

# VAYU

IV/2015

## Aerospace & Defence Review



**Airline of the  
Thunder Dragon**

**Airbus Innovation  
Days 2015**

**Helicopters for India**

**Preserving the (Aerial)  
Lifeline**

**Paris Air Show 2015**

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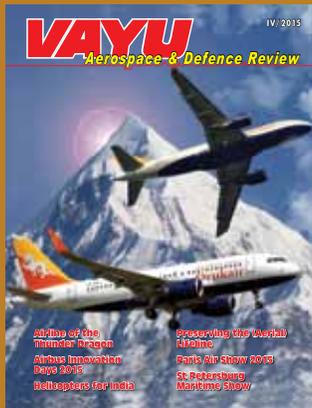
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Artist's dramatic imaging of Drukair Airbus A319s in Bhutan (Painting by Priyanka Joshi)

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### 36 Airline of the Thunder Dragon



Now in its fourth decade, Drukair, airline of the kingdom of Bhutan, began its services modestly with the Dornier 228 light transport aircraft initiating services in January 1983. With steady expansion and building of infrastructure, Drukair went jet with the BAe 146 in 1988 and moved on to the Airbus A319 in 2003, steadily expanding the fleet and air services to various destinations in India and Asia.

### 44 Airbus Innovation Days 2015



Vayu was at Toulouse, France in late May for the 'Airbus Innovation Days' where senior executives of the Company briefed the international media on new products across the spectrum. A tour of the A350XWB Final Assembly Line (FAL) was extremely revealing even as continued success of the A320 Family was celebrated.

### 54 Complete Confidence at Airbus Defence and Space !



As the company recommences deliveries of its A400M heavy airlifter and the C295 continues its sales successes, there is

"complete confidence" in the A400M which was vigorously demonstrated in flight at Le Bourget. Meanwhile, there are several new operators of the C295 medium transport aircraft and the A330 MRTT has also been selected by the Republic of Korea.

### 58 A Huge Wish List



The Indian Armed Forces have an ongoing requirement for new and additional helicopters, which range from light utility to heavy transport types. The requirement for large numbers of reconnaissance & surveillance helicopters for the Army/Air Force is long pending and to this is added the Navy's requirement for similar (but specific role) helicopters. A review and analysis by Angad Singh.

### 65 Preserving the (Aerial) Lifeline



Lt General BS Pawar, former ADG Army Aviation examines on the operational implications of delays in replacing the HAL Cheetah and Chetak fleet, made even more imperative by recent aggressive posturing in the high altitude frontiers with China.

### 71 'Izmir Cougars'



The Turkish Army Aviation is expanding and re-equipping with new helicopter types as it assumes increasing commitments. This update, with photos, is by Carlo Kuit and Paul Kievit.

### 75 Paris Air Show 2015



This Vayu on-the-spot report of the 51st Paris Air Show highlights the key events at Le Bourget in mid-June, even though the 'fizz' seemed to have gone, with non-participation of some major firms and a subdued air display. Nonetheless, the 'biggies' notched impressive business, Airbus with orders of 421 aircraft and Boeing for 331 aircraft. The French 'pride' in their Rafale's string of export successes was echoed by the Sino-Pakistani JF-17 Thunder whose first export order was announced at the Show.

### 99 Maritime Matters in Saint Petersburg



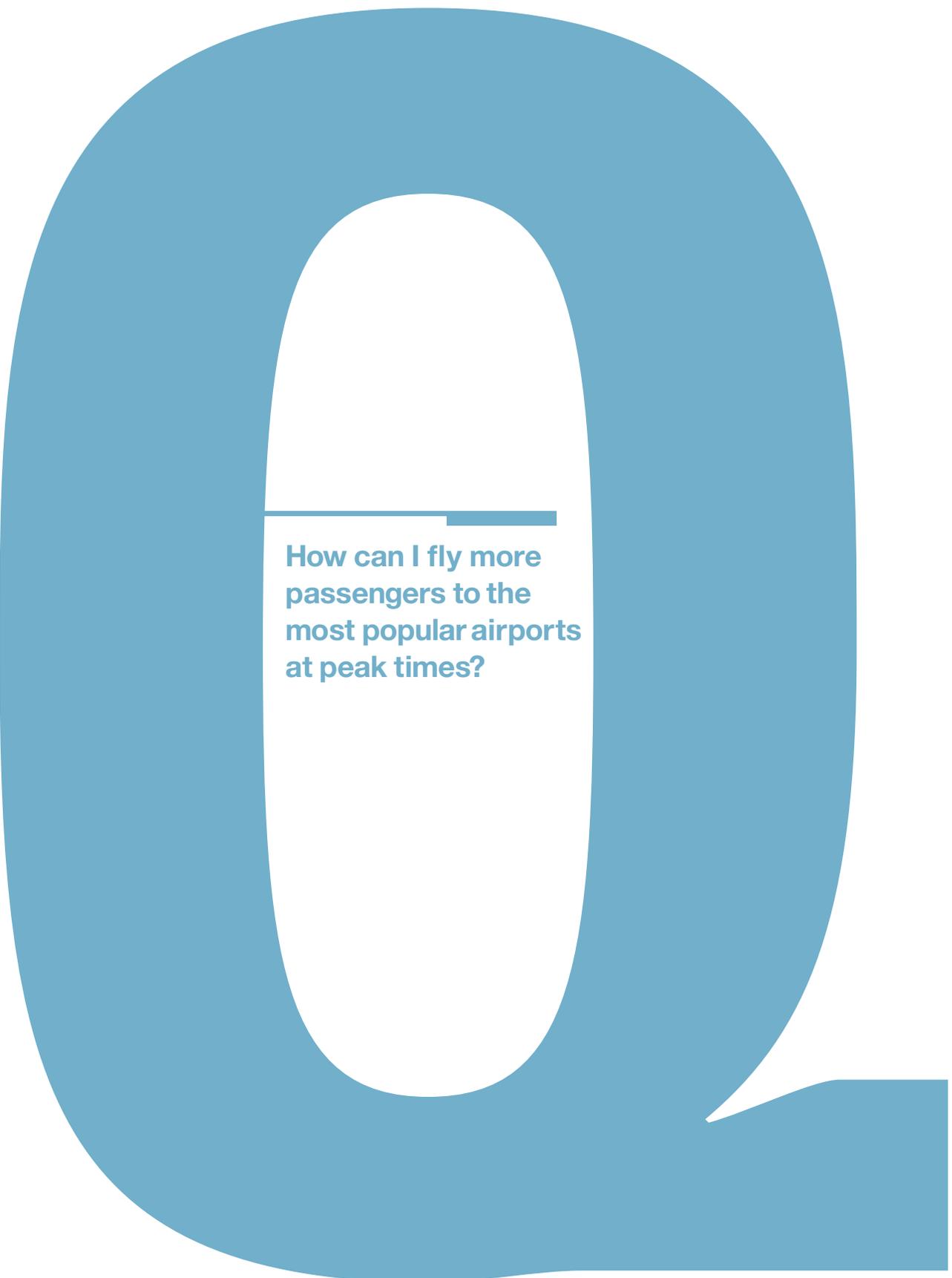
Angad Singh of Vayu was specially invited to Russia and visit Saint Petersburg for the International Maritime Defence Show (IMDS) in early July. His exclusive report highlights that the "Russian shipbuilding industry is keen to work with India". He was also granted rare access to the Admiralty Shipyards who have manufactured over 300 submarines in the past century.

**Also : Naval Aviation Seminar 2015; Fast tracking the AMCA; Tiger in the Sky; The Chinook; Interview with Honeywell's Faizi Mohsini; 'New Horizons' past Pluto.**

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## The Paris Air Show – and Military Aviation’s Future

Paris Air Show 2015 was dominated by the commercial sector, which in terms of market and money is clearly more important than the defense aerospace market. But the simple size of that civilian market is not the most critical consideration. As the aerospace world met in Paris in 2015, national survival is becoming a more pressing concern so the military market remains crucial.

The commercial market is also not the most innovative part of the aviation business; military technology still plays a central role in innovation. This can be seen in many areas, such as materials, propulsion, avionics, electronics, and security. Innovations in the military sector clearly influence the commercial side as well.

This decade will see fundamental transformations as the F-35 becomes a key element of US and allied airpower. The F-35 is at the heart of change for a very simple reason – it is a revolutionary platform, and when considered in terms of its fleet impact, even more so. The F-35 Lightning II has a revolutionary sensor fusion cockpit that makes it effective in air-to-air, air-to-ground and electronic warfare. Allied and US combat pilots will evolve and share new tactics and training, and over time this will drive changes that leaders must make for effective command and control to fight future battles.

And there is the European cargo plane, the A400M : in spite of the recent tragic crash this aircraft is redefining how European air forces are addressing the role of air lift within their overall approach to operations ... in other words, the A400M will provide a strategic capability for France, whereby interventions can occur directly from France without having to preposition forces in theatre.

With regard to the fighter market, there is substantial business to be generated in modernising legacy fighters to work with the F-35. There is a substantial global fighter market beyond the current mainstream offerings as well. ... the “Gripen Model” is worth noting. First, the aircraft has been designed from the ground up to be supportable. Second, the Gripen has been shaped in an environment in the post-Cold War period where interoperability with NATO and an ability to work in multinational coalitions and conditions has been highlighted. Sweden has emphasised Gripen as a fully interoperable aircraft. Third, the Gripen has been designed from the beginning to be a very flexible aircraft. Fourth, the aircraft is designed to work as well in a variety of packages. Thailand purchased the Gripen and then Saab 340AEW and the ground control suite.

The Gripen case highlights that the market for manned fighters is much broader than Rafales, Eurofighters or F-35s, and nature abhors a vacuum.

The Chinese and the Russians are ramping up their global assertiveness and activity as well. They want to expand their client relationships to sustain and support their global agendas, as well as their aerospace industries. It is quite likely that the Chinese and Russians will build and display aircraft which will be impressive at air shows (the JF-17 Thunder at Le Bourget is a case in point)

as the electronics and fusion of data becomes a key discriminator in operations and will not be visible at airshows – engines and turning ratios will be. Here the Russians and Chinese will seek to demonstrate their competitiveness.

Clearly, both China and Russia will seek Third World sales to augment their aerospace industry. For Russia, India remains a key ally. Yet the recent Rafale deal between France and India may pose a significant threat to that relationship. In April, India decided to buy 36 Rafales directly from the Dassault factory. By buying 36 aircraft directly through a government-to-government agreement, the Indian Air Force will get combat-ready aircraft much more rapidly than via any other means and at a lower cost. Simply put, one can project the cost of an aircraft coming off a mature production line – projecting the cost of aircraft not yet coming off of a new production line, is alchemy.

As India flies Rafales and Indian industry works with the French to sustain the aircraft, a new era in Indian military aerospace could open up, one where the Indians may look at the Russian contribution – and pause. Such a pause could have significant impact on the global fighter market.

In short, we are facing a decade of significant innovation. The reality of military aviation is that there is always a reactive enemy and the dynamics of change are fluid. And military aviation is so inextricably intertwined with overall defense capabilities, that the success or failures of those forces are the ultimate market indicator.

*Robbin Laird*

*Extracts from the ‘Second Line of Defence’ website*

## Need for transparency

Transparency was the victim when Modi, visiting Paris this April, junked a three-year selection process for fighter aircraft. He instead placed an order for 36 ready-made aircraft from the same company that had won the original tender for 126 fighters but was not yielding ground on the transfer of technology. When former Defence Minister AK Antony questioned the rationale behind Modi’s decision, he might have been trying to retrieve the lost political ground in his party after criticising the Congress government in Kerala. But that should not detract from the larger question he has raised — while it is sometimes politically expedient to change the previous government’s decisions, the prime mover for this deal was the politically non-partisan IAF which wanted only 18 ready-made fighters and the remaining to be made in India.

The junking of the tender means the Modi government might have taken the first step in ending the practice begun by the UPA government of introducing competition in defence purchases. The only flaw was they took a long time to decide because losers would prevent finalisation of the contract by persuading opposition politicians to point out flaws. Antony was too caring about his image to call their bluff. The UPA could have finalised the tender during its tenure but a full year was lost as a diffident Antony ordered a re-examination of the entire deal after BJP veteran Yashwant Sinha raised questions. With Modi in office, Sinha no longer comments on the reworking of the deal.



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Another explanation—that the IAF urgently needs the aircraft and cannot wait for an indeterminate length of time — is deceptive because the delivery schedule is likely to be the same. Only there is no certainty about when more aircraft will be inducted. The only rational explanation, that this got India out of a diplomatic cul-de-sac because it was unable to honour earlier commitments to France, would be a heavy price to pay if the practice of tenders in defence purchases and their accent on technology transfer is buried for good.

From *The Tribune*

## Take 'Act East' further

It is evident that national security adviser Ajit Doval's visit to Myanmar is an imposed necessity following Naypyidaw's unhappiness at the way Indians handled the communications and media strategy after the unilateral military action to hit camps of the Naga insurgents' Khaplang faction on the Myanmar side of the border.

The 9 June military action was noted for its precision and outstanding operational success. However, the political crowing that followed among the ministerial colleagues of Prime Minister Narendra Modi angered not just Pakistan but also upset friendly Myanmar. Given the background, it was necessary to soothe ruffled feelings in that country.

Restoring equilibrium will be crucial to India's effort at dealing with various insurgent groups in the Northeast. The declared objective of the NSA's visit is to coordinate security-related actions with the Myanmar authorities for future actions against the NSCN (Khaplang), and the Paresh Barua-led Ulfa. These two groups currently believed to nestle somewhere in Myanmar.

For years the Northeast rebels have operated out of Myanmar, Bhutan and Bangladesh, and have slipped back into these territories when confronted with assault from the Indian side. For a broader Indian effort to deal with them, it is required that we coordinate with the authorities in these countries on a close and sustained basis. Joint operations with the intelligence and security units of our neighbours have indeed been carried out in the past to round up the insurgents.

The NSA's trip therefore comes not a day too soon. Indeed, the dividend would have been the greater had such a consultation taken place before 9 June. Sharing credit with neighbours when it is due can seldom be a bad idea. Mr Doval could profitably follow up his Myanmar visit with trips to Bhutan and Bangladesh as well. This would send a salutary message to the rebels, their leaders, and handlers, among whom are suspected to be elements of the Myanmar side as well as the Chinese Army, going by the understanding of Indian intelligence agencies.

The Indian thinking to follow up quickly on the success of the 9 June military action against the NSCN (Khaplang) is both logical and sound. Apart from the diplomacy and the coordination needed with neighbours, gearing up for the action within our own territory must also be done with despatch. The Motor Vehicles Agreement that was signed in Thimphu between India, Bhutan, Myanmar and Nepal will no doubt also help

to tackle insurgencies, and arms and drugs smuggling gangs, besides aiding the broader cause of economic connectivity. When passenger and goods vehicles cross borders seamlessly, government cooperation is automatically facilitated. That's a big plus.

From *The Asian Age*

## Manner of remembrance

The government is reportedly making massive plans to mark the 50th Anniversary of the India-Pakistan 1965 war. Details of a "carnival" that the ministry of defence has asked the three services to put up on Rajpath are still being worked out, but going by this government's fascination for setting records, it seems safe to assume that it will put into shade any war commemoration that India has so far witnessed. Nations across the world do, in one way or another, commemorate their military victories, and honour soldiers who sacrificed their lives for their country. In May this year, the World War II Allies — the US, France, the UK, and separately Russia — marked the 70th anniversary of Germany's surrender. The leaders constantly stressed that it was not the defeat of one country at the hands of others that was being commemorated, but the defeat of Nazism and fascism. The war ended decades of hostility between Germany and its neighbours, and could even be said to have paved the way for a European Union.

In South Asia, where India and Pakistan have remained hostile, barring a few unsuccessful and shortlived attempts to make peace, a month of gung-ho events to celebrate a war fought with a neighbour 50 years ago does not seem like a good idea.

Given the current no-talk atmosphere between the two countries, recent statements made by ministers on sending "a message to Pakistan" via Myanmar, and tensions flaring along the Line of Control repeatedly, fears that such a long and festive calendar of events can only have a negative impact on India-Pakistan ties are justified. The event, positioning the outcome of the 1965 war as a "victory", is already being viewed in Pakistan with concern. Pro-democracy lobbies in that country see the planned Indian celebration as something that will reinforce anti-Pakistan sentiments in India, which in turn will provide more oxygen to anti-India lobbies on their side. It may be that the government has decided to go all out on the anniversary as a way to blunt the mounting criticism from servicemen over its failure to implement the 'One Rank, One Pension' promise. But that political purpose too may not be achieved — ex-servicemen's associations have already declared they will boycott the events.

Certainly, let there be a commemorative event for the 1965 war. India must not forget the bravery of the soldiers who sacrificed their lives defending the nation. But it would be best if, instead of playing on victors and vanquished through a carnival-like celebration, the remembrance could stress that wars are a sad business, should be fought reluctantly if at all, and are definitely not the best way to settle differences with other countries.

From *The Indian Express*

# Know thine enemy

**For China, air and space are high-priority areas**



Almost unnoticed and barely reported, except in some national dailies, was news in the website of the People's Liberation Army indicating that China's aviation industry is working on a new short-takeoff, vertical-landing aircraft that is "needed for an important role in the Chinese navy's future operations" and that research and development of the fighter aircraft's engine and other components have already begun. Coming barely a day prior to the Indian prime minister's departure to China on a historic visit, the significance of the timing of this report, whilst being of peripheral interest to the larger diplomatic and security community, has certainly raised interesting questions in the minds of those in India on whose shoulders rests the future of aeronautics.

It is by now well known that the Chinese are adept at attempting to unsettle our leaderships on the eve of significant events by indulging in proxy mind games, or worse, provocative actions. Recall the fact that when Atal Bihari Vajpayee, the then foreign minister, was on a landmark

visit to China, his hosts 'embarrassed' him by invading Vietnam. More recently, it was during the visit of the Chinese president, Xi Jinping, to India that armed soldiers of the PLA intruded into the disputed region of Aksai Chin. Professor Bharat Karnad narrates an interesting facet of Prime Minister Narendra Modi's ready wit displayed at the time. When faced with this embarrassment, the prime minister turned the tables by asking President Xi if the PLA dominated the political leadership as it does in Pakistan. Clearly put on the defensive, President Xi professed ignorance and, not surprisingly, the PLA elements retreated the next day.

Having been at the receiving end of this diplomatic battle of wits, the Chinese may well have considered it prudent to switch from diplomatic turf to the aeronautical and technological landscape for their mind games in anticipation of the prime minister's visit. This is one area where they are sure-footed and they perceive their guest to be on soft ground. It is, after all, no secret that Indian aeronautics is fragmented and

somewhat in disarray. The Chinese were no doubt aware of the contents of the report of the comptroller and auditor general of India on the indigenous light combat aircraft that was tabled in the Rajya Sabha only weeks earlier. The CAG had some serious observations to make on various aspects of the management and performance of the programme, not the least with the initial operational clearance being accorded with many waivers and concessions from the requirements, deficiencies in electronic warfare capabilities, and indigenous content being a low 35 per cent, and all this after a toil of some 30 years.

One can conjure some plausible reasons why such a non-traditional approach would appeal to the wily Chinese. For one, the most reported and debated aspect of the prime minister's recent visit to France was his bold announcement of a government-to-government decision to procure 36 Rafale fighters from France in fly-away condition, when he emphasised India's urgent operational need and, hence, fast delivery. Here was possibly an opportunity for China to discreetly drive home to their guest their superiority in the field of military aeronautics and the attendant strategic and operational autonomy that this bestows on them, against India's continued dependence on others for such basic operational tools as trainer and combat aircraft.

Also, knowing full well that Modi is a zealous believer in technology as the driver of growth and prosperity and recalling what a previous Indian president, APJ Abdul Kalam, in his scientist avatar, had said about aeronautics being the most significant technological influence of modern times which empowers the nation with strength for international partnership and is a major tool for economic development, the Chinese were perhaps subtly conveying that they were more wedded to the Kalam dictum than his own country!

Added to this is their awareness of the prime minister's laudable campaign of 'Making in India' in India. Here again, the message perhaps being conveyed was that indigenous manufacture in aeronautics is not an activity that can be generated with the flick of a switch or the coining of a slogan. It needs a broad-based and sound ecosystem that can only be born out of a strategic vision, followed by a meticulous plan that needs determined and undivided implementation. Indeed, in the lexicon of

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Chinese aeronautics, the phrase ‘aeronautical patriotism’ is increasingly been heard, as they believe that aeronautics is one of modern day’s tickets to big power status to which they believe they have a divine right.

And finally, nothing that China ever does is divorced from its long-term strategic interests. The Chinese are deeply conscious of the fact that for the security and success of their so-called 21st-Century Maritime Silk Route Economic Belt, which would stretch from South China to Southeast Asia and beyond, air-power dominance at sea will be a crucial element. Towards this, China is currently operationalising its first aircraft carrier, the CNS *Liaoning*, and developing a carrier-borne fighter, Shenyang J-15, alongside. The PLA article acknowledges that it will take considerable time before more such carriers are put into operation - hence the justification for a STOVL aircraft that will be able to operate from smaller ships. So the subtle message to those maritime strategists who debate Indian Ocean choke points and the dominance of the Indian Ocean region is that China will be ready.

Indeed, on the larger security canvas, the message that the Chinese were perhaps conveying is that a sound capability in design and manufacture in aeronautics is not just a national security imperative, but also a driver of technology and demonstrator of technological prowess of a nation, and that, in this endeavour, they are well on their way to challenging the only super power. The message that an ambitious aeronautical challenge is in the offing for their latest (and grossly expensive) STOVL Lockheed

Martin F-35B will also not be lost to the American security establishment.

Grandstanding this may be, but, in the field of aeronautics, the Chinese have indeed walked the talk. This writer recalls a visit to a People’s Liberation Army Air Force base in the early 1990s as part of the delegation of the then defence minister, Sharad Pawar. At the time, the defence minister was proudly shown their jet trainer, the JJ-2, and there was a tepid flying display by the J-7, both Chinese derivatives of the erstwhile Soviet MiG-15 and MiG-21 respectively. Indeed, when the defence minister later asked this writer for general impressions, having flown both these variants in the erstwhile USSR, all one could conclude was that the PLAAF had a very long way to go in aeronautics.

That was then. In the intervening years, China has used every trick in the book for advancing in military aeronautics. From licence production to reverse engineering to stealing technology, they have rapidly moved up the capability chain. Today, they have two fifth generation fighter programmes, the Chengdu J-20 and Shenyang J-31, currently under development and testing. Further, the Shenyang J-15 carrier-borne fighter is under development, with the latest STOVL now joining the list. On the civil aviation front, for commercial reasons, they are even more aggressive. The message that China is investing heavily in aeronautics is therefore deliberate, because aeronautics has been recognised as one crucial pillar on which their strategic security interests rest.

Speaking to defence officials on an inspection visit to the air force headquarters

in Beijing last year, President Xi Jinping, who is also the chairman of the central military commission, called for a stronger air force and urged the air force to adopt an integrated air and space defence capability not only to boost the country’s military power but also to offer balanced strength in defensive and offensive operations. Clearly, the Chinese authorities have identified air and space to be high-priority areas not just from the military and security point of view, but also towards making a strategic plan of developing military technology, building a sound military industrial base and to use the export of military hardware not just for financing their own military expenditure, but also to further their economic, geo-political and diplomatic interests.

They are hence working towards a strategic plan in aeronautics, the vision of which talks of developing aeronautics with Chinese characteristics, which are broadly defined as technological progress, self-reliant advancement, aeronautical patriotism and priority to civil over military aeronautics. As in the case of their human space programme, so in aeronautics, the strategy towards this vision is guided and directed by the highest political leadership. Little surprise then that China has invested enormous resources, created a huge manpower base, which, in turn, has resulted in a dramatic growth in their aeronautical ecosystem in the last 15 years.

It is unlikely that the prime minister’s packed agenda would have permitted the Chinese side to expose his delegation to any of this directly, but it can hardly be denied that above everything on the agenda of discussion and deliberation for the delegations was the shadow of rising Chinese military power in all its dimensions, underpinned by the country’s phenomenal progress in aeronautics.

On returning from his successful overseas trips, when he does find some moments for refecation, the prime minister may be tempted to open the ancient Chinese military treatise, *The Art of War*, attributed to Sun Tzu, a military general, strategist and philosopher, wherein he advises, “Know your enemy and know yourself and you can fight a hundred battles without disaster”. The prime minister may well consider choosing the field of aeronautics to put the wisdom of Sun Tzu to test.

*Air Marshal Brijesh D. Jayal (retd.)*

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## In defence of our defenders

### Delay in OROP implementation could affect morale of soldiers

The fast for justice being held by India's ex-servicemen at Jantar Mantar in New Delhi and in over 50 other cities is continuing. The protesting veterans are demanding the rollout of the *One Rank One Pension* (OROP) scheme, which has not been honoured by successive governments.

The quest of the veterans for OROP, a term coined by a Parliamentary committee headed by KP Singh Deo in 1983, goes back several decades. In 1973, while implementing the recommendations of the Third Pay Commission, the government reduced the pensions of armed forces personnel from 73% of the last pay drawn to 50%.

The concept of 'military pension', designed to provide monetary compensation for truncated service due to early retirement, was diluted. Soldiers, sailors and airmen opt to retire between 35 and 37 years of age when most of their family responsibilities are still ahead of them, while most of the officers retire at the age of 54.

Despite their discipline, dedication and talent, they find it difficult to get jobs. Personnel in the Central Armed Police Forces (CAPFs) like the BSF, CRPF, ITBP, CISF, SSB and the state police retire between the ages of 57 and 60 years. The Fifth Pay Commission had recommended that armed forces personnel be laterally transferred to the CAPFs after five to seven years of service.

This would enable the armed forces to maintain a young profile and reduce the pension bill of the government. However, the government of the day lacked the political will to push through this win-win measure.

Officers of the CAPFs and all other civilian officers (IAS, IFS, IPS, IRS) retire at the age of 60 years, while only 0.84% of armed forces officers make it to the rank of major general, who retire at 58. A still smaller number are lieutenant general and retire at 60. Incidentally, every IAS officer is routinely promoted to the position of joint secretary, considered equal to a major general.

The national consensus favours the implementation of OROP for the armed



forces. The Congress-led UPA government gave a commitment to implement OROP and even allotted a sum of Rs 500 crore in the interim budget for FY 2014-15. Union finance minister Arun Jaitley doubled it to Rs1,000 crore when he presented the budget in July 2014.

Prime Minister Narendra Modi unequivocally promised to implement OROP while addressing the veterans at an election rally at Rewari in September 2013. However, in a surprise to 25 lakh veterans and three lakh widows, the prime minister recently said that it was a “complex” issue and that there were several definitions of OROP.

Veterans, however, agree to an unambiguous definition of OROP. In February 2014, the following definition of OROP was approved in a meeting chaired by the defence minister: “OROP implies that uniform pension be paid to the armed forces personnel retiring in the same rank with the same length of service, irrespective of their date of retirement and any future enhancement in the rates of pension be automatically passed on to the past pensioners.”

The recommendations made by the defence minister, in consultation with the chiefs of the armed forces and the veterans, are reportedly being opposed by the finance

ministry on the grounds that the annual cost of Rs 8,400 crore is “unaffordable” and that a similar demand may spring from the CAPFs. It appears that the issue might be referred to the Seventh Pay Commission for a ‘holistic’ overview.

Often, the personnel in CAPFs serve much longer than the ones in the armed forces, which means that they earn more increments and therefore must not be equated for pension. The additional expenditure on OROP is less than 10% of the pension bill of Rs 88,521 crore for 2015-16, which is much less than other subsidies.

Hence, the recommendation of referring the issue to the Seventh Pay Commission is seen as an insidious plot to scuttle the OROP scheme.

Civil-military relations in India have a troubled past and any attempt to indefinitely delay a long-pending welfare measure will only aggravate the situation. As it is, the serving and retired members of the armed forces feel wronged at having been deprived of their dues in several cases in the past, including the ‘rank pay’ case, 36 pending anomalies in the implementation of the awards of the Fifth and the Sixth Pay Commissions, and the withholding of non-functional upgradation (NFU) of pay for officers denied promotion for lack of vacancies.

Also, the ministry of defence has repeatedly appealed against the court judgements that favour the veterans and soldiers’ widows—often contesting the award of paltry sums, even as the cost of litigation exceeds the amount at stake.

The government must take note of the impact of the prolonged delay in the implementation of OROP on morale—not only of the veterans, but also of the serving soldiers; it may also affect many second or third generation soldiers who are witness to the sad plight of those before them.

The day a soldier takes his oath, he undertakes to selflessly serve his nation and even make the supreme sacrifice when necessary. He swears allegiance to *Naam, Namak, Nishaan* and has never faltered. In turn, the nation’s covenant is that no effort will be spared to look after his welfare and that of his family.

Addressing the United States servicemen some years ago, US President Barack Obama said, “... when you take off the uniform, we will serve you as well as you’ve served us—because no one who fights for this country should have to fight for a job, or a roof over their heads, or the care that they need when they come home.”

Indian veterans also need to be given a similar assurance, but one that is credible.

**Brig. Gurmeet Kanwal (retd.)**





# VAYU

## 4 Aerospace

### Indian excellence in international aviation journalism!

2015 marks the 41<sup>st</sup> year of Vayu and these four decades have been appropriately matched by the enormous enthusiasm of readers, worldwide, for this journal. Recognising Vayu's excellence in aerospace journalism, have been numerous awards bestowed upon it at the international arena in the past – and this continues !

India's oldest defence journal, the *Vayu Aerospace and Defence Review*, published in New Delhi by The Society for Aerospace Studies, provided stellar representation for India at the annual Aerospace Media Awards ceremony, held this year at the Paris Air Show (17-21 June 2015). Indeed, *Vayu* was the only Asian publication shortlisted for the prestigious awards, standing alongside giants of the aviation journalism world including *Flight International*, *Aviation Week*, *Defense News*, and *The Wall Street Journal*.

*Vayu* was nominated in four categories this year. Angad Singh was nominated as 'Best Young Journalist,' and also for the prestigious 'Bill Gunston Technology Writer of the Year' award, for his article on Gallium Nitride semiconductors. In addition, his photograph of an Indian Navy Tupolev Tu-142M long-range maritime patrol aircraft at INS *Rajali* was shortlisted along with five others for the 'Best Aviation Image' award.

*Vayu's* Founding Editor, Pushpindar Singh, received special recognition for his contribution to aerospace publishing over a period of more than four decades, winning the 'Lifetime Achievement Award.'



The winners across various categories (including Pushpindar Singh) at the entrance of Aero Club de France, Paris.

# nominated for Media Awards

## Congratulations !

Vayu was delighted to receive fan mail from its readers worldwide but specially letters of congratulation from Chief of the Naval Staff, Indian Navy and the Director General Indian Coast Guard.



*The nominated picture of IN  
Tupolev Tu-142M by Angad Singh*

As Admiral RK Dhowan, Chief of the Naval Staff from the Indian Navy wrote 'At the outset, let me congratulate you and your team at Vayu Aerospace on your publication's stellar achievement at the Paris Air Show. The recognition

of your contribution on the international stage only reaffirms the commitment and quality of the work being undertaken.

I am confident that Vayu Aerospace and Defence Review will continue to provide valuable insights into contemporary issues related to technology, aerospace and procurement of hardware in the coming years that would be of interest to readers in the military and other walks of life. I wish the 'Team Vayu Aerospace and Defence Review' the very best in all its future endeavours'.

In his letter, Vice Admiral HCS Bisht, Director General Indian Coast Guard wrote 'I am delighted to learn about your journal's nomination in four categories in the Paris Air Show 2015 and conferring of lifetime achievement award to Mr Pushpindar Singh. I take this opportunity to congratulate Mr Pushpindar Singh, Mr Angad Singh and 'Team Vayu' for this recognition.

For an Indian enterprise to have flourished in the highly competitive and vastly global Defence Publishing business speaks volumes about the quality of its product and dedication of its staff. The recognition achieved by the magazine in the international arena is truly well deserved.

The Indian Coast Guard family joins me in congratulating 'Vayu Aerospace & Defence Review' on this singular and momentous achievement. We further wish you and your team years of continued excellence.'

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### DAC clears new defence programmes



On 14 July the defence acquisitions council (DAC), chaired by Defence Minister Manohar Parrikar, gave clearance to pending projects amounting to some Rs 29,000 crore (\$ 4.5 billion) in total, including additional Boeing P-8Is and the upgradation of air defence guns. Also, approved were a host of programmes ranging from warship combat management systems and artillery bimodular charge systems to multi-spectrum camouflage nets and microlights for NCC cadets.

428 guns will reportedly be involved in replacement of obsolete air defence artillery guns of the Army (L70 and ZU 23) worth Rs 16,900 crore, while acquisition of another four Boeing P-8I long-range maritime patrol aircraft for the Navy will cost Rs 4,380 crore.

Under the 'Buy & Make India' project, private sector companies including Tatas, Punj Llyod and Bharat Forge are said to be shortlisted for the gun upgradation programme for which a tender is to be issued, involving import of an initial quantity with the rest to be made in India in a joint venture with the foreign collaborator.

### Airbus offers assistance with LCA Mk.II



Minister of State for Defence Rao Inderjit Singh confirmed at the Paris Air Show, held in June 2015, that the European Group Airbus had offered assistance in the development and production of the LCA Mk.II fighter. He indicated that discussions,

albeit of a preliminary nature, have already taken place between Airbus and Indian officials. Speaking more broadly, he said, "PM Narendra Modi has already invited global majors to invest in industrial projects in India and if Airbus can create something like 'Airbus Asia' in India as a manufacturing base, the government will do its best to facilitate the project."

Although the Tejas Mk.I has achieved IOC and is currently in series production at HAL Bangalore, the LCA Mk.II would address inherent shortcomings in the Tejas, which prevent it from meeting the IAF Air Staff Requirements. The LCA Mk.II variant is intended to incorporate the more powerful GE F414 engine and a host of aerodynamic and avionics improvements required to meet the Indian Air Force's ASR.

Asked if the timeline for development of the LCA Mk.II could be compressed, Rao Inderjit Singh pointed out that aircraft development is a complex process, and the goal at present was to at least meet the stated deadline of 2021 for the LCA Mk.II.

### IAF requests 48 additional Mi-17V5 helicopters



The Indian Air Force has mooted a \$1.1 billion proposal to acquire 48 Mil Mi-17V5 medium lift multirole helicopters, in addition to the 151 already contracted for. The IAF proposal also calls for establishment of local maintenance facilities and the usual offset obligations of 30 per cent. These helicopters will replace the ageing Mi-8 variants currently operated by the IAF, which are expected to be phased out progressively over the next few years, giving the Air Force a standard medium-lift rotorcraft fleet of Mi-17V5s.

The Indian government has a total of 151 Mi-17V5s contracted for, with at least 140 of these already delivered after being assembled from kits at No. 3 Base Repair Dept (3 BRD) at Chandigarh.



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## Sweden offers India collaboration in defence production



Sweden has offered to collaborate with India on production of light combat aircraft along with state-of-the-art submarines as part of the 'Make-in-India' initiative.

Discussions were reportedly held in this regard, during Swedish Defence Minister Peter Hultqvist's visit to India in early June 2015, with his counterpart Manohar Parrikar during which a range of issues were addressed. According to an official statement, "the issue of participation of Swedish firms in defence manufacturing in India under the 'Make-in-India' initiative was also reviewed by both sides, which included possible collaboration and manufacture of light combat aircraft as also submarines".



On the following day, Mr Hultqvist visited Bangalore and spent time at the facilities of Hindustan Aeronautics Limited and Bharat Electronics Limited. According to observers, the company Saab, whose JAS-39 Gripen is considered as one of the most advanced multirole fighters extant, would propose a government-to-government (G2G) relationship should India clear induction of this type into the Indian Air Force and its quantity production in the country.

The Swedish Defence Minister was in India just two weeks after President Pranab Mukherjee had visited Sweden on a state visit from 31 May to 2 June 2015, seen in the photo with King Carl XVI Gustaf and Queen Silvia.

## Sweden backs India's MTCR entry

As a key member of the Missile Technology Control Regime (MTCR), Sweden has backed India's bid for entry into the group of countries that seek to prevent the proliferation of missile and unmanned aerial vehicle technology. The information was reportedly conveyed to President Pranab Mukherjee visiting Sweden in June. The Swedish Prime Minister Stefan Lofven also shared the view that in a reformed United Nations Security Council, Sweden believed that India had credentials to be a part of this. "In view of the size as well as speed at which it was growing, India is a natural claimant for being a part of the UNSC," Lofven was quoted by Secretary (West) in the Ministry of External Affairs Navtej S. Sarna.

## 'Combat' Hawks for IAF



Hindustan Aeronautics Ltd has signed a memorandum of Understanding (MoU) with BAE Systems for upgrade of Indian Air Force (IAF) Hawk Mk 132 Advanced Jet Trainers. The MoU also includes development of a 'combat Hawk' for both the IAF and export markets. HAL sources have stated that the MoU includes maintenance aspects and cooperation for supporting the IAF's Hawk and Jaguar inventory. As Mr T Suvarna Raju, HAL's CMD stated: "It is important that both the teams finalise the scope of Hawk Mk 132 upgrades and other work packages under the MoU agreement at the earliest." The MoU was signed by MN Shrinath, HAL's General Manager (Aircraft) and BAE Systems' Steve Timms, Managing Director (Defence Information, Training and Services).

Hawk Mk 132s are currently being produced under licence in India by HAL, following manufacture of an initial batch of 24 in the UK, the first of which were delivered in November 2007. These were followed by a batch of 42 HAL-assembled Hawks, the first handed over on 14 August 2008 and the last in 2012. A further contract was signed in July 2010 for an additional 57 Hawks for the IAF and Indian Navy of which HAL has produced 25 to date and expects to have completed all 40 by 2017. Meanwhile, 11 Hawk Mk.132s have been delivered to the Indian Navy, the remaining six due for delivery in 2016-17.

## Indian Air Chief visits South Africa



*Seen in an earlier visit to India, Lieutenant General Fabian Zimpane (Zakes) Msimang, Chief of the South African Air Force, with Air Chief Marshal Arup Raha at Air Headquarters, New Delhi.*

Air Chief Marshal Arup Raha made a four-day visit to South Africa in mid-July 2015 on the invitation of Lieutenant General FZ Msimang, Chief of Air Force, South African Air Force. In recent years, there have been close and frequent contacts at political and military levels between the two countries which are members of the tri-lateral initiative IBSA (India, Brazil and South Africa). Air Chief Marshal Arup Raha's visit to South Africa "would further boost bilateral relations between the two Air Forces and provide impetus to the 'Make in India' initiative".



During his visit, Air Chief Marshal Raha reportedly held talks with South Africa's senior military leadership and discussed a wide range of bilateral issues on enhancing defence cooperation between the two countries. His itinerary included a visit to Armscor, the Armament Corporation of South Africa and visits to SAAF airbases including Makhado, the 'Fighter Centre of Excellence' where are co-located Hawk AJTs and Gripen multi-role combat aircraft.

## New AEW&C aircraft base in the Punjab



According to press reports from Chandigarh, the Indian Air Force will be setting up a base for operating its Embraer EMB 145 AEW&C aircraft at the Bhisiana Air Force Station near Bathinda in the Punjab. Two such aircraft will constitute initial inventory of No.200 Squadron reportedly being formed, while the third such aircraft remains under systems integration and testing with the Centre for Airborne System (CABS) at Bengaluru.

Bhisiana will become the second IAF base to operate early warning aircraft after Agra, which is home to No.50 Squadron operating the A-50 Phalcon AWACS aircraft, based on the Il-76 heavy-transport aircraft. The IAF presently operates three A-50s with two more expected next year.

Earlier this year, the Defence Acquisition Council cleared a proposal for the purchase of two Airbus A330 aircraft that will be integrated with an advanced early warning and control system being developed by the DRDO.

## Heli-Hubs for Army Aviation

According to reports from New Delhi, the Army's Northern and Eastern Commands are to establish 'Heli-Hubs' in their respective regions during the current year. This would "enhance the serviceability of the Army's helicopter inventory, with a total of some 300-helicopters operated by 12 squadrons of Chetak and Cheetahs and 6 squadrons equipped with Dhruv ALH".

The heli-hubs will be manned by the Army's technical staff from the Corps of Electrical and Mechanical Engineers, with HAL specialists 'on call'.

## Akash SAMs for the IAF

Defence Minister Manohar Parrikar formally handed over the first Akash Surface-to-Air Defence missile to the Indian Air Force on 10 July 2015 at the Air Force Station Gwalior in presence of the Secretary Defence (R&D) Dr S Christopher, CMD of Bharat Electronics Limited (BEL) SK Sharma and the first Project Director of Akash Missile system Dr Prahalada. "The Akash is a potent supersonic mobile multi-directional, multi-target point/area Air Defence system that can simultaneously engage multiple air targets using sophisticated multi-function phased array radars.



The advanced ECCM (Electronic Counter Counter Measures) features provide secure communication links with other Air Defence Command and Control networks to handle the counter electronic warfare scenario”.

On his arrival at Air Force Station Gwalior, the Defence Minister inspected a Guard of Honour against the backdrop of two Sukhoi Su-30MKIs, a MiG-21 and a Mirage 2000 and thereafter witnessed a live demonstration of the missile system wherein ‘live’ tracking of fighter aircraft was carried out by switching on the radars.

Air Chief Marshal Arup Raha, who formally received the ‘key’ of the Akash system from Mr Parrikar said that a total of 27 missiles had been fired to ascertain serviceability of the system in various conditions and a “high success rate” had been achieved.

## Hot Weather Flight Trials of LCH



HAL’s Light Combat Helicopter (LCH) completed the hot weather flight trials recently at Jodhpur : “test flights were carried out in the temperature range of 39° to 42°C. These involved pilots from the Indian Air Force and Army in presence of representatives from RCMA and DGAQA”, stated T Suvarana Raju, CMD, HAL.

The LCH prototype TD-3 had been ferried from Bengaluru to Jodhpur for the trials and flight testing which covered ‘temperature survey of engine bay and hydraulic system’, ‘assessment of performance’, ‘handling qualities and loads’ at different ‘all up weights’, ‘low speed handling’ and ‘height-velocity diagram establishment’. The LCH prototype had earlier completed cold weather flight testing at Leh in February 2015.

## Turbomeca and HAL partnership



Turbomeca (Safran) and Hindustan Aeronautics Ltd (HAL) signed a Memorandum of Understanding (MoU) at the Paris Air Show to establish a joint venture to support customers in India “as well as in other countries.” This joint venture will provide maintenance, repair and overhaul for Turbomeca–HAL engines TM333 and Shakti, installed on HAL helicopters.

“Turbomeca and HAL intend to offer their Indian customers a first-class service, with the goal of optimising engine availability.” With a fleet of over 1,000 engines, including 250 TM333 and 250 Shakti, India’s armed forces are the largest operator of Turbomeca-designed engines in the country. Shakti is the Indian designation of the Turbomeca Ardiden 1, co-developed with HAL, and produced under licence.

## Parliamentary Standing Committee on Defence visits HAL



*Members of the Parliamentary Standing Committee on Defence at HAL's Helicopter Complex*

The Parliamentary Standing Committee on Defence visited HAL at Bangalore on 2 June 2015 and witnessed flight demonstrations of various HAL-built aircraft including the Tejas LCA, IJT, Jaguar (Darin III), LCH and ALH Weaponised version (Rudra). Major General BC Khanduri (Retd), Chairperson of the Committee, described the visit as “extremely educative” with detailed briefings from HAL. Accompanied by Mr T Suvarna Raju, CMD, HAL and other senior officials, the members also visited HAL facilities at the engine division, aerospace division (PSLV/ GSLV shop floors), ALH design hangar, ALH flight hangar and Tejas LCA manufacturing facility.

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### BEL performance highlights for 2014-15



Mr SK Sharma, CMD of BEL addressing Press Conference

BEL's turnover for 2014-15 was Rs 6695 crores with employee turnover at Rs 68.99 lakhs per person and value added per employee at Rs 29.43 lakhs. The current turnover from defence business was 87% and turnover from indigenous technology around 80 %.

Exports registered substantial growth and were pegged US \$ 58 million and a target of US \$65 million has also been set for 2015-16.

Some of BEL's products exported included hull mounted sonar for ships, naval surveillance radar, unit level switch boards, electronic voting machines, hand held radios and other electronic gadgets, the countries including Myanmar, Sri Lanka, Namibia, Russia, Israel and USA. Besides, BEL is keen to increase the non-defence business from the current share of 17%. Critical infrastructure protection, air traffic management radars, solar power plants and smart city elements are some of the areas for diversification. A reasonable investment for R&D efforts stands at Rs 510 crores and BEL is gearing up with strategies and action plans to maintain its technological edge and future growth.

### HAL-BEL partnership

Hindustan Aeronautics Limited (HAL) and Bharat Electronics Limited (BEL) have signed a MoU to share "their expertise in



S. Subrahmanyam, Director (Operations), HAL and PC Jain, Director (Marketing) BEL exchanging the MoU. Also seen are T Suvarna Raju, CMD, HAL, SK Sharma, CMD, BEL and other senior officers of HAL and BEL.

design, development", engineering and manufacturing to develop and produce advanced airborne communication equipment. Quarterly reviews of the MoU will be held under the Chairmanship of Director (R&D), BEL and Director (Engg, R&D), HAL. HAL and BEL have agreed to share the business from the Indian defence services as the former has expertise in design, development, engineering, manufacture of airborne communications equipment, whereas the latter has the expertise in design, development, engineering and manufacture of communications and secrecy products and solutions.

### Boeing and Tata in strategic aerospace partnership



(Left to Right): Dennis Swanson, VP, Boeing Defense, Space & Security, India; Shelley Lavender, President Boeing Military Aircraft; Sukaran Singh, CEO and MD TASL; and Pratyush Kumar, President, Boeing India at the signing ceremony in Hyderabad on 15 July.

Boeing and Tata Advanced Systems Limited (TASL) have signed a framework agreement to collaborate in aerospace and defence manufacturing with potential for integrated systems development opportunities, including unmanned aerial vehicles. "The companies intend to access markets jointly for products and platforms developed together by Boeing and TASL." The agreement was signed by Shelley Lavender, President of Boeing Military Aircraft and Sukaran Singh, MD and CEO of TASL. TASL is already on contract to manufacture aerostructures for Boeing's CH-47 Chinook and AH-6i helicopters. "This agreement with TASL is significant because it demonstrates Boeing's commitment to expanding its aerospace manufacturing footprint in India," Lavender said.

"As we step into our 100th year in business, a new aerospace partnership with India is the perfect milestone to accelerate the momentum we have generated for making in India," said Pratyush Kumar, President Boeing India. "It is noteworthy that TASL will produce Chinook helicopter parts in India even before the procurement contract is signed with the Indian government."

Other Tata group companies – Tata Advanced Materials Limited (TAML) and TAL Manufacturing Solutions (TAL) – are also supplying major components to Boeing. TAML has delivered power and mission equipment cabinets and auxiliary power unit door fairings for the P-8I long range maritime surveillance and anti-submarine warfare aircraft. TAL is manufacturing complex floor beams out of composite materials for the Boeing 787-9 and has provided ground support equipment for the C-17 Globemaster III.

## Airbus Helicopters form JV with the Mahindra Group

Airbus Helicopters and the Mahindra Group subsidiary, Mahindra Defence “will manufacture helicopters in India in order to augment India’s military requirements.” This joint venture is significant considering the country’s ‘Make in India’ ambition.

“We have an unparalleled track-record of successful industrial collaborations with local partners across the world. We are convinced that with Mahindra we will not only have a mutually rewarding association but one which will offer immense benefits to India,” stated Guillaume Faury, Airbus Helicopters President & CEO. “The tie-up is in line with our intent to develop an indigenous industrial ecosystem for helicopters. The joint venture will be dedicated to supplying the Indian Armed Forces with Made-in-India, state-of-the-art helicopters of high reliability, quality and safety standard based on combat-proven platforms.”

Both companies will finalise the formation of the joint venture which will act as the prime contractor for India’s military helicopter tenders including the reconnaissance and surveillance helicopter, the naval utility helicopter and the naval multirole helicopter procurement programmes.

## Cochin Shipyard undocks INS Vikrant

The indigenous aircraft carrier INS *Vikrant* was undocked on 10 June 2015 after completion of structural work at the Cochin Shipyard. The Indian Navy is slated to take delivery of the carrier in end-2018. Senior officials and workers of the yard were present when tugs pulled the warship, presently weighing about 26,000 tonnes, out of the dry dock where it was undergoing construction for about a year-and-a-half after its launch in August 2013 into the

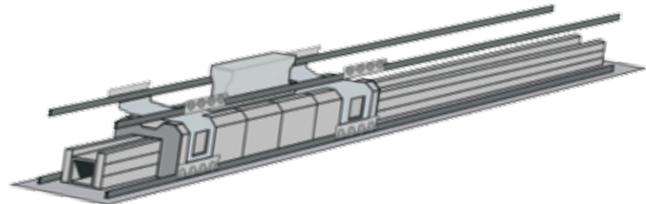


Kochi channel. The carrier will now be outfitted for over a year-and-a-half before the basin trials begin, most likely in 2017, followed by sea trials ahead of delivery.

“Almost 90 per cent of works below the fourth deck—all underwater works—are over. Cabling, piping, electrical works, and heat and ventilation works will take place now. Delivery of systems and components for the aviation complex designed by the Russian Nevoske design bureau is expected anytime now,” stated an official spokesperson.

## Shipyards for building IAC-2

According to Indian Navy sources, expressions of intent have been sought from several establishments including Mazagaon Dock, Hindustan Shipyard, Cochin Shipyard, Garden Reach Shipbuilders and private sector companies including Pipavav, Larsen & Toubro, ABG and Bharti for construction of the proposed second indigenous aircraft carrier (IAC-2), of 65,000 tonnes. It is learnt that the Indian and US Governments are to work together in the design of the IAC-2 for which the US has offered the Electromagnetic Aircraft Launch System (EMALS), developed by General Atomics. The EMALS will be installed in the USS *Gerald R Ford*, to be commissioned into the US Navy next year, and the world’s first carrier to use the new technology.



The proposed IAC-2, to be named INS *Vishal*, is a follow on IAC-1 (40,000 tonnes) being built at the Cochin Shipyard and scheduled for commissioning in 2018-19.

## Commissioning ICGS Rani Durgavati

ICGS *Rani Durgavati*, the third inshore patrol vessel of its class for the Indian Coast Guard was commissioned at Visakhapatnam by Vice Admiral Satish Soni, FOC-in-C Eastern Naval Command in the presence of Inspector General SP Sharma Commander Coast Guard region (East) and other senior dignitaries of the central and state government.

The 51-metre inshore patrol vessel, ICGS *Rani Durgavati* has been designed and built indigenously by Hindustan Shipyard Limited and is equipped with the most advanced and sophisticated navigational and communication sensors and equipment. The ship is propelled by three MTU 4000 series diesel engine of 2720 kw capacity at 2100 rpm each coupled with three 71S2 Rolls Royce Kamewa jets to a maximum speed of 34 knots. Special features include an Integrated Bridge System, Integrated Machinery Control Systems and an indigenously built gun mount with fire control systems.

## INS Viraat to become a Museum



The Andhra Pradesh Tourism Development Corporation (APTDC) authorities have received an in-principle approval from the Ministry of Defence to convert INS *Viraat*, the *Centaur*-class aircraft carrier of the Indian Navy, into a museum after its decommissioning in 2016.

It is planned that the warship be docked alongside a suitable site at Kakinada port in coastal Andhra, for which the state government is planning to invest over Rs 20 crore to convert it into a museum.

The INS *Viraat* was commissioned in 1959 as the Royal Navy's HMS *Hermes* and was transferred to India and commissioned as INS *Viraat* on 12 May 1987. As HMS *Hermes*, it was flagship of the Royal Navy during the Falklands war in the south Atlantic in 1982.

## L&T to construct floating dock



Representative Image

Larsen & Toubro (L&T) has been awarded a contract, valued at Rs 468 crore, by the Ministry of Defence for the design and construction of a floating dock for the Indian Navy. The floating dock is expected to significantly enhance the support infrastructure of the navy for docking of warships and submarines for repairs and refits.

"In keeping with Government's 'Make in India' thrust, complete design and engineering of FDN will be undertaken in-house at L&T's Warship Design Centre. The Floating Dock will be capable of docking Naval Ships and Submarines of up to 8000 tonnes displacement with draughts up to 7 m, during day and night," stated MV Kotwal, President, Heavy Engineering and Member of the Board, L&T. "The Dock will conform to international norms and

will incorporate fully automated Ballast Control System. The FDN will be self-sufficient, catering to the dock side services requirements of docked and berthed warships."

L&T is already executing MoD contracts for design and construction of 54 fast Interceptor Boats (IBs) for the Indian Coast Guard (ICG). 27 IBs have already been delivered so far to ICG with the latest boat having been delivered two years ahead of schedule. The floating dock contract for FDN comes to L&T on the back of a recent order for design and construction of seven offshore patrol vessels for the ICG at Rs 1432 crore.

## Cochin Shipyard Limited launches 16th FPV



Cochin Shipyard has launched the sixteenth of 20 Fast Patrol Vessels (BY 516) ICGS *Arnavesh* being built for Indian Coast Guard. In a simple ceremony at Cochin Shipyard, the vessel was launched by Mrs. K Belina, wife of R Admiral K Ravikiran, Admiral Superintendent, Naval Ship Repair Yard, Naval Base, Kochi. R Admiral K Ravikiran, Admiral Superintendent, NSRY also laid the keel of BY 517, the 17th FPV for the Indian Coast Guard.

CSL has so far delivered 13 vessels in the 20 vessel series and the fourteenth vessel is getting ready for sea trials. The thirteenth vessel ICGS *Anmol* was handed over to the Indian Coast Guard on 1 June 2015 nearly 20 days ahead of the schedule.

## Fast Patrol Vessel (BY 513) ICGS Anmol for the ICG

CSL has delivered the 13th of the series of twenty Fast Patrol Vessel ICGS *Anmol* under construction for the Indian Coast Guard. The protocol of delivery and acceptance was signed by Capt R.S. Sundar, Director (Operations), CSL and Commanding Officer (Designate) of the vessel Cmdt. Satish Bisht. DIG T P Sadanandan, Principal Director (Material), DIG G Devanand, CGRPS (KOC), DIG S Ghosh, CSO (Tech-NE) and other senior officials of ICG and CSL were present on the occasion.



## XIV National Maritime Search & Rescue Board Meeting

The fourteenth National Maritime Search and Rescue (NMSAR) Board meeting was held at Gandhinagar on 17 July 2015, under the chairmanship of Vice Admiral HCS Bisht, Director General Indian Coast Guard. The meeting was attended by Board Members from Coastal States/UTs and other agencies involved with Search and Rescue (SAR) operations in the region.



The Indian Coast Guard is mandated to undertake duties of National Maritime Search and Rescue for assisting mariners in distress within the Indian Search and Rescue Region (SRR). Coordination for Maritime SAR Operations is done from the Maritime Rescue Coordination Centres (MRCCs) of the Indian Coast Guard, located at Mumbai, Chennai and Port Blair. Over the last few years, the Government of India has accorded enhanced impetus towards strengthening bilateral, regional and international cooperation in the domain of Maritime SAR, as envisaged under International Search and Rescue Convention, 1979. The ICG has accordingly evolved cooperative mechanisms and signed Memorandum of Understanding (MOUs) with a number of maritime states in the Indian Ocean Region. It also conducts regular exercises with the maritime agencies of these states.

## Indo-British Army Exercise 'Ajeya Warrior 2015'

Exercise 'Ajeya Warrior 2015', a joint exercise between the Armies of India and Britain, was held from 13 June to 28 June 2015 at Westdown Camp, Salisbury Plains Training Area in the UK. The bi-annual exercise aimed to build and promote positive military relations between Indian and UK Armies and to enhance their ability to undertake joint tactical level operations in counter insurgency/counter terrorism environment under United Nations Charter.



A Company strength of troops from the Kumaon Regiment of the Indian Army had been nominated for the Exercise, the Indian Army contingent initially getting acquainted with the weapons, equipment, tactical drills and the terrain. The Indian Army COAS General Dalbir Singh, during his official visit to the UK, interacted with the troops participating in the exercise.

## UTC Aerospace Systems' equipment for IndiGo



UTC Aerospace Systems will supply the wheels and carbon brakes for IndiGo's fleet of new Airbus A320neo aircraft through its Landing Systems facility in Troy, Ohio, with first aircraft delivery scheduled for November 2015. The A320neo carbon brakes use proprietary DURACARB carbon heat sink material which has "exhibited superior brake life performance on other in-service programmes thereby creating significant cost savings over the life of the aircraft for our customers through fewer brake removals and associated maintenance and overhaul activity. "We are excited to welcome IndiGo as a Landing Systems customer and we look forward to supporting this new fleet with our latest generation A320 wheels and brakes," stated Jim Wharton, president, Landing Systems. IndiGo currently operates a fleet of ninety-seven Airbus A320 aircraft.

## GE Aviation collaborate with Mahindra Aerospace



Following a Memorandum of Understanding (MoU) established in 2014 between GE Aviation's Hamble facility and India's Mahindra Aerospace, the two companies have signed an agreement for manufacture of an Airbus Single Aisle package of work, following Airbus transfer of work approval. The initial MOU enabled both companies to manufacture of aerostructures and the new agreement will have them collaborate for production of small, metallic complex structural sheet details and assemblies within Mahindra's new Aerospace facility in Bangalore.

As Stefanie Darlington, Executive Sourcing Leader for GE Aviation's Composites Value Stream stated, "The establishment of this agreement marks a key step in the development of a long term relationship to support existing and potential new opportunities by adding Mahindra to our international supply chain with first hardware due in 2015." "Manufacture of components, assemblies and aerostructures is an integral part of our vision. While this agreement makes us part of GE's supply chain, we are also working to collaboratively leverage our respective capabilities on assembly work packages for A&D majors," said Arvind Mehra, Executive Director and CEO, Mahindra Aerospace (above in photo).

## Air India selects Pratt & Whitney for B-787 APU

Pratt & Whitney AeroPower, a division of United Technologies Corp has signed a long-term repair support agreement for the APS5000 auxiliary power unit (APU) with Air India for its fleet of seven future and 20 existing Boeing 787-8 series aircraft. The support agreement covers repairs of the APU and its Line Replaceable Units (LRU).

As Marty Kessell, general manager, Pratt & Whitney AeroPower said, "This programme closely aligns with Air India's emphasis on affordability with flexibility to develop internal capability at an appropriate time in the future. It also builds on our long-term APU



support relationship already in place with Air India through almost 20 years of operating and repairing the PW901A APU installed in their B747-400."

## Air India's MRO facility at Hyderabad



The Minister for Civil Aviation, Ashok Gajapathi Raju Puspapati, has recently inaugurated Air India's modern facility at the Rajiv Gandhi International Airport, Hyderabad for Maintenance, Repair and Overhaul (MRO). Developed by Air India Engineering Services Limited (AIESL), a wholly owned subsidiary of Air India, the facility will exclusively serve the Air India fleet and will provide full aircraft base maintenance service, line maintenance, engineering and technical support, component and full material support, aircraft engine services and technical training services on all major aircraft types.

Developed with an investment of Rs 79.20 crores, the unit will provide the capacity to service the world's contemporary aircraft types. It can accommodate two narrow body aircraft at a time or one wide body aircraft. The hangar covers an area of 9000 sq. metres and has a height of 24 metres. It features an open bay that is capable of providing MRO services for such next-generation, wide-body aircraft as the Boeing 787/ 777/ 747 and Airbus A320/321/319 aircraft.

H R Jagannath, CEO, Air India Engineering Services Ltd. (AIESL), stated that “Air India has great potential in MRO facilities. More support from the Government of India can bring about more improvements in the country in terms of revenue generation and manpower development and utilisation in the country as we are one of the biggest MRO in the region.” As Rohit Nandan, CMD, Air India stated “We are pursuing the ‘Make in India’ initiative of the Prime Minister of India and this MRO unit is a very strong platform in that direction.”

## OIS-AT contract with LH Aviation

LH Aviation has signed an MOU with OIS-AT to establish a manufacturing plant for the LH-D tactical UAV in India, with the aim to produce locally a hundred tactical LH-D UAVs, intended to the Indian market. The LH-D is a multi-sensor tactical UAV, with automatic take-off and landing, developed from the LH-10 platform. With a payload of 280 kg for an autonomy of 24 hours, it offers its users a wide range of speeds from 61 knots to 185 knots, and has the ability to be reconfigured as manned controlled version for escorts or missions over urban areas or to facilitate training missions or systems testing. It can be deployed rapidly because of its removable wings. Its operating cost of less than €80 per hour of flight makes the LH-D the most cost-effective French UAV on the market.

“We were really amazed by the capabilities of LH Aviation LH-D when compared to other tactical UAVs on the market” stated Mr Bhandari, Chairman of the OIS group. “The LH-D displayed at Aero India 2015 was very well received by the Indian military and civilian authorities, especially since it will be manufactured locally which is a real advantage for the Indian market”.

## DassaultSystèmes and DIAT conduct joint workshop



Dr Chandan Chowdhury, Managing Director, India, DassaultSystèmes

DassaultSystèmes, the 3DEXPERIENCE Company and world leader in 3D design software, 3D Digital Mock Up and Product Lifecycle Management (PLM) solutions took part in a recent workshop conducted by the Defence Institute of Advanced

Technology (DIAT), Pune on Model Based Systems Engineering (MBSE) for Armament and Combat Vehicle Technology. The participants included students, faculty members from DIAT and other premier educational institutions within India and DRDO scientists from armament and combat vehicle clusters, naval science and aero cluster and industry participants. It introduced professionals and scientists to the MBSE fundamentals with a focus on armament and combat vehicle.

## ‘Innovation Excellence Award in Defence’ for MKU



ASSOCHAM, India’s Apex Chamber for Commerce and Industry has presented MKU with ‘Innovation Excellence Award in Defence’. This was by the Union Minister for Science & Technology YS Chowdhury during the 3rd Innovation Summit cum Excellence Awards at Hotel Le Meridien, New Delhi. The award was given for MKU’s innovative Quick Release Bullet Proof Jacket, ‘Instavest’, which was developed indigenously by the company’s technical team, in response to challenges faced by the armed forces in special situations globally. The company holds the patent for this product in US, Europe and India.

## Panasonic launches products for Indian defence services

As a part of Panasonic India’s efforts in continuing to focus on product differentiation coupled with developing innovative technological solutions, the company has announced the launch of its fully-rugged, 5-inch handheld tablet Toughpad FZ-E1/X1 and its semi-rugged Toughbook CF-54. “These devices are purpose-built to improve efficiency and productivity for professionals working in the field of defence, public safety, logistics, utilities, manufacturing, retail and field services”.

Mr Hide Harada, Managing Officer in charge of Mobile Business Division, Director of IT Products Business Division (ITPBD), AVC Networks Company, Panasonic Corporation



(Left to right): Mr Gunjan Sachdev, National Business Head - Tough book, Panasonic India, Mr Hide Harada, Managing Officer in charge of Mobile Business Division, Director of IT Products Business Division (ITPBD), AVC Networks Company, Panasonic Corporation, Mr Toru Hasegawa, Divisional Managing Director, Solutions Division, Panasonic India

stated, “With mobility increasingly becoming a crucial factor in determining business success today, the launch of these products is a strategic step towards enhancing our focus on the mobility segment. We are among the few device manufacturers to offer complete customisation for our rugged-devices, with everything in-house”.

## ‘Made in India’ mission consoles for BAE Systems’ P-8 programme



Kineco Kaman Composites India (KKCI) Private Limited, a joint venture company between Kineco Group of Goa and Kaman Aerospace Group USA, have delivered the first Composite Mission Consoles to BAE Systems, Inc. for the Boeing maritime patrol aircraft, for which BAE Systems supplies the Mission Computing and Display System. Each P-8 aircraft has five consoles which serve as the main user interface to control and interact with sensors, communications and weapon systems on the aircraft. The consoles are a complex assembly, manufactured using carbon composite and glass composite panels, with a multitude of metallic inserts.

BAE Systems initiated this sourcing activity as part of its “commitment to help develop aerospace and defence industrial capabilities in India and over the last eighteen months, the company’s team has been developing KKCI’s capabilities to achieve readiness for this production. KKCI is the first supplier in India developed through P-8 industrial commitments by BAE Systems.”

## L-3’s TACAN+ for HAL’s LUH



HAL has selected L-3’s Tactical Airborne Navigation System (TACAN+) for its new Light Utility Helicopter (LUH) programme. The TACAN+ transceiver is a small and light tactical airborne navigation system capable of tracking up to four ground stations simultaneously in range and two in bearing. It can be installed on rotary and fixed-wing platforms and used for air-to-air and air-to-ground operations.

HAL is developing the new LUH to meet reconnaissance and utility rotorcraft needs of the Indian Air Force and Indian Army. The first LUH prototype, the PT-1, is scheduled to commence test flights later this year, with initial operational clearance anticipated in 2017. Deliveries to the IAF and Indian Army are expected by the end of 2017, with production taking place at a new site near Bengaluru where HAL expects to produce approximately 50 helicopters annually.

## Honeywell TPE331-12B for HTT-40

Honeywell Aerospace will provide the TPE331-12B turboprop engine for its HTT-40 turboprop training aircraft. “Our TPE331-12B is one of the most widely used and capable turboprop engines in service today,” stated Arijit Ghosh, president, Honeywell Aerospace India. “With our engine at its core, HAL’s new, locally developed HTT-40 will offer pilots rapid acceleration, low fuel



consumption, improved reliability and the ability to train for a wide range of missions.”

Honeywell has delivered more than 13,000 TPE331 engines for both military and civil applications around the world, with the engine family completing more than 122 million flight hours to date. “From light general aircraft to the world’s most advanced unmanned aerial vehicles, the TPE331 is recognised for its ability to enable short takeoff and rapid climb and cruise, while at the same time offering very low fuel consumption”.

HAL has been manufacturing the TPE331-5 turboprop engine for the HAL-built Dornier 228 light transport aircraft since the mid-1980s at its Engine Division and this programme continues.

## HAL’s ‘Orbiter Craft Module Structure’ for Chandrayaan-2



*Orbiter Craft Module Structure of Chandrayaan-2*

HAL delivered the ‘Orbiter Craft Module Structure’ of the Chandrayaan-2 to ISRO Satellite Centre (ISAC) on 22 June 2015. Chandrayaan-2 is a two module configuration spacecraft comprising of the ‘Orbiter Craft’ and the ‘Lander Craft’. “The Orbiter Craft Module structure is a 3-tonne category bus structure made out of a central composite cylinder, shear webs and deck panels”, stated T. Suvarna Raju, CMD, HAL.

The Chandrayaan-2 mission is aimed at placing an Orbiter around the moon and sending a Lander and Rover to the surface of the moon. It will be launched by a Geo-Stationary Satellite Launch Vehicle (GSLV-MKII). HAL has partnered and supported ISRO throughout its journey by providing hardware for satellites, SLV, ASLV, PSLV, GSLVMKII and GSLV MKIII (LVM3).

## PSLV-C28 launched with 5 UK satellites

On 10 July 2015 the Indian Space Research Organisation launched its Polar Satellite Launch Vehicle (PSLV-C28) carrying five UK satellites. A short time later, the rocket placed three identical DMC3 optical earth observation satellites, an auxiliary earth observation micro satellite (CBNT-1) and one technology demonstrator nano satellite (De-OrbitSail), in the designated orbits. This was PSLV’s 30th flight and 29th consecutive successful one.



The overall liftoff mass of the five satellites added up to 1,440kg, more than twice the mass of its last commercial launch of SPOT 7, a French satellite weighing 712kg which was put in orbit by PSLV on 30 June 2014.

## Air Marshal Birender Singh Dhanoa is Vice Chief of the Air Staff

Air Marshal Birender Singh Dhanoa took over as the Vice Chief of the Air Staff (VCAS) on 1 June 2015. Commissioned in the IAF in June 1978 as a fighter pilot, he is an alumnus of the RIMC at Dehra Dun, the NDA at Kharakvasla and the DSSC at Wellington.

The Air Marshal is a qualified flying instructor and has flown various types of fighter aircraft. During the Kargil Operations, he commanded No. 17 Squadron with MiG-21Ms and flew numerous night strike missions himself in the mountainous terrain. His other operational appointments include Station Commander of a fighter base and leader of an Indian Military Training Team abroad. He has also served as Chief Instructor (Air) at the Defence Services Staff College, Wellington, Assistant Chief of the Air Staff (Intelligence) at Air Headquarters



and was Senior Air Staff Officer of two operational Commands. Prior to being appointed as Vice Chief of the Air Staff, he was Air Officer Commanding-in-Chief of South Western Air Command.

## Air Marshal Ravinder Kumar Dhir is AOC-in-C, SWAC

**A**ir Marshal Ravinder Kumar Dhir took over as AOC-in-C South Western Air Command (SWAC) on 1 June 2015. An alumnus of National Defence Academy Khadakwasala was commissioned into the fighter stream of the IAF on 15 June 1979, has flown over 3200 hours on more than 25 types of aircraft in his career spanning over 36 years. The Air Marshal is a qualified Flying Instructor, an Experimental Test Pilot and has commanded the Air force Test Pilot School. During his tenure at ADE, he has been involved in the LCA project.



## Rear Admiral Philipose G Pynumootil appointed as ACNS (Air)

**R**ear Admiral Philipose G Pynumootil has taken charge as the new Assistant Chief of Naval Staff (Air), responsible for all staff functions of the Air Arm of the Navy. Earlier, Admiral Philipose G Pynumootil was earlier the principal director of aircraft acquisition at IHQ MoD (Navy).

Commissioned into the Navy in January 1986, the Flag Officer did his Staff Course at the DSSC, Wellington, Tamil Nadu and the Higher Air Command Course at the College of Air Warfare, Hyderabad. He is a postgraduate in Defence Studies, and holds MPhil in strategic studies and is also an alumnus of the Royal College of Defence Studies, London, and attained his MA (International Relations) from Kings College, London.

A rotary wing pilot qualified on Sea King and Chetak helicopters, Admiral Philipose has served as Flight Commander of INS *Delhi*, senior pilot of the Marine Commando Flight and INAS 330, both based in Mumbai. He also commanded the Anti-



Submarine Warfare (ASW) Sea King Squadron INAS 330, which embarks on the aircraft carrier. He was also the commissioning commanding officer of Naval Air Station INS *Shikra* in Mumbai.

## Dr S Christopher is new DG, DRDO

**D**r S Christopher has been appointed as Secretary, Department of Defence Research and Development and Director General, DRDO. A BE (Hons) in Electronics & Communication Engineering from University of Madras and M.Tech in Microwaves and Radar Engineering from IIT, Kharagpur, he joined IIT Madras, as Project Associate and carried out research in Microwave Antenna Design and Near-field Measurement Techniques. He obtained his PhD in Antennae and Measurement Techniques from IIT, Madras.



*A file photo of Dr S Christopher, then DG CABS, seen with Dr S Saraswat (then SA to RM) and visiting IAF officers with the EMB-145 AEW&C aircraft at Bangalore*

Dr S Christopher earlier worked for Bharat Electronics, Ghaziabad as Senior Engineer, and has led a team to create the Automated Planar Near Field Measurement Facility at LRDE for the first time in the country. He was Project Director for the LCA's Multi Mode Radar and led the team for designing and developing slotted array technology, which was used for several airborne and missile projects. He was earlier Project Director for the ASP project and also development of Maritime Patrol Airborne Radar *Super Vision 2000* for the Indian Navy.

## CD Balaji appointed Chief of ADA

**C**ommodore CD Balaji (Retd), project director LCA (Navy) has taken over as Director of Aeronautical Development Establishment (ADA) and Programme Director LCA, vice PS Subramanyam whose tenure ended on 30 June 2015.



Cmde Balaji, a BE in Mechanical Engineering and Masters in Aerospace Engineering from Indian Institute of Science, was commissioned into the Indian Navy in September 1978 into the Engineering Branch and specialisation with Naval Aviation, serving as the Air Engineer Officer of INAS 310 (Alizes, now Dornier 228s). He joined the Aeronautical Development Agency on deputation in 2002 with responsibility for development of the Naval Light Combat Aircraft (LCA Navy). As project director LCA (Navy), he has overseen maiden flight of the first naval variant of LCA (NP1) on 27 April 2012 followed by the maiden ski jump launch on 20 December 2014.

In addition, he was also responsible for the build of the Air Force Trainer Prototypes and conceptualising and building the Shore Based Test Facility (SBTF), replicating the aircraft carrier with ski-jump for take-off and arresting gear for recovery of the aircraft, at the Naval Air Station at Goa.

## Airbus Group appoints Pierre de Bausset as President, India operations

Airbus Group has consolidated its Divisions in India under Airbus Group India Private Limited under its new President Pierre de Bausset, a 25-year veteran of the Airbus Group and its former Corporate Secretary. India is the first international market where local operations have been brought under a single company as part of the Group's 'one roof' policy.



"Given India's importance for us, we have implemented a new organisational structure there with Pierre in charge. There will be more internal coordination, pooling of resources and basically a far more efficient engagement with our local stakeholders. Formation of a single company will also greatly support our 'Make in India' plans and allow us to take a leap in our relationship with the country. Pierre is perfectly positioned for this role due to his wealth of experience, network amongst key decision makers within the Group and an in-depth understanding of our businesses," stated Airbus Group CEO Tom Enders.

"Synergies, growth, consistency and coherence are the main tenets of my vision for a robust Airbus Group India. My mandate is to further boost Airbus Group's collaboration with India and embed it durably in the overall Airbus Group's industrial organisation," stated Pierre de Bausset. "A mature Indian aerospace and defence sector is in our own interest. It would open up more opportunities for us to partner with domestic players to fulfil requirements of our local customers as well as jointly target export markets."

## Puneet Kaura is MD and CEO of Samtel Avionics

Puneet Kaura has been appointed as Managing Director & CEO of Samtel Avionics Ltd. Samtel Avionics, along with its joint ventures with HAL and Thales, which "is set to follow an accelerated growth path to newer domains in modern avionics systems and applications for military and commercial platforms". The company is under various levels and kinds of partnerships with at least 5 of the top 10 international players in the aerospace and defence sector and has been supplying to leading companies including Hindustan Aeronautics Ltd. (HAL) and Honeywell for more than 5 years.



## Pipavav and Zvyozdochka in agreement for submarine overhaul

The Anil Dhirubai Ambani Group (ADAG)-owned Pipavav has announced an agreement with Russian shipyard Zvyozdochka, a specialist in submarine refit and modernisation, for the upgrade and overhaul of Indian Navy *Kilo*-class diesel-electric submarines. The agreement, signed on 21 July, is expected to evolve into an Indo-Russian joint venture company, which will be the first Indian private sector entity to conduct submarine refits on this scale.

The Defence Acquisition Council had cleared second refits for four Indian Navy *Kilo*-class boats in August 2014, aiming to extend their operating lives by some 15 years at a cost of around Rs 5,000 crore. The contract is still being negotiated, and once signed, Zvyozdochka officials indicated to *Vayu* (see *On-the-Spot report 'Maritime Matters in Saint Petersburg' in this issue*) that the first submarine would be overhauled in Russia, where workers from Pipavav would be trained 'on the job' by their Russian counterparts. The second submarine onward would be refitted by Pipavav at its Gujarat facility, with Russian assistance.



## Japan included in Indo-US naval exercise



As a sign of the close relationship being fostered between India, Japan and the USA, and as the three nations look to counter an increasingly assertive China in the Indo-Pacific, India has formally included Japan in the annual *Malabar* series of naval exercises, normally conducted only between the Indian and US Navies. The last such instance was in 2007, when India invited Japan, Australia and Singapore to join the US Navy in the Bay of Bengal, prompting a sharp reaction from Beijing. The exercise was subsequently scaled back, and the Indian Navy ensured that bilateral exercises remained smaller affairs whilst conducting multilateral engagements only when deployed away from home waters, such as RIMPAC 2014.

*Malabar* 2015 is scheduled to be held in October this year, and it is understood that representatives from India, Japan and the USA have already met to plan the exercise.

## US Secretary of Defence visits India, extends defence pact

Highlighting the renewed Indo-US strategic ties, US Secretary of Defence Ashton Carter made a three-day visit to India in June 2015, so as to bolster key areas relating to defence cooperation between the two countries. Carter met separately with the PM, External Affairs Minister Sushma Swaraj, National Security Advisor Ajit Doval, and his Indian counterpart, Defence Minister Manohar Parrikar.



PM Narendra Modi with US Secretary of Defence Ashton Carter (photo: US DoD/Glenn Fawcett)

On 3 June, Carter and Parrikar signed a ten-year extension to an existing agreement on Indo-US military cooperation, the Framework for the India-US Defence Relationship, which “provides avenues for strategic engagement, continued exchanges between the military forces of both nations, and a mutual strengthening of defence capabilities”. Recognising the importance of the Defence Trade and Technology Initiative (DTTI), the agreement also included specific areas of cooperation. Carter highlighted jet engines and aircraft carrier technology, as future areas of collaboration and spoke positively on the convergence between Prime Minister Modi’s ‘Make In India’ initiative and the DTTI, saying that he “expects cooperation (under the 10-year framework) to increase.”

## M2K to bring Jetpack to India



New Delhi-based M2K Group, with interests in the aviation, biotechnology, hospitality, and real estate sectors, has signed an alliance agreement with Martin Aircraft Company Limited (Martin Aircraft), of New Zealand to bring the world’s first practical Jetpack to India.

The Martin Jetpack, flown by a single pilot or via remote control, can take off and land vertically (VTOL) and because of its small dimensions, it can operate in confined spaces such as close to or between buildings, near trees or in confined areas that other VTOL aircraft such as helicopters cannot access. The Jetpack will be deployed for patrolling, surveillance, emergency, rescue, entertainment and a host of other applications. The Martin Jetpack’s manned version gives it a competitive advantage in key markets: first responder, military, commercial and recreation. In addition as a heavy lift Vertical Take-off and Landing (VTOL) unmanned air vehicle (UAV), the Martin Jetpack has a significant operational advantage being able to carry payloads of up to 120kgs.

With a focus on safety, the Martin Jetpack has a composite structure pilot module that protects the pilot in the event of any incident and a ballistic parachute system that can deploy and safely recover the aircraft from only a few metres above the ground. This will make the Jetpack one of the safest aircraft in the world today.

# Fast tracking the AMCA

*The Observer Research Foundation (ORF) and The Society for Aerospace Studies, (SAS) publishers of the Vayu Aerospace and Defence Review, held a joint workshop on 26 May 2015, with the twin topics of 'Beyond the MMRCA: Numbers and Missions' and 'Fast Tracking the indigenous AMCA programme'.*

*ORF's Pushan Das summarises the day's proceedings, with a detailed report to follow in Vayu VI/2015.*



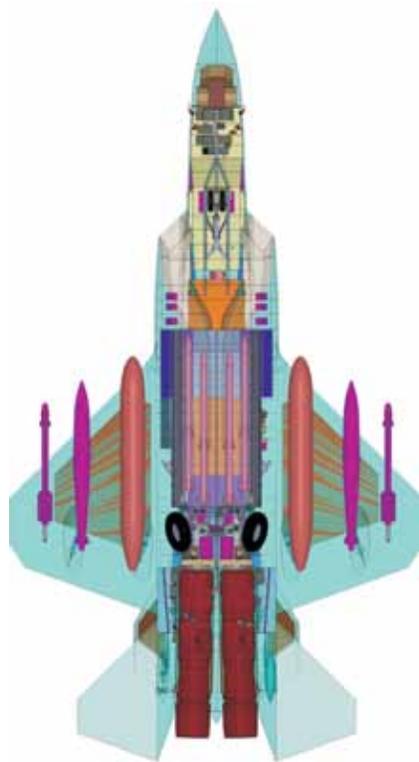
The original M-MRCA requirement for 126 aircraft, involving comprehensive transfer of technologies for manufacture of the selected aircraft in India, has been virtually set aside with the Government of India now pursuing a truncated deal for 36 Rafales, all to be imported. The Defence Minister has stated that there would be no further additions to that number and the Indian Air Force may well have to pursue other options to meet its increasing degradation of fighter aircraft numbers. However, the lack of clarity and commitment from the Government gives the Indian Air Force an impetus to work on longer-term procurement plans.

Even if the Rafale deal for two squadrons comes through, this will only somewhat alleviate the decline in the IAF's combat strength. The long-term solution may be in 'fast tracking' the Advanced Medium Combat Aircraft (AMCA) being developed by the Aeronautical Development Agency (ADA), rather than only resort to expensive import solutions.

Strategic autonomy demands that India reduce its dependence on arms imports. Simply obtaining licences for producing technology-intensive weapons systems does not reduce dependency. For the 'Make in India' objective to be a practical success, we need to create the capacity to develop and produce critical platforms particularly combat aircraft types. We have, for half a century, built various fighters, from the Gnat, MiG-21 and Jaguar to the Sukhoi Su-30MKI through this route, but accrued very

little in the way of indigenous development capabilities.

The three decade journey in developing ADA's Light Combat Aircraft has been long and torturous, and the Mk.I is yet to be finally cleared to enter the IAF in numbers. Still, its development has laid the foundations and technological infrastructure for development of new



*(The writer is a researcher at Observer Research Foundation, Delhi)*

generation aircraft and includes design expertise, integration of weapon systems and advanced avionics. This can be leveraged for the development of India's next indigenous fighter aircraft, the AMCA, which if still very early in its development phase, holds considerable potential to replace a wide range of legacy IAF fighters in the medium-weight multi-role category.

The Aeronautical Development Agency (ADA) is designing the AMCA as a platform having high survivability to meet the challenges

of future air warfare. Its design philosophy seeks to balance aerodynamics with stealth characteristics and the AMCA will be optimised to seamlessly swing between air-to-air and air-to-ground missions.

The AMCA must perform a generation ahead of what the IAF currently operates and will increase the force's capabilities dramatically. Conceptualised around air staff requirements issued in 2010, this 5th generation fighter will incorporate stealth features, have super-cruise, with smart sensors fully integrated and carry advanced weaponry, both internal and external. However, ADA must avoid the pitfall of developing this next generation combat aircraft without first identifying the powerplant which must have growth potential.

The AMCA programme is expected to receive formal approval at the end of 2015 after the programme definition and feasibility are completed over the next months. Crucial for the programme's success will be the timeline for its development and series production. Unlike the LCA in the 1980s, when India embarked on design, develop and build decided a fourth generation fighter aircraft from scratch, the AMCA will draw upon the three decades of experience gained since and build upon already available technologies and systems.

The IAF has been accused of lacking strategic long-term planning but in backing the development of such a fifth generation indigenous fighter aircraft, the Service has an opportunity to break free from the past.

# “Transforming for Future Challenges”



## NAVAL AVIATION SEMINAR 2015

### Discussing what comes next for Indian Naval Aviation



*Since its formation in 1953, the Indian Navy's Air Arm has evolved into becoming a key element of the nation's maritime force, expanding from a handful of Short Sealand amphibians inducted in 1953, to the present force of carrier-borne fighters, long range maritime patrol aircraft, a variety of helicopters and an increasing number of UAVs. The Naval Air Arm is embarking on a period of modernisation and transformation. Recognising the need for discussion and debate on the path ahead, the Navy organised a two-day seminar in New Delhi, with the theme 'Indian Naval Air Arm - Transforming for Future Challenges.'*

On 14 May 2015, the Defence Acquisition Council (DAC) gave formal sanction for the Navy to proceed with preparatory work for the construction of a second indigenous aircraft carrier (which project is often abbreviated as 'IAC-2'). Only a few weeks earlier, the Kothari Auditorium in DRDO complex was full of senior IN officers, both retired and serving, key industry figures and domain experts, all of whom shared their experiences and expressed opinions on the future of Indian naval aviation.

The inaugural day 30 April, had P Ashok Gajapathi Raju, Minister of Civil Aviation in attendance as the Chief Guest, with Rao Inderjit Singh, Minister of State for Defence present as the Guest of Honour. In his address, the MoS for Defence stated unequivocally that defence preparedness



*Admiral Dhowan addressing the media in between seminar sessions*

and military modernisation are key priorities and that “the importance of the ‘winged

component’ of the Navy – its Air Arm – is well understood at the highest echelons and we are indeed looking at equipping the Indian Navy with a whole array of aircraft to meet the myriad tasks with which it is regularly tasked.”

The seminar was devoted to presentations and discussions on a range of key topics, the focus remaining on carrier aviation and what the future holds for the Indian Navy in this domain. Although Admiral RK Dhowan, Chief of Naval Staff, appeared sanguine when questioned about the planned second indigenous carrier, saying that “every effort will be made” to compress timelines on the programme and ensure that the ship is commissioned as soon as possible, discussions during the seminar highlighted many of challenges that face the Navy on this programme: comprehensive perspective

planning, the imperatives of international relations with 'friendly' countries, and the status of combat aircraft which will eventually equip the vessel critically.

Rear Admiral AK Saxena, Director General of Naval Design (DGND) remarked that composition of a carrier's air wing must be frozen before design of a carrier can commence. Vice Admiral Anil Chopra reinforced this obvious factor, that the Navy must first define the goals of an aircraft carrier's air wing, then the size and composition of an air wing to meet those objectives and finally design a ship around the air wing. To start with design and displacement limitations, he noted, was to impose constraints on oneself from the outset.

So, what is the role and composition of the embarked air wing? Without deciding on whether the carrier will be desired for STOBAR or CATOBAR operator a choice of combat aircraft is impossible. This leads to a 'chicken and egg' situation, where the composition of IAC-2's air component depends on the ship's design – and vice versa! US Navy Vice Admiral Mike Shoemaker, himself a naval aviator and Commander US Naval Air Forces and US Naval Air Force, Pacific, highlighted this in his presentation where he outlined the future composition of a typical USN Carrier Air Wing (CVW) and the design parameters of the upcoming *Gerald R Ford*-class supercarriers which will host such air wings.

There is no doubt that the USA wishes to replicate the level of closeness that Russia has historically enjoyed with Indian defence and to that end, US officials have hinted that Indian reservations regarding transfer of technology and limitations of use would be seriously addressed by the US bureaucracy. One of the flagship projects under the Indo-US Defence Trade and Technology Initiative (DTTI) is the incorporation of General Atomics' Electro-Magnetic Aircraft Launch System (EMALS) in the second indigenous aircraft carrier (IAC-2) currently approaching design finalisation. The package is also likely to include GA's new Advanced Arresting Gear (AAG) aircraft recovery system.

EMALS has already been selected to equip the next generation of US Navy supercarriers (*Gerald R Ford*-class), the first of which will be commissioned in 2016. The development and testing work for the system has been completed. AAG, although



ACNS (Air) Rear Admiral DM Sudan speaking at the seminar

not as mature as EMALS, will likely be fully operational by the time construction of IAC-2 commences, as it will be installed aboard the first *Ford*-class supercarrier in a year's time.

The Indian Navy currently relies on ski-jump flight decks for its Sea Harriers aboard INS *Viraat* (STOVL) and the MiG-29Ks on INS *Vikramaditya* (STOBAR). These limit the Navy to the operation of only light and medium weight aircraft, precluding the use of larger ship borne AEW&C, transport and tanker aircraft such as the E-2, C-2, S-3 and so on. EMALS and AAG in combination with a larger (65,000 tonne displacement) design would make IAC-2 a true blue-water carrier that the Navy craves for. On the other hand, the Navy already operates a large number of Russian-made MiG-29K carrier fighters and will shortly be operating three Russian-designed STOBAR systems (INS *Vikramaditya*, INS *Vikrant* and the Shore-based Test Facility in Goa). The under-development Naval LCA is also STOBAR-capable and designed to be compatible with the Russian aviation system in use on land and at sea. Assessing long-term asset selection and support is therefore essential before electing to add any new options along with attendant testing, validation and, possibly, new aircraft that go with it.

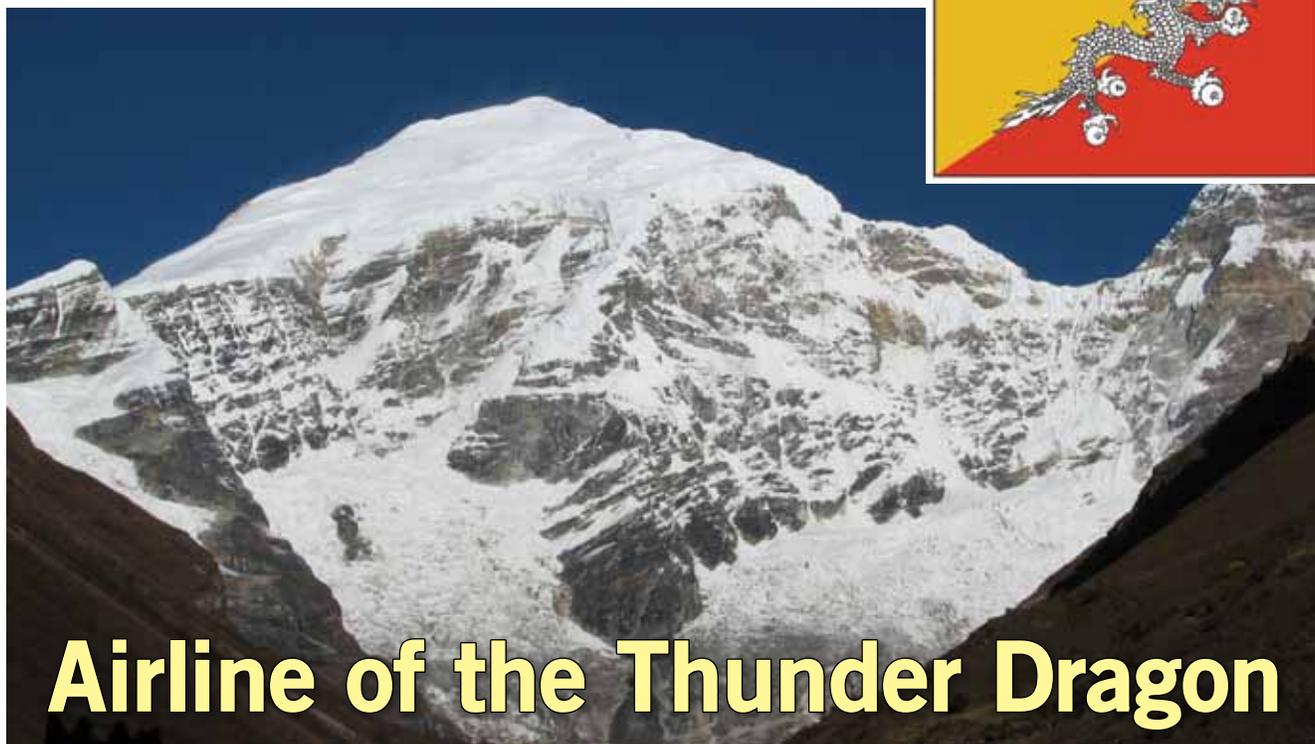
Should the Navy go forward with IAC-2 as an EMALS-equipped CATOBAR carrier, a number of changes will have to be effected. Routine logistics and training aside, the current carrier fighter fleet (MiG-29Ks) will have to be made compatible with the new system. While there is nothing to suggest that a MiG-29K absolutely cannot work with EMALS and AAG, the pairing will nonetheless need to be validated. Similarly, the Naval LCA, and indeed any future aircraft to be operated from IAC-2 will need to be tested to ensure it will work with EMALS/AAG and more broadly with the new, larger carrier design.

It was pertinent that Commodore CD Balaji (ret'd), who now heads ADA, and Commodore Jaideep Maolankar, Chief Test Pilot at the National Flight Test Centre (NFTC) highlighted the challenges of adapting the land-based Tejas for STOBAR operations, and the challenges that their team has faced during development of this aircraft. While operational fielding of this aircraft remains some years away, the development team is optimistic and the Navy remains fully committed to supporting the programme, in keeping with its oft-stated aim of being a 'Builder's Navy' rather than a 'Buyer's Navy.'

[Detailed report in *Vayu* VII/2015]

**Text and photos: Angad Singh**

# Fourth Decade of Druk–Air\*



## Airline of the Thunder Dragon

In yesteryears, the few privileged visitors to the Himalayan Kingdom of Bhutan would travel on pony back for the last lap to the Paro Valley. The ethereal beauty of the Himalayan Kingdom remains unchanged 76 years later but travel to Paro today, though less exotic, is infinitely swifter by aircraft of Druk-Air, the relatively young but vibrant airline of the Royal Kingdom of Bhutan now in its fourth decade.

Bhutan still remains a mythical Shangri-La to most of the world. Druk Yul, or Land of the Thunder Dragon, as the Himalayan Kingdom is known to its inhabitants, nestles in the heart of the greatest mountains in the world. Towering in the north-west are the stark mountains of the Chomolhari range which provide the frontier with the strategic Chumbi Valley of Tibet. Towards the north stand the savage, but beautiful snow peaks of the Great Himalaya, infinite wastes of perpetual ice and snow, bordering the Tibetan region of China. To the south and east, the series of mountain spurs come to meet the northern plains of the West Bengal and Assam states of India. Wedged between giant neighbours, the two largest countries on earth in terms of population and secluded by some of the highest

mountain ranges in the world, Bhutan with a population of just about a million has remained a fabled land of colourful people, of rulers in silken robes living in lofty castle-like dzongs clinging to the sides of mountains, of a thousand rivers plunging through mountain passes, of trails winding around rock faces and dense forests, of giant rhododendrons and wild orchids, of exotic birds and near extinct animals.

In the early years of the twentieth century, a hereditary monarchy was established and over the decades Bhutan found itself slowly transformed from a long period of self-imposed isolation into a developing member of the world community, albeit a measured and philosophical process of integrating the new with the past. For all the outward symbols of modernity, Bhutan has remained a profoundly traditional and religious society where the former blends with the present in a rich and wonderful manner.

### Establishing Druk-Air

Druk-Air, airline of the Kingdom of Bhutan, was established by Royal Decree on 5 April 1981 which ushered in a new era, representing, in marked manner, aspirations of the Kingdom towards opening up links



*A319s sport the resplendent national colours of Bhutan with the unique thunder dragon emblem*

with the outside world. Journeys which once took several days were now possible in a couple of hours.

Till then, the normal manner to Thimpu, capital of the Kingdom, or the beautiful valley of Paro was first to fly by Indian Airlines to Bagdogra in the heart of the tea-growing

\* Now Drukair, but kept as earlier for uniformity in this article

Doors of North Bengal and then undertake a half-day precipitous mountain road journey via the border town of Phuntsholing. Now the Druk-Air flight from New Delhi to Paro takes ninety minutes, which has created an entirely new dimension for citizens and visitors alike.

Druk-Air came into existence after weighted consideration of the programmes and policies of the King and members of the *Tshogdu* (National Assembly) and in line with the values and wishes of the Bhutanese people. Just as tourist facilities were being gradually established in the land's most attractive and historic areas, an air link with Calcutta, the capital of West Bengal in India and an important international air terminal, meant that the arduous journey for tourists, officials and others alike would largely be obviated.

Establishment of an airline was to be an exciting, if somewhat unknown, challenge in a land where the infrastructure had to be put together almost literally from the grass roots. An airstrip had been built by the Indian Border Roads Organisation in the Paro valley, 7,500 feet above sea level, and dedicated to the people of Bhutan, but was essentially used for special Indian helicopter operations on call from the Bhutan Government. The steep approach to the runway, then of some 4,000 feet length, through narrow valleys bounded by high ridges, made selection of right type of aircraft crucial for efficient, safe and reliable operations.

### An appropriate aircraft

The initial requirement was for an 18-20 seater, STOL-type aircraft, having high service ceiling, rate of climb and good manoeuvrability. Above all, the aircraft would have payload-range capability to allow the Calcutta-Paro-Calcutta services to take place without refueling at Paro, where the airfield infrastructure facilities were minimal.

A number of possible aircraft types were considered and, in fact, the Canadian DHC-6 Twin Otter, Australian N-24 Nomad and Spanish Casa C-212 were flight evaluated in India and Bhutan during 1978-1980. However, two of these were considered unsuitable because of their WAT limitations in hot and high conditions, their relatively poor single-engine service ceiling and unacceptable drift down rates.

The third type on the other hand met most requirements except for payload-range. Operating with reasonable passenger loads

from Calcutta, this aircraft would perform have had to make a technical landing at Bagdogra for refueling before flying into Bhutan and this, obviously, meant some passenger inconvenience and would require additional logistic support.

Meanwhile, in mid-1981, the Government of India had established a high level committee to carry out detailed technical evaluation of a number of aircraft types in consideration of its own Light Transport Aircraft (LTA) programme which envisaged the selection and licence production of an optimum-performance aircraft to meet the varied requirement of both military and civil users in the country. By this time, the German Dornier 228 development programme had progressed from the design to flight stage, and this advanced technology commuter/utility aircraft received consideration as the leading contender to meet India's requirement. Whilst industrial and commercial negotiations continued with Hindustan Aeronautics Limited, plus flight and technical trials under severe operating conditions in India and Bhutan, the Government of Bhutan selected this most appropriate aircraft, in conjunction with the Indian flyaway competition. In establishing Bhutan's airline Druk-Air, Indian managerial and technical assistance was requested.

### Dornier 228 : the pioneer

Following joint operational analysis and technical feasibility studies, the Government of Bhutan selected the Dornier 228-200 and finalised orders for the first aircraft (January 1983 delivery) with an option for the second aircraft (late 1983 delivery). The Dornier 228-200 of 18-19 passenger seat configuration and functional toilet, was selected because of its extraordinary performance capability

in meeting the exacting requirements of the Bhutan operation.

The scenario required scheduled flights with normal passenger loads from Calcutta to Paro and return, without refuelling at Paro (a 1200 km round trip), with sufficient reserve margins. Vital performance aspects were the Dornier 228's short take-off and landing ability, performance margins at hot and-high (airfield at 7,500 ft. above sea level, temperatures up to ISA+20) conditions, high single-engine service ceiling good rate of climb and excellent manoeuvrability. Of great economic benefit were the aircraft's fuel-economics which, combined with high cruise speed, would generate operating surpluses even with limited passenger loads.

### Establishing facilities

Such exacting requirements were well met by the Dornier 228. Indian Airlines management assisted Druk-Air in planning for the new airline, establishing operational and commercial procedures, recruiting personnel and setting up maintenance support facilities at Dum Dum airport in Calcutta, which would initially be the airline's technical base. Under an agreement signed between the two Airlines, IA engineering personnel were to be responsible for maintenance and ground handling of Druk-Air's Dornier 228, and a number of engineering staff were seconded for training with Dornier at Munich. Assisted by Dornier product support, Druk-Air's maintenance facility was set up in a special hangar at Dum Dum airport and special courses conducted for technicians by Indian Airline's Eastern Region and Dornier's resident Technical Representative.

Druk-Air recruited its own aircrew, mostly former Boeing commanders from Indian Airlines and Air India plus



*Still in its temporary German registration, Druk-Air's first Dornier 228-200 (later receiving its Bhutan identity as A5-RGB)*



former Indian Air Force pilots with extensive mountain flying experience. After conversion training at Dornier's Oberpfaffenhofen facility near Munich, the Druk-Air commanders were given conversion training on the Dornier 228 at Calcutta and operational procedures established for valley flying after intensive route proving trials.

As recorded by the pioneering pilots:

*The flight distance between Calcutta and Paro is some 585 kilometres and follows the inter-national air route R.98 which crosses over Bangladesh up to the north Bengal town of Cooch Behar. From here onwards the route is uncharted, the area northwards being shown as a 'blank' in Jeppesen Charts, and it is from here that the beautiful vista of the Bhutan Himalaya unfolds.*

*Key navigation points are, in fact, the world's highest mountains. As he approaches Cooch Behar, the pilot has Mount Everest and its neighbouring peak of Makalu to his 10 o'clock with Kanchenjunga, the third highest peak in the world, straight ahead. The pilot turns to the north-east before the valley route into Bhutan is entered, along the Radok river, over the reference points of Chima Kothi, the Chukha hydel electric project up to Confluence, where the rivers Wang Chu and Paro Chu meet. Turning into the Paro valley, the pilot looks to Mount Chomolhari, abode of the Goddess and within minutes is above the Paro airfield. Descending over the famous Paro Dzong (Monastery), the aircraft skims over the last ridge to touch down at Paro, 7,500 feet above sea level and is then parked on the apron near the Air Traffic Control building, built in the typical Bhutanese style architecture.*

### Inauguration of the Air Services

First ever landing by the Druk-Air Dornier 228 (serial No. 8006) at Paro was on 14 January 1983. The exact time of landing, the number of passengers on board and

the direction in which the aircraft had to be parked on the apron had been earlier determined by the *Neten* (High Lama of the Paro Dzong). At the auspicious moment, the *Neten*, accompanied by some 40 other Lamas chanting Buddhist prayers, blessed the aircraft with traditional ceremonial scarves tied to its nose, holy water sprinkled and incense sticks lit. The religious ceremonies over, Dornier's test pilot and the Indian crew took up groups of senior Bhutanese Ministers, officials and the Lamas for short flights over the capital of Thimphu where thousands of citizens stood to cheer the sight of their first aircraft ever in history.

Scheduled air services were inaugurated by Druk-Air on 11 February 1983, Flight 101 departing Paro for Calcutta with distinguished guests on board and returning the next morning as Flight 102 from Calcutta. During the first four weeks the air link was flown three times weekly, increasing to daily flights from mid-March.



(Above) Druk-Air Dornier 228 (A5-RGB) at Paro airport and (below) received by traditional dancers before formal induction into service



The Druk-Air Dornier 228 was also considered for wet charter by the Indian commuter airline Vayudoot, for services to Eastern India points on its regional network.

Initially, Calcutta was connected by a three-times weekly service and in the first year of service some 3500 passengers were carried. By the end of 1988, the Paro-Calcutta sector was being operated daily while Dhaka, in Bangladesh, had been added to the Druk Air network, with a bi-weekly Dornier 228 operation. The total number of passengers carried had, in the intervening period, increased by over 300%.

With a rapid increase in demand, plans were considered for an expansion of the airline's capacity. In 1986, the SAARC heads of state had resolved to air-link each other's capital cities at an early opportunity. At about the same time, the Bhutan Government considered the feasibility of developing domestic destinations in order to increase the pace of economic activity, social integration and for providing a faster means of communication and transport for the administration and developmental agencies.

This dual objective meant that sooner than later, the two Druk-Air Dornier 228 aircraft would be required to operate on the proposed domestic network and to support lean routes on short range international sectors. For the longer range operations, for instance to Delhi or Kathmandu in the first phase, a larger, pressurised aircraft, with significantly higher block speeds was

considered as necessary. However, inspite of the high double-digit growth rate of traffic, the total number of passengers carried (11,000 in 1987) was not considered sufficient to justify the acquisition of a larger, and therefore far more expensive, aircraft.

### Going jet with the BAe 146

The tussle between long term social and policy objectives and immediate economic realities stood out in stark contrast. It was to the credit of the Royal Government that, after careful deliberation, extensive discussions and detailed studies, a bold decision was taken resulting in selection of the 80-seater British Aerospace 146-100 aircraft to airlink Paro with Delhi and other key cities. The BAe 146 jetliner performed wonderfully in the sectors envisaged for scheduled-services and was another "first" for Bhutan : the first BAe 146 to go into service in South Asia. The Paro-Delhi link was inaugurated on 25 November 1988, the return flight taking place on the following day. Paro was now airlinked directly with Delhi by a bi-weekly service while soon enough, in 1989, Kathmandu was scheduled for airlinking with Paro after relevant formalities had been completed.

At the time the Dornier 228s were acquired in 1983, Druk-Air had neither the base facilities at Paro nor the trained man-power for aircraft maintenance. Therefore, initially, Druk-Air entered

into an arrangement with Indian Airlines for the maintenance and housing of its aircraft at the Dum Dum base of Indian Airlines. With commencement of its Dornier 228 operations, Druk-Air engaged Bhutanese engineering graduates and technicians, who were sent for type and basic training to India, Germany and the United States. By 1987-88, Druk-Air personnel had acquired sufficient expertise and self confidence to warrant assuming all front line maintenance in-house. The maintenance base for the Dornier 228, however, still continued at Calcutta owing to lack of hangarage and workshop facilities at Paro. Infrastructural facilities at Paro became available only sometime during 1989, and the maintenance was then re-located from Calcutta.

The BAe 146 aircraft were based at Paro from the very start with British Aerospace and Lycoming providing maintenance and training support to the airline.

### Building the infrastructure

After the acquisition of Dornier 228 aircraft, the main thrust was not only on maintenance engineering but also for pilot training. Since then, an increasing number of young Bhutanese joined the airline, while other Bhutanese national graduate engineers and technicians and mechanics received training, both on the Dornier 228 and BAe 146.

With induction of the BAe 146, new areas of services were created for Druk-Air,



*Computer-generated rendering of a Druk-Air BAe 146 on 'finals' as it comes to land at Paro airport*

including apron handling, in-flight services, catering and inter-lining. Above all, the four-fold increase in capacity of the aircraft required a re-appraisal of marketing policies and training in marketing, advertising, public relations, commercial statistics and agency work. It was fortuitous that Thai International assisted Druk Air in this area.

Airline operations in general and Druk-Air with its geographical constraints in particular, required a most reliable, fast and efficient communication system. Without this a commercially viable operation was not feasible and Druk Air took firm steps to install a via satellite network to connect Thimpu/Paro with the outside world and joined the SITA network in early 1989.

Engineering workshop facilities to facilitate maintenance of the BAe 146 and Dornier 228 aircraft became operational within the first quarter of 1989. Under a UNDP aid programme, VOR/DME facilities were shortly thereafter installed at Paro.

### Expanding services

Druk-Air continued daily flights to Calcutta with the Dornier 228 aircraft and added a once-weekly flight with the BAe 146s, doubling its route capacity in the process. The flights to Dhaka continued at two flights per week, again with the Dornier 228 aircraft. The Paro-Delhi route began with twice a

Bhutan had requirements for aerial survey, mapping, aerial-seeding, forest surveillance and evacuation of emergency medical cases. In order to achieve these operational capabilities, Druk-Air also examined proposals to suitably reconfigure one of its own Dornier 228s for this role.

The studies leading to selection of the BAe 146 had envisaged the addition of a second such aircraft in 1990-91. However, the pressure on network expansion, sooner than envisaged in the plan required an earlier date of acquisition. Druk-Air, therefore, rightly examined proposals for offsetting the economic distress of such an earlier acquisition by additional capacity leasing to Indian Airlines, which were likely to remain in an under-capacity situation well into the nineties.

It may seem strange that the world's youngest (and perhaps smallest) airline had stepped into the breach to help-out one of the world's largest domestic air carriers in 1983-94. Astute political wisdom, minimal bureaucratic meddling and the will to learn correctly from the grass roots has remained Druk-Air's favoured legacy.

For nearly six years, the young Bhutanese carrier learned the fundamentals of airline operation and management with its fleet of two Dornier 228s as its backbone, systematically building up its

In an almost identical situation, Druk-Air led rest of the sub-continent in selecting the BAe 146 and putting it into scheduled services well before Indian Airlines had even begun to seriously evaluate aircraft for its turboprop replacement.

Druk-Air's BAe 146, in resplendent colours, operated on scheduled services on behalf of Indian Airlines, from Delhi to Bangalore and back, from Delhi to Calcutta and back, also become a familiar sight at Bangkok, Dhaka and Kathmandu.

### For the record

On 30 December 1987, a US\$25 million order had been placed for a BAe 146-100 STOL regional jet, the purchase of the aircraft financed by the government, obtaining, for the first time in the country's history, a commercial loan. In 1988, the airlines' operational base was shifted from Kolkata to Paro Airport and the airline also hired its first flight attendants who were trained by Thai Airways International. On 21 November 1988, a BAe 146 flew into Paro Airport and with its introduction, Druk-Air was able to widen its network to link Paro with Delhi on 26 November 1988, Bangkok on 28 January 1989 and Kathmandu in April 1989. In the first full year of operational service with the BAe 146, the airline achieved an average load factor of 50-60 percent, well above the 40 percent which was forecast carrying 12,732 passengers over the 1989-1990 period. In 1990, the runway at Paro Airport was lengthened from 1,400 metres (4,600 ft) to 2,000 metres (6,600 ft) and reinforced for heavier aircraft. A hangar was also constructed for the aircraft, which was funded by the Indian government as part of the *Paro Airport Development Project*.

The Airline's lone aircraft was requisitioned by Druk Gyalpo Jigme Singye Wangchuck on 9 November 1990, to have the King and his party travel to Tokyo for the coronation of Akihito as Emperor of Japan. From Japan, the King then travelled to Malé in the Maldives for the South Asian Association for Regional Cooperation summit in November, and return to Bhutan in order for the aircraft to re-enter service with the airline on 25 November. A second BAe 146 joined Druk-Air in 1992, and on 11 November 1993, the airline introduced an Executive Class on the aircraft. On 13 May 1991, Druk-Air was registered under



week operations by BAe 146 and at the end of 1989, were increased to three flights weekly, while the Paro-Kathmandu sector operated once per week with the BAe 146 aircraft.

Druk-Air also entered the charter market within the sub-continent and elsewhere with its two Dornier aircraft, to further help in improving the financial health of the corporation. With its developing economy,

strength and experience. In stark contrast, the Indian feeder airline Vayudoot, starting with its infinitely vaster resources of men, material and experience, however operated in somewhat 'reckless' manner even with the same aircraft-type as its backbone. For instance, Vayudoot had a score of premature engine removals over their first year of services while Druk-Air had none.

the Companies Act of Bhutan. Services to Yangon, the capital of Myanmar, began on 6 January 1997.

During 2000–2001, Druk-Air operated with a single aircraft for over a year owing to a corrosion defect on its other aircraft (A5-RGD) in the wing tanks that was detected during a routine check at Woodford. The wings were replaced. In 2002, an RJ70 was wet-leased from Air Baltic to cover for maintenance to A5-RGE.

Druk-Air also became launch customer for the Avro RJX-85 in April 2000 placing an order with BAE Systems for two aircraft, with deliveries initially scheduled to take place in November 2001 and January 2002. Delays in the first flight and certification of the RJX pushed back expected delivery for Druk-Air to after April 2002. BAE Systems eventually cancelled the RJX programme in November 2002, since it had received orders from only two airlines, Druk-Air and British European. With British European threatening legal action to enforce their contract with BAE Systems, the aircraft manufacturer offered to fulfil the contract, although airline management decided against acquiring the aircraft, citing potential problems with sourcing spare parts for the aircraft in future.

### Enter the Airbus A319

In order to find a replacement for the two BAe 146s, Druk-Air management sought proposals from Airbus, Boeing and Embraer to determine airliner suitability to meet Druk-Air's stringent operational requirements. Bombardier was also invited by management to demonstrate the CRJ900 regional jet, however, the airline was advised by Bombardier that the aircraft would be

unsuited for operations at Paro. In February 2002, the Airbus A319 became the largest aircraft to ever land at Paro Airport, when Airbus demonstrated their aircraft to the airline. By October, Boeing had withdrawn from the competition not being able to source an aircraft to demonstrate to the airline. With the Embraer E-190 yet to fly, it was expected that Druk-Air would order the A319. However, the government had concerns regarding financing for the purchase and in October the final decision was delayed. After a short period of time, the government instructed management to begin evaluations once again, and a Boeing 737–700 conducted eleven test flights at Paro Airport in February 2003, in which it demonstrated meeting requirements of the airline for operations into Paro.

The decision however was in favour of the A319 and Airbus signed a memorandum of understanding with Druk-Air in July 2003 for two 114-seat Airbus A319-115s, powered by two CFM56-5B engines, for delivery in the second half of 2004. Purchase of the two jetliners, valued at 3,534.36 million Bhutanese ngultrum (BTN), was the biggest single purchase ever made by Bhutan and was largely responsible for a 250 percent increase in the Bhutanese trade deficit over the previous year for the financial year 2004–2005. The Bhutanese government issued BTN 1,767.18 million in government bonds to pay for one aircraft and for only the second time in Bhutan's history, intended to seek a commercial loan for the other aircraft. However, in October 2004 it announced that it would instead seek a soft loan for this purpose.

On 11 November 2003, on the birthday of Druk Gyalpo Jigme Singye Wangchuck,

Druk-Air initiated services to Gaya, in India, the site of the Mahabodhi Temple where Siddhārtha Gautama, the Buddha, had reached enlightenment and to where 30,000–40,000 Bhutanese make the pilgrimage every year. Pilgrims previously made the pilgrimage to Bodh Gaya via a 2–3-day overland trip from the Bhutanese border town of Phuntsholing and Druk-Air management now planned to meet 20–30% of this traffic.

The first Airbus A319 arrived in Bhutan on 19 October 2004, the date chosen after a Buddhist astrologer was consulted to ensure the aircraft arrived in Bhutan on an auspicious day in the Buddhist calendar. Before entering service on commercial flights on 31 October 2004, Druk-Air took their A319 on a country-wide flight in honour of the ascension of Crown Prince Jigme Khesar Namgyel Wangchuck to the Chhoetse Penlop. The second aircraft was delivered by Airbus to Druk-Air in December 2004. On 31 August 2012, Druk Air took delivery of a third Airbus A319.

In July 2005, the Governments of India and Bhutan signed a new bilateral air services agreement which increased the allowable number of weekly flights between the two countries from 12 to 49. In addition to destinations already served by Druk-Air, the cities of Mumbai, Chennai and Guwahati were included in their services agreement, with Bhutan being granted fifth freedom rights from several Indian cities to onward destinations such as Yangon, Dhaka and Singapore.

Domestic helicopter services were inaugurated in November 2005, in line with a resolution by the Council of Ministers in April 2001 which stated that domestic services should be introduced. Thirty heliports across the country were identified, and the introduction of services had, for example, the 550 kilometres trip from Thimphu to Trashigang taking just an hour, instead of two to three days!

Flights to Dhaka, which had been suspended since 29 December 2003 were resumed on 23 October 2006, and the airline was given rights to fly to Chittagong and Cox's Bazar by the Bangladeshi authorities. The airline announced plans in July 2007 to start scheduled flights to Mumbai via Kathmandu from March 2008, in line with the strategy of Druk-Air management to increase the number of Indian tourists travelling to Bhutan during the low season months of June through August and



*Druk-Air's first Airbus A319 arrived in Paro on 19 October 2014*



*Airbus A319 (A5-JSW) is the latest to join Druk-Air's fleet*



*Druk-Air's latest A319 with sharklets*

November through February. These plans were put on hold in March 2008, as Paro Airport was not able to handle night flights and the airline only secured landing slots at Mumbai's Airport at 3 a.m. Plans for services to Hong Kong, Singapore, Abu Dhabi, Dubai and Sharjah were also shelved.

In 2007, Druk-Air posted its first profit of BTN 31.15 million. The two BAe 146 aircraft were sold to Star Perú in October 2007 for US\$3.3 million, and left Bhutan for Peru in November and December 2007. On 11 November 2007 Druk Gyalpo Jigme Khesar Namgyel Wangchuck issued a Royal Kasho establishing *Druk Holding and Investments Limited*, a holding company which would manage existing and future investments of the Royal Bhutanese government. As a result, seven government-owned companies, including Druk-Air, had their ownership transferred from the Ministry of Finance

to the newly formed holding company. Incorporated on 13 November 2007, Druk Holding and Investments announced in December 2007 that given Bhutan's tourism industry being reliant on Druk-Air, the head of the government agency overseeing tourism development in Bhutan would become the chairperson of Druk-Air, and would be responsible for improving the performance of the national airline.

In March 2008, Druk-Air introduced a new uniform for its flight attendants, consisting of a contemporary *kira* and *tego*. The uniforms were introduced for the centenary celebrations of the monarchy, as well as the airlines own silver jubilee.

Owing to its limited network which is reliant on fifth-freedom rights, Druk-Air regularly leased its aircraft to other airlines, such as Myanmar Airways International, Air India and Bangkok Airways in order to keep utilisation rates on its aircraft higher than they would under normal circumstances, whilst at the same time earning extra revenue.

The airline planned to begin flights on 20 April 2009 to Bagdogra Airport in India, but had to delay the inaugural flight owing to the lack of immigration and customs facilities at the airport. The inaugural flight to Bagdogra Airport left Paro Airport on 18 June 2009, making Druk-Air the first international airline to operate into the airport.

In October 2009, the Bhutanese government planned construction of an airstrip in Yongphulla. The airstrip, which was expected to be 3,900 feet (1,200 m) in length and operational by March 2010, would allow for service by small aircraft in the 15–16 seat category. The project was

being financed with Nu.34 million from the budget which was previously allocated to the development of domestic helicopter services. The airstrip would however only be operational during the morning hours owing to high winds in the afternoon, making safe operations risky.

Druk-Air conducted feasibility studies for operating flights to the airstrip from Paro, as well as two others under construction at Bathpalathang and Gelephu, with a feasibility study conducted into the viability of an international airport near the southern Bhutanese town of Gelephu. In the five-year plan (2008–2013) funds had been allocated by the Bhutanese government for development of the new airport, a preliminary survey conducted in May 2006, but in October 2008 the project was shelved, and the Bhutanese government decided that the airport at Gelephu would be used for domestic flights only.

On 21 April 2010, an ATR 42 turboprop regional aircraft was delivered to Druk-Air at Paro under a nine-month lease, the aircraft used on flights from Paro to Kolkata and Kathmandu. The ATR 42 first operated on a nine-month lease from April 2010 was evaluated by the airline with the possibility of a future purchase. On 4 June 2011, a purchased ATR 42 arrived in Paro. Druk-Air had bought the 48-seater with the view of using it to service the domestic routes to Bumthang and Yonphula in late 2011.

Under the *Vision 2020 Plan*, the Royal Bhutanese Government identified the requirement for improved external air links by 2017, in an effort to increase



The 48-seat ATR 42 has enabled Druk-Air to service domestic and some regional international routes



Druk-Air A319 taxiing past the Paro Dzong before reaching the runway threshold



(Top) : As in January 1983, when Druk-Air's first Dornier 228 landed at Paro to be greeted in traditional manner, Druk-Air's latest Airbus A319 (partly built at the same site in Germany) is greeted by Bhutanese dancers in March 2015 (Below) An evocative scene: The A319's sharklet's painted with Thunder Dragons close to the arrival hall at Paro airport



tourism revenue 150% by 2017. Druk-Air conducted feasibility studies into the commencement of operations to either Hong Kong or Singapore. Preliminary studies showed that Bhutanese traffic to Singapore would consist mainly of official travel, whilst traffic to Hong Kong would be mainly commercial, with good prospects for tourism development.

Another Bhutanese airline Tashi Air was the second airline based in Paro and began operations in 2012 with one wet-leased A320 from a Lithuanian operator. The operation continued sporadically and once the wet-lease term was completed, the airline dry-leased two ex-China Eastern 2001 vintage A319s in 2014.

### A319 with 'Sharklets'

Druk-Air's latest airliner, an Airbus A319, flew into Paro International airport, on 16 March 2015. Registered as A5-JSW after the initials of His Majesty the Fourth Druk Gyalpo, this newest A319 has expanded Druk-Air's fleet to five aircraft, four of which are A319s plus one ATR-42 turboprop. Arrival of the new A319 was a little more than a decade after Druk-Air's last A319 was

received and came equipped with new technology, that most noticeable being the blended winglet that Airbus calls 'sharklets', attached to the tips of the two wings. Besides a fuel saving of four percent, the sharklets allow A5-JSW to take off from Paro airport with 1,800kgs more than Druk-Air's existing A319s. With temperatures at Paro about 19 degrees Celsius (or below), A5-JSW will be able to take off with a full load of 122 passengers and fly non-stop to Bangkok.

Inside this new A319, the most visible addition is an in-flight entertainment system where drop down or bulkhead screens are available. Currently, only the flight route, position of aircraft, timings and distances are displayed but the airline plans to eventually screen documentaries on Bhutan as well.

Druk-Air has placed emphasis on ensuring that passengers and observers know that the airline is a 'Royal Bhutan Airlines' by enlarging the font size displayed on the fuselage. The CEO stated that as the aircraft is dedicated to the Fourth Druk Gyalpo on the occasion of His 60th Birth Anniversary and to the Crown, "it was deemed necessary to emphasise it as 'Royal Bhutan Airlines'."

The new aircraft will replace the leased A319, which has been used since 2012 and scheduled to be returned by July 2015. Druk-Air requires a minimum of three A319s, with one of them serving as a back up aircraft in case of weather or technical problems. With the airline's two A319s now into their 10th year of service, minor technical issues were more frequent which could cause delays and cancellations if a third aircraft was not available and on stand by.

Given the enhanced performance of the airline's new A319, this will be operated on the airline's longer routes such as to Singapore, and for additional and charter flights. Druk-Air plan to operate charter flights to the Indian cities of Ahmedabad and Mumbai later in 2015.

Now in the fourth decade of its existence and with an exciting future, the airline which sports Bhutan's unique emblem of the Thunder Dragon, is confidently reaching out to meet the expectations of its visionary founders.

[Sources : Vayu Aerospace Review Issues VI/1982; I/1989; Airbus Industrie; Gyalsten K Dorji]

# Airbus Innovation Days 2015



## New products across the spectrum

*The A320neo concluded its first flight with CFM International LEAP-1A engines on 19 May 2015 with a touchdown in Toulouse, France.*

It's *Airbus Innovation Days* again! Some eighty media persons from all around the world gathered at the traditional event in Toulouse for the company's programme update. Arrivals into Toulouse went on throughout 27 May and for the ones that got in at a respectable time, a tour to the A350XWB Final Assembly Line (FAL) was organised by Airbus. Needless to say, it was an extremely detailed tour with much information garnered. The same evening, a welcome dinner at the Radisson Blu Hotel was hosted by the ever pleasant Stefan Schaffrath, Head of Airbus Media Relations.

After an early morning and welcome coffee at the *Jean-Luc Lagardere Airbus A380 FAL* (Final Assembly Line) conference hall, the opening remarks and presentation was made by John Leahy, Chief Operating Officer – Customers, who focussed on an overview as well as about “meeting customer needs”.

‘Comfort without compromise’ was the next session conducted by Kiran Rao, Executive Vice President - Strategy & Marketing followed by a talk on ‘Preparing the future’ by Tom Williams, Chief Operating Officer.

Very detailed and long, but very pertinent presentations followed on ‘Airbus Programmes Update’ by Didier Evrard, Executive Vice President – Head of Programmes and Bruno Hernandez, Senior Vice President – Head of A350 Programme Developments. Didier Lux - Head of Customer Services, spoke on ‘Delivering world-class services’.

Ed Bastian, President of Delta Air Lines, who was in Toulouse to receive his 242-tonne A330-300 (and the very first aircraft of this type) gave an insightful talk on his airline and the airline industry.



continuing appetite for the A330's winning combination of unbeatable economics, best-in-class comfort and high reliability. As for all members of our product family, we are continuously improving the A330 through incremental innovations, such as adopting some of the latest technologies developed for the A380 and A350 XWB. The popularity and success of the A330 is such that our top ten customers have placed repeat orders for the type more than eight times on average. The A330 is one of the world's most efficient aircraft with best in class operating economics which is why an A330 takes off or lands every 20 seconds and over 1,100 A330 Family aircraft are flying with airlines serving more than 400 airports worldwide".

"As for the A320 Family, it is the world's best-selling single aisle airliner with more than 11,500 orders to date and over 6,400 aircraft delivered to 400 customers and operators worldwide. The newest member of the A320 Family, the A320neo, incorporates many innovations including latest generation engines and Sharklet wing tip devices, which together deliver more than 15 percent in fuel savings from day one and 20 percent by 2020. With more than 3,600 orders received from 70 customers since its launch in 2010, the A320neo Family has captured a solid 60 percent share of the market".

"We have also launched the A321LR which is the latest member of the A320neo Family, it is able to fly longer routes of up to 4,000 nm. The A321LR provides additional flexibility as it has the longest range of any single aisle airliner, making it ideally suited for transatlantic routes and enables airlines to tap into new long haul markets which were not previously accessible with current single aisle aircraft. With 206 passengers in a typical two-class layout, the A321LR

## Over 1,500 orders for the A330



The Airbus A330 Family has notched a major milestone : winning over 1,500 firm orders from over 100 customers. Total sales to date (1,501) include a recent order for four A330-200 Freighters from Turkish Airlines and 25 A330-900neo from Air Lease Corporation. The A330 belongs to the Airbus Widebody aircraft Family, which comprises the A330, A350 XWB and A380, and spans the 250 to over 500 seats segment.

offers the possibility for each passenger to carry up to three bags".

Kiran Rao, Executive Vice President - Strategy & Marketing amplified on passenger comfort especially since Airbus offers an 18" seat width across its product range – no compromise on passenger comfort! While it is tempting to reduce seat pitch and add more seats to aircraft (thus improving bottom lines for airlines), this is something Airbus does not support.

As for the A380, the mega airliner first performed its maiden flight 10 years ago, and it was clear that Airbus was "once again shaping the future of air transportation". A decade later, the company's vision and passion for aviation is keeping the A380 at the forefront—providing a very large jetliner that is more than ever meeting passengers' changing expectations and matching the evolving trends in air traffic, while generating significant revenue for its operators. This is best illustrated by airlines' current use of the A380 on nearly 100 routes to some 45 destinations, linking major airports, accommodating growing traffic on intense regional segments, connecting hubs to key city destinations and serving busy domestic flights. On certain routes, A380s

Fabrice Brégier, President and Chief Executive Officer gave the closing remarks on the 'main challenges ahead' which was followed by a Q&A session.

After this long day, we were ferried to the 'Fondation Bemberg Hôtel d'Assézat' museum in Toulouse city centre for a sumptuous and fantastic dinner!

Now into the deep end : there is much confidence in the A330 family. As John Leahy, Chief Operating Officer – Customers, stated, "It's great to see the strong and growing market for the versatile A330 Family. This reflects the market's



John Leahy, Chief Operating Officer – Customers, Airbus

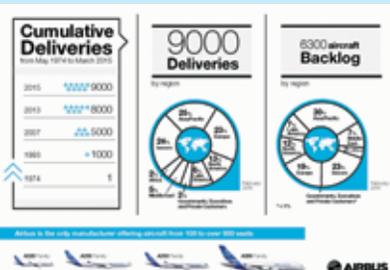
are operated on multiple frequencies – up to seven per day.

The A380's interior volume enables operators to choose the cabin configuration that meets the needs of their specific routes and passenger preferences. As an example,

## Airbus celebrates delivery of its 9,000th Aircraft

The company celebrated the delivery of its 9000th aircraft at a ceremony in Hamburg, Germany on 20 March 2015. The aircraft is the first A321 to be delivered to Vietnamese carrier VietJetAir and will join the carrier's all-Airbus A320 Family fleet flying on its fast-growing Asia-Pacific network.

"The delivery of our 9000th aircraft comes as we enjoy ongoing strong demand for aircraft across



our product line," said John Leahy, Airbus Chief Operating Officer, Customers. The 9000th delivery comes less than two years after Airbus reached its last milestone of 8000 aircraft-delivered in August 2013. Over the last 10 years, Airbus has doubled its deliveries to reach over 600 aircraft a year today – a figure that is set to rise further as the demand grows.

*VietJetAir first A321 delivery ceremony in Hamburg*



many airlines are incorporating a Premium Economy cabin, adding higher-revenue economy class seating while maintaining equivalent overall passenger count totals. As a result, airlines are able to boost the average passenger yield and generate approximately \$13 million in additional revenue annually for each of their A380s. Airbus also is offering an 11-abreast Budget Economy class layout, which retains Airbus' comfort standard with 18-inch-wide seats.

"But we aren't stopping here, as we have some new cabin innovations that allow even more optimisation of the cabin space, thereby allowing us to add additional business and premium economy seats. The new higher seat count configuration, together with the increase in yield, will generate up to \$20 million each year in additional revenues for every A380. The A380's cabin enables further enhancements of first and business class offerings as well, including private three-room suites for the most discerning travellers, while higher density arrangements for the A380 also are possible – with one airline announcing a two-class 600-seat configuration".

In developing the A380, teams at Airbus set their sights high from the design and technology point of view, introducing innovations literally from nose to tail. This includes the Runway Overrun Prevention System (ROPS) for enhanced safety during landing, and the AFDX backbone network technology for on-board data exchange – both of which are used on the A350 XWB, and have become recognised industry benchmarks.

Sales of the A380 now total 317 from 18 customers, representing a 90 per cent share of the very large aircraft market. More than 150 A380s currently are flown by 13 operators, carrying approximately two million passengers every month. Somewhere in the world, an A380 "shares the love" by taking off or landing every four minutes!

The A350 XWB's wide-body fuselage encompasses a 221-inch wide cabin. With generous room in all classes, the A350 XWB features the Airbus long-haul standard 18-inch wide Comfort economy seats (9-abreast). Allowing passengers greater lateral movement and more personal space on long-range flights, the Comfort Economy seat is expected to be used in around 90% of airline economy cabin applications. The aircraft is entirely suited to bringing efficiency to new markets and expanding market segments as it also offers Premium (8-abreast) and Comfort (9-abreast) Economy class options. Other First and Business class configurations including 4-abreast are equally available. The A350 XWB cabin design with panoramic windows helps creating a pleasant and soothing atmosphere. Built from the start with 4th-generation systems, the A350 XWB takes in-flight entertainment to 'a new dimension'. With high-bandwidth fibre optics, high-definition video becomes a reality for all passengers, on screens of up to 12 inches in Economy-class. Personal space is further increased by virtually invisible seat-connect boxes and cables that run entirely under a completely flat



*Sunny Guglani, Justin Dubon and Kiran Rao of Airbus at the Jean-Luc Lagardere Airbus A380 FAL (Final Assembly Line) conference hall.*

floor. Large A350 XWB overhead stowage compartments enable passengers to store more hand luggage – more than one roller bag per passenger. Full LED mood-lighting offers 16.7 million shades of colour to create individual ambiances for each airline and well-being for passengers through every phase of their flight. Lighting scenarios mimicking natural sunrise and sunset help reduce the effects of jet-lag. The mood-lighting system is controllable both lengthwise and across the cabin, which is unique to the A350 XWB.

The Airbus A350 XWB’s air management systems help passengers to enjoy a more relaxing flight. Total cabin air is renewed every two to three minutes in a draft-free environment at the optimum temperature. The A350 XWB also benefits from lower cabin pressure altitude – lower than 6,000ft throughout the entire flight, which contributes to the feeling of well-being.

But back to the A330, Tom Williams, Chief Operating Officer, stated, “As a result of this success, the A330 Family has been extended to include Freighter, VIP, and Military Transport/Tanker variants. Development continues on the A330 with numerous on-going product enhancements entering service in the coming years, ensuring the A330 Family remains the



Vayu’s visit to the A350XWB Final Assembly Line (above and below)



## EasyJet delivery of its 250th Airbus aircraft

**E**asyJet and Airbus celebrated their successful partnership at a ceremony in Hamburg to mark the delivery the airline’s 250th Airbus A320 family aircraft. Carolyn McCall, easyJet CEO, Jean-Paul Ebanga, CFM International President and CEO, Didier Evrard, Airbus EVP and Head of Programmes, and Christopher Buckley, Airbus EVP Europe, Africa and Asia-Pacific were present at the event. To celebrate the 250th delivery, easyJet unveiled its newest A320 with a unique livery featuring 250 miniature aircraft. As with other recent deliveries to easyJet, the A320 is equipped with the latest technology and fuel-saving ‘Sharklets’.

The airline flies 234 aircraft on more than 750 routes to over 130 airports across 33 countries. easyJet

operates Europe’s largest and the world’s fourth largest Airbus single aisle fleet. Since easyJet took delivery of its first Airbus aircraft (an A319) in September 2003, Airbus has delivered an aircraft on average every 16 days since the first

delivery. easyJet has 158 aircraft currently on order, and in terms of total aircraft orders is Airbus’ third biggest airline customer. Currently easyJet fly a fleet of 85 A320s (180 seats) and 149 A319s (156 seats).





*A380 economy class*



*Showing its nimble flying characteristics, the A380 in flight demonstration*

most cost-efficient and capable widebody aircraft. These enhancements include the more capable 242 tonne take-off-weight variant (available for both the A330-200 and the A330-300), the A330 optimised for regional and domestic routes and the A330neo. In the future the A330 will be operating in combination with the A350 XWB as 85% of A350 XWB customers are also A330 customers or operators”.

“Now building on the proven economics, versatility and high reliability of the hugely popular A330, the A330-800neo and A330-900neo launched in July 2014 will reduce fuel consumption by a further 14 percent per seat compared with today’s A330, making them the most cost efficient, medium range widebody aircraft for the future on the market. To date Airbus has won 145 orders from seven customers for A330-800neo and A330-900neo”.

In his concluding remarks, Fabrice Brégier, President and Chief Executive Officer, stated, “Ten years after the first

take-off on 27 April 2005, the Airbus’ A380 has clearly established itself as the world’s favourite Very Large Aircraft (VLA), with the 317 orders booked from

18 customers, representing a 90 per cent share of this market. The A380’s track record is as remarkable as the jetliner’s distinctive profile, transporting nearly three million passengers every month on some 200 flights performed in daily service with its 13 current operators. Emirates is the fleet leader, having received its 60th A380 in May 2015, with deliveries pending for 80 more. The other operators flying A380s today are Air France, Asiana Airlines, British Airways, China Southern Airlines, Etihad, Korean Air, Lufthansa, Malaysia Airlines, Qantas, Qatar Airways, Singapore Airlines and Thai Airways International”.

“Currently there are three final assembly lines for the A320 Family based in Toulouse, France; Hamburg, Germany and Tianjin, China. Toulouse has responsibility to build A320s; Hamburg assembles the A318, A319, A320 and A321 while Tianjin builds A319s and A320s. Tianjin is Airbus’ first assembly facility located outside of Europe, resulting from a joint venture involving Airbus with a Chinese consortium comprising the Tianjin Free Trade Zone (TJFTZ) and China Aviation Industry Corporation (AVIC). Joining this network will be a new A320 Family production facility in Mobile, Alabama USA. Officially called the Airbus US Manufacturing Facility, this is to start manufacturing A319, A320 and A321 jetliners by end 2015”.

“Airbus’s Widebody Family of twin-aisle aircraft are the most advanced, streamlined and comprehensive fleet line up in the industry. These aircraft offer airlines the

## Rockwell Collins selected by Airbus to provide wireless EFB solution

**R**ockwell Collins has been selected by Airbus to provide the Electronic Flight Bag (EFB) interface and communication unit (EICU) for Airbus A320 and A330 aircraft families. The optional system for airlines, exclusively provided by Rockwell Collins, will be available and certified next year. The EICU, a lightweight, compact unit that is part of Rockwell Collins’ Secure Server Router product portfolio, leverages proven technology from the onboard information management system that the company already supplies for other Airbus aircraft types. It securely connects to portable and factory-installed EFBs in the cockpit via wireless or wired connections. The system’s embedded router enables the EFB to interconnect with select onboard and external networks, including the avionics, maintenance information, airline operating centers, connecting gates and the cabin.

## Avianca firms order for 100 A320neos

Following a Memorandum of Understanding (MoU) in February, Avianca has formalised a purchase agreement for 100



A320neo Family aircraft, the largest single order ever in Latin America's aviation history. The agreement, which includes A319neo, A320neo and A321neo aircraft, will allow Avianca to maintain one of the youngest fleets in the region as the airline aims to replace aircraft currently operating from their Bogota, Lima and San Salvador hubs. To date, the Avianca airline group has ordered nearly 300 aircraft including 276 A320 Family (among them, 133 A320neo Family) and 15 A330 Family.

smartest, most efficient way to capitalise on the extraordinary growth in medium and long-haul air travel across the world. As demand on these routes surges thanks to rising wealth levels in the emerging economies, nearly 7,800 new twin-aisle aircraft are likely to be needed over the next 20 years to keep pace (Airbus Global Market Forecast, 2014-33). The A330, the A350 XWB and the A380 allow airlines to cover all of their wide-body requirements: from regional to low-cost flights, and from long-haul journeys between the world's rapidly-growing mega-cities, the ever-busier 'hubs' of global air travel, to newer routes linking smaller, but equally far-apart airports", the CEO stated with obvious pride.



Welcome by Fabrice Brégier, President and Chief Executive Officer



The A380 : "The world's favourite Very Large Aircraft"



A380 business class



Members of Airbus' current management team, from left to right: Didier Evrard, Executive Vice President Head of Programmes; Tom Williams, Chief Operating Officer; Fabrice Brégier, President and CEO; and John Leahy, Chief Operating Officer – Customers

## First flight of CFM LEAP-1A in the Airbus A320neo

CFM's advanced LEAP-1A engines have successfully completed their first flight powering the new Airbus A320neo. The flight test occurred right on schedule, "reinforcing the success of the LEAP development programme and the confidence shown in the performance and durability of the new product". This first flight is another major step in the joint airplane/engine development programme that will culminate in the entry into commercial service in 2016.

The LEAP engine was chosen as a powerplant for the A320neo in December 2010. Since then, the engine has garnered orders and commitments for 2,508 LEAP-1A engines, representing 55 percent of the orders to date of A320neo aircraft

for which an engine selection has been made. There are currently a total of more than 30 LEAP engines (all three models) on test or in final assembly and the programme has logged a total of more than 3,660 certification test hours and 5,460 test cycles.



In presence of the international media during *Airbus Innovation Days*, the delivery ceremony (of the first 242-tonne A330-300) at Airbus' headquarters in Toulouse, France, was particularly notable as the airline had brought along some 100 employees, each a member of Delta's Chairman's Club. "Delta's addition of this Airbus A330-300 marks a major milestone and reflects our continued strategy of making prudent investments in our fleet that enhance our customer experience and operational reliability," stated Delta President Ed Bastian at the delivery event. "Having our Chairman's Club honorees, true examples of the Delta spirit of service, here to help us welcome this new aircraft into the Delta family makes this occasion even more special."

"As the launch customer and launch operator of the 242-tonne A330-300, Delta is demonstrating its continued confidence in the performance and comfort of the A330, which has been part of the airline's fleet for twelve years," said John Leahy, Airbus Chief Operating Officer – Customers. "The higher take-off weight allows the airline to fly both trans-Atlantic and trans-Pacific routes, all in unrivalled comfort with operational reliability over 99 percent. The 242-tonne A330 clearly paves the way for the A330neo and A350 XWB to join Delta's fleet in the next few years."

The Atlanta, Georgia (USA)–based airline is the first to receive the aircraft type from among 11 worldwide customers having the option. Delta has selected GE CF6-80E1 engines to power its new A330-300. Launched in 2012 as Airbus' latest evolution to the twin-engine widebody

A330 Family, the increased take-off weight A330-200 and A330-300 incorporates a new aerodynamic package, engine improvements and an optional centre fuel tank (the latter for the A330-300 version). These upgrades on the A330-300 allow for an extended range of up to 6,100 nautical

## Singapore Airlines' first A350 XWB takes shape

Airbus has begun final assembly of the first A350-900 for Singapore Airlines at its facilities in Toulouse, France. The aircraft is the first of 70 A350 XWBs ordered by the airline and is scheduled for delivery in the first quarter of 2016. The A350 XWB will form a major part of the future Singapore Airlines fleet and will be operated on the carrier's medium and long-haul routes. The aircraft is now at the initial fuselage section joining phase.



## Launch of the ACJneo Family

Airbus has launched the ACJneo Family with the order for an ACJ320neo from Acropolis Aviation of Farnborough, near London, which is the first to order the new aircraft.

Delivery of Acropolis' ACJ320neo, which will seat 19 passengers, is planned for the fourth quarter of 2018. Cabin outfitting details and engine choice will be decided later.

Airbus' ACJ320neo features

new and more efficient, engines, wingtip-mounted Sharklets, and a more comfortable cabin. The ACJ320neo will be able to fly 25 passengers 6,000 nm/11,100 km.

Airbus' ACJ320neo will be complemented by a new ACJ319neo, also with new engines, Sharklets and a more comfortable cabin, which can fly eight passengers 6,750nm/12,500km. More than 170 corporate jets have been sold to date.



*Delta's President Ed Bastian*

miles while offering up to 2 percent fuel consumption reduction. This incremental innovation to Airbus' A330 Family received airworthiness approval from the European Aviation Safety Agency (EASA) in April 2015, and received parallel certification from the Federal Aviation Administration (FAA) earlier in May 2015.

Delta Air Lines, which is Airbus' biggest A330 customer in North America, currently flies both Airbus single-aisle and widebody aircraft, including 57 A319ceo and 69 A320ceo aircraft, plus 11 A330-200s and 21 A330-300s. In addition to nine more A330-300s and 45 A321ceos still to be delivered to Delta, the airline has ordered 25 A350-900 and 25 A330-900neo Airbus widebody aircraft last year.

VSC



*Delivery of Airbus' first 242-tonne A330-300*



## Vietnam Airlines to operate the A350XWB

Vietnam Airlines has become the second airline in the world to operate the all-new A350XWB, following a special ceremony in Toulouse. The A350-900 aircraft was delivered to global lessor AerCap on lease to the airline for operation on long haul routes. Altogether, Vietnam Airlines is set to acquire 14 A350XWBs, including 10 ordered from Airbus and four from lessors.

## ST Aerospace, Airbus & EFW for A320/A321P2F conversions

Singapore Technologies Aerospace Ltd (ST Aerospace) has signed agreements with Airbus and Elbe Flugzeugwerke GmbH (EFW) for a collaboration to launch the A320/A321 passenger-to-freighter (P2F) conversion programme. Under the agreements, ST Aerospace will lead the A320/A321P2F engineering development, working in tandem with Airbus and EFW, with conversions to be undertaken in EFW and in ST Aerospace's global network of facilities. The A320/A321P2F programme includes two versions - the A320P2F and the larger A321P2F. The fuselage design of the A320 and A321 allows bulk cargo or containerised freight to be carried in belly holds, delivering more loading flexibility.

## CAS for 45 A330s

China Aviation Supplies Holding Company (CAS) has signed a General Terms Agreement (GTA) for 45 A330 Family aircraft and a Memorandum of Understanding (MoU) for options for 30 A330s. According to Airbus' market forecast, China will become the leading country for passenger air traffic, for both domestic and international markets, as passenger traffic in the country grows well above the world average. Domestic air traffic in China will become the world's number one within 10 years. In the 20 year period between

## Saudi Arabian Airlines launch customer for A330-300 Regional



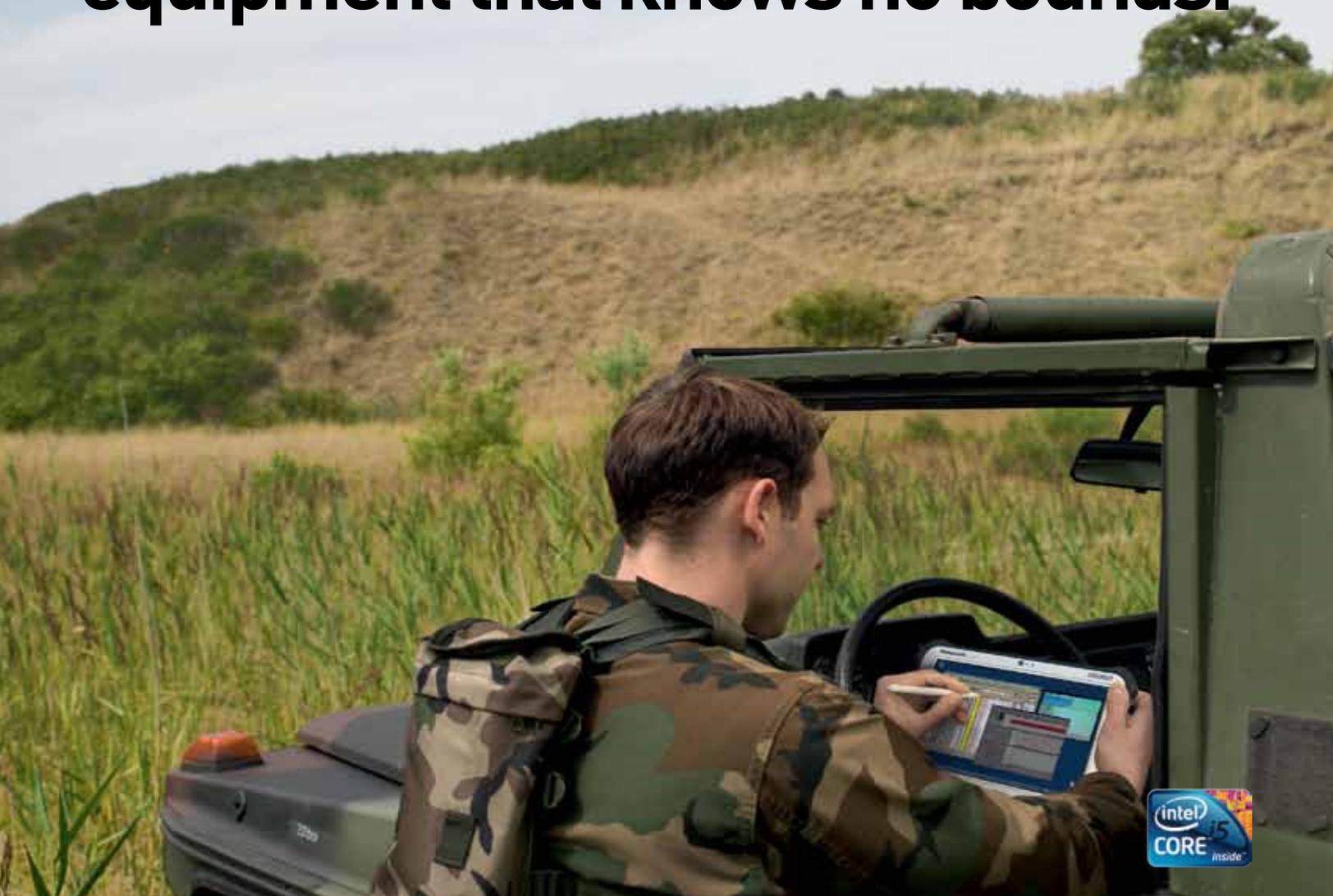
Airbus has announced Saudi Arabian Airlines as its launch customer for the A330-300 Regional with a firm order for 20 of the aircraft plus a firm order for 20 A320neos. Saudi Arabian currently operates 12 A330-200s and 50 A320 family aircraft. The airline is expanding its domestic and regional network and the new A330-300 Regional is 'optimised for high-density regional routes with a capacity for up to 400 passengers on ranges up to 3,000 nautical miles'. The lower-weight A330-300 Regional is targeted for use on shorter-haul domestic and regional routes where greater capacity is needed.

2014 to 2033 Airbus forecasts a demand in China for more than 5,300 new commercial passenger aircraft sized over 100 seats plus freighters.



# Panasonic

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# Complete Confidence at Airbus Defence and Space!



*A400M serial number MSN6 during its flight display at the Paris Airshow 2015*

**A**irbus Defence and Space is about to recommence deliveries of Airbus A400M aircraft following the lifting of all remaining flight restrictions on new production aircraft by the Spanish regulator DGAM. As a result, all A400Ms are now cleared for flight provided they have undergone the checks specified by the manufacturer in the Alert Operator Transmission (AOT) of 19 May 2015. Airbus Defence and Space's own three development aircraft, plus the 12 aircraft delivered to operators prior to the accident were not affected by the restrictions. The production plan for the year is under review following the accident but currently is still targeting at least 13 aircraft in 2015, with up to four more subject to flight-test results due this summer. Two aircraft which were due for delivery at the time of the accident are expected to be delivered soon with a number of others to follow.

Head of Military Aircraft Fernando Alonso said: "We appreciate the Spanish

authorities' timely action in restoring our permission to fly without restriction as well as our customers' patience and support in recent times. We are working hard to bring the schedule back on track while continuing to support the investigation."

Meanwhile, Airbus Defence and Space brought an A400M to the Paris Airshow which took part daily in the flying display performing the same routine that it has been demonstrating at airshows since 2010. The aircraft (MSN6) was flown every day from Monday 15 June to Friday 19 June by test pilots Nacho Lombo and Tony Flynn. Alonso stated: "We have complete confidence in the A400M and we are delighted to fly our demo as planned. We want to share our pride in the aircraft with all the passionate aviators at Le Bourget".

Concerning the Airbus C295W, Mexico and Saudi Arabia have signed an agreement for the tactical transport aircraft. With this, the Mexican Navy (Semar) has become launch customer of the latest version of

the C295, the new C295W equipped with winglets. Thanks to these winglets, the C295W will be able to transport more payload to a longer distance with around a 4% fuel savings, even in hot and high conditions.

The Mexican Navy has specified the winglets for two C295s, for which the order was already announced and winglets will be standard for all new C295s ordered from now on. "The advantage of the winglets in hot and high conditions means that the development of the C295W is a key step for our highly successful light and medium transport family. And it is a particular pleasure to deliver this first aircraft to Mexico, which already has the biggest Airbus Defence and Space transport fleet in Latin America," said Antonio Rodríguez Barberán, Head of Commercial for Airbus Defence and Space in Latin America.

"The C295 has served us well for many years. We had some concerns about

## Airbus DS TRS-4D Active AESA Radars for Freedom-class LCS programme

Airbus Defence and Space, is under contract with its affiliate, Airbus Defence and Space GmbH, to provide an additional TRS-4D naval radar for the U.S. Navy's Littoral Combat Ship (LCS) programme through Freedom-Class LCS prime contractor, Lockheed Martin. The radar is planned to go aboard LCS-21 following the already planned installations of TRS-4D aboard LCS-17 and LCS-19. The TRS-4D radar for LCS is a rotating version of the Active Electronically Scanned Array (AESA) fixed panel TRS-4D radar currently going aboard the German F-125 - class frigates. It combines mechanical and electronic azimuth scanning to achieve fast generation of target tracks.



System characteristics of the TRS-4D are an excellent addition for the environment faced by LCS and its evolution to a frigate. The radar's AESA technology delivers increased sensitivity to detect smaller targets with greater accuracy, as well as faster track generation to give LCS more time to react to advanced threats. This software-defined radar is programmable by the customer, enabling changes to radar characteristics to match future threats that evolve over the life of the ship. The ability to customise characteristics of the TRS-4D helps enable LCS to evolve through its service life and adapt to evolving required operational capabilities and projected operational environments in an affordable manner.

Employing state of the art AESA technology, the TRS-4D is a three-dimensional, multi-mode naval radar for surveillance, target acquisition, self-defence, gunfire support, and aircraft control. It automatically detects and tracks all types of air and sea targets, alleviating crew workload requirements. LCS affordability is further enhanced by reliability of the TRS-4D's solid state system design, keeping maintenance costs low and further contributing to lower LCS life cycle costs.

## New multi-use Protection System from Airbus DS

Airbus Defence and Space has developed a new protection system, the Multirole Jammer, that combines the highest efficiency countering radio-controlled improvised explosive devices (RCIEDs) with comprehensive monitoring of the signal spectrum and



tactical communication jamming. Based on latest software-defined radio technologies, this Multirole Jammer analyses the signal spectrum around a vehicle and is thus in a position to jam the radio signals intended to ignite a roadside bomb in an extremely target-efficient way. In an extended role, the device can be used for operational signal intelligence, thus contributing to the generation of a comprehensive picture of the signal situation – a task that previously could only be accomplished by separate systems which are scarce in number and much more difficult to deploy. The multirole jammer also takes over classic tactical jamming tasks, as well as supporting the developing counter-UAV systems. Making use of the indispensable RCIED protection equipment ensures efficient use of available space, weight, power and budget.

This Multirole Jammer uses the ultra-fast SMART Responsive Jamming Technology developed by Airbus Defence and Space to substantially enhance protection compared to conventional systems. Thanks to new digital receiver and signal processing technologies, the system achieves reaction times of well below a millisecond. The jamming power is focused on the detonation signal's specific frequency instead of being distributed over the whole frequency range, as is the case in conventional systems. The SMART Responsive Jamming Technology is already operational in the company's Vehicle Protection Jammer.

operating a mixed fleet of aircraft with and without winglets, but when we studied the enhanced performance of this new version it was clear that it would bring very significant operating benefits for us that could not be ignored”, said Rear Admiral José María García Macedo of the Mexican Navy.

The Ministry of Interior of Saudi Arabia after carrying out a complete evaluation, have ordered four C295W aircraft to enhance its airlift capabilities. “The C295W has been chosen based on its demonstrated excellent operational capabilities in hot and severe conditions and its proven affordable maintenance and operational costs. We are very proud that the C295W is joining the Airbus A330 MRTT Multi-Role Tanker Transport and CN235 transports previously ordered by Saudi Arabia. We greatly appreciate the confidence shown in the C295W by a nation with long expertise in operating military aircraft in desert conditions”, observed Antonio Rodríguez Barberán, Head of Commercial for Military Aircraft.

Together with previous orders received from Algeria, Egypt, Jordan and Oman, this new order from Saudi Arabia “cements the C295’s position as the ‘market-leading’ medium transport and patrol aircraft in the Middle East and North Africa region.”

## Airbus DS unveils new mobile welfare communication portfolio

A new portfolio of scalable welfare satcoms services for UK military personnel has been introduced by Airbus Defence and Space. The focus of the new Wel2Go portfolio is to “provide reliable, value for money and easy to transport, deploy and operate private communication channels in the field.” The new mobile connectivity suite is part of the WelComE (*Welfare Communications Everywhere*) services provided to the UK Ministry of Defence (MoD). The Wel2Go portfolio features three core services for various levels of deployments that will succeed in satisfying the future requirements of the UK MoD. The Wel2Go Small solution is carried in a single lightweight backpack and features a small deployable node for reliable private VoIP, satellite and data network. The system can be deployed and configured in less than five minutes and is an ideal solution for deployments of up to 60 people that require quick, flexible communications.

The Wel2Go Medium solution is a quick deploy VSAT (*Very Small Aperture Terminal*) system transported in aircraft hold cases. Comparatively compact and lightweight, the system provides significant throughput for up to 300 users and is simple to set-up and operate. It is perfectly suited for providing private VoIP and wireless connectivity for personal communication in temporary camps and can be moved easily to the next base of operations.



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C295W of the Mexican Navy



## A330 MRTT selected by Republic of Korea

“Airbus Defence and Space is greatly honoured for the A330 Multi Role Tanker Transport, powered by Rolls-Royce, to be selected by the Republic of Korea as its future air-to-air refuelling and transport aircraft after an open and objective competition. This contract will also allow Airbus Defence and Space to establish a long-term and sustainable cooperation with the Korean industry, as already exist with other divisions of Airbus Group. We will carry out our contractual obligations faithfully and are looking forward to executing this programme in a timely and efficient way as we have done with other A330 MRTT contracts and to playing our role in the security of South Korea for many years ahead. The decision means that the A330 MRTT has won every tanker competition (outside of US) since it entered the market and has now been selected by nine nations plus the European Defence Agency”, stated the company spokesperson.

## Airbus DS a leader in radar technology

For some 60 years now, the Airbus Defence and Space location in Ulm has been the “radar stronghold” in Germany and a centre for international radar technology. The anniversary recently celebrated goes back to the time when the allies lifted the restrictions in place at that time following the Second World War: Following this decision, Telefunken opened their radar development and production facility in Ulm in 1955. Since then, the developers in Ulm have been involved in all the important radar projects in Germany, and later in multinational joint ventures as well, initially as part of AEG Telefunken, later as DASA and the successors of DASA. Their developments range from aircraft radar as well as naval and air defence radar systems to radar systems for satellites and air traffic control systems.

Innovation topics which Airbus Defence and Space has actually turned into current, market-ready products include

multifunctional software-defined radar systems based on AESA technology. In this market segment, the company offers the TRS-4D naval radar system, which the F125 frigates of the German Navy and the Littoral Combat Ship of the US Navy will be equipped with.



*In the aptly-named ‘Microwave Factory’ at Airbus Defence and Space GmbH in Ulm, next generation radar modules are produced under clean-room conditions.*

## Two more A330 MRTTs for Australia

Airbus Defence and Space is to provide two more Airbus A330 Multi Role Transport Tankers (A330 MRTT) to the Royal Australian Air Force under the terms of a newly signed contract. The agreement was announced by the Australian Minister for Defence. The two additional aircraft will join the fleet of five A330 MRTTs currently operated by the RAAF which was the launch customer for the aircraft and designates it the KC-30A. These aircraft will be based on two previously-owned Qantas Airways A330-200 airliners which will be converted to A330 MRTTs by Airbus Defence and Space at Getafe near Madrid and delivered in 2018. The RAAF selected these particular aircraft as they are extremely close to the same basic specification as the KC-30As already in service.



# A Huge Wish List



## Helicopters for the Indian Armed Forces

The past few years have seen helicopters as the central, or at least most visible, element of Indian military air power in action. The Indian Air Force in particular, has focused on helicopter employment for in humanitarian assistance and disaster relief (HADR) situations, and it is fair to say that the IAF's Mil Mi-17V5 medium lift rotorcraft have become the mainstay for rescue operations in India and neighbouring nations. The Air Force's few but mega Mi-26 'Halo' heavy lift helicopters, based in Chandigarh, have been equally invaluable in establishing air bridges and transporting outsize or heavy loads to hitherto inaccessible areas.

The Indian Army, with its inventory of HAL Dhruv, Cheetah and Chetak helicopters has been an active participant in large HADR operations, notably in flood relief efforts in Kashmir during 2014, in Uttarakhand in 2013, and in the massive international earthquake relief operations that were carried out recently in the Himalayan kingdom of Nepal.

On the maritime front, the Indian Navy and Coast Guard have been playing the role of guardian angels. In June 2015, for instance, an Indian flagged merchant vessel, *Jindal Kamakshi*, sent out a distress call when it began listing heavily in bad weather. Despite strong winds, heavy rain and poor visibility, the Indian Navy



*IAF Dhruv seen during earthquake relief in Nepal*



*The Navy operates a large number of HAL Chetaks, which are due for replacement under the NUH programme (photo: Angad Singh)*

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WHEN RESULTS MATTER

immediately launched a rescue operation involving Sea King Mk.42C helicopters and Coast Guard Chetaks, with the destroyer INS *Mumbai* in close proximity to provide support. 19 Indian crewmen of the merchant vessel were winched to safety by an Indian Navy Sea King, while the Master of the stricken ship was rescued by a Coast Guard Chetak.

Recently, helicopters have been in the news as invaluable combat assets. On 4 June 2015, militants from the National Socialist Council of Nagaland-Khaplang (NSCN-K) conducted their most brazen attack in decades killing 18 Indian soldiers and injuring 11 others in the north-eastern state of Manipur. In a strong and swift response, the Indian government authorised an armed operation: on 9 June, the militants were tracked to camps on the India-Myanmar border and neutralised by the Indian Army. Instrumental in this mission was the use of IAF Mi-17 helicopters, to fly in troops from the special forces, reportedly the Army's 21 Para (SF) plus Assam Rifles to landing zones near the targeted camps, and then safely extract them once the mission was complete.



*An IAF Mi-17V5 hovers low to drop Nepal Army troops at Doramba village in of Nepal on 31 May 2015*

of firepower, range and speed will become necessary elements of such a combat unit.

Other side of this reality, however, remains the glacial pace and often diffident nature of decision-making in South Block. The current focus on 'Make in India,' though certainly laudable, has created a period of uncertainty in the defence acquisition sphere,

votes, still remains the deciding factor for key modernisation programmes, including a number of helicopter projects.

A sustained push for modernisation and fleet renewal of the existing Indian military helicopter inventory began in earnest about a decade ago. However, with the exception of a single government-to-government deal,



*File photo of Mi-35 gunship firing 57mm rockets (photo : Angad Singh)*

The use of Mi-35 helicopter gunships to obliterate some militant camps was reported, but not confirmed.

This operation captured the nation's imagination, and the vitality of helicopters for such missions was once again confirmed. Indeed, should political dispensation allow for more such retaliatory strikes, precision fire support helicopters with their combination

particularly with regard to procurement projects that have long been under discussion, with several high-profile programmes being summarily cancelled or re-structured (see *Lt Gen BS Pawar's accompanying article*). In addition, the present government's strong mandate has not necessarily translated into any appreciable alacrity in decision-making, primarily because funding, not

and that too for a variant of an already-operational helicopter type (the Mi-17), there has been no change in material terms. Selections are announced, negotiations commence, but ink rarely meets paper in the form of a contract, leaving the Services in an all too familiar situation of having to make do with ageing, outmoded, and often unsafe, rotorcraft.



*Armed Cheetah light helicopter of the Army (photo : Angad Singh)*

offensive capability in high-altitude areas where contemporary attack helicopters have difficulty in operating.

However, not one of these has materialised as yet. The 'in-development' status of the LCH notwithstanding, this helicopter actually seems likeliest to wear Army markings in any reasonable time frame. While the Kamov Ka-226T has reportedly been selected to meet the decade-old RSH requirement under a government-to-government deal with Russia, there are numerous details to be dealt with before that agreement actually produces deliverable helicopters.

The Army has also projected its requirement for 60 'tactical battle support' helicopters in the 10-12 tonne class, to be employed for swift and precise

It was planned that Indian Army Aviation, following major policy initiatives, would support each of the strike corps (I Corps at Mathura, II Corps at Ambala and XXI Corps at Bhopal) with aviation brigades consisting of attack, reconnaissance and utility helicopters. There were also plans to raise dedicated combat helicopter squadrons for close air support and anti-tank roles. At present, most of the Army's support and combat aviation needs remain met by the Air Force, with their Mi-17s and Mi-35s. The Army has plans to acquire 114 of HAL's in-development Light Combat Helicopter (LCH) to provide an airborne



*HAL's Light Combat Helicopter in flying display*



*Relief material being offloaded from an IAF Mi-17V5 helicopter at Philim village in Gorkha District in Nepal*

transportation of troops in a tactical scenario. Helicopters in this role/weight class include the Boeing CH-47 Chinook, Sikorsky UH-60 Black Hawk and S-92 Superhawk, NHI NH90, Eurocopter EC725, and Mil Mi-17, amongst others. However, there is no clarity at present whether this is a realistic requirement that the MoD will pursue to conclusion, as the Air Force has sternly opposed duplication of inventory, with over 200 Mi-17 variants in its service or on order.

Still, the Army Air Corps should see significant growth within the next 5-10 years, although, as always, there is no telling what will happen at South Block, which has repeatedly demonstrated its propensity to delay acquisition programmes for years. There is also a significant opportunity to leverage these long-delayed modernisation plans by instituting large-scale procurement, making indigenous manufacturing and local partnerships more economically viable for foreign OEMs (and indeed their prospective local partners !), but financial constraints and poor prioritisation by the Services and MoD bureaucrats makes this unlikely.

Acquisitions for the Air Force are progressing in a similarly disjointed manner. *Vayu* has earlier recorded a rather smooth induction timeline for Mi-17V5 medium-lift helicopters, assembled from Russian-made kits at the IAF's No.3 Base Repair Depot (3 BRD) at Chandigarh. These



*The Boeing CH-47 Chinook*

rotorcraft, contracted for in 2008, are slowly supplanting the IAF's existing fleet of around 250 Mi-8/17 family rotorcraft. In December 2012, a follow-on order to the original contract was placed, bringing the cumulative order to 151 aircraft valued at some \$2.6 billion, with all deliveries slated to be completed later this year.

At the same time, the IAF is looking to augment capacity in the heavy-lift role by replacing its few Mi-26 helicopters, as also to



*Indian Navy  
Sea King Mk.42C  
(photo: Angad Singh)*



*HAL Dhruvs are entering service in large numbers with the Army (pictured) as well as the Air Force (photo: Angad Singh)*



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replace its Mi-35 gunships with more modern combat helicopters. Both these programmes are yet to be formalised despite the Ministry having selected Boeing's CH-47F Chinook for the first requirement and the Boeing AH-64E Apache Guardian for the second. In fact, the Defence Acquisition Council has also granted offset waivers and cleared both acquisitions, but contracts remain un-signed.

On the light helicopter front, HAL's domestic sales of various ALH variants continue, with total Indian military deliveries projected at 300 units over the next 5-10 years. The Army and Air Force have enthusiastically adopted large numbers of Dhruv ALH in the utility role, and the armed Dhruv ('Rudra') has also entered operational service.

The Indian Navy, also affected by delayed fleet recapitalisation and modernisation, and without the benefit of being able to induct the HAL Dhruv in large numbers (owing to its lack of suitability for ship-borne operations), is looking at major rotorcraft inductions to maintain its edge in the IOR and to reverse the regrettable trend of commissioning warships into service without any organic ASW/AsuW helicopter capability. The Navy has three notable

acquisitions in the offing : for 16 multirole helicopters (MRH) in the short term, and in the medium-term it has a larger 120 naval multi-role helicopter (NMRH) requirement along with 56 naval utility helicopters (NUH) to replace the HAL Chetak.

The first of these acquisitions, for 16 multirole helicopters (MRH) has been reported as "nearly complete" for a number of years now, with Sikorsky (offering the S-70B Seahawk) selected as the winning bidder by the Indian MoD. Unfortunately, as with the Apache and Chinook procurements, selection of a helicopter and DAC clearances have not yet translated to an order. Although seemingly small, an option clause for a further 44 aircraft makes the contract as important to Sikorsky as a larger purchase would. In addition, MRH will in all likelihood influence the larger 120 multirole helicopter order being considered by the Navy, as platform commonality will be an important factor regardless of any differences in equipment fit and roles envisaged for the two separate programmes.

The Naval Utility Helicopter (NUH) programme is intended to replace the 60-odd HAL Chetaks in Navy service, and although RFPs had already been sent

to eight manufacturers, including HAL, the project in its original form has been cancelled and re-issued to bring it in line with the 'Make in India' initiative.

With HAL still struggling to engineer a main-rotor blade-folding mechanism, essential for the Dhruv's use aboard naval vessels, the new NUH tender will come down to a competition between foreign manufacturers with Indian production partners. Likely contenders are Airbus Helicopters' AS565 MBe Panther, a militarised variant of the widely used AS365 Dauphin helicopter, Bell's 429 and AgustaWestland's Super Lynx 300.

The current helicopter scenario has its vagaries. HAL has multiple rotorcraft development programmes underway, the private sector has at last been "allowed" to participate in the hitherto tightly controlled military industrial arena, and there appears to be some semblance of political will in place at Raisina Hill. The key challenge however, and it is far from an insignificant one, is funding. Overall, however, the opportunities to succeed far outweigh the challenges and the next few years are going to be exciting indeed !

*Angad Singh*



*The Sikorsky S-70B Seahawk*

# PRESERVING THE (AERIAL) LIFELINE



## Lt General BS Pawar, former ADG Army Aviation examines the operational implications of delays in replacing the HAL Cheetah and Chetak fleet

The modernisation and transformation plans of the Army, and its Aviation Corps in particular, faced a major setback last year in August, when arguably the most important – nay critical - project

for acquisition of 197 Reconnaissance and Surveillance Helicopters (RSH) to replace the current obsolescent HAL Chetak and Cheetah fleet was cancelled by the Ministry of Defence (MoD). This decision was the

likely fallout from an ongoing investigation into the AgustaWestland VVIP helicopter deal as investigations had allegedly come across some unconfirmed reference to technical deviations during the selection

*Army Aviation HAL Dhruv ALH inducting troops at high altitude*



process which also had implications on the 197 RSH project. An immediate result has been that the army will remain bereft of a suitable helicopter to replace its ageing Cheetah and Chetak fleet, which will undoubtedly impact on the overall operational capability of the army, especially in high altitude areas where the Cheetah helicopter virtually remains the lifeline of troops deployed along those extreme climatic heights. This unnecessarily

of the Army, their replacement having been accorded the highest priority in the overall transformation and modernisation plans of the army for some time. Because of the nature of terrain along India's Eastern and Northern borders and particularly the Siachen Glacier ('highest battlefield in the world') such class of helicopters are critical to maintain defence preparedness and operational readiness. The Cheetah helicopter is the last bastion for formations

### The saga of unending trials

First evaluation trials for replacement of the Cheetah and Chetak helicopters fleet took place during 2005-2006, with Eurocopter's (now Airbus Helicopters) AS 550 C3 Fennec and Bell Company's Bell 407 in competition. Russia's Ka-226T was also a contender but did not proceed beyond the technical evaluation, because its engines were at the time "not certified". However, in December 2007, while at the final stage of price negotiation, the entire evaluation process was cancelled by the MoD owing to extraneous reasons, which were for many "beyond comprehension". The acquisition plan was for 197 helicopters essentially for the army with the transfer of technology clause built in. A fresh tender was issued in July 2008 for acquisition of 197 helicopters (RSH) for the army and air force (137 and 60 respectively).

Trial evaluations for these was concluded more than two years back, this time the competing types being the Eurocopter AS 550 C3 Fennec and Russian Kamov Ka-226T helicopter. The third contender, AugustaWestland's AW-119 was removed midway during the trials owing to a technical mismatch in nomenclature of its engine. However, as stated earlier, this crucial RSH procurement process has since been "cancelled".

A fresh RFI was issued (published on 31 October 2014), in a 'Buy-and-Make-India' approach with a certain number of helicopters to be supplied by the selected OEM in flyaway condition, the remaining numbers to be built at a production facility in India, by an Indian partner through licensed



'cautious' decision, which resulted in cancellation of the project, was taken despite the fact that an Oversight Committee appointed by the MoD during the previous Government, had cleared the trial process of any irregularity. It is also pertinent to recall that extensive trials for the RSH had been conducted by a joint IAF and Army team of experts and no single entity could have "influenced" the outcome.

The Indian Army's Aviation Corps (AAC) is now in its 29th year of existence since its establishment in November 1986. Its inventory comprises the largest number of helicopters amongst the three Services, with the major part of its fleet consisting of reconnaissance and observation class helicopters (some 200+ Chetak and Cheetah helicopters). However, this inventory is now of 40 years vintage and has been awaiting replacement for well over a decade. These HAL-built helicopters have remained mainstay of our armed forces for the last four decades and form a crucial component

and troops deployed in these formidable areas, but unfortunately they are of outdated technology : India's armed forces, with its army being the third largest in the world, deserve far better !



First evaluation trials of the AS550 C3 Fennec by the 'Indian Armed Forces' took place in 2005-06

transfer of technology. Essentially, this RFI envisaged identification of probable Indian vendors (private or public), including those who would form joint ventures (JVs) and establish production arrangements with an OEM so as to provide the helicopters, followed by licensed production in the country. The response date was extended twice from the original 17 December 2014, with the final date being pegged at 20 April. This generated much interest, and was key topic of speculation during Aero India 2015. While this was a welcome step and the actions taken by the Government demonstrated its concerns, the entire process was expected to take at least another three years, provided everything moved smoothly with no further hitches or glitches. The recent clearance by the Government for 200 Russian Ka-226T helicopters as a 'Make in India' project, has left the fate of the 197 RSH project hanging in balance with no clarity from the Government : while the RSH project has not been cancelled, total confusion reigns in the industry and the armed forces regarding the future of the RSH programme.

With the current dismal state of the Chetak and Cheetah fleet and serious maintenance and safety concerns, the writing is clearly on the wall. There is understandable disquiet on this matter within India's aviation fraternity which needs to be taken serious note of, as this gravely impinges on operations in high altitude areas.

### Present Status and Implications

The existing Cheetah and Chetak helicopters are difficult to service and maintain, with the

*HAL Chetak of Army Aviation (photo: Angad Singh)*



spares situation becoming critical : without mincing words, maintenance of this fleet is becoming 'a nightmare'. HAL is finding it increasingly difficult to keep this fleet serviceable and safely airborne : the armed forces have repeatedly expressed their concerns. The Chetak helicopter, developed by HAL for the Army and Air Force as a 'stop gap' measure is not a satisfactory solution as this is essentially a Cheetah airframe with a more powerful engine, the basic technology remaining the same. HAL has long stopped production of Cheetah and Chetak helicopters and is presently focusing on the Chetak to make up current shortfalls of the fleet as an interim measure.

For the future, HAL has embarked on its Light Utility Helicopter (LUH) project of the 3-tonne light observation category

and hopes to field this by 2016, which seems unrealistic even as HAL had been set a target of manufacturing 187 LUH, within the total requirement of some 400 helicopters of this class required for the Army and Air Force.

In fact, HAL already has its hands full with manufacture of the Dhruv ALH and its armed version the Rudra. The ALH still continues to face problems in operations and maintenance, especially at high altitude. The Army reportedly experiences poor serviceability of the ALH and is most affected being the largest holder and operator (60-70 helicopters) of



*Lancer light attack variant of the Army's HAL Cheetah (photo: Angad Singh)*



*HAL's light combat helicopter (LCH) should receive its IOC by end 2015 (photo: Angad Singh)*



*The Kamov Ka-226T was shortlisted for meeting the RSH requirement and is reportedly under consideration for manufacture in India by HAL.*

this class of helicopters : the problems are likely to accentuate with the fleet inventory increasing every year (Far afield, two ALH accidents in Ecuador within a short span of a fortnight earlier this year is also a matter of serious concern). In addition, HAL is also in the process of achieving initial operational clearance (IOC) of the Light Combat Helicopter (LCH) by the end of 2015, designed for operating at high altitudes.

With India's private sector also having entered the helicopter manufacturing

market, JVs are expected to be established with some major helicopter companies to include Sikorsky, Bell, Airbus Helicopters and Kamov : the competition will increasingly become acute and HAL will have to prove its capability in this regard. While HAL is also a respondent of the RFI for the RSH tender and has been scouting for partners (OEM), there are reports which indicate that HAL is very much onboard for the 'Make in India' project for the 200 Ka-226T helicopters.

However, irrespective of the above developments, a period of next 3-4 years

remains critical during which the armed forces will perform have to continue operating the obsolete and increasingly unreliable fleet of Chetak and Cheetah helicopters. The last fatal accident of a Cheetah, at Bareilly Army Aviation Base, has accentuated grave safety concerns about the continuing operation of this type, especially in high altitudes, where these helicopters must operate at their extreme performance envelope.

The non-availability of such a critical asset to the Mountain Divisions (and the Mountain Strike Corps under raising) will markedly affect operational capabilities : 15 years back, during Kargil 1999, the Cheetahs were the only helicopters capable of operating at such extreme altitudes and were a crucial factor in outcome of the war. There have been suggestions in some quarters - both Government and Military - that the Army could induct more ALHs and employ them in the reconnaissance and surveillance role. This should be rejected outright as both professionally, and operationally, this not a viable alternative, nor an option. Recent aggressive posturing and standoffs by the Chinese in the Depsang Valley at an altitude of 16,000 feet has only heightened the concerns and sent out a loud and clear message : "modernise and transform the helicopter fleet - or face the operational consequences" !



*The Indian Army continues to rely on the HAL Cheetah for high altitude reconnaissance and surveillance tasks but its phase out of frontline service is overdue.*

# A Tiger in the Sky



**D**esigned and developed for airborne operations in support of ground troops at high altitudes, the maiden flight of Hindustan Aeronautics Limited (HAL) Light Combat Helicopter (LCH) had taken place on 29 March 2010 marking successful culmination of three years of design and development efforts by Rotary Wing Research & Design Centre (RWRDC) of the Helicopter Complex. It was unofficially named as 'Tiger Bird' perhaps inspired from its exceptional high agility and the logo painted on the prototype. Projected to meet the requirements of the Indian Air Force (IAF) and the Indian Army (IA), who have ordered 64 and 114 units respectively, the LCH is being developed as a dedicated attack helicopter derived from the Dhruv Advanced Light Helicopter (ALH), to be fitted with weapons and special mission systems and having a crashworthy wheel landing gear.

The LCH inherits many technical features of the Dhruv including its rotor system transmission, power plant, hydraulics, IADS, and avionics. The features that are unique to LCH are its sleek and narrow fuselage, tri-cycle crashworthy landing gear, tandem cockpit, self-sealing fuel tanks, and aerofoil shaped stub wings for weapons, armour protection, Nuclear, Biological, Chemical (NBC) protection and low visibility features which make the LCH "lethal, agile and survivable."

Notably, the flight controls and hydraulics of Dhruv have been redesigned for the LCH. The helicopter is powered by two HAL/Turbomeca Shakti turboshaft engines, each of which can generate up to 871kW and can run for up to 3,000-hours without maintenance. It features a Full Authority Digital Electronic Control (FADEC) system, which decreases the work of the pilot by automatically counting engine cycles. The LCH has a cruise speed of 260kmph, a maximum speed of 275kmph and a climb rate of 12m/s. The LCH has a ferry range of 700km.

Fitted with a chin-mounted M621 20-mm cannon in a Nexter THL-20 turret, LCH armament will include Belgian 70-mm rockets and air-to-air/air-to-ground missiles and Laser Guided Bombs (LGB) on the weapon stations. MBDA's PARS3 and indigenous Helina with a range up to 7km are favoured anti-armour weapons. MBDA Mistral 2 air-to-air missiles (AAM) are carried to provide self-protection during scouting operations and to decimate hostile Unmanned Aerial Vehicles (UAV). The helicopter would have day/night targeting systems for the crew including the helmet mounted sight and an Elbit Compact Multi-Purpose Advance Stabilisation System (CoMPASS) electro-optic/infrared turret (being licence built in India by Bharat Electronics Limited) consisting of CCD camera/ third generation 3-5  $\mu\text{m}$  Forward-Looking Infra-Red (FLIR)/Laser Range

Finder (LRF)/Laser Designator (LD). The LRF and LD facilitate measurement of range to the target and guidance to the laser guided missiles respectively. The Digital Video Recorder would enable recording of the vital mission for debriefing purposes. The turret gun skewing is controlled by the Helmet Mounted Sight (HMS) of the gunner, who along with the pilot receives adequate inputs from Multi-Function Displays (MFD). The digitally camouflaged LCH is also fitted with a Self-Protection Suite consisting of Radar/Laser warning receivers

and Missile Approach Warning Systems (MAWS) and Counter-measures dispensing system. It is planned to integrate IR/Laser missile jammers on the helicopter. Another addition is a Data Link for Network-Centric Warfare (NCW) operations facilitating transfer of the mission data to the other airborne platforms and ground stations operating in the network, thus facilitating force multiplication. The LCH is designed for low detection (visual, aural, radar and infrared) and includes armour protection of critical areas.

A 30-minute dry running capability of the gear box is a built in-feature to survive after any ballistic hit to the transmission system. Crashworthiness features are built into the wheel landing gear and main structure while dual redundant systems also enhance effectiveness of the helicopter in the battlefield environment. The performance features of the LCH including rate of climb, cruise speed, service ceiling, are comparable with those of contemporary helicopter types such as the Agusta A129 Mangusta and Tiger. Development costs of the LCH have been "relatively low" compared to that of other helicopter types in its class, ensuring lower unit costs.

"LCH design is optimised to ensure ease of maintenance with improved reliability of all the onboard systems to keep the life cycle operating costs low as well," stated a HAL designer.

*Sayan Majumdar*

# The Chinook – a truly multi-mission helicopter



US Army Chinook at the Paris Airshow 2015

When there is a large-scale disaster anywhere in the world, it is usual to see destruction of transportation infrastructure and physical isolation of the population, who often have no shelter and no food supplies, with large numbers of injured or stranded people in need of rescue. There are also additional challenges with inadequate medical services, an inability to evacuate survivors or bring rescue teams to the disaster site, and an inadequate supply of heavy equipment necessary to restore workable transportation routes as well as to support rescue and emergency reconstruction.

In almost every such world-wide situation the military is the most capability-equipped and trained organisation to respond on large scale. Among the many assets deployed is usually the Chinook helicopter.

The Boeing CH-47F Chinook provides the capability of heavy-lift and high-altitude transportation for a multitude of military, humanitarian, rescue, disaster relief, fire-fighting and civil operations in all climates and conditions and altitudes. The aircraft is certainly suited for India's vast distances, austere environments and high altitudes.

The Chinook has unsurpassed ability to deliver heavy payloads in the higher altitudes and is eminently suitable for operations in the region's high mountains. The type has been battle-tested in diverse and extreme conditions throughout the world and has proven to be supremely capable for conducting life-saving missions in the wide range of conditions that typify the Indian geography, whether it is

operating at the high altitude of Ladakh or the extreme climates of the deserts.

Besides its ability to lift heavy and bulky loads, its tandem rotor configuration also provides exceptional handling qualities that enable the CH-47 to operate in temperature, altitude and crosswind conditions that typically keep other helicopters from flying. Chinooks can fly more than 315 km/h with full load and deliver those loads more than 370 kilometres away, with standard fuel tanks. It is capable of handling loads up to 24,000 lbs (10,886 kg) with a maximum gross weight of 54,000 lbs. (24,494 kg).

Its ability to be reconfigured and conduct myriad diverse missions is unmatched. For personnel movements, the Chinook can transport 35 seated troops or be used as an evacuation platform with 24 casualty stretchers. For cargo missions, the aircraft can carry three large pallets of goods internally, or can carry larger loads externally utilising its triple cargo hooks for stability. These varying capabilities and high airspeeds allow the Chinook to perform the work of three utility helicopters.

The newest variant of the Chinook, the CH-47F, has a Digital Automatic Flight Control System (DAFCS) that enables pilots to conduct missions which they previously would not have attempted. DAFCS allows the pilot to pick a spot on the ground, have the aircraft fly a hands-off approach to that point, the aircraft will then move in increments less than a metre, laterally or vertically, with feather-touch controls.

Such capability is especially effective during slingload operations as well as in

difficult snow and dust environments. In addition to DAFCS, the CH-47F has a glass cockpit with significantly improved capabilities. The Common Avionics Architecture System (CAAS) allows pilots to plan a flight route with their computer, place the route and known airspace information on a moving map and then make real time changes during flight. CAAS provides exceptional situational awareness to the crews.

The Chinook has a new airframe that has greatly reduced the workload of maintenance crews. The monolithic airframe that is central to the CH-47F represents a change in aircraft manufacturing providing significant short- and long-term benefits. This method of machining airframe structures rather than using sheet metal and rivets substantially reduces the number of parts required; reduces, production costs as well as the operation and sustainment costs for the users. This new process also reduces vibrations, which leads to a higher operational availability to front-line units.



Ch-47F Chinook (Photo: Mathias Henig)

That the Chinook is truly a multi mission platform that routinely performs missions ranging from humanitarian assistance to fire fighting to medical evacuation to logistical resupply, and personnel transport, is to state the obvious. It has been used extensively throughout Asia for disaster and relief operations, including the 2005 tsunami rescue and recovery operations, the Japanese tsunami response in 2011, hurricane relief in the U.S. and earthquake and flood relief in Pakistan.

More than 875 Chinooks are operated by 18 nations around the world; as testament to its unsurpassed capabilities, virtually every nation that has operated the Chinook has ordered more or upgraded to the latest version.

**Randy Rotte, Director,  
Boeing Vertical Lift, Cargo  
Helicopter Business Development**



# ‘Izmir Cougars’

## Turkish Army Aviation today

“Our primary mission is to provide aviation support to our land forces at specific places and at specific times, as an Army Aviation Regiment under the control of Army Aviation Command focusing on the west and southwest of Turkey,” states Lt Col Baysan, explaining the tasks of the 3rd Regiment (*3ncü Kara Havacılık Alayı*) based at Izmir-Gazimир. Lt Col Baysan graduated as an Army pilot in 1998 and is currently one of the instructors for the Airbus AS532 Cougar helicopter fleet. The Army Airbase of Gazimир is located just northwest of the international airport of Izmir, Adnan Menderes. The history of the 3rd Regiment dates back to 1975 when the Aegean Army Command was established in Izmir.

The end of the Cold War and the disintegration of the Warsaw Pact in 1990 led many countries to reduce their armed forces. During this period the Turkish Army went through a major change, switching focus to future combat environments,

high mobility, firepower, night operations, optimised their mobilisation system and adapted the Army structure to battalions, brigades, corps and armies. The Turkish Army Aviation Command was established on 15 August 2003 under the Land Forces Command in order to establish a central command and control system.

The 3rd Regiment at Gazimир currently has two battalions (*Helicopter Taburu*) on strength: AS532ULs are part of the Medium Helicopter Battalion and Bell UH-1s and Agusta-Bell AB205s are part of the Light Helicopter Battalion used for training and liaison duties. Sikorsky S-70s are no longer part of the inventory of the 3rd Regiment. “A decision was made in 2008 to relocate the S-70 fleet to the Southern part of Turkey to execute missions in the mountains where the S-70 performs best,” according to Lt Col Baysan. Relatively new to the unit is an Attack Detachment equipped with two AH-1P Cobra helicopters. This allows attack helicopter crews to train in a different

environment than the area near Güvercinlik, 40 kilometres north of Ankara, where their parent unit is stationed.

To supplement Turkey’s AH-1W fleet, a number of AH-1P/S were offered by the United States. In total the Turkish Army received 36 ex-US Army Cobras in five separate batches, with all deliveries complete by 1995. The AH-1s were upgraded in a programme that commenced in July 1995. Subsequently, all Turkish AH-1P/S Cobras have been upgraded in collaboration with IAI (Israel Aerospace Industries). The improvements include addition of a 20mm cannon, Tactical Navigation System (TNS), ALQ-144 IR suppressor, improved internal wiring and AN/APR-39V(3) and ARC-182 self-defence systems to counteract SA-7 missiles.

Lt Col Baysan continues: “Lastly, we have the Cessna T-182 for fixed wing basic training. These aircraft have been replacing the U-17 (Cessna 185) training aircraft since 2010.”



*Combat Search and Rescue (CSAR) training underway with an AS532 Cougar*



*The upgraded cockpit is clearly visible on this AS532, as is the sole female co-pilot in service with the 3rd Regiment*

The initial batch of twenty AS532 Cougars was ordered in 1992 with deliveries as part of the 'Phoenix I' programme. During 1997, the Turkish government signed a new contract for an additional thirty AS532ULs. The contract consisted of an agreement for this batch of helicopters to be built in Turkey, and for this purpose a consortium between Eurocopter and TAI (Turkish Aerospace Industries Inc.), called EUROTAI was established. The contract, named 'Phoenix II,' was for the supply of ten AS532ULs for the Turkish Army and twenty AS532s for the Turkish Air Force, all of which were delivered by 2003.



*The 3rd Regiment regularly conducts Combat Search and Rescue (CSAR) exercises with Turkish Army Commandos*

The UH-1H Iroquois helicopter has been standard utility helicopter of the Turkish Army from 1970 until the first deliveries of the S-70 in 1993. Between 1970 and 1974 the United States Army delivered 58 UH-1Hs, of which 42 were for the Turkish Army. After two AB205A1s had been bought in 1968 an order for a further 44 AB205s was awarded to Agusta for delivery from 1974 onwards, twenty being intended for the *Jandarma* (Military Police). In 1983 forty-six were of the type were ordered for delivery in 1983-85 (including four for the *Jandarma*). An agreement was signed in September 1982 with Bell Helicopters for the assembly and part manufacturing of 70 UH-1Hs, 25 being delivered by Bell Helicopters from May 1984 to February 1986 (of which ten were for the Turkish Air Force). Four sets of fifteen helicopters were assembled by the 901 *Uçak Ana Depo ve Fabrika* between 1984 and 1992. Since 2003 a modernisation and engine upgrade programme has been performed, bringing 52 UH-1Hs to the UH-1HT standard and 23 AB205 to the AB205T standard.

"Currently the whole fleet of Army Cougars have been equipped with a glass cockpit which has been modified and installed locally by TAI (under Project *Yarasa*)," says Lt Col Baysan. "In our Regiment's inventory we have four SAR Cougars for immediate response in case of an accident or a natural disaster. In addition to the flight crew there are some extra personnel on board: one extra SAR technician, one doctor or medic and two SAR experts. For any possible mission the helicopter and all of its crew are organised according to the 24-hour concept during



*AH-1P hovering*

day and night. This type of mission is rather unique in the Turkish Army, and the reason we are involved in SAR duties is the vicinity of the Aegean Sea. We cooperate with the Coast Guard as required. The SAR

Cougars are modified locally (by TAI) with approval of the Airbus Company. We have additional functionality compared to the standard AS532UL: searchlight, Forward Looking Infra-Red (FLIR), loudspeakers

and auto-hovering capabilities. Two of the SAR Cougars are located at Gazimir, and two with a detachment in the Turkish part of Cyprus. In order to be certified for SAR duties, an additional 20 hours of training



*Rather new to the 3rd Regiment is a detachment of two AH-1Ps, normally based at Güvercinlik*

*UH-1H coming in to land at Gaziemir*



is required by the crews,” Lt Col Baysan concludes.

The Army Aviation School located in Güvercinlik is essential so as to expand and maintain quality within the pilot community. Besides the Turkish Army, the Navy, Gendarmerie, Coast Guard and Police Aviation are also trained at Güvercinlik. Pilot Training is split into two phases: Basic Training and Advanced Training. Rotary Wing Pilot Basic Training is conducted with the AB206 and UH-1H/AB205. Advanced training is provided either with S-70s or AS532s for an additional 14 weeks and 35 hours of flight, which is finalised with a check ride before the young pilots can execute operational duties.

The initial pilot training at the Army Aviation School takes about 51 weeks in which flying starts with the AB206 for around 100 hours. The next phase is transition to the UH-1/AB205 with an additional 80 hours of flight. Based on demand by the Turkish Army Aviation Command, graduate pilots continue with their advanced training on either the S-70 or AS532UL, with this phase running for about 35 flying hours, conducted within the regiments that operate either type of helicopter. Not all pilots will undergo this advanced training, however, as large

numbers of UH-1 and AB205 are also required. Lt Col Baysan explains: “When a new pilot is added to the unit, a 25-hour familiarisation programme is followed with an official check ride before we have the pilot added to active duties on the AS532. On average we have a demand of about 8-15 new pilots per year.” Currently about 38 pilots are on active duty with the 3rd Regiment, including a female pilot who has been on active duty for two years, flying the UH-1. In total there are 21 operational female pilots in Turkish Army Aviation, flying various types of helicopters and fixed wing aircraft.

Lt Col Baysan adds, “In our regiment, training exercises are arranged and organised according to our combat tasks and missions. Within this context, all training exercises for air combat operation, transportation of personnel, Combat Search and Rescue (CSAR) operations and medical evacuations are planned and executed both during night and day. We are especially proud of our night operations capabilities. In addition to that, the SAR operations and medevac tasks we carry out in natural disasters constitute a great proportion of our duties.”

“The helicopters and Cessnas are subject to different levels of maintenance according to the flight hours and time intervals. All

maintenance is done exactly according to the technical documents provided by the supplier and is conducted by our experienced technicians. We are self-supporting and perform maintenance in intervals of 10, 25, 50, 100 and 200 hours. Basically all maintenance up to 1,000 hours is performed at Gaziemir. After 3,000 hours or 15 years, each airframe is being overhauled in Ankara by the 5th Main Maintenance Centre Command,” says the Chief Technician of the 3rd Regiment. “The maintenance in our authorisation level is done as quickly as possible in order to be ready for any kind of mission. However the 5th Main Maintenance Centre Command based in Ankara does some of the detailed maintenance, checks and repairs beyond our authorisation level of maintenance.”

Currently the 3rd Regiment is involved in continuous deployments to Cyprus with a number of AB205s and AS532s. Furthermore, the pilots and crew are part of a regular rotation schedule to East Turkey in support of the border security mission in that region. Each of the regiments (Gaziemir, Malatya, Ankara and Istanbul) is part of the rotation schedule providing round-the-clock security of Turkish borders.

**Text and photos: Carlo Kuit and Paul Kievit/ Bronco Aviation**

# Round and Around the Paris Air Show 2015



As the 51st edition of the Paris Air Show came to a close on that summer afternoon in mid-June, one could not but wonder where the fizz had gone from the champagne! Missing were the 4-hour long air displays, the relentless noise made by their engines (drowning all conversations but exciting), 'miles' of static displays. Non-participation of some major aerospace and defence firms, scaling down

of stands/ booths in the halls and outdoors was obvious. Yes, we know there are just too many shows each year with almost every country with any sort of aerospace and defence manufacturing aspirations hosting an event. Yes, it's just too expensive for companies to be everywhere. Yes, companies are now focusing on core markets with sales potential. Yes, first there were air shows, now there are air shows, military shows,

naval shows, UAV shows, helicopter shows, business aviation shows... and there are ever more in the offing but then this was *the* Paris Air Show and one better be there!! Besides the business, flying displays are integral to the event and that's what keeps the adrenalin flowing!

French President Francois Hollande inaugurated the 51st edition of the world's oldest air show on 15 June 2015 with hopes for big contracts for the home team Airbus and an appeal for energy savings, as his country prepares to host a major UN climate conference later this year.

"The aviation sector created 10,000 jobs last year, we have hopes to create nearly as many in 2015," Hollande said at Le Bourget. Airbus Defence and Space made a point of flight demonstrating its A400M military transport to show confidence in this European programme after an unfortunate crash earlier this year.

130 aircraft including the Falcon 8X, Dassault Aviation's latest business jet, were on public show for the first time, as was the Airbus A350. Obvious attractions were Dassault Aviation's Rafale, Bombardier's CS 300, the JF-17 fighter from Pakistan, the Boeing 787, the NH90 helicopter and the Airbus Group's E-Fan, all of which drew much interest. In what has become an annual faceoff, Airbus secured more orders than



*Flying the flag: Dassault's Rafale during its flight display.*

## Pilatus showcases the PC-21 and PC-12NG



The PC-21

Pilatus showcased their PC-21 for training military pilots of the future and the PC-12NG, termed as the world's "greatest single." With over 70 years of experience building rugged, yet 'finely-crafted' utility aircraft, Pilatus has earned its place as the largest single-engine turboprop manufacturer in the world.

"Carefully tailored to provide an optimum training solution, the PC-21, was developed from ground up and delivers unparalleled performance, cockpit equipment, flexibility and ease of maintenance for a turboprop aircraft. Given the budgetary constraints of Air Forces, the PC-21 provides a low-cost but highly effective training platform for pilots destined to fly jet fighters, without actually requiring them to fly jets until much later in the training system!"

## Sagem and Securitech in collaboration

Sagem (Safran) and Mexican partner Securitech have signed a collaboration agreement for the joint development in Mexico of cutting-edge technology solutions for defence and homeland security applications, including drone systems, airborne surveillance and command & control. Sagem will contribute its skills and expertise in aerial surveillance, based on its Patroller drone system, underpinning industrial collaboration between France and Mexico. Developed by Sagem, the Patroller is a 1-ton class drone. It features a modular design, enabling it to carry a multi-sensor payload up to 250 kg, in the fuselage or in pods (optronics, radar and electronic warfare), with endurance exceeding 20 hours and a ceiling of 20,000 ft.

carrier Wizz Air for 110 A321neos, worth more than \$12.5 billion at list prices, made the European company fly past Boeing in financial terms. In the commercial aviation industry, Airbus revised its 20-year forecast for airliner demand in the commercial aviation industry, including hopes of long-term demand for the mega A380 airliners. Airbus projects that 32,600 new aircraft worth a total of \$4.9 trillion will be needed by 2034. John Leahy, Airbus' chief operating officer for customers, projected

Boeing to take top honours in this annual competition to sell commercial jets. Boeing, however, signed more deals for wide-body airliners. As the final tally was reviewed at close of the show, the two 'rivals' had together

booked over \$107 billion in orders and commitments.

Airbus stacked up \$57 billion worth of business for 421 aircraft. The announcement of a provisional deal by European low-cost



Airbus President and CEO Fabrice Brégier: "Globally we have never been so strong. We have never had such a new family of aircraft in every category"

Airbus' new-generation A350 XWB, which entered commercial service in January 2015, seen in flight at Le Bourget



that the *very large aircraft* segment would grow to about 1,500 airliners over that span.

“We had another very successful Paris Air Show,” reflected Fabrice Brégier, Airbus’ President and Chief Executive Officer, at the company’s traditional end-of-show press conference. “It confirms that the market trend is extremely positive and that we will achieve – and I hope exceed – our target communicated earlier this year, which was to have a book-to-bill ratio of above one”.

Boeing rallied with orders and commitments for 331 aircraft worth \$50.2 billion. Its biggest deal was with Dutch leasing company AerCap for 100 737MAX-8 airliners worth some \$10.7 billion at list prices. Boeing spokesman Daniel Mosely insisted the total numbers did not tell the whole story. He said that, not counting provisional deals, Boeing did better, with firm orders for 145 aircraft, valued at \$18.6 billion, compared with 124 aircraft worth \$16.3 billion for Airbus. And Boeing was also ahead in selling the more

## OIS-AT announces JV alliance with Rafaut

OIS-AT announced its newly concluded JV partnership with a “top-rated French defence firm” that will considerably augment the Indian company’s ‘Make in India’ capability. The Joint Venture between OIS-AT and Rafaut SAS, a French weapons-to-aircraft interface expert, envisages an exclusive strategic collaboration for R&D, transfer of technology, manufacturing, marketing, sales and services of a range of weapons-to-aircraft interface devices and flight controls equipment and sub-systems. “With this partnership OIS-AT is set to leverage the French firm’s know how to undertake manufacture of pylons and allied interface equipment that carry munitions and stores on aircraft and helicopters at a new facility planned in Bengaluru.”

*A Boeing 787-9 Dreamliner takes off as it participates in a flying display during the 51st Paris Air Show.*



## Thales’ Cerberus for RN Merlins



The Thales Cerberus has been selected under the UK MOD’s ‘Crows Nest’ project to provide the Royal Navy with its next airborne surveillance and control system (fitted to Merlin helicopters) to serve aboard the new *Queen Elizabeth*-Class aircraft carriers from 2018. This will follow the planned phasing out of Sea King Mk.7 ASaC helicopters, which first entered service in 1983 in a ‘fast-track’ acquisition during the Falklands War. They have continuously served ever since and after a previous upgrade to the current Mk 7 standards, the twelve specially equipped Sea Kings have played a major overland force protection role in Iraq and Afghanistan as well as in anti-piracy operations in the Indian Ocean and Red Sea. The chosen solution, to be managed by Lockheed Martin UK, is based on the UK-built Searchwater radar and Cerberus mission system which can detect and track multiple moving targets over land, sea or in the air. Through new innovative radar modes and performance against low radar cross section targets, the new system, combined with the advanced avionics, communications and glass cockpits on the modernised Agusta Westland Merlin Mk 2 will provide a flexible new-generation RN airborne surveillance and control solution, equally suitable for deployment at sea or from land bases.

*(Text: Richard Gardner; photo: Thales)*

expensive wide-body aircraft, with orders and commitments for 77 compared to 51 for Airbus. “By any measure, this was a fairly good air show,” said Randy Tinseth, Boeing’s vice-president for marketing,

“We’ve seen a deep and broad customer base, and a deep and broad model mix.” Boeing, meanwhile, is betting on smaller wide-bodies such as the 787. Boeing’s overall sales forecast for the next 20 years is

for 36,770 aircraft worth \$5.2 trillion, with single-aisle airliners the fastest-growing, and largest overall segment.

Industry watchers had actually been expecting a more modest haul of orders as airlines level off from a record-breaking spate of aircraft buying in recent years. High fuel prices up until a year ago had prompted airlines to invest massively in new generation, more fuel-economical aircraft like the Airbus A320neo and the

Boeing 737MAX. Against those lowered expectations, this year's results were more than satisfactory!

Boeing Commercial Airplanes President and CEO Ray Conner also provided a 'progress report' on the three programmes still in development : the 737 MAX, 777X and 787-10. "We've increased airplane production by more than 60 percent over the past five years by building our products on a lean and responsive production

## Thales launches STAR NG



On opening day of the Paris Air Show, Thales unveiled its STAR NG, a new generation Air Traffic Control (ATC) radar, an S-Band Primary Surveillance Radar (PSR) which can perform all the operational primary surveillance requirements of both civil and military air traffic control. The "technological breakthroughs" developed for the STAR NG allow the radar to address some of the key challenges of the industry. Most notably, the system provides increased mitigation of windfarms, as well drastically reducing the impact on operational performance caused by the noise of 4G networks. STAR NG is ideally suited to the specific needs of dual military civilian applications, as it has a spectrum of military capabilities no civilian radar possesses, essentially the ability to detect both slow and fast moving targets such as helicopters and fighters as well as very small targets such as UAVs. It also incorporates anti-jamming functions, and has the ability to provide altimetry information.

## Safran highlights innovation



*Patroller multi-sensor tactical drone (photo: J.Sabak)*

Safran highlighted its full spectrum of innovation by showing its flagship engines and aircraft equipment, starting with the new-generation LEAP engine from CFM that will succeed the CFM56. Also showcased was the Silvercrest, Snecma's new engine for business jets in the premium large-cabin, long-range class. Of interest were the Vinci cryogenic upper-stage rocket engine for the Ariane 6 launcher, the nacelle for the Airbus A320neo, the Patroller multi-sensor tactical drone and XDI, an X-ray diffraction system that can inspect carry-on luggage.

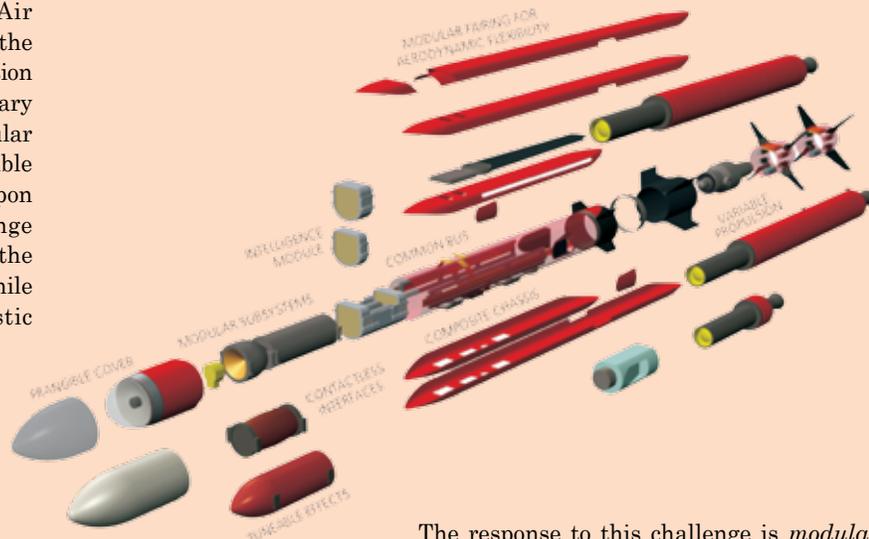


*The 'open rotor' is a future-generation aircraft engine developed by Safran. It leverages the revolutionary architecture to deliver fuel-consumption and CO<sub>2</sub> emission goals.*

## MBDA's FLEXIS : vision for air power projection

At the Paris International Air Show 2015, MBDA unveiled the CVW102 FLEXIS, an innovative vision for delivering and sustaining military capability. FLEXIS is a fully modular missile architecture concept capable of delivering a step change in weapon adaptability, increasing the range of effects deliverable as well as the endurance of a projected force, while significantly reducing the logistic burden on the commander.

"The challenge we had," explains Edward Dodwell, Head of MBDA's five-nation *Concept Visions 2015* team, "can be exemplified by carrier strike where there is a need to respond quickly to emerging conflicts and deliver effects within the constraints of the equipment held on board. This presents the challenge of having the right weapons in the right quantities to combat a growing variety of future scenarios within a weapons hold that will not grow."



The response to this challenge is *modularity*, not only applied on the production line but also up to the moment when the weapon is loaded onto the aircraft. This modularity needs to be simple and robust to allow the operator to configure the missile 'in the field'. These technologies allow FLEXIS to provide capability breadth and munition depth from a finite stockpile. They also enhance affordability through the removal of duplicated development and qualification, system evolution to meet future threats and mission requirements, and offer increased efficiency and effectiveness in complex high threat environments.

system," said Conner. "Our focus is on executing our production rates and getting airplanes into the hands of our customers. We remain on track to deliver between 750 and 755 airplanes, a new industry record."

Conner also outlined progress on the company's Airplane Development programmes. For the first time, Boeing announced that the 737 MAX would roll out by the end of this year and fly early next year. "Performance of the 737 MAX is meeting all of our expectations, with the airplane being 20 percent more fuel efficient than the first Next-Generation 737," said Conner.

Smaller manufacturers also took a larger slice of the spotlight. The spokesman for ATR David Vargas said that their company received 46 firm orders and 35 options worth a total of \$1.98 billion. That included breaking into the Japanese market with a firm order from Japan Airlines for 8 aircraft and options on another 15 (*see item in this article*). Sukhoi Civil Aircraft Company was at the event and exhibited the Sukhoi Superjet 100 painted in the colours of Mexican Interjet. Bombardier Commercial Aircraft provided an exciting display in-flight

and on the ground of its entire family of commercial aircraft. The line-up was led by CS100 and CS300 airliners, both models in the all-new CSeries family of aircraft.

"Bombardier arrived at the Paris Air Show at a very exciting time as we debut our CSeries family of aircraft," said Fred Cromer, President, Bombardier Commercial

Aircraft. "We are proud to present the first all-new designed, single-aisle aircraft that the industry has seen in over 25 years. Bombardier's ingenuity and investment in both our business and customer relationships are available for everyone to witness at this air show." The show was good for Embraer too (*see item in this article*).

## Finmeccanica/ Selex ES' SAGE for Indonesia



Finmeccanica–Selex ES has signed a contract with US-based prime contractor Integrated Surveillance and Defense Inc. (ISD) to provide a SAGE 600 digital Electronic Support Measure (ESM) system for the Indonesian Air Force. The system will be delivered in September for integration onto a maritime patrol mission system for an Indonesian Air Force Airbus CN-235 aircraft. SAGE is an electronic warfare system for RF intelligence, surveillance and reconnaissance missions, which passively collects emitter data from RF sources at a tactically significant range, compares them with an emitter library and then identifies and geolocates any threats.

# ATR at Le Bourget—and India



ATR had “a good Show”, announcing 46 firm aircraft orders and 35 options at a total value of 1.98 billion dollars. The contract signed with Japan Airlines will open up a new market for ATR and record over 1,500 firm orders since the beginning of the programme. ATR signed a number of orders during the show and launched a new, high-density version of the ATR-72 : Cebu Pacific will eventually be flying 16 of the 78-seat version. Braathens Regional, Bahamasair, Binter Canarias and Air New Zealand also placed orders for the ATR airliners.



ATR 42 and 72 aircraft are familiar at small islands in the Caribbean and Southeast Asia where short runway performance is essential and short flights are the norm. The ATR 72 is mainstay of Air New Zealand’s domestic fleet, with subsidiary airline Mount Cook operating a fleet of six, with another seven on order. The airline has for several years operated these alongside its mainline trunk domestic jet flights between the capital Wellington and the South Island’s largest city, Christchurch and is increasing its fleet as it upgrades regional routes from older 19-seater aircraft types.

One of Air New Zealand’s future ATR 72-600 aircraft was on display at the Paris Air Show, with seats from ATR’s new Armonia cabin. At the Paris Air Show, ATR also began offering an even higher density of its Armonia cabin, adding an extra row of passengers to the existing 74 for a maximum of 78 passengers. ATR Head of Sales, John Moore updated *Vayu* on developments in the company as well as

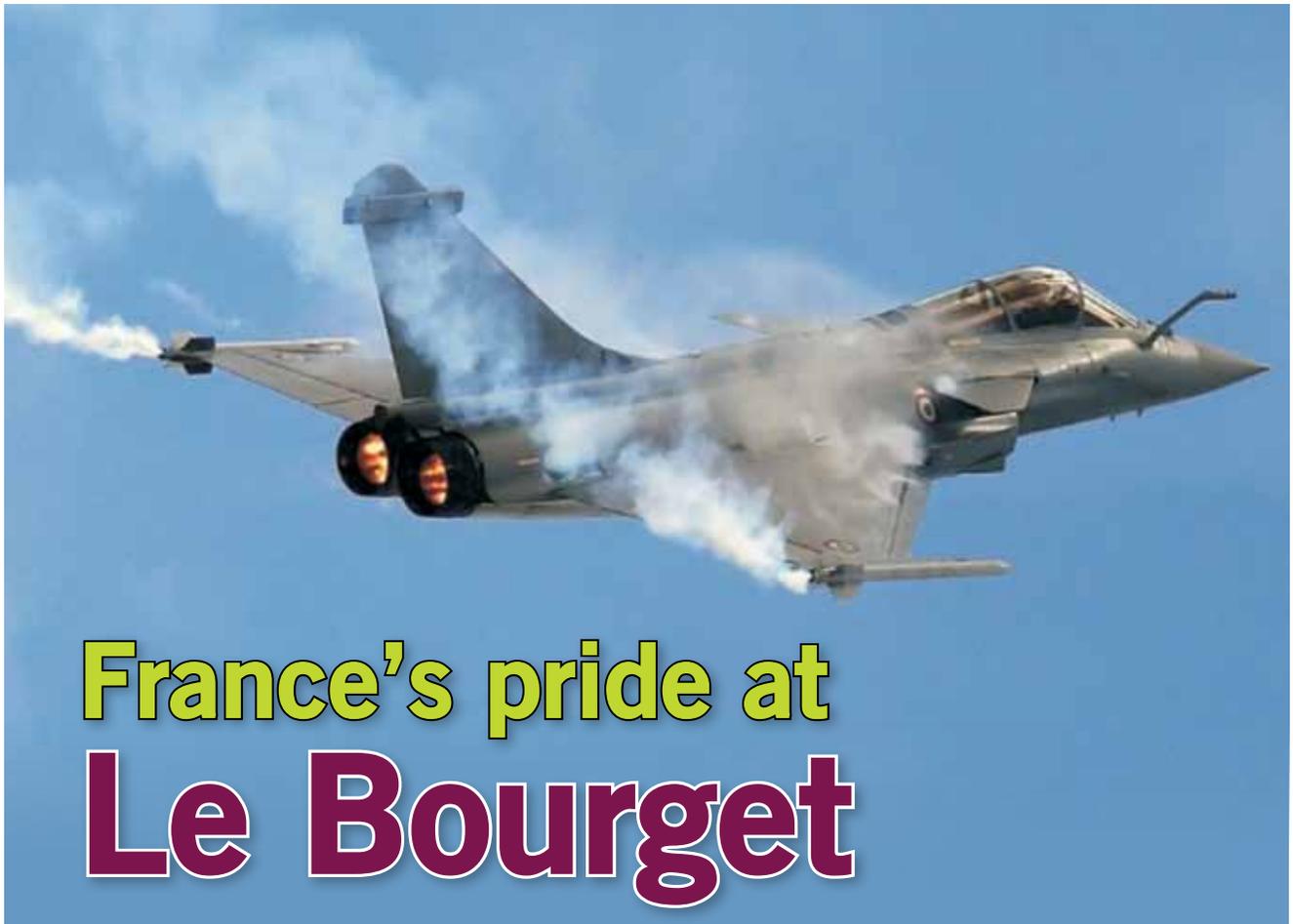
the Indian scenario. Air Pegasus is the latest airline in Indian airspace and plans to operate a fleet of only ATR 72 aircraft. The airline received its first ATR 72-500 on 27 September 2014. Six months after receiving its first aircraft, Air Pegasus was granted its Air Operator’s Permit

(AOP) by the DGCA. The second ATR-72 aircraft was expected by the middle of 2015. The airline also plans a third ATR-72 later this year and once all aircraft are with the airline, will become India’s first all-ATR-72 operator.

Air India has introduced two new ATR 72-600 aircraft into its fleet, leased from Singapore-based leasing firm Avation, the first of five that the airline has contracted for. These brand new ATR 72-600s are configured with 70-seats and the Armonia cabin. The airline currently has 4 ATR 42-320s among its fleet of regional aircraft and plans to induct nine of the airliner by end-2016.

Patrick de Castelbajac, ATR Chief Executive Officer, said that “We have partnered with Air India for more than 10 years, and we are honoured by this new proof of confidence in the ATR aircraft family. The new ATR 72-600 perfectly fits with the aim of the airline to progressively renew their fleet with more fuel-efficient aircraft, while adding seat-capacity into their main routes.”

Jet Airways has been a long time operate of ATR airliners currently operating 15 ATR-72-500s and 3 ATR-72-600s. It is understood that ATR is currently in discussion with a number of other potential start-ups in India.



# France's pride at Le Bourget

In the wake of several export successes, the Dassault Rafale was in its element during the Paris Air Show 2015. This was virtually 'home ground' for this 'omnirole fighter' and certainly was the star when French President Francois Hollande visited the event on the first day, 15 June 2015. Vying for his attention too was Airbus CEO Tom Enders who alongwith and Dassault Chairman and CEO Eric Trappier had ample reasons for wearing French pride on their sleeves.

Recent months have been very eventful, what with breakthrough export orders for the Rafale, Egypt being quickly followed by Qatar while there is cautious optimism that



*The French President at the Rafale static display park*



*At the end of his flying display, the Rafale pilot waves out to visitors at Le Bourget*

India will eventually continue with its full requirement for 126 Rafales to meet the original MMRCAs requirement. Eric Trappier was hopeful that the contract with India for 36 Rafales would be formalised by September 2015. He also revealed that Dassault would take the lead to find “local partners”, clearly indicating that HAL may not be the prime contractor should additional Rafales be built under licence in India.

Continuing on the optimistic streak, Mr Trappier suggested that there were other export prospects for the Rafale which include Canada, Kuwait, Belgium and the UAE. In any event, Rafale production rates would have to be ramped up at Merignac, but there are certain challenges for the supply chain involving some 500 entities. While Dassault is overall responsible for some 60% of the aircraft, Thales manufactures 25% while Safran’s Snecma, which builds the M88 engine, has 15% of the total share.

Future developments include fitment of the Thales RBE2 AESA radar which company also supplies the Spectra EW system, optronics, communication and navigation systems, IFF, range of avionics and other systems. In 2014, the French

Government cleared a \$ 1 billion upgrade of the Rafale to its F3R standard which will also see integration of MBDA’s Meteor BVR missile and the SAGEM Hammer AASM.

According to Dassault, such a heavily armed ‘omnirole’ Rafale is a true force

multiplier, illustrating this claim by stating that “a pair of Rafales have the same combat potential as six Mirage 2000s” .

At Le Bourget in June 2015, even as a Rafale showed its paces in dramatic flight demonstrations, the ‘C’ and ‘M’ variants were at the static park, thronged by visitors.



# An Indian flavour in Paris

The most visible manifestation of Indian participation at the 51st Paris Air Show was the 'tiranga' hoisted over HAL's double-storied chalet whose entrance was adorned with the now familiar 'Make in India' lions. Inside, senior executives from the international industry held meetings and special visitors were hosted by the Minister of State for Defence, Rao Inderjit Singh and HAL Chairman/Managing Director T Suvarnaraju.

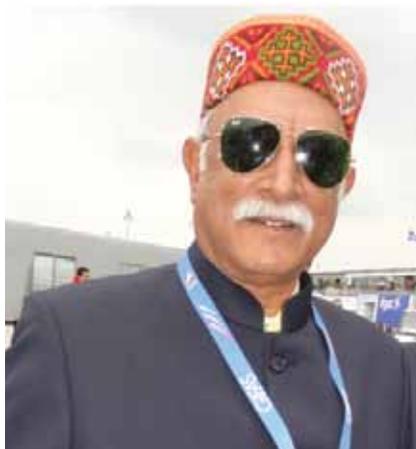
There certainly was no mistaking origin of the tantalising aroma of aromatic curries !



Although there was considerable Indian presence in Paris during June 2015, in fact, the first tributes to an Indian aerospace entity were received on eve of the 51st Paris Air Show when the *Vayu Aerospace Review* was honoured at the Aero Club de France. India's oldest journal vied with some of the world's leading professional publications to be shortlisted for numerous categories, the founding editor receiving the 'lifetime achievement award' at a glittering ceremony in the heart of Paris.

*Vayu*, of course, remained very active at Le Bourget over the next four days, even as scores of Indian industrialists, businessmen and journalists were in evidence as they criss-crossed the lines of chalets and visited the several exhibition halls and static display parks. On the sidelines, and in a brief discussion with Pusapati Ashok Gajapati Raju, Minister of Civil Aviation, *Vayu* learnt that the hitherto parallel Air Show events in India (*Aero India* at Yelahanka and *India Aviation* at Begumpet) may well be merged in the future which is entirely practical (see *Vayu Issue II/2015*).

SIATI (Society of Indian Aerospace Technologies & Industries) from Bangalore organised the only public Indian event : a discussion on *Relating Indian and Global*



*Pusapati Ashok Gajapati Raju, Minister of Civil Aviation at Le Bourget*

*Aerospace – opportunities for 'Make in India' and 'Make for the World'.* This was held at the Planetarium, *Musee de l'Air et de l'Espace* during the Paris Air Show.

However, the most important 'India-related' announcement took place after the Show had ended when it was formally announced that Airbus Helicopters will assume a 49% stake in the Mahindra Group. According to Mr Guillaume Faury, President & CEO, Airbus Helicopters, "we have an unparalleled track-record of successful industrial collaborations with local partners across the

world. We are convinced that with Mahindra we will not only have a mutually rewarding association but one which will offer immense benefits to India". The joint venture will bid to manufacture defence helicopters for the Indian Armed Forces which include the long awaited Reconnaissance and Surveillance Helicopters for the Army and Air Force as well as Naval Utility Helicopters plus Multirole Helicopters for the Indian Navy (see main article in this issue).

That the Airbus Group were interested in meeting various Indian aspirations was



*Rao Inderjit Singh with the Vayu at the HAL chalet in Le Bourget*



*At the Aerospace Media Awards : Pushpindar Singh flanked by Fred MacAulay, David North and Vadim Feldzer*



*Dr Srinivasan Dwarkanath, MD Airbus India, speaking at the SIATI India event*



*Lt Gen PK Bharali, DG Army Aviation with LCH model at HAL's chalet*

reinforced by the statement of Rao Inderjit Singh who confirmed that the European Aerospace major had offered “to help develop the Indian LCA Mk.II and also set up a manufacturing hub in India.” In fact, the Minister of State for Defence was the first Indian cabinet minister to visit France after Prime Minister Modi’s 10 April announcement that 36 Rafales would be bought for the Indian Air Force.



*French dressing! Liason Officer with Indian delegation at the HAL chalet*



*Model at Le Bourget : the light combat aircraft (LCA) whose Mk.II is under development*

# Turkish delight : Dornier 328 relaunched



A new chapter in the enigmatic Dornier 328's life has begun with the US company Sierra Nevada Corporation (SNC) restarting the Dornier 328 and 328JET programme in cooperation with Turkey. This was formally announced at the Paris Air Show by the 328 Group Managing Director Dave Jackson who confirmed that SNC has signed an MoU with the Turkish Ministry of Transport Maritime Affairs & Communications to produce both the 328 turboprop and Jet versions. These will be renamed as the T328 and TRJ328, continuing as 32-seaters but the new owners plan to develop the TR628 and TRJ 628JET, doubling the passenger capacity to 64 seats.

The 328 certainly has had a chequered past. The Do 328 programme was initially launched while Dornier was still owned by Deutsche Aerospace, the prototype first flying on 6 December 1991 and entering commercial service in October 1993. The 328's wide fuselage allowed for comfortable three-abreast seating, with the potential for a four-abreast configuration. Adopting a 'supercritical' wing initially developed for the Dornier 228, gave the 328 excellent cruise and climb performance.

Amongst the first operators was VIF Airways of Hyderabad in India which



*The 328JET*

had ordered an initial four aircraft. Unfortunately (predictably) this start up regional airline closed down within six months as was to become the pattern in Indian skies at the time. However, the 328 had entered a market awash with other competing turboprop aircraft at the time, as well as increasing competition from new regional jets in the early 1990s.

Because of public perception of noise and reliability issues with turboprops, the

subsequent owners, Fairchild-Dornier developed the turbofan-based 328-300 or 328JET, which utilised the same cabin arrangement as the 328. Also begun was development of a stretched version, the 44-seat 428JET (by IAI) but Fairchild-Dornier was unable to finance the development of further models. The 328JET was therefore the last commercial aircraft to be produced by the former Dornier Company before it became insolvent in 2002.

328 Support Services GmbH which “inherited” the type certificate for the 328JET since June 2006, did not resume manufacturing, but concentrated in providing maintenance, repair and overhaul services to the in-service fleet of around 330 examples of both the jet and turboprop versions of the aircraft. In February 2015, 328 Support Services GmbH was acquired by Sierra Nevada Corporation based at Nevada, owned by the Turkish-American Fatih Ozmen who established a private corporation named *Özjet Havacılık Teknolojileri A.Ş.* at Bilkent, Ankara. The future TRJ-628 is intended to be designed, developed and built entirely in Turkey.

Going back several decades, in the 328, the Indian Government and industry lost an amazing opportunity to fast track entry into the regional airliner market. In the all-encompassing agreement of 1983, formalised between the erstwhile Dornier GmbH and HAL, the latter was to follow up the 19-seat Dornier 228 utility aircraft with a 30+seater aircraft but in 1986-87, this opportunity was let by and the 328 was developed by Dornier without Indian involvement. A decade later, Fairchild Dornier launched the 728 and 928 new generation regional



*Dave Jackson (left) and Cem Ugur, General Director of ESEN System Integration with model of the 328JET at the Paris Air Show 2015.*

airliners but owing to certain circumstances, the now American-owned company went insolvent in 2002. In context of the Indian Government’s aspirations to develop and produce 70-100 seat regional airliners, there

was another opportunity to acquire the 728/928 which could well have propelled the Indian industry to achieve international levels at minimal cost and time.

But that was not to be.



*If only! The Fairchild Dornier 728 prototype unveiled at Oberpfaffenhofen airfield (near Munich)*

# Thunderstruck !

## JF-17s over Paris



Although the Sino-Pakistani joint fighter JF-17 has taken part at several international air shows earlier including Farnborough, Dubai, Zuhai and in Turkey, it was at Le Bourget in June 2015 that this light weight, multirole fighter carried out its curtain opening flying display in European skies.

Three JF-17 Thunders of the Pakistan Air Force were flown to France in first week of June 2015 to participate in the 51st Paris Air Show: this type certainly vied for attention (and export orders) in what is arguably the world's most important such event.

The JF-17 Thunders were from both Nos.16 and 26 Squadrons, based at Peshawar, and were flown to Paris with six stops enroute : from Karachi to the UAE, thence Saudi Arabia, Turkey and Italy,

over three days, supported by a pair of C-130 Hercules carrying ground support equipment and personnel. The Pakistani delegation included senior officials from the Department of Defence Production, Air Vice Marshal Arshad Malik, Chief Project Director JF-17, Air Commodore Khalid Mahmood, Chief Executive JF-17 Sales & Marketing and Air Commodore Syed Muhammad Ali, Director Media Affairs.

The JF-17's daily flying display was carried out alternatively by Wg Cdr Usman



*"Fighter Ace, now Ace Marketeer" : Air Commodore Khalid Mahmood during the Paris Air Show 2015. As a Flight Lieutenant, flying the F-16, he had intercepted and shot down two intruding MiG-23s and a Su-22 on the Afghan Border in November 1988.*



*JF-17 in inverted flight over Le Bourget*



*PAF pilots and other personnel next to a JF-17 fighter at Le Bourget*

Ali and Sqd Ldr Yasar Mudasser-Aslam, and had to be done under very-stringent flying display regulations. As Usman amplified: “There is a maximum altitude of 4,000 ft and a minimum of 500 ft with sector minimas, so we have to keep to those limitations. But we push the aircraft to its limits. We are not holding back. We want to show the full envelope of the JF-17” !

That their objective was achieved is verified by the statement of a former Swedish Air Force test pilot, Bjorn Fehrm who said that “As a former fighter pilot and developer of fighters (the Gripen), I discussed the Chinese-Pakistani JF-17 Thunder at length with the pilots that flew the demonstrations. I was surprised by how good the aircraft flew and the level of its systems. They are not far behind the fourth generation fighters that the West has”.

Co-developed in Chengdu, China and Kamra, Pakistan the aircraft is virtually synonymous with Pakistan’s ambition to achieve self-sufficiency in combat aircraft and the JF-17 Thunder is built exclusively at the Pakistan Aeronautical Complex (PAC) at Kamra. After completion of Block I, with some 50 aircraft built, PAC are busy manufacturing Block II aircraft with ‘increased capabilities’ including air-to-air refueling. 50 of this batch are on order, the first of which flew on 9 February 2015. The present production rate is 18 aircraft per year and all Block I/ II aircraft will eventually be upgraded to Block III standard. In fact, it is the JF-17 Block III which has particularly excited world attention with its considerable potential which could include an alternate powerplant, AESA radar, HMD and

additional weapon systems to increase its lethality.

The Sino-Pakistani consortium has long been making efforts to export the JF-17 Thunder and there reportedly are 12 countries “shortlisted”, from Argentina to Zimbabwe with rumours of Egypt of having been the first likely but this has not come about. Air Commodore Mahmood was candid in his statement that “sales had been delayed due to the political turmoil in numerous countries in the Middle East.”

However, the redoubtable Air Commodore had his strenuous activities crowned with success when on the first day of the Paris Air Show 2015 he announced that “a contract has been signed with an Asian country”, without revealing the identity.

*Watch this space!*



*Air Commodore Syed Muhammad Ali, Director Media Affairs, PAF*



*JF-17 Thunder taxis past Vietnam Airlines Boeing 787-9 at the Show*

## CAE announces series of contracts

CAE announced a series of contracts with more than 30 airlines around the world for commercial training solutions. “CAE is pleased to be able to serve the global airline pilot training market with the broadest range of commercial aviation cadet to captain training solutions on the largest variety of aircraft platforms,” said Nick Leontidis, CAE’s Group President, Civil Aviation Training Solutions. The contracts have an estimated value of more than C\$90 million. The full-flight simulators are at list prices, which include the value of OEM aircraft-specific data, parts and equipment (DP&E), normally procured by CAE in the manufacture of its simulators. In the case of these contracts, which are CAE’s first four FFS sales for fiscal 2016, some customers are providing part of the OEM content.



## CFM signs \$14 billion in new contracts



CFM International’s LEAP and CFM56 product lines remain the ‘engines of choice’ for single-aisle aircraft, with the company signing orders, commitments, and long-term service agreements for a total of 835 engines at the 2015 Paris Air Show. “What a great show” exclaimed Jean-Paul Ebanga, president and CEO of CFM International. “In just three days, we more than doubled our total orders for this year, with the CFM56 and LEAP product lines doing very well. More than 80% of the CFM orders and commitments have come from lessors and Asian customers which are pulling the aerospace market forward.”

## M-346 starts its activity as an ‘aggressor’



An M-346 of the Italian Air Force’s 61st Air Wing (called T-346A by ItAF) has been temporarily deployed to Grosseto Air Base to start testing the aircraft’s capability as an ‘aggressor’ in dissimilar combat training missions with Eurofighters, of the Operational Conversion Unit of the 4th Air Wing. Starting in August the Italian Air Force will accomplish the training’s phase IV on the new M-346 before moving to operational aircraft. The ItAF’s M-346 will train future Eurofighter pilots in DACT (Dissimilar Air Combat Training) scenarios.

## Safran teams up with DSNA

The French air navigation service provider, DSNA (*direction des services de la navigation aérienne*), the leading provider of air navigation services in Europe, and Safran, signed an agreement to work together on the integration of drones in civil airspace. The aim of this agreement is to pool the two partners’ resources and expertise to jointly bid on contracts offered within the scope of the European research programme SESAR 2020. (Single European Sky ATM Research) which is a European programme designed to modernise air traffic management systems, financed by the European Commission and the Trans-European Transport Network, TEN-T. The agreement mainly covers research & development projects concerning anti-collision technologies (‘Detect & Avoid’) and associated procedures. The ability to automatically detect and avoid possible collisions, identical to the ‘see & avoid’ function on aircraft, is in effect a technological and regulatory key to the future integration of drones in air traffic.

## First Rolls-Royce Trent 7000 engine

Rolls-Royce is to build the first of its new generation Trent 7000 engines, which was announced by Airbus as “exclusive powerplant” for the A330neo aircraft at the Farnborough International Airshow 2014; the company already “the clear market leader for the A330 aircraft with its Trent 700 engine.” The 68-72,000lb thrust Trent 7000 will deliver significant performance benefits compared to the current version of the Trent 700, will improve specific fuel consumption by 10 per cent, have twice the bypass ratio and will reduce noise. As Eric Schulz, Rolls-Royce, President – Civil Large Engines, said: “I’m proud that we are starting a journey to deliver the latest addition to our Trent engine family. The Trent 7000 offers a step change in performance and economics, and I look forward to the engine’s first test bed run later this year.” Deliveries of the A330neo will start in Q4 2017.

## Dassault Systèmes and Safran enter strategic partnership

Dassault Systèmes announced a partnership with the Safran Group to develop expertise in the virtual validation of the additive manufacturing process using Dassault Systèmes’ 3DEXPERIENCE platform. Additive manufacturing, also known as 3D printing in other industries, uses computer-aided design, engineering, manufacturing and materials science software (CAD/CAE/CAM/CAMS) to create 3D models of parts and subsystems that are then built using successive layers of materials. The effective use of this manufacturing process in the aviation industry can enhance production times as well as product performance in terms of strength, weight and environmental impact—improvements that are impossible to obtain with traditional methods. This new end-to-end process will address upstream material design and downstream manufacturing processes and testing to provide digital continuity for all engineering parameters necessary for the additive manufacturing of an engine part: material science, functional specification, generative design, 3D printing optimisation, multi-robotic production and certification.

## Progression of Irkut’s MC-21 airliner

Irkut Corporation (a UAC company) took part at Paris 2015 where they introduced a new version of a procedure simulator for the of MC-21 airliner family. The simulator has MC-21 panels and controls design, simulating flight and aircraft on-board systems tests.

The French company Stelia which and produces nose landing gear bays for the A320 family will provide Irkut with 114 sets of landing gears. “Our components make up a large share of the Stelia assembly line. Therefore, French partners visit Irkutsk aviation plant at least once a year”, said director of the international cooperation of IAP Sergei Migunov.

Ludwig Courbet of Stelia stated: “I am very impressed by the production of civil aircraft MC-21 organisation: in shops, assembly lines are organised clear and transparent. It’s neat and clean everywhere. Everything is under control” !



*The MC-21’s first flight is planned for 2016.*

## Sagem Hammers for Egypt’s Rafales

Sagem (Safran) has signed a major contract with the Egyptian Ministry of Defence for AASM Hammer air-to-ground missiles to be deployed by the Egyptian Air Force. This contract follows the acquisition by Egypt of 24 Rafale omnirrole fighters from Dassault Aviation. Developed and produced by Sagem as prime contractor, the AASM Hammer is a new family of precision-guided air-to-ground weapons. Sagem will deliver the first AASM Hammer missiles by the end of 2016, along with associated support services.

The contract with Egypt covers all three versions of the AASM Hammer now in service: hybrid inertial/GPS guidance, inertial/GPS and terminal infrared guidance, and inertial/GPS plus laser terminal guidance.



## Elettronica's experience and innovation

Elettronica and Expert System have created the CY4Gate to address the fast converging market of Electronic Warfare (EW) and Cyber Intelligence solutions. The joint venture, established in December 2014, has its premises in Rome, will provide Intelligence, Law Enforcement and EW commanders, at various levels, a complete range of solutions capable of providing superior, comprehensive, fast and structured analysis of non-uniform data streams from Elint, to Tactical/Strategic Comint and Open Source Intelligence (OSINT), Semantic Intelligence, Virtual Humint, Meta Data Analysis, Data Mining, Data Fusion, integrated within both cyber defensive and offensive applications.

To illustrate its activities and capabilities, Elettronica presented a range of products that highlight the benefits of implementing the most advanced technologies such as Virgilius which is an advanced, multiplatform, fully integrated, flexible Electronic Warfare architecture which exploits advanced signal processing techniques and key enabling technologies to deliver superior range of performance, as well as a very high modular architecture that makes the Virgilius family of products available for installation in airborne, naval and ground platforms.



## Rolls-Royce Trent 1000 for Neos

Italian carrier Neos will become a new operator of Rolls-Royce Trent 1000 engines, which will power three leased Boeing 787-8 Dreamliner aircraft, the aircraft to be provided by lessor AerCap. Neos has also selected long-term TotalCare engine service support.



Bruce Blythe, Rolls-Royce, Senior Vice President – Customers, Civil Large Engines, welcomed Neos “into our family of Trent engine operators, and look forward to supporting their strategic ambitions. Our engines offer outstanding reliability, performance and lifetime fuel burn on the 787 Dreamliner.”

## Thales I-master on Textron's Scorpion jet



Thales and Textron AirLand have jointly integrated Thales' I-Master radar on Textron AirLand's new Scorpion Jet. The addition of the radar into the Scorpion's mission system complements the Intelligence, Surveillance and Reconnaissance (ISR) sensor suite which already includes a high end EO/IR capability.

Having integrated the multi-mode radar into Scorpion within just two weeks, the first flight trials took place in late May. Combined with an EO/IR camera, I-Master adds long range, wide area surveillance and target tracking. Both payloads can be operated simultaneously by a single operator.

Textron AirLand's Scorpion was introduced in 2013 and has completed more than 400 hours of flight testing “with a high mission availability score.” The aircraft has twin-engine power, two-seat operation, large internal payload capacity, high-definition ISR cameras, wing-mounted weapons stations, and modern avionics within an all-composite structure. The Thales I-Master radar is a compact, lightweight, all-weather tactical surveillance radar, providing Ground Moving Target Indication (GMTI), Synthetic Aperture Radar (SAR) performance and Maritime Moving Target Indication (MMTI) mode.

# Israeli revelations at Le Bourget 2015



## New performance from Rafael's I-Derby ER

Rafael displayed a new, extended range version of its Beyond Visual Range (BVR) active radar-guided air-to-air missile: the I-Derby ER, an evolutionary version of the Derby BVR missile unveiled earlier this year at Aero India. The initial Derby entered service in the mid-1990s and is fielded with six operators worldwide.

The latest variant is equipped with a new seeker that employs an advanced solid-state Software Defined Radar (SDR), based on combat proven technology derived from the Tamir interceptor used in Rafael's Iron Dome system.

The new seeker is lighter and more compact than its predecessor, thus clearing valuable space which has been used by the missile designers to increase the propulsion system by adding a second mode (kick),

accelerating the missile at the terminal phase of the flight. This new addition increases the range of the I-Derby ER to beyond 100 km., significantly more than its current 'short/medium' range capability.

This 'second kick' greatly improves the missile's performance. This phase is not in series, but operates independently of the primary rocket propulsion as it is activated at any time during the fight by the flight control system. The second pulse would likely kick in when the missile is closing on its target, accelerating and increasing its kinematic envelope, thus increasing its "no escape zone."

Currently completing development, I-Derby ER will soon be available for new orders, or replacement of existing stocks. "We already have several customers seeking long-range intercept capabilities and some are looking at I-Derby ER as the most suitable and affordable solution for their requirements," states Rafael.

A major advantage of the I-Derby ER is that it uses the same missile envelope. Unlike others in its class, I-Derby ER will be compatible with aircraft currently cleared to carry Derby, including the F-16 (Block 52), F-5E, Kfir and Sea Harrier, I-Derby ER integration tests are currently underway on the Indian Tejas LCA.

## IAI UHF radar to track stealth

Israel Aerospace Industries unveiled an advanced UHF Active Electronically Scanned Array (AESA) Radar at the Paris Air Show, designed to search, detect and track "air breathing targets" including low-observable (stealth) aircraft, missiles, UAVs and ballistic missile targets at very long range, operating early warning missions. The new radar, which has already become operational with an "unspecified customer," is part of the new Ultra family of UHF radars developed by IAI's ELTA Systems Group and subsidiary.

"Ballistic missiles present a significant global threat to nations," observed Nissim Hadas, IAI executive VP and President ELTA. "We note increasing requirements worldwide for early warning radars in order to extend the currently available air situation picture and allow commanders and decision makers the valuable extra time for



The ULTRA C-22 Radar

making informed and educated decisions concerning necessary defensive measures.”

According to ELTA sources, the Ultra (ELM 2090) often operates as an early warning asset, supporting other radars, such as Super Green Pine (ELM 2080S) and Multi-Mission Radar (ELM 2084). It provides increased early warning of all types of threats, including stealth aircraft and unmanned aerial systems (UAS) well beyond the range of existing sensors. Once such targets are detected, tracks can be transferred to other assets, providing target acquisition and fire control.

The basic module, designated Ultra-C1, comprises a single AESA cluster measuring 3x3 meters. It is mounted on a rotating pedestal covering 360 deg. Ultra C-1 is configured as a relocateable system designed to provide an autonomous search and detection capability up to 500 km for a typical fighter aircraft.

Another variant is the Ultra-C6 using six clusters (three stacks of two units), designed for an early warning and long range of satellites, ballistic missiles and airborne targets at long ranges. The Ultra C-22 (in 22 clusters configuration) is a strategic system for ballistic missiles and space objects detection and tracking at very long ranges.

## David's Sling augments Israel's air defence

Israel's David's Sling weapon system for air and missile defence has recently completed its third test series (DST-3), performing successful intercepts of targets representing relevant threats: missiles and rockets of different sizes, fired from medium and

long ranges, and flying at low, medium and high altitudes. The system will be ready for operational deployment following the fourth test phase planned for later this year, according to the Israel Defence Forces.

Conceived in 2006 as a Short Range Ballistic Missile Defence System, David's Sling was developed with US cooperation and joint funding of \$250 million. Israel has requested additional US funding of \$150 million for the initial procurement phase. Deployment will involve two systems controlling multiple fire units and covering all of Israel.

David's Sling will expand Israel's air defences, enabling effective engagement of medium- and short-range ballistic missiles, guided ballistic missiles, cruise missiles and other weapons. David's Sling is expected to become part of the



national missile defence system, which includes Arrow 2 and Iron Dome by 2016. The Stunner interceptor missile will be primary endo-atmospheric interceptor of the system. The Arrow 3 ballistic missile weapon is expected to join the network after 2016, adding exo-atmospheric interception capabilities.

Like the Arrow systems, David's Sling will provide coverage from two central locations, rather than the distributed deployment of Iron Dome. With a protected footprint larger than that of the Iron Dome batteries, David's Sling will be more effective in intercepting long-range rockets such as those used against Israel in recent conflicts.

DST-3 represents the third series of tests of the Stunner interceptor, developed for David's Sling. The Stunner missile is slated to become part of other air-defence systems, including the future Patriot 4 planned by Raytheon. Stunner is compatible with Patriot fire units, thus extending their range and engagement capabilities and improving battle economy against overwhelming threats. Raytheon and Rafael are proposing the Stunner-Patriot option to international customers.

The prime company producing David's Sling is Rafael, with Raytheon a prime subcontractor. The multi-mission radar is from Israel Aerospace Industries/Elta Systems while Elbit Systems/Elisra developed the battle management centre.

## Controp enforces 'No Fly' zones for drones

Controp Precision Technologies has introduced a fast-scanning electro-optical camera capable of detecting very small moving targets, including micro-UAVs flying against ground clutter. The new sensor, named Tornado, acts as a passive EO radar, providing 360-degree panoramic coverage of the surrounding area.

“Drones are becoming more prevalent and they present new threats to personal security. Most of the radar-based air defence systems are not designed to withstand the threats of small drones that fly below 100 feet. We recognised this gap in technology and came up with an IR-based solution to this urging problem.” The Tornado was recently tested and proven capable of detecting and tracking even the smallest and lowest flying drones.”



According to Johnny Carni, VP marketing at Controp, Tornado uses software algorithms to automatically detect and track man-made flying aircraft along its path: small multi-rotor and micro-UAVs, small (unmanned) Vertical Take Off and Landing (VTOL) aircraft, helicopters, fixed-wing aircraft, even at heights of only a few feet above ground level, and at various flight speeds. The sensor can detect very small targets hundreds of meters away and large targets even tens of kilometres away.

Tornado can be operated locally or remotely from a Command & Control Centre, as stand alone system or integrated with other systems such as Radars, EO/IR observation and command and control systems.

## IAI to balance defence and commercial

Earlier this year IAI reorganised its commercial aircraft activities under the newly established Civil Aviation Organisation that coordinates activities of the company's Commercial Aircraft Group and its Engineering Group, operating in both the civilian and defence fields. "Civil aviation today accounts for about 30% of IAI's activities," corporate VP, commercial aviation Gadi Cohen said. Heading the new organisation, he expects civilian operations to increase in the future, reaching the level of IAI's defence business. "Coordinating IAI's civil aviation activities on a company-wide basis will

allow us to build and develop an efficient, unified strategy and make the most of the potential synergies between the groups," Cohen said. "We intend to streamline our operations and reduce overhead costs and duplication," he added. IAI also plans to introduce new products, particularly at the low-end of the civil aviation market.

The company has invested in expanding its manufacturing lines, especially in the field of composite materials, supporting orders from Boeing for a number of aero structures for the 777 and 787. Cohen is also optimistic about obtaining sub-contracts from other manufacturers, particularly Airbus, to which IAI has offered aero-structure elements made of composites as cost-effective alternatives to parts currently made of aluminium.

IAI is one of a handful of companies capable of designing and certifying commercial aircraft to FAR25 standards. They began with acquisition of the Commodore Jet in the 1960s, and continued with the design, development and manufacturing of over 1,000 aircraft, including the original Jet Commander 1123, and its later derivatives, the Astra and Galaxy business jets.

Currently IAI produces two variants of the Gulfstream line: the G150 midsize, and the G280 super midsize, which was the first aircraft the company developed under a cooperation agreement signed with Gulfstream in 2001. Development took about six years, followed by two years for certification, well below average for the industry. Cohen attributes this short cycle achievement to the highly experienced and motivated design, testing and air operations

teams, the availability of advanced design and simulation capabilities, and the efficient data processing of simulation and test flights.

## Rafael unveils Litening 5, RecceLite XR

Coupling Rafael's latest reconnaissance and targeting pods with scene-matching electro-optical-guided weapons, enables air forces to tighten targeting cycles from days and hours to a few seconds: Rafael unveiled the Litening 5 at the Paris Air Show. This fifth generation of the targeting pod that defined this product category two decades ago is now capable of targeting from long range, enabling strike aircraft to employ guided weapons from standoff range without relying on external support.

Litening 5 employs a new sensor pack, utilising an optical assembly and larger aperture tailored specifically for the new sensors, enabling the increased identification and recognition distance. The pod uses two FLIRS: a Mid-Wave Infra-Red (IR) and Short Wave IR (SWIR). The later extends observation range using active laser illumination. Complementing the sensor pack is a colour CCD HD-TV, improving target recognition and separation of man-made objects that are often harder to spot in the thermal, monochromatic image. Colour improves the ability to share a common understanding with ground forces and recognise specific vehicles based on their colour. Images can be fused or displayed separately, based on the level of avionics used in the aircraft.

Rafael's 'image-based common targeting language,' also known as *Matchguide*, is integrated in the new pod, which allows



Litening 5

rapid target handoff between the targeting pod or ground-based forward air controller and guided weapons carried on board. Matchguide is fully integrated in the Litening 5, enabling the pilot or ground controller to designate a target simply by touching its image on a display to deliver the targeting as coordinates or a scene to the attacking weapon. This method dramatically shortens the 'sensor-to-shooter cycle.'

Rafael also introduced a new version of its tactical reconnaissance pod, RecceLite XR, at the Paris Air Show. This multi-spectral, multi-role, real-time standoff reconnaissance system consists of an airborne pod, a wide digital datalink and a ground exploitation station. Similar to the Litening 5, RecceLite XR received an enhanced sensor package comprising megapixel-size arrays of Near-Infra-Red (NIR), MWIR, panchromatic (colour) sensors and SWIR. As with the Litening 5, SWIR adds a significant long-range performance, since its spectral band is the least affected by atmospheric absorption.

## Mini UAV becomes a suicide drone

Israel's UAV company Aeronautics displayed several new versions of unmanned systems at the Paris Air Show, among them a new version of the Orbiter: the Orbiter 1K, configured as a loitering weapon based on the airframe and properties of

Aeronautics' electrically-powered Orbiter 2. According to Dani Eschar, Aeronautics' VP Marketing, Orbiter 1K is designed as an expendable system being the first loitering weapon presented by Aeronautics. The main difference between the Orbiter Mini-UAV and this loitering weapon variant is the shape of the nose section, modified to carry a pre-fragmented warhead weighing 2.2 kg. The same warhead can be used against moving targets, including light armoured vehicles. A gimballed multi-sensor camera is mounted underneath the warhead, equipped day-CCD and uncooled thermal channel for day and night operation.

The Orbiter 1K is launched from a catapult and can remain on a mission for 2-3 hours, controlled via datalink from a personal ground control system. The drone can patrol a given path, passing specific waypoint, and it can cover a designated area, loiter over specific points of interest or follow specific moving targets. Its electrical propulsion is quiet, giving no sign of its existence either in day or night.

Once a target is identified, the drone attacks either by airburst or direct impact. If a target is not detected or conditions are not suitable for an attack, the drone recovers using the Orbiter's standard parachute and an airbag recovery system. "We are at the final development phase of this product and expect to begin operational demonstrations in the upcoming months."

## Elbit Systems introduces BrightNite and Skylark I-LEX

Elbit Systems has introduced the BrightNite, a solution that enables utility helicopters to perform Degraded Visual Environment (DVE) missions, providing them with piloting capabilities of attack helicopters and enabling a new level of operational flight. Lightweight, compact and cost-effective, BrightNite is a multi-spectral end-to-end panoramic piloting solution that delivers the essential data directly to eyes of the pilot, enabling intuitive flight in a head-up, eyes-out orientation in pitch dark and other DVE conditions.

The unique solution comprises non-gimballed uncooled FLIR and highly sensitive Complementary Metal-Oxide Semiconductor (CMOS) sensors that present an ultra-wide field of regard intuitive image to a display system which projects to the ANVIS/HUD night Helmet Mounted Display (HMD). The display is overlaid by a synthetic layer that follows the contours of the landscape and a third layer of 3D conformal symbology, which displays hazards, mission conformal symbology and tactical data. Multiple crew-members can simultaneously scan the entire field of regard using a single sensor and the synthetic world, enabling them to fly in common Line-Of-Sight (LOS).

Low-flying aircraft are especially vulnerable to threats including difficult terrain, enemy fire and the intersection of utility wires in the flight path. Sorties must often be carried out in a Degraded Visual Environment (DVE), adding to the already heavy workload and leaving flight crews to rely on NVGs to accomplish their mission. Factors limiting the pilots' FOV include: complete darkness, poor weather conditions, brownouts, whiteouts and sandstorms.

The company also introduced a new generation of the legacy Skylark I-LE mini-UAS. The Skylark I-LEX, based on years of knowledge and experience, is a man-portable electric propelled UAS, best fitted for organic "beyond the next hill" reconnaissance, counter insurgency and force protection missions, as well as civil applications including perimeter security, border and coastal surveillance, anti-terror and a variety of law enforcement missions.



Orbiter 1K



*BrightNite from Elbit*

antenna configuration, measuring merely 30 by 50 centimetres, is optimally suited for the Camcopter. The patented compact HF system is currently going through installation phases.

HF communications play an increasingly significant role for military, para-military and civilian applications. Beyond Line-Of-Sight (BLOS) communications are currently achieved through HF radios without the need of using expensive satellite communication, and risk of being intercepted through SATCOM communication servers.

Installed on the S-100 UAS, with automatic shipborne vertical take-off and landing (VTOL) capability, the ELK-7065 3D HF COMINT SENSOR can operate autonomously or as part of Intelligence, Surveillance and Reconnaissance (ISR) networks in joint operations.

**Compilation of news by Noam Eshel/ David Eshel (Show News and Defense Update) and the Vayu Aerospace team.**



*Launching the Skylark*



*On display*

The Skylark I-LEX is already operational as the standard battalion level UAS of the Israeli Land Forces and has accumulated thousands of operational sorties. Several international contracts have also been received this year for the Skylark I-LEX system.

## **IAI and Schiebel Camcopter UAS**

Schiebel and Israel Aerospace Industries' (IAI) subsidiary ELTA Systems Ltd., are to demonstrate the ELTA ELK-7065 3D High Frequency (HF) Band COMINT interception and geo-location system installed on the Schiebel Camcopter S-100 UAS (Unmanned Air System) during Q3 2015. The ELK-7065 3D HF COMINT provides quick labelling and identification of HF signals, creating a reliable Electronic Order of Battle (EOB) picture and accurate geolocation. The HF airborne



*The Camcopter UAS*

## Faizi Mohsini, Country Head - Defence & Space, Honeywell Aerospace India



**VAYU** : Honeywell's TPE 331-5 turboprop is already licence-produced in India by HAL. At Aero India 2015, there was talk of an upgrade programme for HAL-built Dornier 228s that would include improvements to avionics and powerplants : will Honeywell be working with HAL on this programme, and will you offer an uprated TPE331 variant, or an entirely new engine?

**FM** : The TPE331 is one of our most long serving and widely used engines - we have delivered more than 13,500 units and the engine family has logged over 122 million flight hours to date. Its flexibility in serving every aspect of general aviation, combined with its fuel efficiency and fast throttle response, makes it a popular engine for both civil and military applications around the world. In India we have provided a proposal outlining a propulsion system upgrade for the Dornier 228 and we look forward to discussing the potential for future collaboration with HAL on the platform.

**VAYU** : Also at Aero India, Vayu was informed that the HTT-40 trainer under development by HAL is to be powered by another TPE331 variant, the -12B. How different, in terms of design and production is this engine from the TPE331-5 that HAL already manufactures? What is the extent of Honeywell's participation in the HTT-40 project?

**FM** : I cannot discuss the HTT-40 programme today, but the main difference between the two engines is performance, with the TPE331-5 producing 904 ESHP and the TPE331-12B producing 1151 ESHP. Both engines have a similar footprint and are based on the same single shaft

(direct drive) architecture with dual centrifugal compressors, reverse flow combustor, and axial turbine, although the -12B also features upgraded compressor and turbine components, an electronic control system with electronic torque sensing as well as a lubrication system engineered for inverted flight. As well as the extra power the -12B is even more fuel efficient than the -5, something that the entire TPE331 engine family is world renowned for.

**VAYU** : The Air Chief has said that the IAF's Jaguar fleet (six squadrons) has sufficient airframe life remaining to justify an engine upgrade. However, the programme would involve much

*more than a simple engine swap, with critical issues such as changes in centre of gravity likely to result with a much lighter engine in place. Where does the project stand at the moment and how involved will Honeywell be in the process : will you simply supply engines as required, or would you assist in the complete installation and validation activity?*

**FM** : The current status of the project is that we have responded to the Indian Air Force request for proposal for the engine upgrade to its fleet of Jaguar aircraft and



TPE-331 turboprop engine on a HAL-built Dornier 228 aircraft (photo: Angad Singh)

believe our F125 engine is well-positioned to meet the IAF's requirements. Our engine offers a best-in-class thrust-to-weight ratio, a modular engine design, an integrated engine health monitoring system and proven reliability with more than 800,000 operating hours across the F124/F125 engine family. We're not ready to discuss more details regarding the project just yet, but we will keep you posted as further developments arise.

**VAYU** : *Inertial navigation systems have long been a key area of expertise at Honeywell, and you have recently signed an agreement with Tata Power SED to begin production of a tactical land INS (TALIN) in India. Is this agreement intended to support an Indian order for TALIN, or is Tata joining Honeywell's global supply chain? Will made-in-India inertial navigation systems be exported?*

**FM** : In November 2014, Honeywell and Tata Power SED signed a technology-sharing agreement for Honeywell's TALIN inertial navigation system. This Honeywell-patented technology enables vehicles and artillery to navigate precisely, even in GPS-denied environments, to increase troop safety and maximise mission success.

The objective of the partnership is to provide India with its first locally produced, highly accurate and proven inertial navigation system for vehicles and artillery in support of the 'Make in India' drive. This will be the primary focus of Tata Power SED in terms of securing orders for the system; however there is the potential for export in the longer term.

**VAYU** : *Another 'Make in India' element is Honeywell's own presence in-country, with close to 13,000 Indian employees. Could you share some examples of the sort of work being conducted in India that has an impact on Honeywell's global presence?*

**FM** : From strategic defence relationships with Hindustan Aeronautics Limited the Indian Air Force and the Indian government, to local ties with schools, universities and engineering projects, Honeywell is dedicated to supporting India's aerospace and defence industries. Honeywell and HAL began their partnership more than 40 years ago to manufacture high technology products in India. This partnership led HAL to secure a licence for the production of the TPE331-5 engine for domestic and international use,



TALIN tactical land INS alongside howitzer

and the engine remains in service today with the Indian military services.

But as well as engineering technologies for the domestic market, Indian engineers play a pivotal role in supporting Honeywell's entire global aerospace business. More than 2,800 dedicated aerospace engineers work on solutions for India and the world as part of Honeywell Technology Solutions (HTS), which is Honeywell's advanced technology engineering arm. In India HTS develops and supports safety critical aerospace systems for use all around the world, including flight management systems, flight panel displays, environment control systems and engine control systems for commercial and regional transportation, business and general aviation, and aerospace and defence.

**VAYU** : *Vayu understands that Honeywell is interested in working with ISRO : could you detail some areas of possible collaboration?*

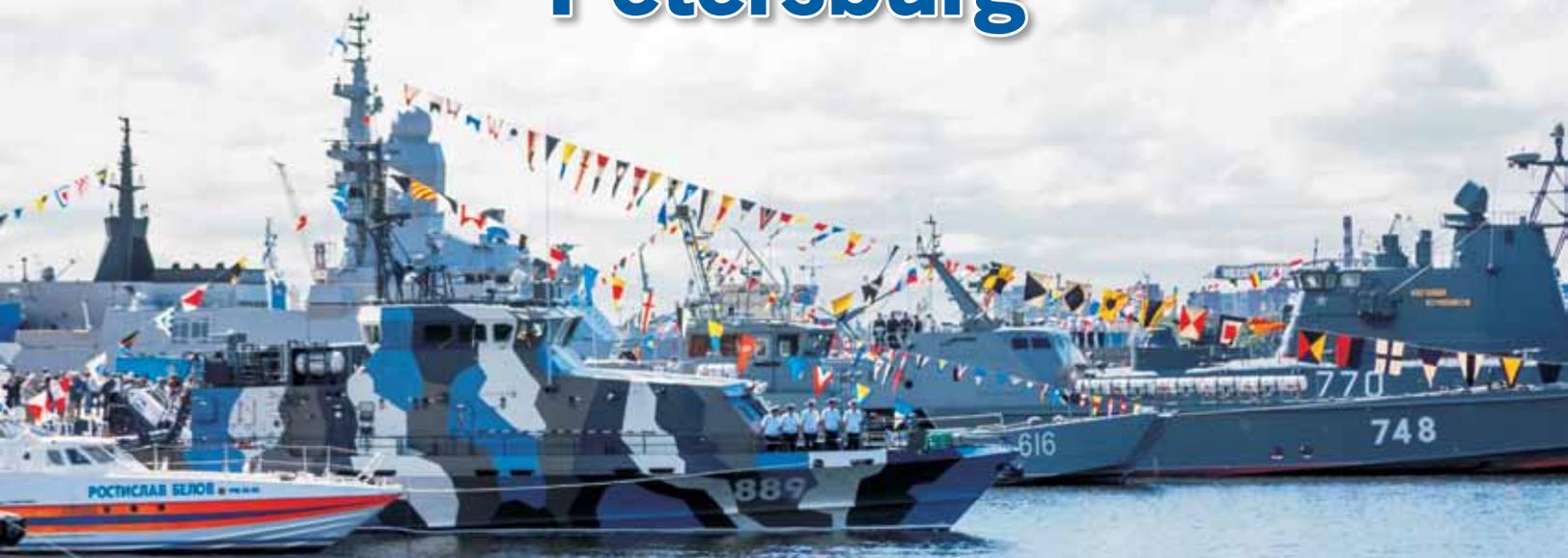
**FM** : We have a long heritage of supporting space missions with technology, including every US space shuttle flight, Neil Armstrong's moon landing, the ESA's Rosetta comet chaser and the International Space Station. We also have technologies such as command and control systems, navigation, gyros and other radiation-hardened electronics on board many satellite

constellations in orbit today. With India targeting new communications, navigation and metrological satellites over the next 10 years, we are eager to see what opportunities exist for us to bring this long heritage and technological expertise to India's space program.

**VAYU** : *In 2013, Honeywell was selected by the Airports Authority of India (AAI) to provide the SmartPath Ground-Based Augmentation System (GBAS) for a pilot project at Chennai International Airport. What is the status of this project and has there been any further interest from AAI to expand this to other airports?*

**FM** : The Indian civil aviation industry is on a rapid growth trajectory. India has a vision of becoming the third-largest aviation market by 2020 and with passenger numbers expected to reach 540 million annually by 2025, the challenge of congestion is one that must be addressed. The AAI is tackling this problem head on, and is installing our SmartPath system at Chennai to help increase capacity at the airport. The project is in the middle of certification, which we are working on, along with the AAI and DGCA, and we see an opportunity for SmartPath to help alleviate the pressure of increased traffic at other airports across India in the future.

# Maritime Matters in Saint Petersburg



## “Russian shipbuilding industry keen to work with India”

Saint Petersburg has been a naval city ever since it was founded by Tsar Peter the Great in 1703. The Tsar was educated, widely travelled and determined to make this new city a cosmopolitan centre of excellence for arts, science and engineering. The magnificent architecture of Saint Petersburg and its still-thriving shipbuilding industry are testament to the vision of Peter the Great. It is fitting, therefore, that the International Maritime Defence Show (IMDS), a maritime-oriented trade show, should be held in Saint Petersburg every alternate year.

The Expo was established in 2003, to coincide with the 300th anniversary of the founding of the host city, and has been held six times since, with IMDS 2013 being the largest, involving 457 participants from 31 countries, along with official delegations from 51 nations, with Ministers of Defence and Navy Chiefs in attendance. IMDS 2015 was a far more muted and Russia-centric affair, which enabled *Vayu* to focus on the Russian shipbuilding industry as it presently stands, current and future Russian navy

programmes – and the opportunities these present to India.

Submarine construction is a key focus area for the Russian Navy – both nuclear and conventional. Renewal of the ballistic missile submarine fleet has been a priority, and three new *Borei*-class (Project 955) SSBNs are already in active service, with another two improved *Borei* submarines, designated Project 955A, which reflect advances over the previous design, now at advanced stages of construction. A third was laid down in December 2014, and will be commissioned early in the next decade. Strategic nuclear submarines are not the only new thrust area for the Russian Navy – a fleet of new ‘multipurpose’ *Yasen*-class nuclear submarines (Project 885 and 885M) are planned, with the lead boat, *Severodvinsk*, already commissioned and in service with the Northern Fleet. These boats are distinct from typical nuclear cruise missile submarines (SSGNs) and attack submarines (SSNs) in that they are designed to execute a multiple roles such as land attack, anti-ship warfare and anti-

submarine warfare with various different munitions fired from vertical launch tubes as well as torpedo launch tubes. At least an additional six submarines are on order, with four of those already under construction. As is convention with Russian military production, the performance of both platforms and availability of finances will dictate further orders, but officials from the state-owned United Shipbuilding Corporation are confident that more *Borei* and *Yasen*-class orders will eventually materialise.

Although Russian sources remain tight-lipped on any future nuclear submarine transfers to India, it is understood that the Indian and Russian governments are working on a lease agreement for a *Yasen*-class submarine. The Indian Navy already operates an *Akula-II*-class nuclear attack submarine (as INS *Chakra*) under a ten-year lease agreement, dubbed ‘*Chakra-II*.’ Operation of this boat is crucial for building experience and developing standard operating procedures for nuclear submarines in the Indian Navy. A second nuclear

submarine would certainly enhance the achievement of these aims, particularly given that India's own nuclear submarine programmes are in their infancy and will take time to begin providing operational submarines in requisite numbers.

On the conventional submarine front, the new *Lada*-class (Project 677) appears to have resolved its teething troubles, with the lead ship, appropriately named

years from the first metal cutting to the submarine putting to sea (*see accompanying box item on Admiralty Shipyards*).

India currently operates 9 of the somewhat more dated Project 877EKM *Kilo*-class boats, and has recently reached an agreement with Severodvinsk-based ship-repair firm Zvyozdochka for a second modernisation and refit of four of these submarines. In keeping with the 'Make in

perform this operation successfully, Indian industry needs to gain experience at this sort of work. For Indian yards to become capable of handling this work they will need time and to put in hard work to acquire the required capabilities."

Most submarines undergo a refit or overhaul in their lifetimes, but this usually only happens once. Multiple overhauls, though not unprecedented, are quite rare.

**The Russian Navy's newest Project 636 (Kilo-class) submarine, *Stary Oskol*, was on display at IMDS-2015**



*Sankt-Peterburg*, accepted into service by the Russian Navy, with the proviso that future vessels incorporate design improvements. The first of these is already under construction at Admiralty Shipyards in Saint Petersburg.

Production of the venerable *Kilo*-class, in the guise of the new *Improved Kilo* (Project 636) continues apace, with three of the class already in service and another three expected to join the Baltic Fleet within the next two years. Russian experience in building these vessels and a six-boat export order from Vietnam in addition to the vessels already under construction for Russia have provided much-needed impetus to the *Kilo*-class programme, which already boasts over 50 submarines in service around the world. Admiralty Shipyards specialises in construction of these submarines, and can produce them at an incredible rate — officials state it takes between two and three

India's initiative, Zvyozdochka has planned collaboration with an Indian private sector yard for this project. Although Zvyozdochka officials refused to name the yard in question, it is understood to be the Reliance (Anil Ambani) facility, formerly Pipavav, in Gujarat (*see news item*).

Evgeny V Shustikov, Deputy General Director for Military Technical Cooperation at Zvyozdochka said that his firm is "in the process of negotiation with a suitable dockyard (sic). In case these talks are successful, this particular yard will become our partner and handle modernisation work of the Indian *Kilo*-class. We hope for a fruitful cooperation with this Indian shipyard, but of course, everything needs time. The Indian partner needs to be prepared, to upgrade its infrastructure to meet the requirements to handle this sort of work. There are some peculiarities that are involved in a second refit, and to

While Zvyozdochka officials would not comment, for reasons of secrecy, on how many Russian Navy *Kilo*-class submarines have received multiple overhauls in their operating lifespans, they did say that "several" submarines have undergone second refits, carried out by Zvyozdochka. Indeed, a cursory examination of open source information concerning the active Russian submarine force does appear to indicate that at least a handful of the early Project 877 boats would have had to undergo second refits in order to remain in service today.

Interestingly, Shustikov was forthcoming on the possibility of Zvyozdochka's Indian partner handling more than just Indian Navy projects. He indicated that foreign *Kilo*-class operators — which include Algeria, Romania, Poland and soon Vietnam — could well see their boats modernised and overhauled in India.

With numerous such boats in service around the world, issues of repair and refit would remain relevant well into the 2030s. When directly asked whether he was worried about taking business away from his own shipyard, Shustikov was frank: “I think that the modern world requires that we build partnerships, and it is necessary in today’s world to build cooperation so that both sides have mutual benefit. During our negotiations, we are trying to work out some form of cooperation that would advantage both sides. Business doesn’t stand still, it requires development and growth. We understand India’s desire to develop, and we believe we can do it together on mutually beneficial terms.”

Of course, one of the priority areas for the Indian Navy and another opportunity for Indo-Russian collaboration—Project 75 (India)—came up more than a few times in discussion with various Russian industry executives. It is well known that this programme is a key element for Prime Minister Modi’s ‘Make in India’ push, and that it will involve significant transfer of technology from whichever foreign partner is selected, along with most (or all) of the construction to be carried out in India, either by a state-owned or private sector yard. Russian officials are at once optimistic but also apprehensive about this ambitious programme.



*The latest ‘Stereushchy’-class corvette, Stoikiy, was a major attraction during the show*

To begin with, USC executives are confident that the *Amur*-class submarine on offer is a competent platform, and regardless of the specifics of the P-75I RFP (specific requirements have been speculated on but are yet to be disclosed), is well suited to Indian operating conditions. Commenting on two key requirements that are expected to be central to the P-75I tender — Brahmos missile integration and Air Independent Propulsion (AIP) — Igor Molchanov, Chief Designer at the Rubin

Design Bureau (responsible for the *Amur*-class design), asserted that Rubin is well-placed to meet the Indian Navy’s needs.

“We have already done comprehensive design work on Brahmos integration. Our belief is that requirement of this missile system will in fact increase the suitability of our proposal.” Molchanov also pointed out that Brahmos capability would be a natural choice for the Indian Navy, as it would endow its new submarines with comprehensive surface attack options:



*A gargantuan Zubr-class landing craft, the largest hovercraft in the world, eclipsed other vessels in attendance at IMDS-2015*



*A Kamov Ka-52K, intended for the Russian Navy's embargoed Mistral-class LHDs, was also on display, along with anti-ship weapons*

anti-ship as well as land-attack. He also appeared to relish the opportunity to integrate Brahmos with the *Amur*-class, noting that submarines are the only launch platforms where Brahmos is not used, even as it is operational on land and from surface ships, and under testing for airborne employment.

However, there would be “quite a large amount of work” in terms of testing and validation that would have to be carried out by Brahmos Aerospace itself, said Molchanov, which would have to be complete before submarine construction commences, as design and production changes would be impossible to effect once the project is underway.

Speaking separately to *Vayu*, officials from Brahmos (who were also exhibiting the missile at IMDS-2015) were confident in their ability to deliver. Subsurface firing tests from a submerged pontoon have already been conducted and the missile, they indicated, would be ready in time for Rubin to integrate it into the *Amur*-class. “If the Indian side expresses a desire to have Brahmos [on P-75I submarines] we will be able to react positively to that request,” concluded Molchanov.

On the topic of AIP integration, Molchanov briefed *Vayu* on the state of the Russian AIP system under development and Rubin’s flexibility with regard AIP

requirements. “An AIP unit was complete and tested on land in 2014. Now we are preparing to test the unit at sea. We already have the basis for a submersible test rig for AIP subsurface trials. This rig will also include the battery, so the final test apparatus will be a comprehensive unit that will allow us to test both the AIP and battery in operationally representative scenarios. In the two years since our last discussion (see *Vayu VI/2013*) we have come quite far!” he said.

However, Molchanov pointed out that at present, there is no RFP and no formal set of requirements for P-75I. “Without a document to refer to,” he noted, “we cannot talk about what the prospective ship would look like. For the sake of information, our plan is to complete all AIP testing by end-2016.”

Given the compressed timelines for the Russian AIP trials and integration, as well as the Brahmos missile’s apparent readiness for submarine integration, Rubin’s Andrey Baranov, Deputy Director for Foreign Activities, expressed his confidence that if the P-75I programme were to require Brahmos capability as well as AIP, Rubin would readily be able to deliver both. In addition, Rubin is already exploring cooperation options with DRDO’s own AIP programme, in case the P-75I RFP requires integration of an Indian-designed AIP

module. “We have exchanged visits with them and identified solutions in common with our AIP and theirs. The critical part is that both Rubin and India are working on fuel-cell AIPs using liquid oxygen and hydrogen,” said Baranov, adding that the similarity in the two approaches makes it easier for Rubin to offer to integrate a future Indian AIP module. Molchanov also lauded the Indian and Russian approaches to AIP, noting that they do not require hydrogen storage, and as such are safer and superior to the implementation on HDW submarines.

However, the Russian shipbuilding industry is less certain on the viability of making all the P-75I submarines in India, particularly given two major factors: the Indian Navy’s urgent need to renew its submarine force, and the inordinate delays experienced with Project 75 (the Scorpene programme underway at Mazagon Dock Limited).

“The determining factor is the time that the Indian Navy requires for delivery,” said Baranov. “As far as we know the Navy wants the first submarine 7 years after contract signature. I think this is a task we can handle, provided there is a dockyard (sic) that has experience of submarine construction. Another condition is that the industry must be experienced and able to produce submarine systems. In that case, the 7-year requirement of the Navy can be met.”

Presently, there is only one Indian yard with any measure of submarine-building experience—MDL with the Scorpene project. Unfortunately, this programme has been marred by repeated delays, cost escalation and poor contract implementation. The challenge with P-75I will be to avoid repeating this. Against this backdrop, the Russians’ trepidation regarding the ability of any Indian yard to execute P-75I successfully appears well founded. The Ministry of Defence and the Navy will have to decide which is more important—complete ToT and local production with all the possible pitfalls, or speedy delivery, which would see at least one submarine of the chosen type built by the OEM in their ‘home’ shipyard.

Alexey Dikiy, Head of the Department of Military Technical Cooperation at USC agreed, asserting that regardless of which submarine is selected for P-75I, building at least one, but ideally two, of the selected submarines in the OEM’s facilities with Indian engineers in attendance so as to

gain experience. This, coupled with the required improvements to infrastructure at the nominated Indian shipyard, would minimise risk of delays in the submarines to be constructed in India. “The ideal situation,” said Dikiy, “is that the first one or two ships can be built in Russia, with Indian personnel in attendance to learn ‘on the job.’ The next step would be that the newly-trained Indians, with oversight of Russian specialists, would commence construction in India.”

Beyond the ‘hot topic’ of P-75I, Russian firms that *Vayu* interacted with at IMDS-2015 are clearly keen to keep up established cooperation, and initiate new projects in other areas such as surface warships and marine systems. USC’s Alexey Dikiy mentioned that as an existing *Kilo*-class operator, the Indian Navy was an ideal candidate to operate the Project 636 (*Improved Kilo-class*) submarines that are being built for Russia and Vietnam at Admiralty Shipyards in Saint Petersburg.

He also discussed the *Talwar*-class frigates, six of which are in service with the Indian Navy. “The 11356 project was very well received,” said Dikiy proudly. “We have already delivered 6 ships, and sale of 3 more such vessels is being negotiated. This is a good design and has a good reputation in the Indian Navy. I believe that the follow on contract will indeed be signed because of the ship’s performance in the Navy.”

Once again, Dikiy signalled his organisation’s willingness to transfer technology and production know-how. “We are well aware of the ‘Make in India’ requirement of the Indian Government, so we are ready to see these ships built in India,” he said. “Broadly speaking, we are willing to offer anything to be built in India!”

Sergey Vlasov, CEO of the Nevskoye Design Bureau, which was responsible for the aircraft carrier INS *Vikramaditya*, was similarly effusive. He highlighted Nevskoye’s subsequent role in both the Shore Based Test Facility (SBTF) at INS *Hansa* in Goa and the design and construction of INS *Vikrant*, the first indigenous aircraft carrier, currently under construction at Cochin Shipyard. “There is an Indo-Russian governmental cooperation structure, and all collaboration happens under this framework. However, unofficially, we have reconfirmed that we are ready to help with whatever is needed by the Indian Navy and industry.”

He also noted that in the 18-odd months since INS *Vikramaditya*’s commissioning, Nevskoye had received positive feedback on the carrier’s operations, and that Commodore Suraj Berry, the commissioning Captain of the ship, had reported that the “carrier’s manoeuvrability is not worse than that of a comparatively small Project 11356 (*Talwar*-class frigate)” Sevsmash, the yard where *Vikramaditya* was converted from a cruiser to a carrier, remains committed to supporting the ship through its lifetime, and Vlasov stressed that Nevskoye would do all that was required to assist Sevsmash in this arrangement.

On the broader issue of product support, Russian officials did not shy away from acknowledging that the conflict in Ukraine had created issues, but they also elaborated on plans to work around these issues in both the short and long term.

“There are some issues with sanctions against Russia,” admitted Alexey Dikiy. “Zorya-Mashproekt [manufacturer of most marine turbine power plants for Russian vessels] has halted all deliveries

of gas turbines to Russia.” However, he explained that the Russian government was already working out a solution: “For the Russian navy ships that have Ukrainian power plants, there is a Russian programme to replace foreign components. If this project is executed on target, we will replace those Ukrainian turbines with Russian ones within 2-3 years. As for the Indian navy ships made in Russia with Ukrainian engines, Ukraine will have no problem directly supporting India.” In the long term, he said the aim was to ensure that Russian ships are built with Russian engines, and that Russian manufacturers are gearing up to meet this challenge.

Every situation presents opportunities and challenges, however, given the position of the Russian shipbuilding industry and the historical closeness between the governments of India and Russia, there is little doubt that the opportunities today, particularly against the context of ‘Make in India’ far outweigh the challenges.

**Photos and text: Angad Singh  
[Visiting Saint Petersburg]**

## Inside Admiralty Shipyards

**1** July 2015 was the first time Indian journalists were granted access to the storied Admiralty Shipyards in Saint Petersburg. This 300-year old facility is not only one of the enduring success stories of Russian shipbuilding, operating from the time of Peter the Great, through the Soviet era and into present day, but it is also special as this is the site where most of India’s submarine fleet has been built. 16 of the 23 submarines that have been operated by the Indian Navy since independence were launched into the icy waters of Saint Petersburg’s Neva River from this very yard.



Besides Indian boats, Admiralty has manufactured over 300 submarines in the past 100 or so years, including 41 nuclear submarines. Presently, however, the yard is a centre for only conventional submarines and the odd surface craft, given understandable concerns over having a nuclear facility in the heart of Russia’s second most populous city. Currently, the shipyard is working on a number of *Kilo*-class boats at various stages of completion, as well as further *Lada*-class submarines for the Russian Navy along with a submarine rescue vessel ‘Igor Belousov.’

***An extended photo essay on this exclusive visit to witness the art of Russian submarine building will be published in Vayu VI/2015 (Navy special issue).***

## First export success for JF-17 Thunder



On day one of the Paris Air Show 2015, first export success for the Sino-Pakistani joint fighter JF-17 Thunder was officially announced although the identity of the country remains 'under wraps'. Air Commodore Khalid Mahmood, Chief Executive, JF-17 Sales and Marketing, revealed that this was "an Asian country" but went no further. It is known that the Pakistan Aeronautical Complex (PAC) which is spearheading the export drive, have shortlisted some 12 countries, ranging from Argentina to Zimbabwe but most likely first customers will be the Air Forces of Myanmar and Sri Lanka. The Commander-in-Chief (Air) of the Union of Myanmar Air Force, General Khin Aung Myint, visited Pakistan in mid-May 2015 and is seen in the photograph above with Air Chief Marshal Sohail Aman, CAS PAF at Air Headquarters, Islamabad.

Meanwhile, with JF-17 Block II series production underway at Kamra, increasing number of aircraft are available for the raising of another squadron, reportedly No.2 at Masroor (Karachi), which joins Nos. 16 and 26 Squadrons plus the CCS which are equipped with the type.

## First Rafales for Egypt

An official ceremony marking delivery of the first three Dassault Rafales for the Egyptian Air Force took place at Istres in



southern France on 20 July 2015 in the presence of Egypt's Ambassador to France and Dassault Aviation Chairman & CEO Eric Trappier.

This first delivery comes just five months after the Egyptian decision to acquire 24 Rafales (16 two-seaters and 8 single-seaters) for its Air Force. At the same time, an initial group of Egyptian Air Force personnel have received conversion training on the Rafale in France. Egyptian Air Force pilots flew the first three Rafales to Cairo the next day.

## Egypt orders MiG-29s

Close on the heels of its order for Rafales, Egypt has reportedly ordered 46 MiG-29 fighters from Russia. The contract worth up to \$2 billion is the largest order received for the MiG-29 since break-up of the Soviet Union. Operating combat aircraft from both



France and Russia has been a long-standing pattern in Egypt and is an option to be exercised against the possibility of US sanctions, which resulted in barring of deliveries of new F-16s in July 2013, although the freeze was lifted earlier this year. It is also suggested that Egypt would buy 24 of the more advanced MiG-35.

## More Su-34s for Russian AF

Four additional Su-34 bombers have been received by the Russian Air Force, joining five delivered earlier. Another was handed over to the Russian Ministry of Defence on 29 May. Sukhoi's Novosibirsk plant has been involved in production of the Su-34 which "will ensure a steady workflow at the factory through to 2020."

## 50 new Tu-160s

Production of the upgraded Tupolev Tu-160M *Blackjack* long-range strategic bomber is to be resumed and up to 50 of the type are involved. Russian Air Force Chief Colonel General Viktor Bondarev has stated that "The aircraft will be restored to production," but this would not have any impact on the new PAK



DA strategic bomber, development of which would continue. The PAK DA is expected to first fly in 2019, with deliveries to the Russian Air Force due to begin in 2023-2025 to replace the Tu-95, Tu-22M3 and Tu-160. The current RuAF fleet of 16 Tu-160s is being upgraded to Tu-160M standards under a two-phase programme.

### PAK-FA (T-50) programme pruned

The revelation by Russian Defence Minister Yuri Borisov on 2 July that his Ministry will order only one squadron of the fifth generation PAK-FA (T-50) in the coming years, which will equip a trials and test unit, shall have major implications for the Indian Air Force. The Government of India had signed a protocol agreement with Russia some years back, which involved joint development (and funding) of the T-50 fifth generation fighter aircraft (FGFA), which was to enter IAF service around 2025.



The programme has been plagued by technical issues and the Russian Air Force has apparently been reluctant to commit on major orders for the PAK-FA, also citing the high cost of the same, preferring to go in for Su-35 which is regarded as the definitive variant of the Su-27/Su-30 family.

The Minister stated at St Petersburg, “Yes, we are reducing the number of PAK-FAs, of which only one squadron will be purchased

in the coming years. At the same time we will increase the purchase of Su-35 fighters, which are cheaper, but their tactical and technical characteristics are far superior to their foreign counterparts”. However, the Minister clarified that series production of the PAK-FA will begin in 2016 as scheduled.

### Gripens in Icelandic air policing



The Czech Republic will deploy JAS 39 Gripens to undertake the Icelandic Air Policing role, with 5 aircraft to be based at Keflavik Air Base, Iceland, for a period of six weeks in July and August. The task had originally been allotted to Royal Canadian Air Force CF-18 Hornets, but because of commitments on operations against ISIL in Iraq and Syria, the Czech aircraft will replace them. Czech Gripens had previously undertaken the Icelandic mission in 2014 over a nine-week period during that autumn.

### USAF block orders for 450 F-35s

A multi-year block purchase of up to 450 Lockheed Martin F-35 Lightning II Joint Strike Fighters is reportedly proposed by the US Department of Defence and this large order could well



drive down costs and allow industry to plan with confidence for the next few years of production. The contract, which would cover Fiscal Years 2018-20, requires Congressional approval before it can go ahead and would include aircraft for international programme partners plus Foreign Military Sale (FMS) customers as well.

The US Undersecretary for Defence acquisition, Frank Kendall has said that all programme partners had expressed interest in participating and noted that the block buy approach was likely to provide “double-digit” cost savings owing to larger economies of scale that will be possible when orders reach 150 aircraft per year. He also noted that the programme was meeting or exceeding new performance and cost milestones set in 2011.

Meanwhile, six US Marine Corps Lockheed Martin F-35B Lightning II Joint Strike Fighters have been deployed aboard the amphibious assault ship USS *Wasp* (LHD 1) for the first shipboard phase of the F-35B Operational Test (OT-1) programme. Objectives included demonstrating and assessing day and night flight operations in varying aircraft configurations; digital interoperability of aircraft and ship systems; F-35B landing signal officer’s launch and recovery software; day and night weapons loading; plus all aspects of maintenance, logistics and sustainment support of the F-35B while deployed at sea.

## General Atomics Reapers for USAF

A contract has reportedly been awarded for eight more General Atomics MQ-9A Reaper unmanned air vehicles for the US Air Force. The eight, in Block 5 production configuration, will be produced at the company’s facility in Poway, California by 31 December 2017.



## More C-130Js delivered

Another two Lockheed Martin C-130J Super Hercules have been delivered to the US military, besides a KC-130J tanker to the US Marine Corps and an HC-130J Combat King II personnel recovery tanker to the US Air Force. Meanwhile, the USAF’s Special Operations Command has retired its last two Lockheed MC-130P

Combat Shadows operated by Detachment 1 of the 1<sup>st</sup> Special Operations Wing. Since *Desert Storm*, the MC-130Ps were involved in other operations, including *Northern* and *Southern Watch*, *Deny Flight* in Yugoslavia, *Restore Democracy* and *Uphold Democracy* in Haiti, *Deliberate Force* and *Joint Endeavour* in Bosnia, *Assured Response* in Liberia, *Guardian Retrieval* from Zaire, *Enduring Freedom* in Afghanistan, *New Dawn* in Iraq and *Odyssey Dawn* in Libya.

## KT-1Ps for Peru

The first locally assembled KT-1P Torito basic/advanced training aircraft for the *Fuerza Aérea del Perú* (FAP – Peruvian Air Force) were handed over recently. The aircraft was built through a technology transfer agreement with Korean Aerospace Industries (KAI), which is co-producing 16 of the 20 aircraft on order for the FAP at the *Servicio de Mantenimiento* (SEMAN) maintenance facility adapted for the purpose.

## USN exercises with Malaysian AF



Boeing F/A-18s from the US Navy aircraft carrier USS *Carl Vinson* (CVN 70) participated in a number of bilateral training missions with the Royal Malaysian Air Force in May while the carrier was deployed in the South China Sea. This included Hornets and Super Hornets from *Vinson*’s Carrier Strike Group, with Carrier Air Wing 17 (CVW-17), carrying out dissimilar air combat training (DACT) with RMAF F/A-18D Hornets, MiG-29Ns and Su-30MKMs. These included multiple combat scenarios, which ranged from single aircraft engaging single aircraft to complex multi-aircraft combat sorties.

## Indonesian F-16Cs delivered

Another four F-16C Block 52IDs have been delivered to the *Tentara Nasional Indonesia-Angkatan Udara* (TNI-AU – Indonesian Air Force) to be based at Iswahjudi Air Force Base in Madiun, East Java. Their arrival brings total deliveries to nine aircraft from an order for 24 refurbished former USAF examples which are being acquired under the *Peace Bima Sena*

II programme. Meanwhile, US approval has been granted for Indonesia's acquisition of 30 AIM-9X-2 Sidewinder Block IIs, the \$47 million deal to include 20 captive air training missiles, two tactical missile guidance units, two guidance units and two dummy air training missiles.

## Thales Raytheon Systems contract with NATO

Thales Raytheon Systems have signed a €92.5million contract with NATO for "a significant upgrade" to the Alliance's current missile defence command and control capability by bringing new capabilities to NATO's Air Command and Control System (ACCS). This will allow the Alliance to link national sensors and interceptors with NATO's Air Command in Ramstein, Germany, to plan and execute a missile defence battle. The project involves a transatlantic industrial base across eight countries and 15 industry partners and is expected to be completed by 2018. It will be rolled-out in three steps with the final step offering an integrated single software baseline able to support both air and missile defence.

## Helicopter Synthetic Training

The UK Ministry of Defence have given contracts for new ground-based training equipment for Royal Air Force and Royal Navy helicopter pilots and other crew. These comprise a £51 million contract with Lockheed Martin UK to support Chinook HC6 training and another (valued at £29 million) for Merlin HC4/4A aircrew synthetic training devices being provided by AgustaWestland for Merlin HC4/4As. For the Chinook this will be at RAF Odiham (Hampshire) facility, which will include two flight deck simulators, a rear crew training device and a suite of computer-based training facilities. The Merlin simulators at Yeovilton will be provided by CAE under sub-contract to AgustaWestland, and include two fixed-base flight training devices, a flight navigation procedures trainer and a rear crew trainer. The dedicated Merlin Commando Helicopter Force training facility will begin training courses in late 2017 and achieve full capability in 2018.

## Swedish Sk60 Replacement

According to sources in Sweden, and referred to by the Swedish Air Chief at Paris, the process has begun to establish a new Military Flying Training System (MFTS) to supplant the obsolescent Sk60 (Saab 105) jet trainers. An RFI has been issued by the *Försvarets Materielverk* (FMV-Defence Materiel Administration) and responses were due in July. The MFTS would provide both basic and advanced training covering Phases II-IV of the Swedish pilot training system. According to the FMV, there is no particular preference for a single aircraft or two-aircraft system to achieve the requirements of the MFTS, which should deliver up to 8,000 flight hours per year. Various types in contention are the M-346, Hawk and KT-50.

## NATO AGS Aircraft

NATO's first Alliance Ground Surveillance (AGS) aircraft was unveiled on 4 June, this unmanned aircraft based on the Northrop Grumman Block 40 Global Hawk, which will advance the Alliance's evolving ISR needs covering a full range of NATO's missions. "This marks a significant step forward in achieving NATO's goal of acquiring NATO-owned and operated AGS core capability," stated Erling Wang, Chairman of the NATO AGS Management Organisation (NAGSMO). With an ability to fly for up to 30 hours, the high-altitude long-endurance system is equipped with the Multi-Platform Radar Technology Insertion Programme (MR-RTIP) sensor.

A \$1.7 billion contract had been signed with Northrop Grumman in May 2012 for the AGS system, which comprises five air vehicles and fixed, mobile and transportable ground stations. The main operating base for the type will be Sigonella Air Base, Italy. The system is expected to achieve IOC by the end of 2017, led by Northrop Grumman the industrial team includes Airbus Defence and Space (Germany), Selex ES (Italy) and Kongsberg (Norway), as well as leading defence companies from participating countries (Bulgaria, Czech Republic, Denmark, Estonia, Germany, Italy, Latvia, Lithuania, Luxembourg, Norway, Poland Romania, Slovakia, Slovenia and the United States.)

## First SAR Dauphin for Lithuania

The first AS365NR+Dauphin for the Lithuanian Air Force has been unveiled to the public, the helicopter being one of three acquired for search and rescue duties under a €52 million contract signed in Vilnius on 25 October 2013. Through a co-operation agreement with the Ministry of Environment, the Lithuanian Armed Forces will conduct environmental observation and control and also carry out SAR tasks, fire-fighting missions, casevac and provide emergency support flights.

## German H145M Contract

Airbus Helicopters has been given a full-service contract by the *Bundeswehr* (German Armed Forces) for the new H145M, designated earlier as EC645T2. The helicopter is scheduled to enter



service with the Luftwaffe later in 2015. The contract will ensure optimal availability, reliability and readiness for the Luftwaffe's fleet of 15 H145Ms, which are to be used primarily in missions supporting the country's *Kommando Spezialkräfte* (Special Forces) based at Baden Württemberg, southern Germany.

## A-29 Super Tucanos for the Ghana Air Force



Ghana will acquire five Embraer A-29 Super Tucano light attack and advanced training turboprops, the company providing logistic support for the operation of these aircraft as well as set-up of a training system for pilots and mechanics in Ghana. The A-29 Super Tucano will be deployed for advanced training, border surveillance and internal security missions. The A-29 Super Tucano is currently used by ten air forces in three continents and was also selected by the United States Air Force (USAF) for its Light Air Support (LAS) programme.

## Beechcraft delivers four T-6s

Beechcraft Defence Company recently delivered four Beechcraft T-6D military aircraft to the United States Army, to be part of the Joint Primary Aircraft Training Systems (JPATS) programme and stationed at Redstone Arsenal in Huntsville, Alabama. These will replace the Beechcraft T-34 aircraft currently in use at the facility. The four T-6D aircraft will perform such missions as Operational Support Airlift, utility, training, chase, airspeed calibration support, cloud physics research and stores component research and qualification.

## US weaponry for West Asia

FMS sale to Israel worth \$1.879 billion for JDAM tail kits, munitions and associated equipment, parts and logistical support, has been approved by the US State Department. The Israeli Government has requested 14,500 KMU-556C/B Joint

Direct Attack Munitions (JDAM) tail kits consisting of 10,000 for Mk 84s; 500 for Mk 83s and 4,000 for Mk 82s. Also included would be 3,500 Mk 82 bombs, 4,500 Mk 83 bombs, 50 BLU-113 bombs, 4,100 GBU-39 Small Diameter Bombs (SDBs), 1,500 Mk 83 Paveway kits, 700 BLU-109 Paveway kits, 3,000 AGM-114K/R Hellfire missiles, 250 AIM-120C Advanced Medium Range Air-to-Air Missiles (AMRAAMs) and 500 DSU-38A/B detector laser illuminated target kits for JDAMs.

Meanwhile, the United Arab Emirates has requested 1,600 Guided Bomb Units (GBUs), this possible Foreign Military Sale notified to Congress by the Defence Security Cooperation Agency. Including associated equipment, parts and logistical support, the estimated cost will be \$130 million. The DSCA confirmed that the deal will include 500 GBU-31B/B(V)1 Mk84/BLU-117 bombs, 500 GBU-31B/B(V)3 (BLU-109) bombs and 600 GBU-12 (Mk82/BLU-111) bombs. The UAE continues to provide support to US forces stationed at Al Dhafra Air Base and "plays a vital role in supporting US regional interests."

US State Department approval has also been given for FMS sale to Lebanon of 1,000 AGM-114 Hellfire II missiles, the proposed deal valued at around \$146 million including associated equipment, parts and logistical support. The missiles will replenish Lebanon's depleted Hellfire stocks, which had already been boosted with accelerated shipments of the weapon.

## MH-60Rs for Saudi Arabia

US State Department approval has been granted for a possible Foreign Military Sale to Saudi Arabia of ten Sikorsky MH-60R multi-mission helicopters. 14 APS-153(V) multi-mode radars (comprising ten installed, two spares and two for testing) and four spare T-700 GE 401 C engines are to be included in the agreement. Further equipment comprises 1,000 AN/SSQ-36/53/62 sonobuoys, 38 AGM-114R Hellfire II air-to-surface missiles, five AGM-114 M36-E9 captive air training missiles, four AGM-114Q Hellfire training missiles, 380 Advanced Precision Kill Weapons System rockets, 12M-240D crew-served weapons and 12 GAU-21 crew-served weapons.

## Sweden deploys UAVs to Timbuktu

Sweden has deployed a number of unmanned air vehicles to Mali to support *Mission Multidimensionnelle Intégrée des Nations Unies pour la Stabilisation au Mali* (MINUSMA) for operations from Timbuktu. Three types of UAV have been deployed by Sweden: AeroVironment Pumas and Wasps, plus AAI Shadows, all unarmed and being used to support MINUSMA's western sector forces, providing aerial intelligence, surveillance and reconnaissance.

## US Special Ops CV-22Bs in Japan

A US Air Force Special Operations Command squadron of CV-22B Ospreys will be based at Yokota. The first three Ospreys will arrive in Japan in the second half of 2017 and seven more are to follow by 2021, their deployment to provide increased capability

for US Special Operations forces to respond quickly to crises and contingencies in Japan and across the Asia-Pacific region, “including humanitarian emergencies and natural disasters.” The deployment will increase interoperability, enhance operational co-operation and promote stronger defence relations with the Japan Self-Defence Forces and the move “reflects the United States’ steadfast commitment to defend Japan.”

### Belarusian Yak-130s

Belarus has taken delivery of four Yakovlev Yak-130 jet trainers ordered for the Belarusian Air Force and Air Defence Force. The first was delivered onboard an Il-76MD from the Irkutsk Aviation



Plant facility in Russia to the 116<sup>th</sup> Attack Air Base at Lida, Belarus, on 16 April and re-assembled by Russian technicians. Belarusian pilots and ground crew are currently training on the type at the aviation training centre at Zhukovsky in Russia. The contract for the four jets, signed between the Belarusian Defence Ministry and Irkut Corporation on 18 December 2012, included options on four more. Currently, Belarus trains pilots with ten Aero L-39C Albatross aircraft acquired from surplus Ukrainian stocks during 2005 and 2006.

### Singapore F-16s upgrade

The Republic of Singapore Air Force’s F-16 Block-52 fleet is reportedly to be upgraded. Under FMS, this would be worth



around \$130 million, to cover the upgrade of 20 F-16Cs and 40 F-16Ds. The update would comprise new mission avionics such as the AN/APX-126 Advanced Identification Friend or Foe, embedded Global Positioning System/inertial navigation systems (GPS/INS), and the Link 16 Multi-functional Information Distribution System (MIDS). New weapons include 500lb and 2000lb Joint Direct Attack Munitions (JDAM) and GBU-39/B Small Diameter Bombs (SDB).

### Bolivia seeks AJTs

Bolivia is examining acquisition of up to 20 new light combat aircraft, the government having identified the need for a combat type to supplement the current Lockheed T-33 and Hongdu K-8 jet trainers. The Defence Minister has said that Bolivia requires two squadrons of 10 aircraft each. Five offers have reportedly been received from Argentina, Brazil, France, China and Russia, but the aircraft types are not identified.

### Gripen for Austria, Switzerland ?

In a surprising turn of events, it is reported that Saab has offered Gripen fighters to Austria as replacement for that country’s Eurofighter Typhoons. The Austrian Air Force currently operates 15 Typhoons Tranche 1, which may require replacement as early as three to five years from now, as they have “struggled with the costs of operating the jets, which are used exclusively for air policing.” The Saab offer would involve either refurbished Gripen C/Ds or the improved Gripen E/F, the latter to be available after 2022.



Meanwhile, it is learnt that Switzerland will resume its efforts to procure a new fighter from 2017, the previous plan to buy 22 Saab Gripen Es having been voted out by a referendum in May 2014. Swiss Defence Minister Ueli Maurer stated that a new evaluation will take place in 2017 and that the purchase of a new fighter is now more urgent after the decision was taken to retire 10 F-5E Tiger IIs, which had structural cracks. Maurer believes that the upgrades to extend the service of 32 F/A-18C/D Hornets until 2030 or 2035 are not sufficient to protect Swiss airspace. The Gripen E, Dassault Rafale and “a US fighter aircraft type” will be included in the evaluation.

## Final Luftwaffe Tranche 2 EF2000



The last of Tranche 2 Eurofighter Typhoons for the Luftwaffe was delivered from Manching by Airbus Defence and Space on 7 May. The two-seat aircraft will join *Taktische Luftwaffen Geschwader 73* (TakLwG 73) 'Steinhoff' at Laage air base. All subsequent Typhoons delivered to Germany will represent the definitive Tranche 3 build standard.

## Turkish T129s deployed

Turkey has begun to deploy its new Turkish Aerospace Industries (TAI) T129 ATAK helicopters in combat operations in the south-east of the country. According to the Turkish General Staff, two examples of the T129 ATAK have been deployed to Siirt province to support operations against the outlawed PKK group, being base of the Turkish Army's 3rd Commando Brigade.



## New Bangladesh AF aircraft

The Bangladesh Air Force has received first of three new L410UVP-E20 twin-turboprop transport aircraft on order, the aircraft delivered on 21 April from the factory in Kunovice. The Bangladesh Air Force transport fleet presently comprises three Antonov An-32s and four C-130B Hercules and a proposal to acquire four surplus USAF C-130Es was notified to US Congress in 2012, but it is unclear whether there has been any further progress on this potential acquisition. Five Mi-171Sh helicopters are also on order. Prime Minister Sheikh Hasina has stated that nine new



primary training aircraft are on order, the type not revealed, but these may be new-production Nanchang PT-6s to replace survivors of the 40 PT-6s previously delivered by China.

Hasina also referred to an order for 16 combat training aircraft, probably Yakovlev Yak-130s ordered in late 2013. Deliveries are due to begin shortly and will be used as lead-in fighter trainers, replacing the L-39 Albatross and FT-6 trainers. The first BAF Yak-130 made its maiden flight at the Irkut production facility on 29 April and eight of the BAF aircraft have been assembled to date. Two AgustaWestland AW139s are also on order and will be delivered by the end of the year for the search-and-rescue and utility roles. Other recent purchases include nine Hongdu K-8W jet trainers, the first four being delivered in September 2014.

## Saab upgrades for Pilatus PC-21s

Saab has signed a contract with Pilatus Aircraft to provide the mission and graphics computer with a digital map function for the Pilatus PC-21. The contract covers development, adaptation and delivery of an open system mission computer, plus the digital map software function, for the PC-21 advanced turboprop trainer aircraft produced by Switzerland's Pilatus Aircraft Ltd. Series production deliveries will start in 2016 and will continue over the life of the PC-21 programme. The contract provides options for additional suborders that could include further cockpit functions and systems.



### Maiden flight of China's J-11D

Prototype of the Shenyang Aircraft Corporation (SAC) J-11D (serial D1101) made its maiden flight on 29 April. Featuring several airframe changes, the J-11D prototype reveals several



differences that suggest this as a virtual clone of the Russian Su-35S. A new radome with canted base, similar to that of the J-10B, reportedly houses a new active electronically-scanned array (AESA) radar developed by the 14th Institute and tested on a modified J-11B testbed in 2014. The airframe appears to include greater use of composite materials, especially in the wing and tail sections and other features are a fly-by-wire system reportedly based on that of the new multi-role SAC J-16 and probably an in-flight refuelling probe on port side of the fuselage. The infra-red search and track (IRST) dome appears to have been moved to a new position somewhat offset to the starboard side of the windshield, there are slimmer wingtip pylons, similar to those on the J-16, suggesting standard use of the latest PL-10 infra-red-guided AAM instead of the PL-8.

### New Chinese aircraft carrier

The People's Liberation Army Navy (PLAN) are progressing with the development of its first indigenous aircraft carrier. According to a statement from former PLAN Political Commissar ADM Liu Xiaoganag, China plans to build as many as six new carriers. The first indigenous carrier is being built at Dalian and work at the related dry dock may have been revealed in recent photographs of the shipyard.

Chinese media has also reported the successful development of an electro-magnetic launch catapult. The PLAN is known to have had two different new-generation catapult programmes underway, one a steam system and the other electromagnetic.

### Chinese amphibian aircraft

Plans have indicated that the Aviation Industry Corporation of China (AVIC) AG-600 amphibian may be used for military purposes, to "enhance its operational capability at sea and safeguard its maritime interests" (see artist's depiction). While the primary roles for the AG-600 remains forest fire control and maritime search and rescue, it is also intended to undertake 'law enforcement tasks at sea and other maritime operations that protect rights and interests.' The AG-600 is planned to fly in the first half of 2016 and



will be the world's largest operational amphibian. To date, the rear fuselage of the first prototype has been completed by Shaanxi Aircraft Corporation. The same sources have suggested that the PLANAF has retired its last five SH-5 maritime patrol aircraft.

### KJ-500 in PLANAF service



The latest two KJ-500s AEW&C aircraft from the Shaanxi Aircraft Corporation have been delivered to the PLANAF, the first examples being the KJ-500H. Instead of being delivered to the previously known PLANAF AEW&C unit, the 2nd Naval Division, these have been given to the 9th Division based at Hainan, which formation has also recently received the first two Y-8Q anti-submarine aircraft.

### PAF Chief visits China

The Pakistan Air Force CAS, Air Chief Marshal Sohail Aman, visited China during early June for discussions, which also concerned the JF-17 Thunder Block III version. According to reports, he met with General Ma Xiaton, Commander People's Liberation Army and Air Force (PLAAF); Lin Xuoming, President AVIC (Aviation Industry of China); Li Yuhai, Vice President AVIC; Yang Ying, President CACIC (China National Aero-Technology Import and Export Corporation) and Qu Huimin, President China National Electronics Import and Export Corporation (CEIEC).



During his visit, he inspected J-10s of the 24<sup>th</sup> Air Division at Tianjin before flying to Chengdu to review ongoing modifications on the JF-17 prototype (PT-5) and the JF-17 simulator. At Shenyang he was briefed on the Chinese fifth-generation J-31 stealth aircraft, which is reportedly of interest to the PAF. In early June, three PAF JF-17s flew to France to participate at the Paris Air Show 2015 (see detailed report).

## Lockheed Martin Snipers for Jordan

Lockheed Martin has been contracted to deliver Sniper Advanced Targeting Pods (ATP) to the Royal Jordanian Air Force (RJAF) “in support of urgent operational requirements.” The RJAF is currently conducting precision-strike missions with five Sniper ATPs it acquired in 2014. Under the new contract, Lockheed Martin will deliver ten Sniper ATPs and provide integration support beginning later this year. Sniper ATP detects, identifies, automatically tracks and laser-designates small tactical targets at long ranges and also supports employment of all laser and GPS-guided weapons against multiple fixed and moving targets. Sniper ATP’s interoperability enables coalition air forces to use the pod across multiple platforms, including the F-15, F-16, F-18, A-10, B-1 and B-52 aircraft.

## Javelin missile’s extended range

The US Army and the Javelin Joint Venture, comprising Raytheon and Lockheed Martin, have recently conducted live-fire Javelin missile engagements against tank targets from different launcher and platform configurations as part of demonstration to current foreign military sales users. Each of the three Javelin missiles used during the tests at Redstone Arsenal in Huntsville, Alabama, was fired from a different launcher or platform; from a Command Launch Unit (CLU); from a vehicle using a Remote Weapon Station (RWS); and from the US Army’s recently deployed Containerised Weapon System (CWS), also using a RWS. The CLU-launched missile hit a target at 4,000 meters, while the vehicle-launched and CWS-launched missiles hit targets positioned at 1,100 metres and 700 metres, respectively.

## Saab to deliver RBS 70 missiles

Saab has received an SEK270 million order for the delivery of RBS 70 missiles and additional equipment and training, with



deliveries between 2015 and 2016. The Saab portfolio of short-range ground-based air defence missile systems includes the RBS 70 and the further enhanced RBS 70 NG. The RBS 70 system has an impressive track-record with more than 1,600 launchers and over 17,000 missiles delivered to 19 countries. “One of our customers of the RBS 70 system has placed an additional order to achieve added capacity of its forces. This order demonstrates the reliability of the RBS 70 system, as well as the high quality of our manufacturing and support capabilities,” stated Görgen Johansson, head of Saab business area Dynamics”.

## Saab NLAW for Finland

Saab has received an order from the Finnish Defence Forces for the NLAW Next generation Light Anti-tank Weapon, which is a shoulder-launched, anti-tank missile system that attacks the target



from above., the contract value approximately EUR32 million. In 2007, Finland had ordered the NLAW, becoming the second export customer for the short range anti-tank weapon and has now ordered an additional number of NLAWs.

### Saab spares support for Gripen E

Saab has received an order for spare parts support for the next generation Gripen E from the Swedish Defence Material Administration (FMV). The order is part of the Gripen E framework agreement which was signed between Saab and FMV in February 2013 and comprises components and devices for the Gripen E. Delivery is expected to take place in conjunction with initial aircraft delivery. "This is an important first step to secure the equipment supply for the Swedish air force and Gripen E. We are pleased that we, together with our customer, have been able to secure competitive prices on essential equipment", stated Ulf Nilsson, head of Saab's business area Aeronautics.



### CAE to develop four P-8A flight trainers

Boeing has ordered simulator hardware for four additional P-8A Poseidon operational flight trainers (OFTs), two of which are for the United States Navy, which will bring the Navy's total to 18 P-8A OFTs, whilst other two are part of a United States Cooperative Programme via the P-8 Production, Sustainment, and Follow-On Development Memorandum of Understanding (PSDF MOU) with the US Navy to provide the Royal Australian Air Force (RAAF) with a comprehensive P-8A training system. The contract for the two US Navy P-8A OFTs was signed in CAE's first quarter of fiscal year 2016.

### First RAAF C-27J Spartan in Australia

Air Marshal Geoff Brown received the first RAAF C-27J Spartan battlefield airlift aircraft in Australia at a ceremony held at RAAF Base Richmond on 30 June 2015. The acquisition of the C-27J Spartan will fill a gap in Australia's military capability for tactical fixed wing airlift, which has been felt since phasing out of the Caribou fleet in 2009. Air Marshal Brown said the acquisition



of ten C-27J aircraft, which has been planned since 2012, signifies a considerable enhancement in Australia's airlift capability. "This acquisition represents a commitment to Australia's air power capability which is a critical element of Australia's national security and defence strategy," stated Air Marshal Brown.

### Elbit to integrate JHMCS II on AC-130W

Elbit Systems of America, through its RCEVS joint venture with Rockwell Collins, has recently entered into a NAVSEA Crane contract funded by USSOCOM to integrate the Joint Helmet Mounted Cueing System (JHMCS) II onboard the AC-130W. This is the first JHMCS II integration effort in the US for military cargo aircraft. With current versions of JHMCS flying on most US fighter aircraft, this integration will occur over the course of the next two years and is pivotal to the warfighter, since adding JHMCS II technology is part of a much larger effort to add capabilities to the AC-130 platform. Designed to improve situational awareness, the JHMCS II Helmet Mounted Display System is based on operationally-proven technology that incorporates colour symbology in both day and night modes.



### Swiss is first CS100 Operator



Swiss International Airlines is the first operator of Bombardier CS100s, the carrier having ordered 30 examples of the new airliner and will start operating the type in the first half of next year. The CS100 made its public debut at the Paris Air Show, from where the aircraft flew to Zurich for demonstration flights for Swiss Air employees and stakeholders.

### American's Dreamliner into service

American Airlines has begun flying the Boeing 787-8 internationally from June on its daily Dallas-Fort Worth-Beijing route and then on to Dallas-Buenos Aires frequency two days later. The Dreamliner will be added to the Chicago O'Hare-Tokyo Narita sector in August. The airline is due to receive 13 Dreamliners by the end of 2015.



### Tigerair Philippines rebranded



Cebu Pacific has renamed its Tigerair Philippines low-cost carrier subsidiary as Cebgo, the new identity being to more closely identify the carrier's relationship with its parent company. The airline's A320s will be repainted in the new livery, which includes the yellow and green of its parent company.

### Qatar is 'Airline of the Year 2015'

At the prestigious 'Airline of the Year' SKYTRAX Awards, Qatar Airways were declared winners for 2015, this being their third such award, after 2011 and 2012. Cathay Pacific Airways had won



Group Chief Executive of Qatar Airways, Akbar Al Baker with the award

the award last year, with Emirates having the honour in 2013. Qatar Airways were dominant at the Paris Air Show 2015, with their aircraft and logos prominently displayed.

### Elbit and ATR for ClearVision

Elbit and ATR are integrating ClearVision Enhanced Flight Vision System (EFVS) with the SKYLENS wearable display onboard the new ATR-600 series of turboprop aircraft. The system



can also be offered as a retrofit to other ATR ‘-600’ aircraft already in service. Enhancing flight safety, the new system will also contribute to the operational availability of the aircraft, often required to operate from airfields lacking sophisticated infrastructure. Suitable for day and night operations and in all weather conditions, the system provides head-up information while minimising the dependency on airport instrumentation. Equipped with the new ClearVision EFVS and SKYLENS wearable display, aircraft are capable of take-off and landing in low visibility conditions and in locations that non EVS-equipped aircraft previously could not approach.

## Pilatus PC-12 logs 5 million flight hours

In May 2015, the global fleet of over 1,300 Pilatus PC-12 aircraft accumulated 5,000,000 flight hours since the first aircraft was delivered in October 1994. Since making its debut in the market, the PC-12 has become one of the top selling models of business aircraft, and built a proven record as one of “the safest business aircraft on the market.” The PC-12’s success can be attributed to many factors, but the diversity of its operator base is considered the most predominant reason for its continued strong sales. PC-12s around the world are used for executive transport, special missions, air ambulance, surveillance, airlines, cargo transport, fractional ownership, law enforcement, charter, fire spotting, and relief aid roles.

## New PW307D engine’s Type Certification

Pratt & Whitney Canada (P&WC) has received Transport Canada type certification for its new PW307D turbofan engine, which will power Dassault Aviation’s new Falcon 8X, a three-engine ultra-long-range business jet. Certification of the PW307D, P&WC’s latest engine, follows the Falcon 8X trijet’s successful first flight in February. Through technology enhancements that provide greater performance, efficiency and lower environmental impact, the PW307D delivers “increased takeoff thrust and improved fuel consumption compared to the PW307A engine. The result is a powerful yet highly efficient, clean and quiet business jet engine with one of the highest thrust-to-weight ratios in its class.”

P&WC and Dassault Aviation have been working together for nearly two decades starting with the selection of the PW308C for the Falcon 2000EX in 1999. Since then, P&WC has been chosen to

power the Falcon 2000DX, 2000LX, 2000S and 2000LXS business jets with its PW308C engine, the Falcon 7X with the PW307A and recently the new Falcon 8X with the PW307D.

## Honeywell’s Ovation for Bombardier Global Express

Honeywell Aerospace’s Ovation Select cabin management and entertainment system has been installed aboard a Bombardier Global Express aircraft by Jet Aviation Geneva, adding to the growing fleet of business aircraft using the all-digital and customisable installation enabled by Ovation Select. Global Jet selected Honeywell and Jet Aviation Geneva for their strong support services in Europe and worldwide. This aircraft is the latest to join a fleet of nearly 2,000 business jets with Honeywell Ovation cabin management systems flying around the world today.

## Gulfstream’s 500th G550

Gulfstream Aerospace Corp. has recently delivered the 500th Gulfstream G550 to Abbott, headquartered in Abbott Park, Illinois. The G550 can fly up to 51,000 feet/15,545 metres and at speeds up to Mach 0.885. Powered by two Rolls-Royce BR710 engines, the aircraft can carry eight passengers and four crew over 6,750 nautical miles/12,501 kilometres. The G550 cabin can be configured in multiple manner and can accommodate up to 18 passengers.



## Azul order E195-E2 jets



Embraer and Azul have agreed on 30 firm orders for the E195-E2 jets. The contract also includes an additional 20 purchase rights for the same model, bringing the total potential order up to 50 E195-E2 jets at an estimated value of US\$ 3.2 billion. The firm orders will be included in Embraer's 2015 second-quarter backlog. The first delivery is scheduled for the second quarter of 2020.

## Indra Radars at Karachi and Lahore Airports

The Pakistan Civil Aviation Authority (CAA) has renewed Indra radar systems' contract for serving the international airports at Karachi and Lahore. A system at each of these airports equipped



with primary and secondary radars to facilitate the location and identification of aircraft will be set up by Indra, which will increase security and allow Pakistan authorities to manage a larger number of aircraft.

CAA Deputy Director General Air Vice Marshal Khawar Hussain stated that "the number of aircraft using Pakistani air space would be doubled, as the new and more sophisticated equipment would help reduce the separation distance among the aircraft".

## Boeing 737-800 for Myanmar National Airlines



Myanmar National Airlines have taken delivery of its first Next-Generation 737-800 leased from GE Capital Aviation Services (GECAS), the commercial aircraft leasing arm of GE. The celebration also marked the first all-new Boeing aircraft to be delivered to any Myanmar-based airline and will be the first aircraft to feature Myanmar National Airlines' new livery and interior, and the airline plans to expand its network outside Myanmar with the introduction of its 737.

## DCNS delivers second FREMM multi-mission frigate

On 12 June 2015 DCNS delivered the FREMM multi-mission frigate *Provenceto* to the French Navy in Brest, being the second of the series ordered by OCCAR on behalf of the DGA (French armament procurement agency). Delivery of the FREMM multi-mission frigate *Provence* is the result of a design and construction process managed by DCNS in close cooperation with the French Navy, DGA and OCCAR teams.



Orders by the Royal Moroccan Navy and the Egyptian Navy, as well as announcement of the launch of the intermediate-size frigates programme, augment DCNS' efforts for international development. The FREMM *Provence* marks culmination in the ramping up of SETIS, the latest-generation combat system developed by DCNS, the ship now equipped with a cutting-edge solution that is "perfectly integrated on board." Successful firing of the naval cruise missile on 19 May 2015 from the FREMM *Aquitaine* is demonstration of the anti-land warfare capabilities directed at targets located deep in enemy territory. Added to the anti-submarine, anti-surface and anti-air warfare capabilities, the FREMM has now reached its full technological capabilities.

## Mid-life upgrade for Gotland-class submarines

The Swedish Defence Materiel Administration (FMV) has contracted with Saab for the construction of two new Type A26 submarines and a mid-life upgrade for two *Gotland*-class submarines.



## FREMM *Aquitaine* fires a naval cruise missile

The frigate *Aquitaine*, first unit in the multi-mission frigate programme (FREMM), has test-fired its first missiles: an Exocet MM40 surface-to-surface missile and a naval cruise missile, respectively on 12 and 19 May on the firing ranges of the DGA missile testing centre off Levant Island, this being the first time that a European surface ship has fired a European cruise missile.



The orders, signed with FMV, cover the period 2015-2024 and the total order value is SEK8.6 billion. Saab will construct, verify and deliver two new Type A26 submarines for the Swedish Navy, with deliveries to start in 2022 and be finalised in 2024. Saab will also conduct a mid-life upgrade on two of Sweden's existing *Gotland*-class submarines, including an overhaul and upgrade of the combat system. The two upgraded *Gotland*-class submarines will be delivered to FMV in late 2018 and late 2019, respectively.

The French Navy, the DGA teams and manufacturers MBDA and DCNS are jointly verifying technical capabilities of the FREMMs before entry into active service, this being another major milestone, after the firing of an Aster 15 anti-aircraft missile in 2013 and the commissioning of the MU 90 lightweight torpedo on the Caiman marine helicopter, the naval version of the NH90 helicopter.

## US Navy receives 25th P-8A

The first P-8A Poseidon aircraft of Low-Rate Initial Production (LRIP) lot 4 has been delivered to the US Navy at the Naval Air Station Patuxent River, Maryland, where it joined Air Test and Evaluation Squadron One. This is the 25th Poseidon to join the USN's current P-8 inventory, Lot 4 being comprised of the final 13 LRIP aircraft. Full-Rate Production (FRP) manufacturing commenced in July 2015 and the first FRP aircraft will join the Navy in 2016. As the transition from P-3C Orion to P-8A Poseidon continues, the US Navy has begun to deploy the Poseidon for anti-submarine warfare, anti-surface warfare and intelligence, surveillance and reconnaissance training and operational missions.

Crucial to future of the French Navy, the FREMMs are heavily armed warships, carrying naval cruise missiles, Exocet MM40 anti-ship missiles, Aster anti-aircraft missiles and MU90 anti-submarine torpedoes. All the FREMMs can accommodate a Caiman marine helicopter, as well as Special Forces and their equipment. Six FREMMs will be delivered before mid-2019.



## Netherlands order 12 new Thales Bushmasters



A dozen life-saving Bushmasters are going into production in Bendigo for export to the Netherlands, after the country's Ministry of Defence ordered new vehicles from Thales in Australia. The vehicles will complement the 86 Bushmasters previously purchased by the Dutch customer between 2006 and 2009, and will be delivered by the middle of 2016. Chris Jenkins, CEO Thales in Australia stated, "The Bushmaster has proven itself on operations with the Dutch military in Afghanistan, and is a vital component of their Light Brigade. This export order shows the Army's continuing confidence in the Bushmaster and its ability to protect troops in theatre. The Bushmaster vehicle has repeatedly proven to safeguard personnel against mines and improvised explosive devices". The troop carrier variants will be fitted with additional composite armour, remote weapon stations and Thales's market-leading SOTAS intercom system.

## European flight safety system for drones tested

Ten years after the first flight of the AleniaAermacchi Sky-X, the first European UAV over one tonne class, a series of latest tests were performed in Italy for augmenting future operations of unmanned aerial systems in the civil air zone. Currently confined to operational theatres, test areas or 'corridors' and completely separated from airspace reserved for civil aircraft and helicopters, UAS (Unmanned Aerial Systems) or RPAS (Remotely Piloted Aircraft Systems) require important technological processes in order to exploit their full potential. The industrial consortium comprises Saab (coordinator) for Sweden, Finmeccanica-AleniaAermacchi and Finmeccanica-Selex ES for Italy, Diehl, Airbus D&S and ESG for Germany, Indra for Spain, Sagem and Thales for France and by the aerospace research agencies CIRA for Italy and DLR for Germany.



## RBS15 Mk3 operational tests

Operational capability of the German-Swedish anti-ship missile RBS15 Mk3 'Magdeburg' was proven at a test site in Swedish territorial waters during end-April. The operational test comprises the entire performance ranging from target assignment, mission



planning to missile launch and striking the target. Diehl Defence supplies the anti-ship missile RBS15 Mk3 as main armament of the German Navy's new K130 corvettes. The missile is a result of Diehl and Saab's joint refinement of the Mark 2 version, which has "proved its worth with the Swedish and other navies." RBS15 Mk3 can not only engage naval targets, but is also capable of precise engagement of land targets.

## Raytheon next-gen Standard Missile-3 tested

The US Navy and Missile Defence Agency (MDA) have conducted the first flight test of the Raytheon Standard Missile-3 Block IIA as the interceptor's 'bigger' rocket motors and 'more capable' kill vehicle will engage threats at a faster pace and protect larger regions from short- to intermediate-range ballistic missile threats. The mission, Control Test Vehicle-01, evaluated the SM-3 Block IIA's nose cone performance, steering control section function, booster separation, and second and third stage rocket



motor separation. During the test, a SM-3 Block IIA was launched from an MK 41 launcher located at the US Navy's Point Mugu Sea Range on Saint Nicolas Island in California.

### IAI's HAROP Loitering Munitions demonstrated



Israel Aerospace Industries (IAI) recently completed a series of flight demonstrations of its HAROP Loitering Munitions in Israel for 'a foreign customer', following various other operational exercises performed over the last few months for different customers.

The HAROP demonstrated augmented capabilities in the field of observation, flight altitude and loitering, in addition to better maneuvering and target destruction. The missile loitered for several hours until the target was selected and with maximum precision, dived directly on to it. A HAROP unit is comprised of launchers and a Mission Control Shelter (MCS), which enables missile control with a man-in-the-loop operation, engagement or abort attack capability in real time, thereby avoiding collateral damage.

### Germany agrees to proceed with TLVS

The German Federal Ministry of Defence (BMVg) will proceed with the Tactical Air Defence System (TLVS or *Taktisches Luftverteidigungs* system) based on the development results already achieved by the tri-national MEADS, thereby fulfilling the *Bundeswehr's* requirements for a powerful, latest-generation air defence and missile defence system. Special features of the MEADS-based TLVS include 360-degree coverage, open system

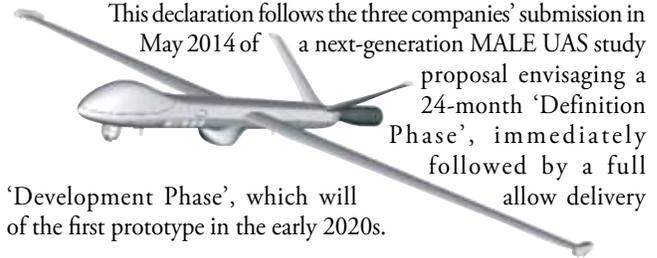


architecture and 'plug & fight' capability, which allows for the coupling of additional sensors and weapon systems, as well as rapid deployability. In addition, the TLVS air defence system can be operated at a significantly lower cost to the user than existing systems and with fewer personnel.

### European MALE drone development

Europe's leading aerospace companies Airbus Defence and Space, Dassault Aviation and Finmeccanica have welcomed the Declaration of Intent (DoI) by France, Germany and Italy to conduct a definition study of a European developed unmanned aerial system. The companies will conduct a two-year definition study of a Medium Altitude/Long Endurance (MALE) drone and a decision will then be taken on whether to start development and procurement of the system.

This declaration follows the three companies' submission in May 2014 of a next-generation MALE UAS study proposal envisaging a 24-month 'Definition Phase', immediately followed by a full 'Development Phase', which will allow delivery of the first prototype in the early 2020s.



### IAI and Thales conduct tests on Heron MALE UAV

Israel Aerospace Industries (IAI) and Thales have conducted risk reduction flight tests for the integration of Thales and Elisra's NATO STANAG 7085 data link on board the Heron Medium-Altitude Long-Endurance unmanned aerial vehicle (MALE UAV). In this joint effort between IAI and Thales, Thales's data link terminal, the TMA 6000, together with Elisra Radio Frequency Modules and antennas, have been integrated on board the Heron system and successfully demonstrated in-flight. During the flight test, both infrared and daylight videos were transmitted in real time to the ground control station, and the sensors were controlled in real time from the ground. The Heron is a MALE UAV developed by Israel Aerospace Industries and capable of operations of up to 45 hours in duration at up to 30,000 ft.





## The SAFFC -and Gripens over the Baltic

The only Air Force in the world which has an official 'Fan Club' is that of Sweden! This then was the 50th anniversary of the *Swedish Air Force Fan Club (SAFFC)*, which is an unusual and unique one-of-its-kind institution whose members this time met in the precincts of the Cercle National des Armes in Paris on 14 June 2015, eve of the 51st Paris Air Show.

Genesis of the SAFFC goes back to the year 1965 when four well-known British aviation writers were invited to visit the Swedish Air Force and industry, essentially the company Saab. Those original four were William Green, John Taylor, Gordon Swanborough and John Fricker, all now sadly departed but their writings having left behind an incredible legacy, inspiring literally hundreds of thousands of 'air enthusiasts' the world over.

In forming the SAFFC, the British journalists intended to honour what they considered an amazing air arm and its supporting industry. At height of the Cold War, the Swedish Air Force was arguably the world's fourth largest and most combat ready air arm in Western Europe, their inventory including the Saab J29 Tunnan, Saab A32 Lansen and Saab J35 Draken. Today, although far smaller in size, the Swedish Air Force fields perhaps the most advanced fourth generation multi-role combat aircraft extant, the JAS-39 Gripen, this type being increasingly scrambled to head off intruding hostile aircraft over the Baltic.

However, going back to the SAFFC, the Swedes were much enthused and thus, beginning in 1966, these get togethers were launched, held every year on the eve of Air Shows in Le Bourget or Farnborough, where the Chief of Staff, Swedish Air Force has been host and addresses specially invited media and 'fans' of the community. In the early 70's, the founding editor of *Vayu Aerospace Review*, then also Indian correspondent for the *Flying Review International*, later *Air International* was specially invited to become



part of this special institution and so was present when the annual event took place on 14th June 2015.

At this SAFFC meeting, the present Swedish Air Chief Major General Michael Bydén gave his annual update briefing and, as always, was articulate and candid when reviewing the situation and challenges. With high readiness maintained 24x7, declared missions of the Swedish Air Force remain that of Reconnaissance (ISR) and Air Defence. Sweden's air power projections were declared, and 'game changing' capabilities enunciated by the CAS. Amongst these are that the continuously upgraded Gripen C/D (MS

20) will, by 2016, carry the revolutionary Meteor active radar guided beyond-visual-range air-to-air missile (BVRAAM) developed by MBDA. The Meteor gives a multi-shot capability against long range manoeuvring targets in a heavy electronic countermeasures (ECM) environment with its range in excess of 100 km.

The Gripen MS 20's night capability has also been enhanced with Recce Pod (IR) and an improved CAS capability through Digital CAS, besides and improving upon the already impressive CBRN, maintenance and logistics capabilities.

Major General Michael Bydén revealed that in the Swedish Government Defence Review for the period 2016-2020, there will be an increase in operational capability of Sweden's armed forces while the Air Force structure will be reorganised to incorporate 4 wings with 6 fighter squadrons, an increase by 50% over the recent past. The F7 Wing training squadrons flying the Gripen C/D will turn operational while there will be a resurrection of previous capability to disperse aircraft between 'war bases', what the Swedes were uniquely known for during the Cold War years.

An equally important decision is to increase the order for Gripen Es by another 10 aircraft. Other major programmes concern a new jet trainer to replace the Saab 105, new transport aircraft to replace the C-130 and antiship missile to replace the current RBS 15.

## EXPLORATION OF SPACE

# 'New Horizons' looks at Pluto

After a decade-long journey through our solar system, *New Horizons* made its closest approach to Pluto on 14 July, about 7,750 miles above the surface – roughly the same distance from New York to Mumbai, – making it the first-ever space mission to explore a world so far from Earth.

"I'm delighted at this latest accomplishment by NASA, another first that demonstrates once again how the United States leads the world in space," said John Holdren, assistant to the President for Science and Technology and director of the White House Office of Science and Technology Policy. "*New Horizons* is the latest in a long line of scientific accomplishments at NASA, including multiple missions orbiting and exploring the surface of Mars in advance of human visits still to come; the remarkable Kepler mission to identify Earth-like planets around stars other than our own; and the DSCOVR satellite that soon will be beaming back images of the whole Earth in near real-time from a vantage point a million miles away. As *New Horizons* completes its flyby of Pluto and



*Pluto nearly fills the frame in this image from the Long Range Reconnaissance Imager (LORRI) aboard NASA's New Horizons spacecraft, taken on 13 July 2015 when the spacecraft was 476,000 miles (768,000 kilometers) from the surface. This was the last and most detailed image sent to Earth before the spacecraft's closest approach to Pluto on 14 July. The colour image has been combined with lower-resolution color information from the Ralph instrument that was acquired earlier on July 13. This view is dominated by the large, bright feature informally named the 'heart,' which measures approximately 1,000 miles (1,600 kilometers) across. The heart borders darker equatorial terrains, and the mottled terrain to its east (right) are complex. However, even at this resolution, much of the heart's interior appears remarkably featureless—possibly a sign of ongoing geologic processes. (photo credit: NASA/APL/SwRI)*

continues deeper into the Kuiper Belt, NASA's multifaceted journey of discovery continues."

"The exploration of Pluto and its moons by *New Horizons* represents the capstone event to 50 years of planetary exploration by NASA and the United States," said NASA Administrator Charles Bolden. "Once again we have achieved a historic first. The United

States is the first nation to reach Pluto, and with this mission has completed the initial survey of our solar system, a remarkable accomplishment that no other nation can match."

The 'Pluto story' began only a generation ago when young Clyde Tombaugh was tasked to look for Planet X, theorised to exist beyond the orbit of Neptune. He discovered



*A portrait from the final approach. Pluto and its largest moon Charon display striking colour and brightness contrast in this composite image from 11 July, showing high-resolution black-and-white LORRI images. (NASA)*



*Recent measurements of Pluto and Charon obtained by New Horizons: A view of how they would appear if placed slightly above Earth's surface and viewed from a great distance. (NASA)*

a faint point of light that we now see as a complex and fascinating world.

"Pluto was discovered just 85 years ago by a farmer's son from Kansas, inspired by a visionary from Boston, using a telescope in Flagstaff, Arizona," said John Grunsfeld, associate administrator for NASA's Science Mission Directorate in Washington. "Today, science takes a great leap observing the Pluto system up close and flying into a new frontier that will help us better understand the origins of the solar system."

*New Horizons'* flyby of the dwarf planet and its five known moons is providing an up-close introduction to the solar system's Kuiper Belt, an outer region populated by icy objects ranging in size from boulders to dwarf planets. Kuiper Belt objects, such as Pluto, preserve evidence about the early formation of the solar system.

*New Horizons'* principal investigator Alan Stern of the Southwest Research Institute (SwRI) in Boulder, Colorado, says the mission now is writing the textbook on Pluto. "The New Horizons team is proud to have accomplished the first exploration of the Pluto system," Stern said. "This mission

has inspired people across the world with the excitement of exploration and what humankind can achieve."

*New Horizons'* almost 10-year, three-billion-mile journey to the closest approach at Pluto took about one minute less than predicted when the craft was launched

in January 2006. The spacecraft threaded the needle through a 36-by-57 mile (60 by 90 kilometers) window in space – the equivalent of a commercial airliner arriving no more off target than the width of a tennis ball.

Because *New Horizons* is the fastest spacecraft ever launched hurtling through the Pluto system at more than 30,000 mph, a collision with a particle as small as a grain of rice could have incapacitated the spacecraft.

*New Horizons* is the latest in a long line of scientific accomplishments at NASA, including multiple rovers exploring the surface of Mars, the Cassini spacecraft that has revolutionised our understanding of Saturn and the Hubble Space Telescope, which recently celebrated its 25th anniversary. All of this scientific research and discovery is helping to inform the agency's plan to send American astronauts to Mars in the 2030's.

"After nearly 15 years of planning, building, and flying the *New Horizons* spacecraft across the solar system, we've reached our goal," said project manager Glen Fountain at APL. "The bounty of what we've collected is about to unfold."

APL designed, built and operates the *New Horizons* spacecraft and manages the mission for NASA's Science Mission Directorate. SwRI leads the mission, science team, payload operations and encounter science planning. *New Horizons* is part of NASA's New Frontiers Programme, managed by the agency's Marshall Space Flight Center in Huntsville, Alabama.

**Courtesy: NASA**



*Pluto by moonlight: Artist's impression of the night region of Pluto, using only the light from Charon, itself softly illuminated by a Sun 1,000 times dimmer than it is at Earth. (NASA)*

# 25 Years Back

## From Vayu Aerospace Review Issue IV/I 1990

### IAF to acquire 'Advanced Fighters'

In a major policy statement, the CAS Air Chief Marshal SK Mehra has announced that the Indian Air Force would acquire "advanced foreign-built jet fighters" because of delays in execution of the Light Combat Aircraft (LCA) project in India. The Air Chief stated that the Air Force had already recommended "a few" fighter aircraft-types to the Government but declined to divulge details. "This new addition will be in tune with the Air Force's policy to phase out some aircraft and induct advanced ones", he said.

Referring to the LCA, he said that the Air Force was "concerned" over the delays but hastened to add that such delays were inevitable considering that design and development of an advanced technology advanced aircraft indigenously was a "time-consuming" process, but added that the defence industry would gain a lot of experience from the LCA project.

### IAF Mirage 2000s

With reference to the recent CAG report about the Mirage 2000 in IAF service having been without its key weaponry for two years after induction into service, the CAS stated that the French fighter was now "fully operational" and that the IAF has "installed matching weapons." As for the damage caused to eight Mirage 2000s when part of the hangar collapsed on them at the Gwalior Air Force Station, Air Chief Marshal SK Mehra clarified that the damage was "minimal". "The necessary repairs were carried out and the fighters are back in service".

### The IAF and Su-27

Answering questions about "plans" to purchase the Soviet Union's Sukhoi Su-27 strategic air superiority fighter, the CAS said that "it is a very good machine but we are not interested." The Su-27, with its long-range interception capabilities and "beyond-visual ranges" missiles, was inspected by the IAF after the Singapore Air Show in February 1990. "The Su-27 does not fit in with the IAF's re-equipment plans."

### Massive losses for Indian Airlines

Indian Airlines is anticipating a loss of over Rs 70 crore during the current year, largely owing to grounding of its A320 fleet and the increased financial liabilities on the corporation on account of fleet acquisition. The total withdrawal of the A320 fleet from IA operations has altogether upset the economics of operation of the airline and this will have compounding impact in the next years.

Already, the corporation has lost over Rs 45 crore from grounding the A320 fleet from 19 February this year. The government's decision on indefinite grounding, when no expert body had detected any fundamental defects in the airworthiness of the aircraft is unprecedented in the world.

### LCA model

A one-fifteenth scale model of the Light Combat Aircraft (LCA) was handed over to Dr VS Arunachalam, Secretary DRDO and Scientific Adviser to the Defence Minister, by the Chairman HAL, Wg Cdr IM Chopra in early June. The one-fifteenth scale model of the LCA which is being developed by the Aeronautical Development Agency (ADA) will be "master-model" for subsequent testing. Speaking at the handing over ceremony of the LCA Model, Dr Arunachalam said it was essential for all agencies involved in the LCA to co-operate with one another. "We have a peculiar kind of past that inhibits us from working together," he said.

### "Go-Ahead" for Indian Defence Exports

For the first time since India started to licence-build the MiG-21 in 1966, the Soviet Union has given permission for Indian-built MiG spares and engines to be exported. This was the highlight of the Defence Ministry meeting on 25 July 1990. Dr Raja Ramanna, Minister of State for Defence told Members of the Consultative Committee including Jaswant Singh, Lt Gen (rtd) JS Aurora, Amal Datta and A Jaipal Reddy that India will export Indian-built defence equipment worth Rs 135 crores (US \$75 million) during the current year.

A number of delegations from foreign countries, especially from Africa and the Middle East had been visiting India's defence manufacturing industries. In addition to selling a licence-manufactured Dornier 228 Maritime Patrol Aircraft to Mauritius, HAL had signed MoUs with companies such as British Aerospace and Aerospatiale for hardware buy-backs totaling Rs 91 crores (\$50 million).

### Third Aircraft Carrier

According to a US-based defence journal, detailed design work for the Indian Navy's third aircraft carrier is underway. It is expected that the design process will be completed in the next twelve months after which the Government will decide on the production date with commission of the carrier in the year 2000. The French naval constructor, DCN, is largely involved in the carrier's design, and the vessel would be built at Cochin which has the only shipyard of the required size to undertake the job. The carrier would have a DWT of around 28,000 tonnes, with an appropriate flight deck and powered by gas turbines.

### Two LCA prototypes approved

The Government has formally approved fabrication of two Light Combat Aircraft (LCA) prototypes, although it was originally intended to build seven. With completion of the project definition phase (PDP), Rs 15,000 million (\$872 million) have been sanctioned for development work. It is stated that by using the full-scale engineering development (FSED) technique with the two prototypes, the ADA will be able to catch up on delays already incurred in the programme and it is understood that the two FSED prototypes should be ready by 1995. However, the Aeronautical Development Agency have stated that they retain the option to build more prototypes if necessary. India has already contracted to buy eleven General Electric F 404 engines, originally destined to power seven prototypes.

# Tale Spin

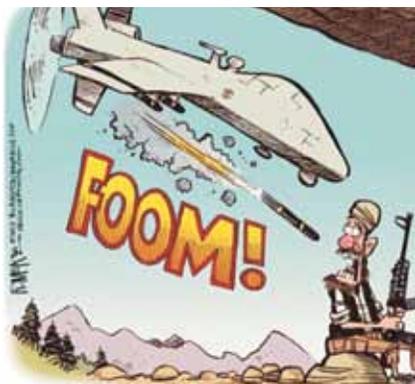
## Inspiring fifth gen fighter designers



With fifth generation fighter aircraft stakes hotting up, this image of a sawfish species recently taken in Florida waters has an uncanny resemblance to the shapes emerging from aircraft design bureaus in various countries. While the US is ahead with several stealth-driven fifth-generation aircraft, and the Russians are struggling to catch up, the Chinese have two models in the air and the Turks, South Koreans and Indians have futuristic projects of their own.

Could this new fish species, evolving from a phenomenon called ‘parthenogenesis’, inspire nascent aircraft designers?

## Love is – a drone strike!

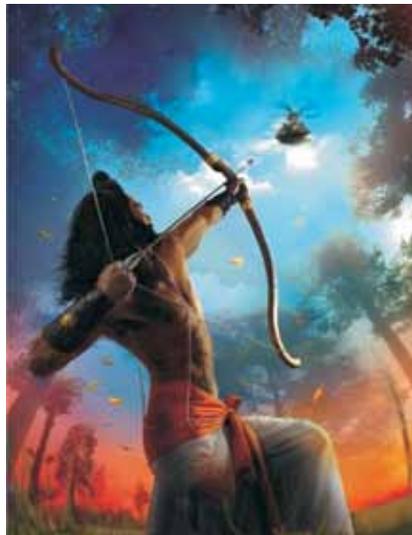


“Your eyes are like a drone strike, I embrace martyrdom watching them like a Talib,” swings the song which is now ‘top of the pops’ in insurgency-plagued Af-Pak! Another lyric invites the drone to “come, look straight into my eyes, attack my heart, come destroy everything, come destroy everything.” Thus crooned popular singer Rahim Shah in the Pashto-language video to *Shaba Tabahi Oka* (“Come On Destroy Everything”).

The decades of violence in the region west - north-west of India has been injected into catchy pop lyrics after more than a decade of war against fundamentalists, who are in fact opposed to all forms of song and dance.

Still some of the hit songs are regarded as deeply poignant in the country’s conservative Pashtun belt, and love conquers all...!

## Ancient Indian AD Weaponry



“The DAC has approved upgradation of 428 air defence guns for Indian Army AD artillery”. This involves the existing L-70/40 and ZU-23 guns and will certainly augment the country’s ground-based defence against aerial threats.

But wait! The ancient Indians already had air defence weaponry of their own, as illustrated in the book cover of a popular novel released recently. Whether the arrow brought down the whirling flying object is speculative but the artist’s imagination hits bull’s eye!

## Nothing like home food!

According to an analysis conducted by the airline Virgin Atlantic, the most common items that Indian students pack to take with them overseas include ladoos, ghee packets, pickles and spices. Rest of the baggage space



is occupied by electronic gadgets and beauty products among other items, with just a little leftover space for books and stationery related to their studies.

That Indians love to carry their own food when travelling abroad is true, with ample stories confirming the same. A priceless recollection is when, at the end of his trip to Europe, a senior distinguished scientist pleaded for a green chilly to spice up his *cordon bleu* meal, much to the amazement and embarrassment of his hosts, who could not conjure any *Chilli Padis* in the ‘city of lights’.

## Cheers to Mars!



In man’s endeavor to search for life in outer space, there is cheerful news from the Red planet. Glass has been found on the planet! Mars which provides clues on the possibility of life having existed there and, intriguingly one wonders whether Martians enjoyed their pints of beer? According to NASA, since glass can preserve ancient signs of life, there is renewed effort to search for evidence of life on the planet. Cheers!

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