Centre and QinetiQ personnel, involved containers weighing around one tonne being dropped in sequence over the Salisbury Plain.



a contract with the Ukrainian Ministry of Interior for the purchase of 55 civil helicopters dedicated for search and rescue (SAR), public services, and emergency medical service (EMS) missions in the country. The 55 aircraft include 21 repurposed H225s, and 10 brand new H145s and 24 H125. The contract, which also foresees the setting up of a local training and maintenance centre, was signed in Kiev on 14 July in the presence of Arsen Avakov, Minister of Internal Affairs of the Republic of Ukraine, and Bruno Even, Airbus Helicopters CEO.



Co-developing futuristic European fighters



France and Germany have reportedly taken initial steps for co-developing a 'future fighter' (see artist's depiction above). Defence ministers from the countries recently signed an agreement on the *Future Combat Air System* (FCAS) in Berlin on 26 April. The FCAS, known in France as *Système de Combat Aérien Futur* (SCAF), is planned to include a piloted component, secure communications, missiles and "highly connected drones able to act either autonomously or within a system of systems." The FCAS programme will be led by Dassault Aviation, alongside Airbus Defence & Space, which aims to replace the Rafale and Eurofighter between 2035 and 2040, the French requirement including a carrier-borne variant.

"Never before has Europe been more determined to safeguard and foster its political and industrial autonomy and sovereignty in the defence sector," said Dirk Hoke, CEO of Airbus Defence & Space. "The schedule is tight, so we need to start working together immediately by defining a joint roadmap on how to best meet the requirements and timelines to be set by the two nations." Eric Trappier, Chairman and CEO of Dassault Aviation, confirmed that the company's plans include developing demonstrators for the FCAS from 2025 onward. However, what is not known are the UK's plans for the RAF following the end of Typhoon production at Warton. [See separate article on the UK's Tempest project].

US Air Force's Next Generation Air Dominance (NGAD) fighters

The US Air Force and US Navy are developing the Next Generation Air Dominance (NGAD) family of advanced fighters to continue air superiority in the late 2020s and early 2030s. The US Joint Chiefs of Staff has approved the capabilities while Congress funded billions of dollars for air superiority studies for land and carrier-based platforms and systems. As US Air Force



Director of Advanced Requirements, Major General Paul Johnson stated, "There is every likelihood it's going to be some sort of family of systems, and hopefully it will be a mix of old and new."

Russia "concerned" about America's 'Space Force' plan

The Russian government has expressed "concern" over US President Donald Trump's plan "for the United States to dominate space exploration and to create a separate branch of the military called a Space Force". Russian foreign ministry spokesperson Maria Zakharova has stated that Russia "noted the US president's instructions... to separate space forces from the air force," saying "the most alarming thing about this news is the aim of his instructions, namely to ensure (US) domination in space."

This was in reaction to Trump's statement that "America will always be the first in space" and "we don't want China and Russia and other countries leading us." He also called for the Pentagon to create a new "Space Force" that would become the sixth branch of the American military, although this requires Congressional approval to take effect. Zakharova warned that the US is "nurturing plans to bring out weapons into space with the aim of possibly staging military action there. US military build-up in space "especially after the appearance of weapons there, would have a destabilising effect on strategic stability and international security."

'Hybrid' fifth-gen fighter for Japan?



Lockheed Martin has reportedly offered Japan a stealth fighter based on its F-22 and F-35, the company reportedly discussing such proposal with Japan's Ministry of Defence (*see image*). Japan is seeking a replacement for its Mitsubishi F-2 with capabilities "exceeding" those of the F-35A (42 of which are also being procured). In March, the Japanese Government notified US and UK governments of the performance requirements for the F-2's successor, which include the capability to carry eight embedded air-to-air missiles and for launching of mini drones.

Finland's HX future fighters

The Finnish Defence Forces' Logistics Command have issued an RFQ for its HX future fighter programme to the governments of France, Sweden, the United Kingdom and United States with the Rafale, Gripen, Typhoon, F/A-18E/F and F-35 to be considered for the 64-aircraft requirement which could be worth around €10bn. The HX programme aims to replace the *Ilmavoimat's* (Finnish Air Force's) F/A-18C/D fleet from 2025. The HX would be used for counter-air, counter-land, counter-sea, intelligence, surveillance and reconnaissance (ISR) and long-range strike. Negotiations with manufacturers are due to begin in the second half of 2019, with the Finnish government planning to select the final candidate in 2021.

More Rafales for Qatar



The Government of Qatar has recently announced the decision to exercise its option for 12 Dassault Rafales for the Qatar Emiri Air Force bringing the total buy to 36. The option for the dozen omni-role fighters, announced on 7 December 2017, followed a contract for 24 aircraft signed on 4 May 2015.

12 Sukhoi Su-57s for 'operational testing'

According to *Tass* in Moscow, the Russian Air Force has placed an initial order for 12 Sukhoi Su-57 Fifth Generation fighters which was confirmed by Russian Deputy Defence Minister Alexey Krivoruchko when visiting the production plant at Komsomolsk-na-



Amur in early July 2018. This batch of Su-57s will enter service with the Russian Air Force in 2019, according to Yuri Slyusar of UAC and will be engaged in operational testing, perhaps including in Syria, where some early model Su-57s were briefly deployed in 2017.

Joint development of the Su-57 (nee PAK FA/FGFA) has been subject of discussions between the Governments of Russia and India for well over a decade and HAL personnel were seconded to Sukhoi's design bureau following India's initial payment as part of the programme where the IAF were to receive some 127 FGFA alongside the Russian Air Force's order for 200 of the type. India's present NSA, Ajit Doval however has made it official that India would not participate in the joint development but that it could consider the Su-57 after it had entered service with the Russian Air Force.

Gripen in MS20 upgrade



Saab has received an order from the Swedish Defence Materiel Administration (FMV) concerning an upgrade of the Gripen C/D system, valued at approximately SEK 224 million. The order mainly involves improvements to and modifications of existing capabilities in the so-called MS20 upgrade, which was introduced across the Swedish Air Force Gripen fleet in 2016. The upgrades concern central capabilities such as target acquisition, self-protection, communication and human-machine interaction, as well as a number of key support and training systems. Deliveries will take place between 2018 and 2020.

Saab GlobalEye AEW&C aircraft in maiden flight



Just weeks after being rolled out of the factory, Saab's GlobalEye Airborne Early Warning and Control aircraft made its maiden flight on 14 March 2018. The 1 hour and 46 minute flight was conducted from Saab's facility at Linköping under the command of company experimental test pilot Magnus Frederiksson, and followed a series of low speed and high-speed taxi tests. As Magnus Frederiksson said, "Today's flight went as planned, with the performance level matching our high expectations. The aircraft's smooth handling was just as predicted and a real pleasure for me to fly." The flight test crew collected aerodynamic flight test data, which will be used to verify the GlobalEye's performance predictions and associated modelling.

The aircraft is the first of three such for the United Arab Emirates Air Force, the launch customer for the GlobalEye programme, known as the *Swing Role Surveillance System* by the UAEAF. The GlobalEye is based on the Bombardier Global 6000 airframe, with a Saab Erieye ER (Extended Range) S-Band active electronically scanned array radar and belly-mounted Leonardo Seaspray 7500E X-band surveillance radar.

Russian Air Force order more Su-30SMs and Yak-130s



Russia's Deputy Defence Minister Yuri Borisov has stated that the Russian Air Force expect to receive 14 Su-30SM fighters and 10 Yak-130 combat trainers during this year. 92 of the Yak-130s are already in service as also 100 Su-30SMs which is "a super-maneuverable multi-purpose fighter jet designed for air superiority as well as ground attack roles".

Upgrade of USAF F-22s



The USAF has requested upgrade of its F-22 fleet including software load increment 3.2B to be installed, which will add the AIM-120D AMRAAM and AIM-9X air-to-air missiles, implement open mission systems to allow integration and fielding of fifth-to-fifth and fifth-to-fourth communication systems interoperability, helmet-mounted weapons cueing and GPS M-Code upgrades for the Raptor. According to reports, the F-22 System Programme Office based at Wright-Patterson Air Force Base, Ohio have adopted an agile software development process called *Scaled Agile Framework*. The process was adopted to speed up implementation of operational flight programme (OFP) software for the F-22, which concept enables OFP software updates for flight-testing under multi-year blocks, to be released every 12 weeks. The F-35 Lightning II Joint Programme Office is reportedly adopting a similar framework for further developing the strike fighter's software, an interesting development so late in the development cycle of the F-35, but one that will likely be adopted by the US Department of Defence and industry which are already working on so-called sixth-generation fighters, both manned and unmanned.

No. 617 Squadron RAF with F-35B

The RAF's iconic No 617 Squadron 'Dambusters' has been reformed as the first unit to fly the new F-35B Lightning II. RAF's Lightning Force Commander Air Cdre David Bradshaw stated that "This is a most momentous day for the UK Lightning Force as we celebrate the reformation of No. 617 Squadron. Manned by highly capable Royal Air Force and Royal Navy personnel and equipped



with the truly remarkable F-35B Lightning, No. 617 Squadron will once again provide potent, flexible air power for the nation.” Currently, No. 617 Squadron is training with the UK’s first 15 F-35Bs at Marine Corps Air Station Beaufort, South Carolina and is scheduled to relocate to its new home at RAF Marham, Norfolk in 2018. Nine RAF Lightnings were expected to arrive in the UK in June for the RAF’s centenary celebrations, including a flypast over London. The RAF plans to declare initial operational capability on this jet before end of year and, significantly, No. 617 Squadron is expected to embark on the carrier HMS *Queen Elizabeth* in early 2020, underlining Britain’s truly integrated force.

Boeing F/A-18 E/Fs for Kuwait



Boeing has been awarded a contract worth up to \$1.16bn to produce and deliver 22 F/A-18E and six F/A-18F Super Hornets for Kuwait by 2022. The deal covers long-lead non-recurring engineering required to develop a baseline configuration for the Kuwaiti fighters. In addition, the contract provides for long-lead items including radar warning receivers and aircraft armament. The US Defence Security Co-operation Agency (DSCA) had announced US State Department approval for the Kuwaiti F/A-18E/F deal in November 2016. At the time, it was to be worth around \$10.1bn for up to 32F/A-18Es and eight F/A-18Fs, including 12 options, as well as avionics, weapons, support, equipment and training.

More Australian F-35As



The Royal Australian AF has taken delivery of its next three F-35As from Lockheed Martin at Luke Air Force Base in Arizona. As Minister for Defence Marise Payne and Minister for Defence Industry Christopher Pyne stated, “These latest aircraft are fitted with the programme’s final software system, which unlocks the aircraft’s full war-fighting potential including weapons, mission systems and flight performance.” Australia is the first international Lightning II customer to receive these jets with Block 3F software capability. The earlier two fighters had the previous Block 31 software installed.

After the RAAF’s No.3 Squadron undergoes its first F-35A airworthiness board in August, the unit will move to RAAF Williamtown, New South Wales in December to commence Australian-specific validation and verification activities. The Australian government is acquiring 72 F-35As under Project AIR 6000 Phases 2A/2B to replace its current fleet of 71 F/A-18A/Bs.

First F-35A to ROKAF

The first F-35A Lightning II for the *Han Guk Gong Gun* (Republic of Korea Air Force) made its maiden flight from Lockheed Martin’s Fort Worth facility on 19 March 2018. This aircraft was officially handed over to South Korea during a ceremony at Fort Worth on 28 March 2018, the ninth nation to take delivery of the F-35 and the first of 40 F-35As for this Asian air arm. Initial deliveries are included in this low-rate initial production Lot 10 and are on plan for delivery in 2018.



Chinese carrier deployed in South China Sea



The Chinese People's Liberation Army Navy Surface Force Type-001 aircraft carrier *Liaoning* has recently been deployed to the disputed South China Sea region as part of a massive flotilla of 50 warships, seen as a challenge to US in the region. Its standard complement of combat aircraft comprise 24 J-15s (Chinese version of the Su-33), six Z-18F anti-submarine helicopters and four Z-18Js, the latter being AEW variants of the licence-built version of the French SA321 Super Frelon, fitted with a multimode active electronically scanned array radar. A small detachment of Z-9s (licence-built AS365 Dauphins) are also carried.

More Su-30SMs for Kazakhstan



On 24 May 2018, Republic State Enterprise Kazspetsexport of Ministry of Defense and Aerospace Industry of the Republic of Kazakhstan and Irkut Corporation (an affiliate of UAC) signed a contract for another batch of Su-30SM multirole fighters, deliveries to be completed in 2020. The Kazakh Air Force which "inherited" various aircraft from the erstwhile Soviet Union has a mixed inventory of MiG-31s, MiG-29s and MiG-27s as also Su-25s and Su-30SMs.

Slovakia selects F-16V over Gripen

Slovakia will reportedly replace its MiG-29 fleet with 14 F-16V fighters, incorporating active electronically scanned array (AESA) radars in a deal valued up to \$2.9bn. As well as 14 F-16V Block 70/72 aircraft, Slovakia has requested 16 APG-83 AESA radars, 14 modular mission computers and 14 Joint Helmet Mounted Cueing Systems (JHMCS). Requested weapons and stores include 30 AIM-120C-7 AMRAAMs, 100 AIM-9X Sidewinders, 224 sets of guidance kits for 500lb (227kg) GBU-12 Paveway II laser-guided bombs, 20 guidance kits for GBU-49 Enhanced Paveway IIs, 150 guidance kits for 500 lb GBU-38 Joint Direct Attack Munition (JDAMs) and six AN/AAQ-33 Sniper targeting pods.

First two-seat JF-17 handed over to Pakistan



The Pakistan Air Force's first two-seat JF-17B combat trainer was received on 17 April, the aircraft being first of two development prototypes to join the service for evaluation. An initial prototype JF-17B made its maiden flight at Chengdu on 27 April 2017 and the aircraft delivered to the PAF was transported to Pakistan on 3 February 2018. It made its first flight in Pakistan, flown by a PAF test pilot on 10 March and delivery to the PAF followed on 3 April, prior to the handover. Meanwhile, the Pakistan Aeronautical Complex (PAC) are reportedly in discussions on potential export of the JF-17 to Malaysia.

Ex-Israeli F-16s for Croatia

The Croatian National Defence Council has announced its acceptance of an Israeli offer to provide surplus Israeli Air Force F-16s, in preference to offers from Greece, Israel, Sweden, South Korea and the United States. These countries had reportedly offered F-16s and Sweden a squadron of JAS 39 Gripens, however, the council's recommendation to accept Israel's offer of 12 F-16D Baraks at a cost of \$500 million is yet to be formally approved by the government.

More M-346s for Poland

According to the Company, Leonardo and the Armament Inspectorate of the Polish Ministry of National Defence have signed a contract to supply four additional M-346 Advanced Jet



Trainers (AJT). The Polish Government had invited Leonardo to review the procurement of eight more AJTs for delivery by 2020 and four more in the 2020-2021 timeframe in January 2016. The March 2018 contract is worth more than €115 million and includes a support package and the option of buying four more aircraft.

Thai AF T-50THs



Korea Aerospace Industries (KAI) has completed delivery of four T-50THs to the Royal Thai Air Force, the advanced jet trainers being formally commissioned into service at Takhli Air Base on 4 April. Thailand had signed a \$110m contract for four T-50THs in September 2015 and another eight examples were ordered in July 2017 in a deal valued at \$260m. The initial pair of T-50THs was delivered to Takhli on 25 January 2018 and delivery of the second batch is likely to begin in 2019.

Final G 120TP-A for Indonesia

Indonesia has taken delivery of the last six Grob G 120TP-A basic trainers, bringing the total acquired by the *Tentara Nasional Indonesia-Angkatan Udara* (TNI-AU, Indonesian Air Force) to 26. In September 2011, Indonesia had selected the type as its new elementary and basic training aircraft and the first four were formally handed over in the factory in May 2013, arriving in Indonesia on board a ship to Yogyakarta. The initial order was for 18, after which options were exercised for a further eight aircraft.

About this time, the T-34C-1 Turbo Mentor was retired from the *Tentara Nasional Indonesia-Angkatan Udara* service. The Turbo Mentor had been in service with this air arm for 39 years.

Indonesian-built aircraft for Ivory Coast and Senegal



PT Dirgantara Indonesia (PTDI) is to supply three CN 235s and NC 212s to Senegal and one to Ivory Coast. The Senegalese Air Force will receive two NC212-200 maritime surveillance aircraft and one CN235-220 maritime patrol aircraft, while the Ivory Coast Air Force is to acquire one CN235-220. Deliveries are scheduled to take place 18 months after the contract has been concluded. Previously, PTDI had supplied two second-hand CN235-220 transports to the Senegalese Air Force, delivered in 2010 and 2011, although one was almost immediately sold to Guinea. A third CN235-220, in MPA configuration, was ordered for Senegal on 6 November 2014.

Third Superjet 100 for Royal Thai Air Force



On 19 June 2018, a third SSJ100 arrived in Bangkok to join the Royal Thai Air Force for VIP transportation. The SSJ100 aircraft has been operated by the RTAF since July 2016, the SSJ100 having been selected in 2014. The aircraft delivered to the RTAF are the first such version acquired while other operators of the version are RusJet, special purpose flight detachment 'Rossiya' of the Facilities and Property Management Office under President of Russian Federation, EMERCOM flight detachment, Kazakhmys Corporation and others.

CV-22B Ospreys in Japan

US Air Force Special Operations Command (AFSOC) CV-22Bs have been deployed to Yokota Air Base, the aircraft having been shipped to Yokohama's North Dock. Three AFSOC CV-22s were



originally slated to arrive in Japan in the fourth quarter of fiscal year 2017, but were delayed. Ten CV-22Bs and around 450 personnel will be stationed at Yokota. According to a USAF statement, the deployment “addresses regional security concerns in line with the 2018 National Defence Strategy.”

Bolstering of Belarus air defence

Belarus will receive an additional four Yak-130 combat trainers before the end of 2018 as also a fifth Tor-M2 (SA-15 *Gauntlet*) surface-to-air missile battery. Lt Gen Ravkov, the country’s defence minister also announced that 12 Su-30SM multi-role fighters ordered from Russia in a \$600m deal signed in 2017 will be delivered in 2019-20.

Uzbekistan orders Mi-35Ms

Uzbekistan will receive “more than ten” Mi-35M assault helicopters from Russia, this being revealed by Vladimir Drozhzhov, deputy director of Russia’s Federal Service for Military-Technical Cooperation. A possible deal involving 12 Mi-35Ms for Uzbekistan was first reported in December 2017, the country currently operating around 24 Mi-24D/P/V variants.

Russia to buy “more than 100” Il-112Vs

The Russian defence ministry has announced plans to buy “in excess of” 100 Il-112V light transport aircraft according to deputy Defence Minister Yuri Borisov. The Voronezh Aircraft Production Association (VASO) facility will become the main producer of Il-112V light transport aircraft, which is currently under development by the JSC Ilyushin Aviation Complex, a part of JSC United Aircraft Corporation (UAC), for the Ministry of Defence of the Russian Federation.

Two Il-112V prototypes, including one for static and fatigue tests and the other for flight tests, will be initially built. Construction and maiden flight of the prototypes was scheduled for 2016 with the first production aircraft to be delivered in 2018.

Indonesian Army AH-64Es delivered



All eight AH-64E Apaches ordered by the *Tentara Nasional Indonesia-Angkatan Darat* (TNI-AD, Indonesian Army) have now been delivered, the final five Apache Guardians shipped from the US by sea to Tanjung. After re-assembly at the port, they were flown out on 20 April to join *Skadron Udara* 11 at Achmad Yani Airport, Semarang, in Java.

Army Defenders transferred to RAF

The B-N Defenders and Islanders flown by 5 Regiment/651 Squadron of the Army Air Corps (AAC) at Joint Helicopter Command Flying Station Aldergrove, Northern Ireland were formally transferred to the RAF on 1 April 2018. Plans to transfer the AAC’s fixed-wing aerial surveillance capability had been discussed for some time and this was officially confirmed in Parliament during October 2016. This ‘reverse’ deployment is shrouded in some secrecy, these aircraft reportedly providing support to special forces operations overseas and counter-terrorist activities within the UK.

17 CH-47F Chinooks for Spain

The US State Department has approved possible sale of 17 CH-47Fs to Spain estimated to cost \$1.3bn. The Spanish government had announced plans to upgrade its 17 CH-47Ds to CH-47F standard in 2015, when it was stated that the work would begin in 2017. Spain’s *Fuerzas Aeromóviles del Ejército de Tierra* (FAMET, Spanish Army Airmobile Forces) originally took delivery of ten CH-47C models from December 1972, adding nine commercial BV414 Chinooks to the fleet from January 1982. Following approval at the end of 1989, all nine BV414s and the nine surviving CH-47Cs were upgraded to CH-47Ds operated by *Batallión de Helicópteros de Transporte V* (BHELTRA V, Transport Helicopter Battalion 5) at Colmenar Viejo.

First Leonardo AW101 Commando Merlin delivered to UK

Delivery of the first AW101 Commando Merlin Mk4 helicopter took place at Royal Naval Air Station Yeovilton, marking a major milestone for Leonardo’s Merlin Life Sustainment



Programme (MLSP) contract to convert 25 former Royal Air Force Merlin helicopters to fully marinised amphibious support Commando Merlin helicopters for use by the UK's Commando Helicopter Force. The Commando Merlin Mk4/4A helicopters are optimised for ship operations and include automatic main rotor blade folding and tail fold, an uprated undercarriage and enhanced cabin safety features.

First Pakistan Army Mi-35Ms



Four Mi-35M attack helicopters for the Pakistan Army Aviation Corps arrived in the country on 4 April 2018, these helicopters having been ordered in June 2016 under a \$153m contract with the Russian Company. The Pakistan Army/ Air Force has had some experience operating earlier variants of the type, as some Mi-24 attack helicopters had been flown to Pakistan by defecting Afghan aircrew during the war in Afghanistan. It is understood that apart from the political implications of this new order, the Pakistan army has expressed interest in acquiring up to 20 such examples.

Interestingly, the Indian government is to supply four refurbished Mi-25s to the Afghan National Defence and Security "in the next few months," these following an earlier batch of four transferred few years back.

Turkey, Pakistan close to ATAK helicopter deal



As reported earlier, the Pakistan government have confirmed their intention to procure 30 Turkish T129 Advanced Attack and Tactical Reconnaissance Helicopters (ATAK), estimated to be worth some \$1.5 billion, an amount "almost equivalent to Turkey's annual defence exports." According to sources in Ankara, the ATAK helicopters were extensively tested for operations and in fact, then Pakistani Prime Minister Shahid Khaqan Abbasi, who visited Turkey in October 2017, declared that the T129 ATAK helicopter was "very impressive." (see photo). Earlier, three ATAK helicopters were flown to Pakistan to take part in a ceremonial parade at Islamabad.

ATAKs for Turkish Jandarma



The first three T129 ATAKs for the Turkish *Jandarma Havacılık Komutanlığı* (Gendarmerie Aviation Command) were handed over on 19 April 2018. These are the first of 18 on order for the Jandarma under a contract signed in 2017 and will "boost the service's close air support capability," while also being used for intelligence gathering and reconnaissance.

Airbus Helicopters delivers final H135 for Bundeswehr training



Airbus Helicopters has delivered the fifth and final H135 to be used for training by German Armed Forces in Bückeburg. The German Federal Office for Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) are leasing these helicopters for initial and recurrent pilot training, these five H135s joining 14 others from the H135 family, which have been in service for training at the Bundeswehr since 2000.

Russian Helicopters reveal VRT500



Russian Helicopters (part of Rostec State Corporation) have formally launched their light multirole VRT500 helicopter developed in co-operation with VR-Technologies, at HeliRussia-2018 International Helicopter Industry Exhibition. The VRT500 has a takeoff weight of 2 tons, this helicopter planned for multiple operations including passenger and cargo transport, as also training.

Schiebel and Airbus Helicopters' Manned UnManned Teaming

On 17 April 2018, Schiebel's CAMCOPTER S-100 UnManned Air System (UAS) and Airbus Helicopters' manned H145 demonstrated a series of Manned UnManned Teaming (MUM-T)



flights. Level 5 interoperability was achieved by providing the user onboard the manned aircraft with full command and control over the UAS and its payload, including launch and recovery. Such technology partnership between the Austrian Armaments and Defense Technology Agency (ARWT) and Schiebel aims to explore the benefits and challenges of delivering MUM-T flight operations, "especially those with highly valuable, mission-enhancing advantages for military aviation."

Production Mi-171A2 in test flight



The first production helicopter Mi-171A2 made its test flight at the Ulan-Ude Aviation Plant owned by the Russian Helicopters Holding Company (part of Rostec), and will be delivered to UTair-Helicopter Services for operations in the polar regions. The Mi-171A2 uses advanced digital technologies and partial transition to electronic design documentation has allowed the company to reduce time and resources in production. The helicopter is equipped with VK-2500PS-03 engines with digital control system.

Raytheon to deliver DAS for F-35s

Lockheed Martin has selected Raytheon to develop and deliver the next generation Distributed Aperture System (DAS) for the F-35 stealth fighter. Developed by the Lockheed Martin-led team, the selection will enhance capability and reduce cost. The F-35's Distributed Aperture System collects and sends high resolution, real-time imagery to the pilot's helmet from six infrared cameras mounted around the aircraft, allowing pilots to observe the

environment, day or night. “With the ability to detect and track threats from any angle, the F-35 DAS gives pilots unprecedented situational awareness of the battlespace.”

MQ-9B Protector development

General Atomics Aeronautical Systems Inc has been awarded a development contract for the RAF MQ-9B Protector unmanned aerial vehicle (UAV) programme. The Foreign Military Sales deal, valued at \$80.8 m, was awarded by the US Air Force Life Cycle Management Centre on 30 March, which provides for the design, development, integration and component level testing required for UK-specific enhancements to the MQ-9B. The RAF’s Protector is a weaponised version of GA-ASI’s Certifiable MQ-9 Predator B. Plans to acquire the Protector to replace the RAF MQ-9A Reaper were earlier announced in the UK’s *Strategic Defence and Security Review*. US State Department approval for the UK to acquire up to 26 Protectors was granted in November 2016, although the initial purchase was planned for 16 UAVs.

Further contract for P&W F135 engines

Pratt & Whitney and the US Department of Defence have announced a contract for the 11th lot of F135 propulsion systems, powering all three variants of the F-35 Lightning II aircraft for some \$2 billion. The latest contract continues to support programme affordability initiatives with reduction in propulsion system price. The 11th low rate initial production (LRIP) contract will cover the engines, as well as programme management, engineering support, production support, spare modules, and spare parts.

Germany orders Heron TP drones

Airbus and the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) have signed an operator agreement for Heron TP unmanned aerial systems (UAS) after parliamentary approval was granted on 13 June 2018, the contract including both the provision of Heron TP UAS as well as all operational services required for the system. Heron 1 drones, which are currently deployed by the German Armed Forces in Afghanistan and Mali, are to be replaced by the more powerful IAI (Israel Aerospace Industries) made Heron which is already fully operational with the Israeli Air Force, although the contract between the Bundeswehr and Airbus is based on this previously successful model. The project will have a two-year set-up phase, followed by an operational phase lasting a further seven years, thereby bridging the gap until a new European drone is developed.

Philippines boost surveillance capability

The Philippines government has acquired six Boeing (Insitu) ScanEagle unmanned aerial systems to boost surveillance operations, as announced in March 2018. The aircraft have been

acquired under a \$13.8 million US Foreign Military Financing (FMF) contract and will be operated by the Philippine Air Force’s 300th Air Intelligence and Security Wing. The ScanEagles were handed over during a ceremony at Vilamor Air Base, Pasay City on 14 March 2018. The Philippine Navy has also announced acquisition of three additional Beechcraft TC-90 King Air aircraft from the Japan Maritime Self Defence Force, the Navy receiving the first two aircraft in 2017 with the five aircraft to be employed for maritime surveillance tasks.

European companies to co-operate on MALE drones



Four European companies intend to combine their “unique and complementary” capabilities for the MALE (Medium Altitude, Long Endurance) drone programme involving France, Germany, Italy and Spain. Designated as the European MALE RPAS (Remotely Piloted Aircraft System), this will primarily be a futuristic ISTAR (Intelligence, Surveillance, Target Acquisition and Reconnaissance) programme. The companies Elettronica, Hensoldt, Indra and Thales signed a memorandum of agreement in compliance with legal and regulatory requirements, confirming their common goal to offer a coherent ISTAR functional chain for the MALE RPAS comprising all elements from sensors and computing through data processing and communications. The European MALE RPAS programme is managed by the European procurement agency OCCAR.

Meanwhile, Airbus, Dassault and Leonardo have unveiled the first full scale model of the European Medium-Altitude Long-Endurance Remotely Piloted Aircraft (MALE RPA) after a nearly two-year definition study launched in September 2016 by the four participating nations Germany, France, Italy and Spain. This follows the Declaration of Intent to work together on a European MALE unmanned aerial system signed by the countries in May 2015.

Saab Giraffe AMB radars with UK GBAD

Saab has delivered a tenth Giraffe Agile Multi Beam (AMB) radar to the United Kingdom’s Ministry of Defence (MoD) making the country the largest operator of land-based Giraffe AMB radars



in the world. Saab's Giraffe AMB surveillance radar system play a pivotal role in the United Kingdom's new ground based air defence (GBAD) Sky Sabre system, and provide air target tracking to its Land Ceptor weapon as recently demonstrated at a weapon firing in northern Sweden. The Giraffe was first acquired in 2008 as part of the Land Environment Air Picture Provision (LEAPP) programme. Since deliveries started in 2010 Giraffe AMB has been operated by the 16th Regiment, Royal Artillery.

MMP missile campaign of firings



In May 2018, the French Army conducted a training campaign of firings in preparation for operational deployment of the MMP missile. In parallel, a number of additional firings were made to test capability of the system beyond its normal operating range, with two firings made over a range of 5,000 metres when the seeker was locked onto the target before firing. The MMP programme comprises a total inter-force installed base of 400 firing units and 1,950 missiles by 2025.

LM's miniature hit-to-kill interceptor at development stage

The US Army Cruise Missile Defence Systems Project Office has awarded Lockheed Martin a \$2.6 million dollar contract to develop the Miniature Hit-to-Kill (MHTK) interceptor, evaluate its



effectiveness and demonstrate manufacturing readiness as part of the Extended Mission Area Missile Programme. The MHTK missile is designed to defeat rocket, artillery and mortar targets through body-to-body contact without a warhead at ranges projected to exceed those of current and interim systems. The compact size of MHTK allows multiple rounds to be packaged in a very small footprint to effectively combat complex threat situations like saturation attacks. The MHTK interceptor complements the Lockheed Martin family of Hit-to-Kill missile interceptors by delivering close range lethality with proven success for truly layered defense.

LM contract for Guided MLRS Rocket Production

Lockheed Martin received an order from the US Army for Lot L13 production of Guided Multiple Launch Rocket System (GMLRS) rockets and associated equipment. GMLRS is an all-



weather rocket designed for fast deployment that delivers precision strike beyond the reach of most conventional weapons. In combat operations, each GMLRS rocket is packaged in a MLRS launch pod and is fired from the Lockheed Martin HIMARS or M270 family of launchers.

GA-ASI launches Team SkyGuardian Canada

General Atomics Aeronautical Systems have announced Establishment of *Team SkyGuardian Canada*, comprising CAE Canada, MDA and L3 WESCAM. The MQ-9B is a 5,700kg



GTOW UAV with over 40 hours of un-refueled mission endurance, capable of carrying wide-area maritime radars, long-range, HD-video, and other sensor payloads. The RPAS Project will provide the Canadian Armed Forces with a MALE RPAS, and include indigenous capabilities, systems and services. The RPAS Project is claimed to enhance existing and future fighter, ISR and space assets through seamless NORAD/FVEY/NATO interoperability.

Elettronica and Indra work on EuroDIRQM

Indra and Elettronica Group are to collaborate in the development of a next generation Quantum Cascade Laser (QCL)-based Direct Infrared Countermeasure (DIRCM) system suitable to protect rotary and fixed wing aircraft. This is based on the high level of respective know-how technological capabilities synergy with the goal to build up an innovative DIRCM system, with proprietary technologies from several EU countries, “to deliver a truly European self-protection solution fully ITAR-free to facilitate international commercialisation.” The system is dubbed EuroDIRQM, reflecting its European roots and its application of QCL technology for DIRCM purposes. The two companies have already completed the development of a first EuroDIRQM prototype system, with QCL operational ground tests performed in March, with the cooperation of the Italian Air Force.

Sino-Russian CR929 concept approved

Concept approval of the Sino-Russian CR929 wide-bodied airliner was given in December 2017, when the board of directors approved the critical design review. The next phase, which



began in early 2018 and will continue until mid-2019, will involve freezing of the design and selecting system and equipment suppliers. Detailed design documentation will be concluded in 2021, aiming for a maiden flight in 2023-24 and service introduction in 2027. Suppliers, including western ones such as Honeywell and United Technologies, should be selected by mid-2019; completion of the request for proposals (RFP) is expected to be concluded at the end of 2019.

Three variants of the CR929 will be offered: the standard version CR929-600 will have 280 seats and a range of 6,480 nautical miles (12,000 km). The shorter CR929-500 will carry 250 passengers in three-class layout for a range of 7,560 nautical miles (14,001 km), while the stretched CR929-700 will carry 320 passengers over 5,400 nautical miles (10,000 km).

Ex-SIA A380 for Hi Fly



The Portuguese company, Hi Fly is to procure second-hand Airbus A380s, having decided on ex-SIA aircraft, the Portuguese wet-leasing entity confirming that its first A380-841 will join its fleet in “mid-2018.” The airline’s president Paulo Mirpuri said, “It is a very proud moment for Hi Fly. The A380 is the largest and most advanced airliner flying today and certainly the aircraft of choice for most discerning air travelers. This acquisition has been part of our company’s plans for a while. We are extremely happy to welcome the first A380 to our fleet.” The A380 joins Hi Fly’s fleet of 16 Airbus large widebody aircraft (11 A340-300s, three A330-200s and one A321-200), which are available for aircraft, crew, maintenance and insurance leases worldwide. With Hi Fly, the A380 will seat 471 passengers across three classes (399 passengers in economy class on the main deck, with the upper deck having business and first class seats carrying 60 and 12 passengers respectively). In a high-density layout, the aircraft can carry up to 868 passengers.

Qantas introduce B-787 direct flights to UK



The first scheduled non-stop flight between Europe and Australia began with Qantas flying a new Perth-London Heathrow roundtrip with the Boeing 787-9. Over 17 hours long, the non-stop service covers 7,828 nautical miles (14,498km), making it the longest sector yet served with a 787 and the second-longest airline flight currently in operation after the Qatar Airways' Doha to Auckland, New Zealand, route. Qantas said that the new route is "performing very well and we are expecting very full flights in both directions."

Vietnam's Bamboo order A321s



Vietnam's FLC Group has signed a memorandum of understanding (MoU) with Airbus for 24 A321s for a new start-up carrier called Bamboo Airways. The carrier is due to start operations in 2019 with leased aircraft before its A321s are delivered. Bamboo is set to operate on both domestic services in Vietnam and on regional Asian flights.

Second Irkut MS-21



The second of four Irkut MS-21-300 airliners that will be used for flight testing was rolled out of the factory at Irkutsk, in Russia on 25 March. The initial MS-21-300, which is currently being flight-tested at the Gromov Institute at Zhukovsky near Moscow, had first flown ten months earlier while the third MS-21-300 is being assembled, and the fourth is under construction. Some \$3.8 billion for additional investment in the MS-21 programme has been provided from Russian banks, the additional investment enabling the production of 50 MS-21s for Aeroflot by 2026.

Turkish Airlines order A350s and B787s



Turkish Airlines has selected both contending types to meet its future twin-aisle widebody fleet, with orders placed for 25 Airbus A350-900s and 30 Boeing 787-9s, plus options on five A350-900s and five 787-9s. The airline said it would receive six aircraft in 2019, 14 in 2020, ten in 2021, 12 in 2022, 11 in 2023 and seven in 2024.

Merger of Peach and Vanilla

All Nippon Airways (ANA) Group is to merge its low-cost carrier subsidiaries, Peach and Vanilla Air, under the Peach brand. ANA said that the integration will start in the second half of this



financial year and "will serve as a strong foundation for further fleet growth and network expansion." Peach started operations in March 2012 from Osaka Kansai and Vanilla did in December 2013 from Tokyo-Narita. The enlarged Peach will operate from both bases, with the plan for the carrier to grow to more than 50 aircraft, from the 35 at present.

Airbus A350-1000 progresses

Of the 169 A350-1000s currently on order for 11 airlines, three carriers in the Asia-Pacific region have already committed to 43 aircraft, representing just over one quarter of the total. Airbus forecasts a demand in the region over the next two decades for 4,000 twin-aisle aircraft, representing 46% of the global total. The most obvious difference between the A350-1000 and its smaller sibling is a fuselage that is 7m (23ft) longer. The aircraft has 11 additional



fuselage frames: five inserted forward of the wing between Door 1 and Door 2, and six aft of the wing between Door 3 and Door 4. In a typical three-class cabin configuration, the A350-1000 can accommodate 366 passengers. In the present configuration adopted by Qatar Airways, this has 44 more seats than does the A350-900.

Boeing 737 MAX 7



The new, smaller variant of Boeing's 737 MAX has recently begun flight testing. The 737 MAX 7 is the 'baby' of the re-engined airliner family and will seat 138 to 153 passengers in a typical two-class layout (172 single-class) compared to the baseline 737 MAX 8's 162-178 seats (210 single), the stretched 737 MAX 10's 188-204 seats (230 single). Boeing also offers a high-density configuration on the 737 MAX 8 called the 737 MAX 200.

The historic 10,000th B-737 airliner



Boeing created aviation history with the building of its 10,000th 737 family aircraft at Renton, becoming the world record holder for the most-produced commercial jet aircraft. This 10,000th aircraft was a 737-800 for Southwest Airlines which made its first flight on 26 March. The roll-out happened less than two years since the April 2016 delivery of the 9000th 737 (for China United Airlines). The first 5,000 737 deliveries were spread across the programme's first 40 years (the 5,000th jet left Renton in 2006), thus half of all 737s built have been turned out in last 12 years. Amongst the largest operators of Boeing 737s in India is Jet Airways, which has recently ordered 150 Boeing 737 MAX airliners.

Boeing 777-9 update



Boeing has confirmed that the forward fuselage section of its first 777-9, the wings for this static test airframe and the first flight test aircraft, the second 777-9 to be assembled, are now in production, with assembly of the fuselage for first flight test aircraft due to begin later in 2018.

Meanwhile, airport planning documents for the 777-9 and 777-8 provide further details about the functionality of the folding wingtip mechanism (FWT) designed for the 777X (*see photo*). During taxi for departure, the 777X will have the FWT folded, but after passing a predetermined location to ensure clearance from ground objects, the flight crew will manually initiate the command for the FWT to extend and lock to the take-off position prior to the hold-short line.

Boeing and Embraer in merger talks

The Boeing Company and Embraer of Brazil are reportedly in "advanced negotiations" over a much-anticipated merger, which would need the go-ahead from the Brazilian government,



and make Boeing as the majority partner. Embraer would however keep sole control of its military activities. According to reports, the aircraft manufacturers had “already prepared the memorandums of understanding and requested a meeting to present” their project to the Brazilian government. [see Farnborough 2018 article]

Drukair orders the A320neo



Drukair, flag carrier of the Himalayan Kingdom of Bhutan, has signed a purchase agreement for one Airbus A320neo as part of its growth plans and complement its existing fleet of three A319s. The aircraft will be powered by CFM LEAP-1A26E1 engines optimised for high-altitude operations and will become the largest aircraft operating out of Drukair’s base in Paro. Featuring a two-class cabin layout, the aircraft will be deployed to increase capacity on existing regional routes to Singapore, Bangkok, Kathmandu, Delhi and Calcutta.

Q400s for Ethiopian Airlines



Bombardier Commercial Aircraft have received a firm order for 10 new Q400 aircraft from Ethiopian Airlines, the order also including an option for five additional Q400 aircraft. Based on the list price of the Q400 aircraft, the firm order is valued at approximately \$332 million.

With its hub and headquarters at Bole International Airport in Addis Ababa, Ethiopian serves a network of 125 passenger destinations, with a mixed fleet including 15 Airbus A350-900s, 27 Boeing 787s, 10 Boeing 777s, 6 Boeing 767s and 30 Boeing 737 MAX, apart from 33 Bombardier Q400s for regional services.

Bombardier CS300 aircraft for airBaltic



Bombardier Commercial Aircraft and Air Baltic Corporation AS have announced the order for 30 CS300 aircraft with options and purchase rights for an additional 30 aircraft of the same type, the order valued at approximately US\$ 2.9 billion.

R-R Trent 700 completes 50 million flying hours



Rolls-Royce has announced that its Trent 700 engine completed its 50 millionth flying hour on 1 June 2018, there being some 380 Trent 700-powered Airbus A330 aircraft in service around the world. This milestone comes as Rolls-Royce use the experience gained from developing and operating the engine to prepare for the entry into service of the Trent 7000, the exclusive powerplant for the A330neo, later this year. The Trent 7000, the seventh member of the Trent family, brings together experience from the Trent 700, architecture from the Trent 1000 TEN—the latest version of the Trent 1000 engine—and the latest technology from the Trent XWB.

Nammo's revolutionary artillery ammunition

Nammo has introduced a new concept for artillery ammunition that will enable armies with modern 155 mm artillery systems to launch precision strikes against targets more than 100 km



away. “This could be a game-changer for the artillery. With the exception of a small number of precision guided shells with 50-60 km range, most artillery systems still fire across the same distances as they did when the M109 was introduced more than 50 years ago. This could completely change that,” noted Thomas Danbolt, VP of Nammo’s Large Caliber Ammunitions unit.

Nammo’s new design is built around a compact solid fuel ramjet which is kick-started by launching it from a cannon, and is a collaborative programme between ammunition and rocket engineers in Nammo. “We have been building rocket motors for about 60 years, and have specialised in small and powerful motors for air-to-air missiles, such as the Sidewinder, IRIS-T and AMRAAM. Some years ago we began looking at using air-breathing motors to help extend their range, but we quickly saw the massive impact this could have if we fitted it to an artillery shell,” said Erland Ørbekk, VP Technology for Nammo’s Aerospace Propulsion Unit. Test firing of the new projectile is planned to commence in 2019-2020, while the new artillery ammunition concept will likely be operational around 2023-2024.

In the picture above are seen Thomas Danbolt, VP Large Caliber describing Nammo’s new 155 mm ramjet-powered ammunition during Eurosatory 2018.

Carl-Gustaf M4 for Swedish Armed Forces



Saab has received an order from the Swedish Defence Materiel Administration (FMV) for deliveries of the Carl-Gustaf® M4, the latest version of the Carl-Gustaf weapon system, with the Swedish Armed Forces being the fifth country to select this weapon. Delivery will take place during 2018. The Indian Army has operated the Carl Gustaf for several decades and the new version Carl-Gustaf M4, launched in 2014, has all the effectiveness and versatility of the Carl-Gustaf system but its improved and lightweight design, weighing less than 7 kg, offers significant mobility improvements to the soldier.

MBDA’s CMM interceptor demonstration

MBDA’s Land Ceptor air defence system has participated in a comprehensive system demonstration firing at the Vidsele Test Range in Sweden, an important milestone for the project prior to entry to service with the British Army. Land Ceptor utilises the proven Common Anti-air Modular Missile (CMM) currently in production and delivering a common system to meet the air defence needs of both the British Army and the Royal Navy (as Sea Ceptor). In British Army service Land Ceptor will replace the current Rapier air defence system and provides a step-change in capability, including over triple the range and the ability to intercept a much more challenging target set.

Czech firm AM-CME joins BAE Systems’ CV90 team

BAE Systems has reached an agreement with the Czech firm AM-CME to provide mechanical components through its subsidiary Strojirny Sobislav s.r.o. to the CV90 Infantry Fighting Vehicle mortar upgrade programme for the Swedish Army. AM-CME becomes the latest Czech company to team up on the CV90 programme as BAE Systems continues to expand its relationship with Czech industry to build industrial cooperation, and to support the company’s offer of CV90s to the Czech government. BAE Systems has a long established history of working indigenously within countries to promote growth, technical knowhow, and job creation in local economies.



Raytheon and Safran developing next-gen combat vehicles

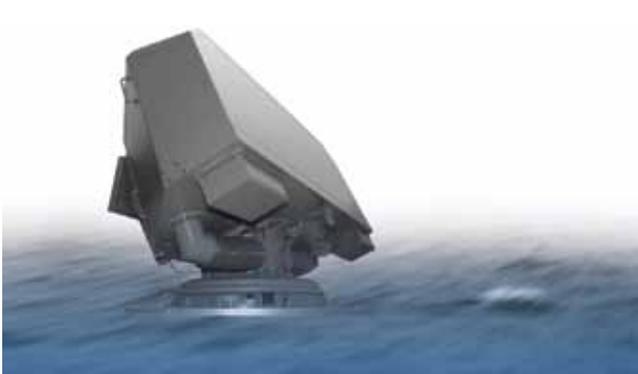


Raytheon and Safran are to collaborate on the next generation of combat vehicle sighting systems, Raytheon combining its electro-optical technology with Safran's inertial measurement unit technology to engineer, manufacture and deliver the latest Forward-Looking Infrared, or FLIR, sights. The new systems will allow soldiers to see across long- and mid-wave bands simultaneously and at very long ranges with a stabilised line of sight. Under the cooperative agreement, next-generation FLIR B-Kits will be integrated with Safran vision sights onto armoured vehicles.

Elbit Systems' acquisition of IMI Systems

Agreements have been reached between Elbit Systems and the Israeli Government for the acquisition of IMI Systems Ltd., as approved by the Committee for the Tender of the Sale of State Shares and by the Board of Directors of the Company. The purchase price will be approximately \$495 million with an additional payment of approximately \$27 million contingent upon IMI meeting certain performance goals. Completion of the transaction is subject to the signing of the relevant documents and receipt of the remaining applicable governmental approvals, including approval of the Head of Israeli's Antitrust Authority.

Saab's Sea Giraffe AMB Radar for the Philippines



Saab will supply the Sea Giraffe AMB naval radar system to the US Navy (USN) for a Foreign Military Sales (FMS) arrangement between the US and the Philippines. The Sea Giraffe AMB (designated as AN/SPS-77 by the USN) will be installed on two Philippine Navy frigates: BRP *Gregorio del Pilar* (FF-15) and BRP *Ramon Alcaraz* (FF-16), both former US Coast Guard *Hamilton*-class cutters. The sale also includes Saab's 9LV for radar control and display for enhanced situational awareness.

Saab's SLWT Torpedo



Saab showcased its latest products in the underwater segment, including a full size model of the new light weight torpedo (SLWT) at the Undersea Defence Technology (UDT) exhibition and conference on 26-28 June at the Scottish Exhibition and Conference Centre in Glasgow. The main focus was on the SLWT torpedo with a full size model as well as a new animation and a 360 degree VR-video. Saab continues development of the new light weight torpedo system which will handle the toughest environment in the world, the Baltic Sea. The new system has already been ordered by Sweden and Finland.

Naval Group tests F21 torpedo from a nuclear SSN



Naval Group has tested the F21 torpedo in frame of the Artémis programme led by the French Defence Procurement Agency (*Direction Générale de l'Armement – DGA*) to equip all the French Navy's submarines with this heavy torpedo. This launch in early May was from a nuclear-powered attack submarine (SSN), the F21 launched under authority of the DGA in a DGA Missiles Testing's underwater acoustic range off the Hyères coast.

GBP850M Sea Ceptor Missile System for Royal Navy



The Sea Ceptor missile for defence against airborne threats including other missiles has been developed and manufactured through UK Ministry of Defence contracts worth around £850m. Sea Ceptor is a major improvement on the existing Seawolf missile system which is being replaced and has improved performance against current and projected future threats, with the ability to engage multiple targets. It will be installed on the Royal Navy's Type 23 frigates, and Plymouth-based HMS *Montrose* became the third ship to test fire the system to also be fitted on the Royal Navy's new Type 26 frigates.

LM's long range anti-ship missile

Lockheed Martin have test fired two production representative Long Range Anti-Ship Missiles (LRASM) from a US Air Force B-1B over the Sea Range at Point Mugu, California, the missiles navigating through planned waypoints, transitioning to mid-course guidance and flying toward the moving maritime target using inputs from the onboard sensors before impacting on target. LRASM is a precision-guided, anti-ship standoff missile based on the successful



Joint Air-to-Surface Standoff Missile – Extended Range. The air-launched variant provides an early operational capability for the US Navy's offensive anti-surface warfare requirement and will be integrated onboard the US Air Force's B-1B in 2018 and on the US Navy's F/A-18E/F Super Hornet from 2019.

US Navy selects Naval Strike Missile

The US Navy has selected the Naval Strike Missile, offered by Raytheon Company and Kongsberg Gruppen, to meet its over-the-horizon requirement for littoral combat ships and future frigates. The Naval Strike Missile is "to enhance the US Navy's vision of distributed lethality, ensuring sea control and freedom of the seas." Raytheon will manufacture and deliver over-the-horizon weapon systems under a \$14.8 million contract for offensive missiles, the contract including options which, if exercised, would bring the cumulative value to \$847.6 million.



Technology Developments

Nammo: Innovative 40 mm programmable ammunition



In combat situations, the enemy avoids direct fire by hiding behind obstacles, which provides a tactical challenge for own troops. Innovatively, Nammo developed the programmable ammunition concept to give forces a reliable advantage, providing a flexible and effective solution to a common war situation. Technological advances have made the battlefield more dynamic

than ever, which means weapon systems must quickly adapt to counter threats.”

Before Nammo developed its programmable ammunition technology, conventional 40 mm ammunition rounds had not changed for over 40 years. In 2002, Nammo initiated a technology programme to explore programmable ammunition to introduce more capability for each round. With introduction of the 40 mm x 53 MK285 Programmable Pre-fragmented High Explosive (PPHE), Nammo became the first company to qualify programmable ammunition for 40 mm Automatic Grenade Launchers (AGL).

Nammo’s innovative 40 mm programmable ammunition technology allows the burst distance against enemy troops to be programmed accurately directly into the round. This achieves more precise targeting in defilade (for example, trenches, rooftops or inside buildings) and enables friendly troops to neutralise enemy forces that are avoiding direct fire.

Demonstrations have also proven this round to be very effective against Unmanned Aerial Vehicles (UAVs). Nammo’s 40 mm x 53 C171 Programmable Pre-fragmented High Explosive – Radio Frequency (PPHE-RF), further improves adaptability by incorporating a wireless communication solution to programme the ammunition. The 40mmx53 High Explosive Dual Purpose Radio Frequency (NM 264) (HEDP-RF), has also been developed with wireless programming, and allows for different target scenarios due to its HEDP and/or RF functions.

Electronica promotes ADRIAN to counter mini and micro drone threats

Electronica, the European leader in electronic and cyber warfare, has launched the ADRIAN (Anti Drone Interception Acquisition Neutralisation) to counter mini and micro drone threats as also the growing security risks posed by lightweight civilian “quadri-copter” drones at public events and in civil airspace. ADRIAN is the state-of-the-art counter-UAV solution designed to intercept and neutralise LSS (Low-Small-Slow) UAV in multiple scenarios and environments, including urban and dense-urban environment.

Traditional sensors and countermeasures may be not effective or not applicable in urban warfare. Therefore ADRIAN is based on multispectral sensors (Radar, EO/IR, acoustic and radio link interceptor) performing data fusion for detection and identification. ADRIAN architecture is modular and can be tailored depending on operational, environmental and cost/effectiveness requirements.

High sensitivity and high efficiency receivers enable LSS platforms detection, while the data fusion algorithm in the mission planner station provides a high probability of intercept, low false alarm rate and a comprehensive situational awareness with the reaction management tool. ADRIAN reactive and smart jammer is capable to deny the remote control link of the platform

and the navigation aids signals used to follow the programmed route through proper waypoints. Innovative jamming techniques enhancing the effectiveness of soft kill disruption of hostile platforms maintaining full operational services of active friendly platforms.

“The company works with its customers to guarantee self-sufficiency and autonomy and has a strong record of successful international collaboration with platform manufacturers as well as with electronic systems providers and integrators in complex and challenging programmes such as Eurofighter Typhoon, Horizon and FREMM frigates, NH90 helicopters, Baynunah corvettes for UAE Navy, AW101 helicopters, AMX and Mirage 2000 fighters.”



Second MC-21-300 aircraft in flight test programme



On 12 May 2018, maiden flight of the second MC-21-300 test aircraft took place at the airfield of Irkutsk Aviation Plant. The test results of the first test aircraft were considered in planning for production of the new aircraft. The duration of flight was 1 hour 7 minutes at an altitude of 3000 metres and at a speed of up to 400 km/hr. The flight programme included testing the aircraft for stability and controllability for various wing configurations with retracting and extension landing gear, as well as testing the on-board equipment.

Acting Minister of Industry and Trade of the Russian Federation, Denis Manturov, stated, “The flight of the second aircraft is a significant event that will ensure the timely conduct of flight certification tests.” The Minister said that three MC-21-300 aircraft were taking part in the test programme: two of them flying and one for static tests in TsAGI. “In addition, the Irkutsk Aviation Plant is building three more test aircraft. In parallel with the flight and static tests, active preparations are being held for the deployment of serial production of the new airliner,” added Manturov.

The President of JSC UAC and Irkut Corporation, Yuri Slyusar, said that Aviastar-SP plant had started manufacturing panels for the first aircraft to be delivered to customers. “In recent years, the Russian aviation industry has undergone a profound modernisation. The most modern scalable assembly line for the newest civil airliners

was commissioned at the Irkutsk Aviation Plant. Within the UAC, fundamentally new competencies have been developed in the field of production of structures from polymer composite materials. Their widespread use is one of the main advantages of the aircraft. The new high-tech production will ensure the development of the MC-21 programme and other perspective aviation projects”, Yuri Slyusar emphasised.

“MC-21 aircraft performance and economy will surpass existing analogues owing to advanced aerodynamics, engines and aircraft systems, as well as of wide use of modern composite materials”, stated Anatoly Serdyukov, Aviation Cluster Industrial Director of the Rostec State Corporation. Rostec is the integrator of number of MC-21 aircraft systems and Rostec Enterprises produce more than 50% of the airliner avionics, providing titanium for the MC-21 programme and also supplies composite panels of the tail unit. United Engine Corporation, a part of the Rostec State Corporation, will supply the PD-14 engines, which, along with the Pratt & Whitney PW1400G engines, will be installed on the MC-21 serial aircraft. In February 2018, Aeroflot airlines signed a firm contract with the Avia Capital Services leasing company (subsidiary

of Rostec State Corporation) for the delivery of 50 MC-21-300 aircraft.

The first MC-21-300 aircraft is undergoing flight tests at the airfield of Flight Research Institute n.a. M.M. Gromov (Zhukovsky city, Moscow region), the aircraft tested for stability and controllability, its takeoff and landing characteristics were determined, various modes of operation of the power plant were tested, including engine start in flight, and the characteristics of the aircraft withdrawal from deep bank roles were determined. A large number of ground tests are being conducted within the programme. In TsAGI, strength tests of MC-21 are carried out, the composite wing box tests (completed at the end of 2017) confirming strength for flight operations at the limit modes. Tests of composite units of mechanisation have confirmed their endurance at the maximum possible loads under the most aggressive operating conditions.



“When Tigers Gather”



The Rafale

NATO Tiger Meet 2018

The 2018 edition of the NATO *Tiger Meet* took place in Poland at the 31st tactical air base Poznań-Krzesiny during 14-25 May. Every year, the European ‘Tiger units’ send their aircraft to the *Tiger Meet* to intensively train together. This year, various CAMAO war scenarios were flown, simulated contemporary reality of war. Besides intensive training, the NATO *Tiger Meet* also concerns the social aspects of the annual meeting, intention being to bring the audience and the participating units closer to each other.

The Tiger Meet history

The origin of the NATO *Tiger Meet* dates back to the beginning of the 1960s when the 79th Tactical Fighter Squadron of the USAF and No.74 Squadron of the RAF became involved in a joint training operation. More than a year later, a new tradition was born to bring squadrons together in a meeting with the *Tiger* as their

squadron emblem. These meetings were so successful that the American Mike Dugan (in those days a Lieutenant, ending his USAF career as a 4 star General) set up the *NATO Tiger Association (NTA)*.

Hosting the Tiger Meet

Colonel Rafał Zadencki has been commander of the 31st Tactical Air Base in Poznań since June 2017. The 6.elt (6th Squadron) is based at Poznan-Krzesiny and operates



Eurofighter Typhoon



Eurofighter 'Tiger' Typhoons

the F-16 *Jastrząb* Block 52+ Fighting Falcon. This unit is the only Polish member of the NATO Tiger Association and it has been a member since 2014. The 6.elt hosted some 22 squadrons from 13 countries during the *Tiger Meet* that included Italy, Spain, Czech Republic, the Netherlands, Germany, Belgium, Hungary, Switzerland, Austria, France and

Great Britain. In total, there were more than 70 aircraft and helicopters at Poznan during NTM2018 and more than 2000 personnel took part in the exercise.



A 'Tiger' F-16 taxis past



The venerable MiG-21 in its tiger stripes

Participants

This year's *Tiger Meet* was held with the aim to promote European cooperation, and the units which participated came from all parts of Europe. The Polish hosts of the 6.elt, flew with six F-16s during the missions. In addition to the Poles, Belgium (31 Squadron), Greece (335 Mira) and the Netherlands (313 Squadron) also flew their F-16s. Besides the F-16 users, there were also three Eurofighter operators which participated in NTM2018. Countries participating with the EF2000 Eurofighter being Germany (TLG-74), Italy (12° Gruppo) and Spain (142 Escadron). In addition to the Eurofighters, the Germans also brought Tornados from TLG-51. Hungary and the Czech Republic were both present with their Saab JAS-39 Gripens (59/1 Squadron & 211 TL). The French Navy participated at NTM2018 with five Rafale Ms (*11 Flottille*) and the Austrian Air Force flew three Saab 105Öes (1 JTS). The Swiss Air Force was the only participant who is not a member of NATO, but this country flew their F/A-18 Hornet (Staffel 11) from Meiringen. All these fighters were based at Poznań-Krzyszyn and the entire exercise was coordinated by an E-3 Sentry AWACS.

The British flew during the missions with a Merlin HM2 (814 NAS) and a Puma HC2 (from 230 Squadron). The Italians



Tigers all ! French Navy Rafale M (above) and Luftwaffe's Eurofighter Typhoon (below) at the meet





German Air Force Tornado



Saab JAS-39 Gripen



An Antonov An-26 on a mission

also had two helicopters at Poznan in the form of two AB-212 ICO helicopters (21° Gruppo). Finally, the Czechs were present with two Mi-24 helicopters (221 LtBvř). The Czechs only participated in the first week of the *Tiger Meet*. In addition to these airfields, *Tiger Meet* missions were also flown from the airfields of the Polish Air Force Powidz, Mirosławiec, Świdwin and Malbork to support the missions.

Objectives of the COMAO Missions

For participants of the NATO *Tiger Meet* 2018, joint training was the main objective, according to Colonel Rafał Zadencki. The main aim during the NTM2018 essentially to gain more knowledge during combined air operations through active involvement in mission planning. This meant that the participants of the NTM 2018 were assigned their missions and thereafter would implement the mission planning themselves. Force integration was the result of this approach, with participants solving various problems during course of the exercise. As a result, the entire training course was largely focused on the execution of COMAOs (Combined Air Operations) and included the scenario of an international crisis in context of conventional and hybrid warfare.

Aircraft were coordinated in flight by IADS to gain and maintain air superiority and to protect their own forces on the ground. During attack missions, specialised aircraft were deployed in the SEAD role to eliminate enemy defences. Other attack aircraft could therefore attack and disable the important enemy positions.

During the NATO *Tiger Meet* 2018, some 1000 sorties were performed and the participants logged over 1600 hours in the air during the scenario missions. Two missions were carried out daily, the morning missions often included COMAO training thus logging most flight hours. Over 50 training missions took place as part of 'Shadow Wave' flights, with different participating countries practicing separately.

The 2019 *Tiger Meet* is planned to be held in France, at Mont-de-Marsan airbase.

*Photos: Alex van Noye
Text: Alex van Noye and
Joris van Boven*



Dassault's Mirage 2000N

Now officially retired!

On 21 June 2018, the official retirement ceremony of the Dassault Mirage 2000N was held at Base Aérienne 125 Istres-Le Tubé or BA Istres, when the aircraft type was officially withdrawn from operational status after 30 years of service in the French Air Force (*Armée de l'Air*), accumulating more than 350,000 flying hours.

In the presence of the French Air Force chief, Général Taprest (*Major Général de l'armée de l'air le général de corps aérien Olivier Taprest*) and chief of the French Strategic Air Force, Général Schuler (*Général Commandant les Forces Aériennes Stratégiques, Général de corps aérien Bernard Schuler*) a formal parade was held and the Mirage 2000N was officially withdrawn





from service. Following the ceremony, there was a flying display, featuring AlphaJets, the 'Couteau Delta' demo team with the Mirage 2000D, the Rafale demo by pilot Martinez and the *Patrouille de France* in their Alpha Jets. There was also a formation flight by a C-135F tanker, the Couteau Delta team in their Mirage 2000D, the demo Rafale and 3 Mirage 2000Ns. Later, the Mirage 2000N aircraft joined-up with the *Patrouille de France* and after this show, the specially painted Mirage 2000 'eNd' participated in some more flypasts.

At the ground show near sunset, a jet powered 'flying-board' of *Team Zapata* flew along a Mirage 2000N that taxied over the platform and the flying-board pilot then waved the Mirage 2000N away,





forever! Later in the hangar, a well-attended party was held for all the pilots, navigators, ground-crew and others involved with the Mirage 2000N during the years.

75 Mirage 2000Ns were ordered by the French Air Force, based on a strengthened version of the Mirage 2000B, two-seat training variant of the Mirage 2000. The first aircraft became operational in 1988 replacing the aging Mirage IVs in the nuclear deterrent role. Their primary role was the delivery of nuclear missiles (ASMP, *Air-Sol Moyenne Portée*, air-to-ground medium range) from the centerline point station, while their secondary role was conventional air-ground attack. For this conventional role, several adaptations were made, including recent adaptation to carry laser guided bombs (LGBs).

After official phase-out of the Mirage 2000N, all remaining aircraft will be transported to BA Chateaudun, the storage and disassembly base of the French Air Force before the end of summer 2018, where the reusable parts (especially the wings) will be stored as spares for the current fleet of French Mirage 2000s (M2000D, M2000C, -5) as they fly on.

*Text and photos by
Alex van Noye & Joris van Boven*

APROC 2018



“That Others May Live!”

Polish Mi-24 over the Netherlands

The Air Centric Personnel Recovery Operatives Course or APROC, which concluded after two weeks on 6 June 2018 at Gilze-Rijen Air Base, home of the Defence Helicopter Command (DHC) of the Royal Netherlands Air Force, had involved over 500 troops, more than 18 fixed and rotary wing aircraft and 140 sorties with a total of over 300 flight hours.

The EPRC

From 2002 to 2006, the European Air Group (EAG) have conducted exercises named ‘Volcanex’ with major focus on Combat Search and Rescue or CSAR. These exercises provided not only valuable training for the participating forces but also fresh aspects. As no other training opportunity of this kind was available in Europe, the EAG developed the Combined Joint Combat Search and Rescue Standardisation Course (CJCSARSC) on the basis of the previous *Volcanex* exercises and their respective lessons learned. The main source of information for the CJCSARSC was NATO documentation on Personnel Recovery (PR). Over the years, these have changed regularly and that provided quite a challenge to the organisers.



AMI HH-101A

In fact, the CJCSARSC was a robust and comprehensive programme, the need for this course had become more pronounced. What emerged is CSAR, which is a narrow subset of PR and many see it as a legacy capability from times passed. In 2013, it was decided by the EAG that a separate multinational hub of Personnel Recovery expertise was to be set up which has, since then, been known as the European Personnel Recovery Centre or EPRC. On

9 July 2015, the EPRC reached Initial Operational Capability, a day after the inauguration ceremony which was held at the Poggio Renatico base in Italy.

The objectives

This course, being the main European training event in the recovery of civilian and military personnel in hostile or non-permissive environment, was conducted by five of seven EPRC members: France,



A Swedish Hkp.16A (or Blackhawk) followed by a French AS.555 Fennec leave the FARP at Gilze-Rijen



French Navy Eurocopter NH-90 returns after picking up a downed pilot



Spanish Air Force Puma hovers over the runway during the first Aproc mission



Italian Navy helicopter taxis back to its parking bay

Italy, the Netherlands, the United Kingdom and Spain. In addition, for this course, helicopters from Poland and Sweden, plus observers, which totalled 12 armed forces.

“Crawl, Walk, Run”

The course is set up in a manner to give participants the possibility to adapt to everything they have learnt on a certain day and take that into account the next day. The first two days were reserved for theory lessons followed by familiarisation flights on the third day over the Netherlands, including the seven landings zones (LZ) which were used for actual missions. Then eight days followed, during which three missions a day were flown, simultaneously. Each mission comprised three daily changing selections of the total field of participants and grew in complexity. “During the first few missions, all information available for the execution of the tasks was accessible” Major Kwiatkowski, DETCO of the Polish Mi-24 Hinds, explained. “But during the course, mission information becomes more scarce compelling participants to collect this from all parties involved.” Lt. Col. Holewijn complemented his colleague: “The course adopts the crawl, walk and run approach with the idea that if a task force is trying to achieve something big, sometimes you have to evolve your approach in stages rather than trying to make all the changes all at once.”

Diversity

As before, APROC attracted a diverse field of participants. Home team of the Netherlands supported the daily task forces with two Boeing AH-64D Apaches, one Boeing CH-47D Chinook and a single Eurocopter AS532 Cougar. Also, two Lockheed Martin F-16s from Volkel Air Base joined some of the missions during the course. Italy provided great input to the exercise as well by sending two Eurofighters in the Fixed Wing RESCORT role together with the afore-mentioned F-16s, and a Gulfstream E-550A which is a converted Gulfstream G550 Conformal Airborne Early Warning and Control System (CAEW) aircraft. This was delivered to the Italian Air Force in December 2016 and during APROC it operated in the Airborne Mission Coordinator (AMC) role, which was very beneficial as all scheduled NATO E-3A AWACS AMC missions in support of the course were cancelled for reasons of aircraft availability. Two Merlins, one Air

Force Augusta Westland HH-101A and a Navy UH-101A complemented the Italian involvement. Merlins were well represented as the Royal Navy sent two examples from 845 NAS as well. Other aircraft of interest were two Polish Mi-24s Hinds and a rarely seen Swedish Hkp.16a (Blackhawk).

Bright future

Being the single entity in Europe, the EPRC provides a course that aims to “educate and train Aircrews and Extraction Forces in the implementation of internationally agreed techniques and procedures for Personnel Recovery operations as a member of a combined and joint force contingent.” The result of this approach to training will be an interoperable force able to provide a viable PR capability for future contingencies.

“For the Polish detachment, we had the aim to train a new Rescue Mission Commander and to further educate more experienced guys of our squadron”, Major Kwiatkowski explained. “We succeeded in our goals and became better trained people, making friends on the side !” The course aims were achieved by executing all scheduled missions except for one day when flight operations were cancelled owing to thunderstorms over the Netherlands. This course enabled the participants to train the Personnel Recovery mission profile in a realistic and international environment that uses the processes and structures found in “international operations.”

“But there is always room for improvement” stated Holewijn, “For the flying phase of the course, the central European location of the host base restricted the freedom of movement of participants because of the layout and density of local airspace. These challenges were tackled and, in most cases, resolved. However, the integration of Fixed Wing and Rotary Wing assets in a PR scenario as planned in the APROC remains an organisational challenge to be considered in the future. The framework of the exercise is very good but next year in Zaragoza (Spain), we will try to improve on this point.”

Although the United States have a similar course called *Angel Thunder*, the APROC course seems a good and cheaper alternative for European forces and will have a permanent place on the European exercise calendar.

Patrick Smitshoek, Stephan van Geem and Remco Stalenhoef



The French Air Force participated with two AS.555 Fennecs from Orange Air Base



The Swedish Hkp.16A



An Italian E-550 provided overall information for the task forces. In the background are two other participants of Aproc being refuelled at the FARP

APROC: Recovery of Isolated Personnel



Simulating a pilot (ISOP=Isolated Person) as being arrested and checked by the British extraction team

The Defence Helicopter Command at Gilze Rijen Air Base was host to the International Air Centric Personnel Recovery Operatives Course (APROC) from 23 May to 6 June 2018. The course was an initiative by the European Personnel Recovery Centre (EPRC), and was the first time that such a course took place in the Netherlands.

What is Personnel Recovery?

To understand the need, one must first define Personnel Recovery or PR. Nations have a moral obligation to take care of their personnel, but besides, PR can also have a negative impact on operational security, morale of assigned forces and importantly, public opinion.

Course Director LTC. Bart Holewijn gave an example: “If your car flipped over because you slipped on a slippery road, you are essentially isolated because you do not have control over your own situation. One drives up in the winter to northern Sweden, and get into a situation like this,

one can simply die because of the cold, one can freeze to death unless you have taken proper precautions. And this is without having an enemy threat !” To prepare personnel for an event where they get

isolated, they train to *Survive, Evade, Resist, Extract* (SERE), which training consists of tactics, techniques, and procedures that will give isolated personnel the manner to survive in any environment and to evade



British extraction force ready for recovery by a HH101 of the Italian Air Force

capture where such a threat exists. And if they get captured, they are taught to resist exploitation by captors and, if the situation permits, escape captivity to be finally recovered and return with dignity.

Holewijn elaborated: “To do that, we have created the European Personnel Recovery Centre (EPRC) in 2015 with seven participating nations. We would like to help NATO, EU, the various EPRC nations, but also other organisations if necessary to develop concepts and doctrines, and also help them educate and train procedures, so that we get standardisation and thus interoperability. This means that at some point in time, we are going to be much more effective, much more efficient in Personnel Recovery missions. Part of being effective is to be safer and if we all use the same procedures then we can be quicker as well.” The centre focuses on the four phases of Personnel Recovery, Preparation, Planning, Execution and Adaptation. To train for this, the Air Centric Personnel Recovery Course (APROC) was established.

APROC

As Director Holewijn explained: “Air Centric is not because we think that one can only do this kind of mission with helicopters. Absolutely not; one can use infantry vehicles, armoured personnel carriers, submarines or, if necessary, Special Forces. The difference is that if we want to do this kind of mission with air assets, we can only do it in a multinational manner. Look at it as a jigsaw puzzle, all nations have a number of pieces of this puzzle and



French Army Fennec providing overhead cover to the extraction forces that rescued the ISOP in hostile area. Two on-board snipers are using a Heckler & Koch HK416



Royal Navy Merlin landing at Ursel Airfield (Belgium) to pick up an Italian extraction force team in hostile area



Pilot ((ISOP=Isolated Person) marked by a smoke grenade, awaiting rescue by helicopter

collectively we have the whole picture: the advantage of doing it together is it is a lot more efficient and a lot less expensive.”

Therefore, focus of the training is the multinational aspect of it. “All the task forces are completely mixed with people from all the different nations. We focus on the process, in particular the planning process. The key is, if one can plan this kind of mission properly, one can execute it. The execution in the course is very important because then one can see how one’s plan worked out.” The course is a crawl-walk-run process. It starts slowly and simply, but will gradually become more challenging. The course is the only specific course that trains this kind of missions, and attracts great interest as various countries now notice the necessity of these capabilities.



EH101 Mk.413 of the Italian Navy picking up the extraction forces near Ede

The Participants in 2018

In 2018, 577 personnel from 12 countries were deployed to Gilze-Rijen Air Base in the Netherlands. The aircraft deployed for this iteration were F-16 (NLD) and EF-2000 (ITA) in the Fixed Wing Rescue Escort role,

AS-555 (FRA), AH-64 (NLD) and Mi-24 (POL) in the Rotary Wing Rescue Escort role and CH-47 (NLD), AS-332(ESP), NH-90 (FRA), Merlin (GBR), EH-101 (ITA), HH-101 (ITA) and UH-60 (SWE) in the Extraction Vehicle role.

The Aims

Holewijn outlined the two main training audiences: “The primary training audience are inexperienced aircrews, who have never done any kind of mission planning in such a complex environment like this. Secondly, we have experienced pilots who will become Rescue Mission Commander (RMC). We need experienced pilots to do this to keep things safe and to also increase their levels of success. And they led these missions throughout the course. Then the Extraction Force leadership participated in the planning, becoming completely immersed in the process. The Extraction Force is key to the mission.”

The secondary training audience were the Airborne Early Warning (AEW) crews, Rescue Escort (RESCORT) crews and the Extraction Forces personnel. The Airborne Early Warning (AEW) crews had to become proficient as Airborne Mission Coordinators (AMC), wherein the French and NATO E-3F AWACS and a new Italian G550 CAEW (Conformal Airborne Early Warning) provided coordination. The Extraction Forces were honing their



French Navy NH90 returning to Gilze-Rijen air base after an APROC mission



Loadmasters of the Swedish Air Force Black Hawk checking the helicopter

skills; mixing the Extraction Forces in order to standardise their procedures.” Personnel involved in the training included staff, opposing forces and specialists in the

exercise of survival, escape, dodge, resist and evacuation from enemy territory. For every person in the training audience, there were two persons on this course in support.

Restricted airspace

The Dutch airspace posed some unique difficulties as this central European location restricted freedom of movement of the course participants. Three landing zones in Belgium were also part of the training areas. Holewijn elaborated: “We had three pick up zones every day, one for each task force. At the base, we gave them routes that they had to take to get out and then return. This way, we ensured that the task forces never met each other in the air. In the very worst case, they all came back at the very same time around the base. There was an air traffic controller so he managed to keep everything safe at that stage.”

“The routes were about 200 kilometres long, so one could fly the route plus some time on the pickup zone, and some time on the FARP, all within about two hours. In the Netherlands, all the Air Traffic Controllers and airfield towers were very close. 26 missions were planned over 9 flying days by 20 aircraft. Over 140 sorties were flown, and over 300 flight hours were made.”

*Article by Jeroen van Veenendaal,
DutchAviationPhoto.com*



Italian extraction forces recovering an ISOP (isolated person). They provide medical care on board a Royal Navy Merlin transport helicopter while the loadmaster of the Merlin is examining the procedure

Exercise Iniochos 2018

“Sound of freedom” echos over Greece



At the Andravida Air Base, home of the 117th Combat Wing situated on the western coastline of Greece, the FWS or SOT (*Scholeio Oplon Taktikis*) was founded in 1976 as a training centre to provide advanced operational flight training to Greek pilots in aerial combat. The Air Tactics Centre or KEAT (*Kentro Aeropirikis Taktikis*) was created in 1983 and the FWS was incorporated into this new centre, which is now a part of the 117th Combat Wing. The first training course was organised in 1976 and was focused on interception tactics and for, pilots flying the F-4E, F-5E and F-1CG.

Apart from training, the FWS has also designed a three-week helicopter course, of which, the first week is mostly academic and the next two weeks used for practical training. The course focuses on imparting high quality training to crews in complex airborne and ground threat situations.

The Hellenic FWS is responsible for advanced operational flight training during tactical air operations; use of weapons and electronic warfare systems in realistic threat environment; academic training on weapon systems (electronic warfare, air-to-air and air-to-surface tactics); planning and observing test and evaluation of air tactics; supporting small and medium scale exercises of the HAF with specialised personnel; testing of weaponry and electronic warfare systems and supporting flight test programmes.

Conceived in the 1980s, *Iniochos* was first established as an annual Hellenic Air Force small scale air warfare exercise to provide advanced training, in planning and conducting Composite Air Operations (CMAAO). In 2013, the HAF added some operations to Exercise *Iniochos* such as developing interoperability and standardisation for HAF units and allied nations; integration of tactics, techniques and procedures in particular air-land and air-sea operations; use of legacy and modern assets and preparing air crews for future battlefield in a hostile environment.

In 2014, a new concept was introduced, being a medium scale INVITEX exercise, bringing together hundreds of participants at one airfield. The concept focused on face-to-face planning, briefing and debriefing with the opportunity to cooperate and exchange ideas and information about tactics between participants with different levels of experience. It was designed to test all aspects of interoperability during high tempo of operations (intense battle rhythm), with maximum use of limited air assets. Pilots were exposed to multiple threat environments such as anti-access area denial, with the use of long range surface-to-air defence systems, 3rd generation *Red Air* aircraft and TBM (Theatre Ballistic Missiles). During the operations, the aircraft used the Athens Flight Information Region, a specified region of Athens airspace in which a flight information service is provided.

Exercise Iniochos 2018

From 12 to 23 March 2018, the Hellenic Air Force hosted this medium-sized multinational Exercise *Iniochos 2018* at base of the 117 Combat Wing in Andravida, home of the Greek Phantoms. The fourth edition of Exercise *Iniochos* had six participating countries including NATO partners and from the Gulf.

The exercise was divided into three phases, with phase one dedicated to organisation/ preparation, phase two focussing on

deployment of all participants to Andravida AB and phase three showcasing the LIVEX/ Execution Phase. With the deployment of around 76 aircraft, the exercise witnessed participation from Hellenic Air Force, Army, Navy and Special Operations forces, Cyprus National Guard, Italian Air Force, Royal Air Force, United Arab Emirates and the United States of America. The Israeli Air Force joined in later with four F-16Cs on 19 March and flew one mission while the Cyprus National Guard participated with an AW-139 SAR helicopter. With nine operational flying days and more than 1000 sorties flown in thirty waves with missions in the morning, afternoon and some in the evening, the Exercise certainly witnessed much action !

Apart from the Air Force, the Greek Navy and Army also took part in the exercise, with the Navy conducting missions in Northern and Central parts of the Aegean Sea with the support of some ten vessels, including four frigates. The Army's POLIFIMOS exercise was completed with the help of tanks and armoured vehicles, some twenty helicopters and nine special operation teams.

Vincent Martens

The author would like to thank the Greek Air Force's press office and the Andravida Base Commander.



A Greek Mirage 2000BG just moments before touch down



The United Arab Emirates participated with four Mirage 2000-9s from 71 Squadron based at Al Dhafra



Israeli F-16C Barak on touch down



The Greek Air Force has one squadron remaining (338 Mira) flying the F-4E from Andravida



A formation of USAF F-15Es and Greek F-4s, coming home after a sortie



The four Israeli F-16Cs flew only during the VIP day. This aircraft belonged to 117 Squadron based at Ramat David



One of the thirteen participating USAF F-15Es. All these aircraft came from 492nd Squadron at RAF Lakenheath in the United Kingdom



Greek F-16s and F-4s



The RAF participated with its Typhoon FGR4 from 3 Squadron at RAF Coningsby



AW-139 of the Cyprus National Guard flew some SAR missions during the Exercise



This EMB-145AEW was employed as a command post during the exercise



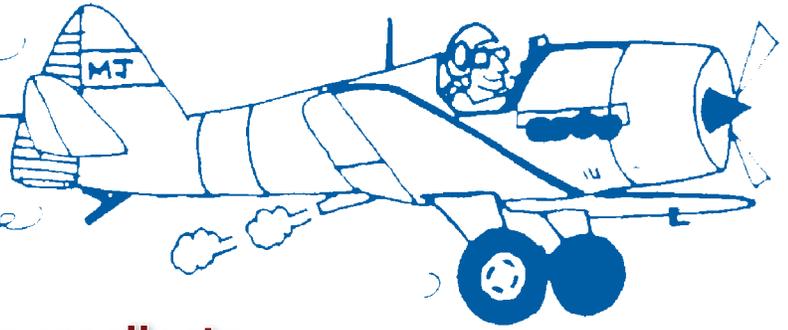
An F-16C from 335 Mira participating in a morning sortie in the background, are three UAE Mirages



An evening mission by a Mirage 2000EG

A report on Iniochos Exercise 'Act with Awareness' appeared in Issue III/2018

Ancient Aviator Anecdotes



Air Vice Marshal Cecil Parker recollects...

Idris Bhai – II

The preceding piece, titled 'Idris Bhai', was penned two and a half years ago in my AAA series, and was much appreciated by ACM and Mrs Latif; in fact, he thereafter signed off his e-mails to me as 'Idris Bhai'! In the recent past, both have passed into history but remain in the memories of those of us who were privileged to have enjoyed their friendship. I was delighted to learn that a commemorative book on this unique couple is being planned and am happy to update the previous article.

In retirement, my wife and I shared a comfortable, relaxed relationship with the Latifs in Hyderabad meeting frequently at functions, homes and kept in regular touch by voice and text. A pot-pourri of some personal recollections follows.

At a Christmas dinner party in our home, ACM Latif reminisced with great feeling about a close air force friend of his in the early 1950s who took him to the annual Christmas midnight carol service, where he greatly enjoyed the singing and the ambience.

When my book 'Airlooms' was published in 2014, I arranged for a complimentary copy to be delivered on his birthday. Both of them were appreciative while Idris Latif was most encouraging by voicing his opinion that, as it contained some nuggets of air force history, it should be in every IAF station library.

A newly bereaved widower (close air force friend and colleague) had arranged a memorial service for his late wife in the church, I am a member of and invited the Latifs who immediately accepted. My wife

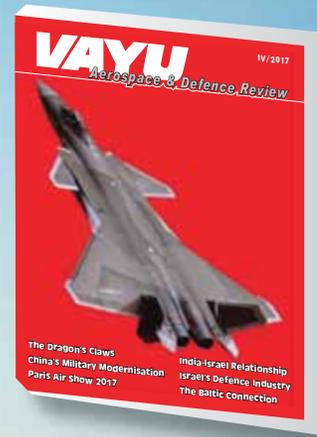
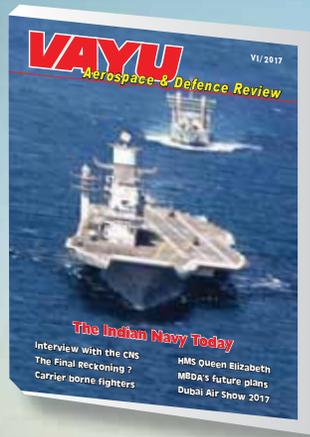


Air Cmde CV Parker, Ms Bilkees Latif, Ms Shirley Parker and ACM IH Latif at Air Force Station Adampur, 1978

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and I were requested to 'look after' them. They required no looking after but after the service, spent a great deal of time walking around the Intach building and putting questions I was hard put to answer! They then both sat quietly for some time in meditation before leaving.

Despite their age, they attended almost every function they were invited to and we admired their remarkable devotion to each other, stamina and patience. I recollect one prolonged Air Force Association meeting when ACM Latif, in his closing address, highlighted some of the difficulties he underwent. He looked directly and fondly at his wife and said, "Dear, I could not have coped without your help and support"; a truly admirable gesture.

At a lunch party in their home, the topic had turned to stress. I shared the story of an air force daughter (whose father Idris knew well) who, at a period of stress in her personal life, found great serenity by meditating alone in a Gurdwara; she just happened to belong to another religion. Mrs Latif related a somewhat similar experience when she visited the Tirumala Temple in Tirupati and expressed the wonder of so many different religious establishments producing a similar outcome regardless of religious identity.

When the Latifs learnt that the Parkers were singing with Hyderabad Choral Society and book reading with The Little Theatre, they demanded to know as to why they had not been invited! They were a wonderful audience sitting in unreserved chairs in the very informal ambience of our performances.

On one of our frequent visits to our daughter and family in London, I met a dapper, spry 90 year old retired officer of the British army named Dick Channer. When he learned that I was from the Indian Air Force, he told me he had met and had lunch on a special occasion with 'the IAF governor of Bombay' in the 1980s and that, if I knew him, I should convey his regards. I did so via a casual e-mail; Idris Latif responded immediately to say that he did not remember the name but did remember the occasion, and that I should kindly reciprocate the good wishes; a gentleman to the core.

In 1980, while at the Farnborough air show in the UK, ACM Latif and I were standing together when a gentleman approached us to greet him. I stepped back to give them privacy but my CAS pulled me back to introduce me to the PAF CAS

who smiled, held out his hand and said he had heard my name. After he left, Idris Latif mentioned that the PAF CAS wanted to know if I was one of the Hunter pilots who had attacked the air base in Peshawar during the 1971 Indo-Pak War. "I told him you had led the strike" said our CAS.

In response to my monthly AAA I would invariably receive an appreciative and encouraging reply from the Latifs. When these became fewer and then stopped, I realised something was amiss. In October 2017 my wife and I were away in London to attend the marriage of our elder grandson. The Latif's son Asgar and our son Kevin have been friends since their student days together at St Stephens. It was through Kevin that he relayed the sad news that Madam Bilkees had passed away. We e-mailed our condolences, but on return were advised against making a personal call as ACM Latif was in no condition to receive visitors. Then last month, we got the news that he too had passed away and joined his wife of 67 years. It is to my regret that, owing to my own indisposition, I was unable to attend either his funeral or the prayer meeting. And so, a well loved, talented couple, who had served both the IAF and the country so proudly, passed into eternity. For my generation, Idris Bhai was a role model par excellence.

Vintage Veteran Voices

Eighty percent of my years in the air force (1951-86) were spent on airfields in various flying assignments. While this gave me great experience of air operations, it also provided me ample opportunities to interact with and learn from personnel of our maintenance and administrative branches without whose support no aircraft could fly. Some of these interactions, regardless of rank or specialisation, developed into friendships of which a few continue in retirement. In my sunset years, it gives me much pleasure to hear from and/ or meet up with air veterans of all generations.

In my April column titled 'Cricket in the Forties', the protagonist was a sergeant of the British army of World War II vintage when I was still in school. Among the responses to this article was one from an ex-corporal of the IAF who had authored a book titled 'The Sergeant's Son' published five years ago; he urged me to read it. By good fortune, a friend had a copy and I found the recounting of his childhood and

early years growing up in an air force family, interesting and educative especially as his (late) father was a contemporary of mine. My only disappointment was that his story stopped just before he himself joined the air force. Well done 'Kalu' you have talent and potential which I hope you will use to continue writing. The written records of air veterans add to the (hi)story of the IAF whose primary resource, regardless of the progress of technology, will always be its 'People'.

Three years ago, my wife and I were at the Hyderabad airport in the wee hours of the morning to catch an international flight. The old immigration form had a small sub-section to indicate 'profession' which I had inadvertently left blank. The serious looking, bespectacled, elderly official sitting behind the desk asked me to fill it in, which I did. After perusing the form and my passport closely, he introduced himself as an ex-flight sergeant of the air force, and said he had heard my name. He smiled, put out his hand, diverted waiting passengers to other counters and personally escorted us through Security introducing me with great pride though we had just met! I appreciated his gesture and thanked him warmly as he left us at the transit lounge. It was a humbling experience and we never met up with this air veteran again.

Not long into retirement, I met a very successful businessman, about five years my junior, who proudly prints 'Ex-Sgt' on his personal letterhead! I learned that he had donated generously for the welfare of air force personnel and their families. From his profits, he had built up a Trust Fund which has a substantial total today. Last month, this air veteran came to seek my help in drafting a suitable letter to the Raksha Mantri offering the contents of his Trust Fund to establish educational facilities for the children of our uniformed martyrs. I do not know the outcome of the offer yet, but my friend, I salute you!

And finally we come to the long retired air officer of the logistics branch, settled in Bengaluru and much my senior – a fact he never lets me forget even now! Last month, I called him up to wish him on his 95th birthday and was delighted to hear him chastise me in colourful language for not having contacted him earlier! Our friendship goes back nearly six decades to when we were both students together at the Defence Services Staff College Wellington in 1960. It was really heartening to hear the cheerful voice of this nonagenarian air veteran who I hope will graduate to centurion status in due course.

25 Years Back

From Vayu Aerospace Review Issue IV/1993

Light Combat Aircraft (LCA) progresses

Following formal sanction issued by the Government on 23 June 1993, the Light Combat Aircraft (LCA) programme will receive some Rs 2200 crore for Phase I development work, or about half of the total sanctioned by the Cabinet which met under the Prime Minister's Chairmanship on 20 April. The financial sanction has immediately generated great revival of activity, with several foreign aerospace companies involved in design and development activities. The Light Combat Aircraft has a tailless compound delta plan form and will have a quadruplex, digital, FBW flight control system. The Indian Air Force presently operates 17 squadrons of MIG-21s which will be phased out by 2005 and the LCA is expected to supplant the MIG-21 in at least 10 squadrons.

Vayudoot merged with Indian Airlines

After just over a decade of existence, the Indian "experiment" with commuter, or third-level or regional air services has been terminated, with merger of the *world's biggest little airline* with Indian Airlines. The Union Cabinet, under chairmanship of the Prime Minister, approved the merger proposal and the Civil Aviation Ministry was directed to take suitable transitional measures and complete the necessary legal formalities. Incorporated in 1981 as a company owned equally by Indian Airlines and Air India, Vayudoot was started with the objective of providing air services to inaccessible areas in the North East. It gradually expanded its services to other regions. Commencing its operations with 20 services initially, Vayudoot was eventually operating 100 services with its fleet of ten

Dornier 228s and an equal number of (Avro) HS-748 aircraft and one Fokker 27 in 1989-90, it was covering 105 stations.

New Air Chief

Air Chief Marshal Swaroop Krishna Kaul took over as Chief of the Air Staff, IAF on 1 August 1993. Previously AOC-in-C Western Air Command, the new CAS has logged 3700 flying hours, was awarded the MVC while commanding No.37 Squadron on Hunters during the December 1971 operations and was later Air Attache with the Indian Embassy in Moscow.

National Aeronautics Policy

The Council of the Aeronautical Society of India has had extensive discussions on the formulation of a National Aeronautics Policy. It was noted that a large number of programmes such as the LCA, ALH, Integrated Missiles which were conceived and planned some time back are presently in advanced stages. It was also noted that tremendous growth is taking place in Civil Aviation operations and the need for new aircraft is increasing significantly, specially in the Asian Region where passenger traffic growth is the highest. It was decided by the Council to form a team, which could go into various aspects of aviation growth and generate a profile of aeronautical activities for the Civil and Military sectors over the next two decades and importantly draft a National Aeronautics Policy.

Women Pilot Officers commissioned

The first 12 women cadets under training at the Air Force Academy, Dundigal (Hyderabad) were commissioned into the IAF on 21 June. Another batch of 18 women cadets are at the AFA and are to graduate in December 1993, also for

postings in the administrative, education and logistic wings. The first women cadets to be trained for flying will be inducted in July 1994, for operating transport aircraft and helicopters.

First JAS 39 Gripen delivered

The first JAS 39 Gripen for the *Flygvapnet* (Swedish Air Force) was handed over to the Defence Material Administration (FMV) during a ceremony at Saab Military Aircraft in Linkoping on 8 June 1993. The JAS 39 Gripen is the first lightweight fighter in the world to combine the interceptor, attack and reconnaissance roles in a single system. It is also the first of a new generation of fighter aircraft already in production. The Gripen reverses the trend towards increasingly large and expensive aircraft system, its architecture making it a programmable aircraft that can be adapted to changed requirements and threat scenarios in the future.

Malaysia orders MiG-29M plus F/A-18

The Royal Malaysian Air Force (RMAF) is to receive 18 MiG-29M air superiority fighters and eight F/A-18 Hornet strike fighters. Malaysia will be the first ASEAN country to acquire Russian combat aircraft and sale of the MiG-29M too represents a major success for the Russians who have of late been bitterly upset by US efforts to upstage even those markets regarded as 'traditional' by the MiG sales organisation.

F-16s for PAF under question

The Government of Pakistan has suspended payments for the purchase of 71 F-16 Fighting Falcons, costing \$1.75 billion, and may well consider scrapping the project if the fighters are not delivered within a specified time. According to Pakistan's Ambassador in the USA, phased payments have continued to be made and upto \$1.4 billion has already been deposited with the manufacturers (General Dynamics, now the ForthWorth-Division of Lockheed). According to reports, eleven of the F-16s built for the PAF are ready at Fort Worth and the other 60 are in various stages of completion.

Tale Spin

Seriously though?



The Times of India has restarted its illustrated serial on 'Agent Rana' which is (reportedly) followed by (reportedly) millions of this newspaper's readers. In fact, readers have been encouraged to suggest new stories and these are now manifest in the national daily, with the 'Season 2' being advertised (see above). Interestingly, in context of the IAF's MMRCA quest, the serial has Agent Rana (good guy) confronting a new enemy (guess who?) and is given air cover by a new avatar : the Gripen !

Shape of aeroplanes to come ?

Yoga is as Yoga does



21 June 2018 was marked as 'International Day of Yoga' and India's Armed Forces participated with full vigour, be they jawans on the Siachen Glacier, sailors on deck of warships sailing the Arabian Sea – or, airmen doing *assan* on the grounds of various stations (including headquarters Southern Air Command at Trivandrum as in photo).

Sense of wellness, the nation is safe !

Our F7, their F-7



Recently launched throughout India, is the newest flagship phone OPPO F7 “for AI-powered selfies, large-screen entertainment”, widely advertised in the country and featuring the nation's heartthrob Deepika Padukone. Contrast that with the neighbour's F-7 fighter, many of which still serve with the *Fiza'ya*, some flown by female pilots.

Who is quicker on the draw ?

Military branches explained

The Army, Navy, and Marines are all brothers in a family. Army is the oldest and mom and dad made all their parenting mistakes with him. The Navy is the middle son, they're the explorers who left home and no one cared. The Marines are the youngest who mom and dad let do whatever they want and they still have an inferiority complex due to their small size.

Well, mom and dad got divorced once all the boys were grown. Mom got remarried to a rich guy and quickly gave birth to a fourth son, the Air Force. Now she loves him the most, showers him with the best toys, and buys him whatever he wants. When they go on vacation they fly first class, stay in 5 star hotels, and enjoy the finest meals. The Air Force is spoiled rotten and his three older brothers have bitter resentment toward him for this.

Finally there's the Coast Guard. The Coast Guard is the rich step dad's son from his first marriage and none of the other brothers think or act like he's part of the family.

That's the best way to explain the various service branches and their internal dynamics to civilians.

Contributed by Air Marshal Anil Chopra (retd.)

Afterburner

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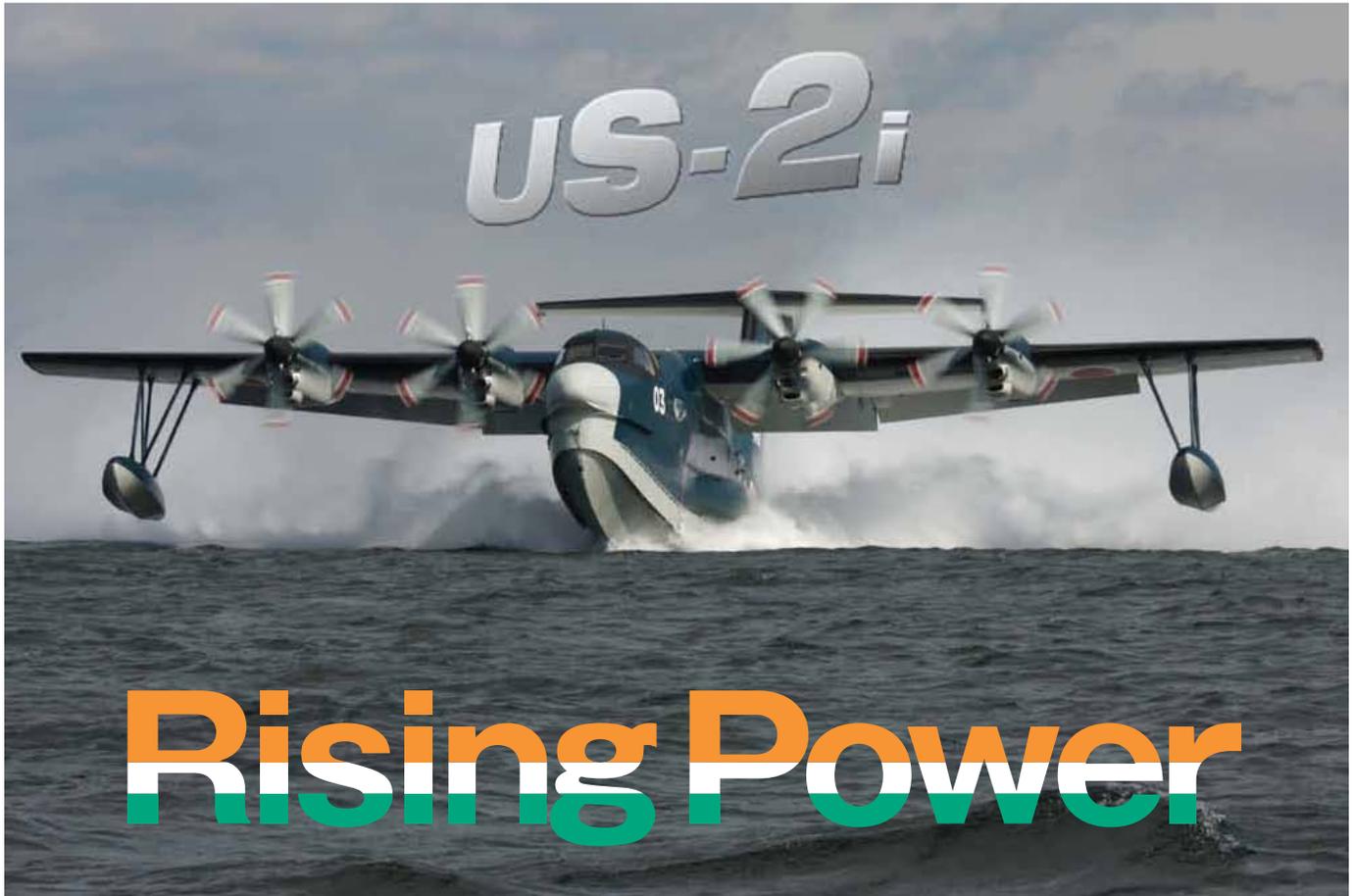
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