



Indian Army Modernisation Soldiers in the Sky The Artillery Arm CNS Interview N-Submarine for IN MBTs for India

### CFM



Cover : Indian Army main battle tank during Exercise 'Sudarshan Shakti' (photo courtesy MoD)

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# pace-& Defence Review

#### 36 Cover Story : Exercise Sudarshan Shakti

One of the largest military exercises conducted by the Indian Army, this was to validate the concept of an enhanced theatre offensive in a joint service environment. Supporting the armoured and mechanised forces in the 'southern sector' were IAF transport aircraft dropping paratroopers escorted by Su-30MKI air dominance fighters.

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gaining on several material fronts,

the case is made for acquisition

of new platforms to replace

the present obsolescent fleet

to provide real integral aviation

support to the army.

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#### Rafale flies high

India's selection of the Rafale multi-role figher aircraft built by French aviation major Dassault will come as a shot in the arm for the Indian Air Force which is in dire need for fighter fleet upgrade and modernisation in keeping with the rapid changes in military aviation and modern warfare the world over. The decision to buy 126 of these medium muliti-role combat aircraft comes after over five years of technical and commercial evaluation that started with six aircraft in the race that included two from the United States and one from its traditional supplier, Russia, as also from Sweden, with the Eurofighter Typhoon being eventually edged out.

Billed as the world's largest open-tender military aviation deal at \$11 billion, India is expected to begin taking delivery of the Dassault Rafale fighters in 2015. A first batch of 18 fighters is to be inducted in fly-away condition directly from France with the remaining 108 to be assembled in India on a transfer of technology basis over the subsequent six years. But before that a formal agreement preceded by some painstaking price negotiations will need to be inked. India will need to ensure that its interests are safeguarded before doing so, considering that New Delhi forgot to negotiate the purchase of munitions from France when it negotiated buying the Mirage 2000H in the mid-1980s!

The deal, however, also serves as a reminder to the fact that selection of the Rafale comes at a time when the IAF's fighter fleet has fallen from the sanctioned strength of 39.5 squadrons to 33, a situation far from satisfactory for an air force tasked to project power and safeguard its vast and geographically diverse terrain along lengthy stretches of disputed borders with its two major neighbours. Equally significant is the need for quicker decision making in the Ministry of Defence since delays can contribute to serious gaps in defence preparedness. Finally, it is imperative that India develops the technology of making its own fighters rather than depending on foreign military hardware. Such lapses and deficiency in capability does not reflect well for a country that aspires to be a major player in world politics.

From: The Tribune

#### Beyond the Rafale deal

India's decision to select Dassault Aviation of France to supply 126 Rafale multi-role fighters caps a process that began in 2004 to replace the Indian Air Force's ageing MiG-21s and augment its fleet of Sukhoi 30MKIs. Given the size of the contract — which, at upwards of \$10 billion, is the largest defence deal struck by India — the acquisition of the Medium Multi-Role Combat Aircraft (MMRCA) was viewed in many quarters as a purchase in which political and strategic considerations would, or even should, play a role. Such a view was bolstered by the fact that each of the six competing aircraft originally short-listed had a lot to offer, the differences between them lying more along the perimeter than in the core. That technical and commercial factors prevailed over extra-contractual considerations became evident when the competition, following a slew of technical tests, was narrowed to two — the Rafale and the Typhoon — produced by a consortium of four European countries. Clearly, the selection process was uninfluenced by the United States administration, which had lobbied hard in favour of Boeing's F/A-18 and Lockheed Martin's F-16, suggesting that the acquisition of either was an important element in forging a closer strategic relationship. The rejection of the U.S.-manufactured aircraft underlined that we had, as one commentator wryly but wrongly noted, "settled for a plane, not a relationship."

At the same time, it would be naïve to assume that arms purchases, particularly big ticket ones by a large nation such as India, are free from strategic implications or considerations. Indeed, for India, the Rafale acquisition widens its strategic options in a world where multi-polarity is a fact of life. At a more immediate level, the decision to buy the fighters, which has been greeted with unabashed glee in Paris, could provide the leverage for India to hold France to its promise of increasing cooperation across a whole range of areas, but especially in the nuclear and defence fields, including the greater sharing of technology and expertise. Of particular interest to New Delhi is the question of enrichment and reprocessing (ENR) equipment transfers. The Nuclear Suppliers Group reneged on its 2008 bargain with India last year by banning the sale of ENR items but France — a key member of the nuclear cartel — has said it will not be bound by the new restrictions. The French must now be held to their word. As for the IAF, the acquisition of the Rafales may stem, in the near- or medium-term, the problem of the reducing number of squadrons. However, the IAF's long-term combat aircraft requirements will need to be met by developing the promised fifth-generation fighter in cooperation with Russia and overcoming the problems that have delayed induction of the Tejas Light Combat Aircraft.

From: The Hindu

### A level flying field

The government's new flight plan for flying overseas has not come a day too soon. Changes have been in the works for some time, and given the mess that national carrier Air India finds itself in, the withdrawal of the sole right to operate foreign flights was only to be expected. The Union Civil Aviation Ministry has now opened up the flights and seats under existing bilateral Air Service Agreements (ASA) to all scheduled airlines in India. With more private airlines qualifying to fly abroad under the original aviation framework of operating for at least five years on domestic routes, it has become imperative to open more routes for them. Under the existing system, Air India had the sole right to utilise capacity under the ASAs. Due to this restriction — and because of

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the political and bureaucratic mismanagement which robbed the airline of the ability to use these routes — hardly 20 per cent of the quota available for India under these bilateral aviation agreements was utilised. The capacity was either going abegging, or foreign airlines took permission to operate additional flights. Now, qualified private Indian airlines will find it easier to fly out to more foreign destinations and thereby improve their bottomlines. Of course, they will have to submit operation plans and satisfy the authorities on the availability of aircraft.

Viewed along with the recent permission being granted to airlines to import ATF or aviation fuel, this marks another positive step to liberate Indian airlines from the financial complications they have got into. Though India's skies opened up long ago and private carriers have overtaken Air India and Indian Airlines in many respects, they have not found it easy to secure flying rights to foreign destinations. Air India not only enjoyed exclusive rights, but also the right of first refusal because of the historic monopoly it enjoyed. Given its inability to be competitive domestically, the national carrier saw foreign operations as crucial. Stricken by persistent financial crisis, and the inability to acquire new aircraft, Air India was unable to utilise the available capacity of flights and seats under the bilateral ASAs, which India has hammered out with 109 countries. These aviation pacts may still have a place, but ultimately, the world is moving towards a clear 'Open Skies' regime in which passenger choice will hold the key. So Indian airlines will have to learn to be attractive and competitive, both in fares and facilities. It is up to the Union Civil Aviation Ministry to regularly monitor the utilisation of capacity, and also ensure that airlines in India meet the highest global standards.

From: The Hindu

### A Bird, a Plane, a Dud?

→ ood times can indeed bubble up, but not float indefinitely U on thin air, it would appear. Accumulated losses of over "6,400 crore and loans exceeding 7,000" crore are dragging Kingfisher Airlines to the ground. The airline is not helping its own cause by cancelling flights indiscriminately, that too without informing the Director General of Civil Aviation (DGCA), and apparently adding to its customers' woes by not paying full refunds on their aborted fares. The situation is bad enough for strong remedial action by the aviation regulator and by the consortium of banks led by SBI. Cancelling flights without notice and full justification amounts to cheating would-be fliers. A cheat cannot be licensed to fly. Till being reassured of good behaviour, DGCA should suspend the airline's licence to operate. This would almost certainly make its finances even worse. The promoters should either infuse fresh capital or the banks should convert their loans into equity and take over the airline. No foreign or domestic investor is likely to buy

into a company with the incumbent management still in charge. Once creditor banks acquire majority control, they can bring in an investor who has the expertise to run an airline. A sizeable minority stake is sufficient for an investor who expects to deploy its own managerial expertise to turn the airline around, provided the bulk of shares are held by financial investors whose primary interest is in seeing their investment prosper rather than in meddling in the running of the airline. This option is superior to the other alternative before the lenders, of foreclosing their loans and liquidating the airline. It is welcome that the civil aviation minister has made it clear that the government would not seek an artificial bailout, and let the banks make their call. This, indeed, is how it should be. With such clarity in the government, the banks should act with speed. Delay can only make matters worse. If they make it clear that they mean business, it would help the promoters concentrate on the core question: should they cut their losses and run or pump in fresh equity? The state of the industry and the fate of Air India should not be allowed to cloud the issue.

From: The Economic Times

### **Out of Afghanistan**

Military retreats are never pretty and can rarely stick to a plan. Washington's signal that it might end the combat role of US forces in Afghanistan sooner than the earlier deadline of 2014 reflects the inevitable confusion surrounding the Western retreat from the prolonged war in the northwestern parts of the subcontinent. US Defence Secretary Leon Panetta announced international forces might shift to training and supportive roles in 2013. The US move comes after French President Nicolas Sarkozy declared he would pull out of Afghanistan in 2013. Both US President Barack Obama and Sarkozy are up for re-election this year and are responding to the growing disenchantment with the decade-long intervention in Afghanistan. While Washington plans to retain a small residual force, the ground realities are likely to evolve rather fast in the coming months.

Until now, all domestic and international stakeholders in Afghanistan have been working with the 2014 deadline for handing over security responsibilities. The US military leadership wanted to backload the process by proposing US forces retain a fighting role until the very end. That the military had been overruled by the White House is the new political message. Afghan President Hamid Karzai, his coalition partners representing non-Pashtun ethnic minorities, and the Taliban will all scramble to secure their own interests. So will Pakistan and Afghanistan's other neighbours.

India has little reason to be surprised at the US rush to the exits. It must now prepare for an accelerated endgame in Afghanistan and step up its own consultations with all the major forces that have the potential to shape Kabul's uncertain future.

From: The Indian Express

### COMMENTARY

### CAE



# Rafale: Flying Into Blue Skies

t last, the deed is done. Final selection of the MMRCA has been announced and the CNC is in progress. However, the decision to select the Dassault Rafale has been assiduously attacked, both by the competition and domestic armchair detractors. It is therefore imperative that certain facts that have been either ignored or suppressed, be scrutinised, before making any informed judgment.

"What do they know about Kebabs and Curries" retorted British MP Peter Brown, on learning that the French had prevailed. This attitude was reflected in several other uninitiated articles and comments, displaying a steadfast colonial attitude. Unsolicited aid and the 'favour' of ruling India for centuries, were used for self-serving promotions to paint the 'native' as being ungrateful and ignorant.

# **Textron Systems**

These critics can be summarily dismissed under the 'sour grapes' category. What is surprising however are the arbitrary comments of 'defence experts' within the country, who have been decrying both the Government and the Indian Air Force.

At the outset, it must be emphatically stated that the Eurofighter Typhoon was as acceptable to the IAF as the Rafale. The 'L1' factor, as per the well-known policy, clinched the deal. I was the first pilot from the IAF to fly the Rafale in 2003. Having flown some of the other competitors in the MMRCA lineup as well and witnessed the evaluation through four countries, I can state with absolute conviction that the IAF evaluation team did a thoroughly professional job, which we should all be proud of. Interacting with personnel of some other countries still looking for a new fighter, I gather that they have closely followed the IAF's evaluation procedures and may well use it to define their own selection. The short-listing of the Typhoon and Rafale also makes total sense, since either one of these aircraft would add great value to the IAF.

Unless we had a single engine (SE) fighter which was found suitable, shortlisting a SE against a twin-engined one would not require a rocket scientist to guess which would have been the 'L1' ! However, reportedly the two SE aircraft fell short of IAF requirements for various reasons.

It is learnt that the F/A-18 and the MiG-35 did not meet a large number of the IAF's requirements, but both are lower in price than the two aircraft finally listed. Adding them to the short list would have ensured their entry into the IAF, through the 'L-1' route.

Firstly, I must set the record straight about 'those' who applauded the choice of the MMRCA based on paper studies. This, according to some seers, reveals serious strategic short sightedness. May I humbly submit that brains are not the sole prerogative of armchair pundits. The IAF too has brilliant minds who always think in the national interest. To be an IAF 'fighter jock' one requires both brawn and brains....and not motivated by mercenary considerations.

The IAF's short list was well considered. The 'L1' could have been either one, but the IAF's selection was based only on professional criteria since the Service was not aware of the price tag of either aircraft at that time. Armchair detractors on the performance and capabilities of the Rafale can only elicit an amused response. There can certainly be differences of opinion, but no debate can ensue where sentimentality and hearsay or second-hand information is the basis of one's convictions. However, those who promote strategic choices need to look back into the history of fighter aircraft inductions in the Indian Air Force.

In the first decades post-independence, the IAF largely flew fighters of UK-origin for obvious reasons. Then two French aircraft types, the Ouragan and the Mystere IVA were inducted into the IAF, before the Soviet MiG-21 entered Indian service. Not one of them was a preferred choice and the selection process was arbitrary. The earliest true 'competition', one can recall was when the Anglo-French Sepecat Jaguar was selected as the DPSA. The Saab Viggen was then denied to India by the US influence while the other contender was the Mirage F.1. The selection of the Jaguar was a 'strategic' decision, though it was clearly the more expensive of the two. 30 years later, we are still searching for a more powerful engine to exploit the full potential of this under-powered aircraft.

After the MiG-21(of many variants), came the Su-7, MiG-23 (MF and BN versions), MiG-25, MiG-27 and MiG-29, before the Mirage 2000 and Su-30 entered service. The IAF flew each one of them, undoubtedly to their limits but without a competitor to choose from. No aircraft, in isolation, can be termed as "bad", unless it is unsafe and we had no comparison to decide their suitability. These were all selected by the Government for 'strategic' reasons. This is not the forum to debate their merits and demerits but suffice it to state that only the Mirage 2000 has proved itself in battle. Of course all of these types have contributed to the numbers, if that was what we were looking for. Most of the MiG-types have retired but the MiG-29, in its updated avatar continues, as none of the other Soviet-origin aircraft could give additional value with upgrades. The upgraded Mirage 2000, however, will continue to add value to the IAF.

The Su-30MKI is still to be blooded, but will form mainstay of our Air Force for another 30 years or so.

Thus now the Rafale will complement the IAF's fighter fleet. The evaluation team found both the short-listed aircraft as compliant against a large number of the 643 parameters that all six aircraft types were assessed for. In areas where they fell short, adequate progress demonstrated by the manufacturers was undertaken to instill confidence that those parameters would also be met by the time the aircraft was delivered to India.

There are some very clear messages that selection of the MMRCA sends out to the World. Sceptics of India's ability to carry out such a complex programme should be silenced forever. The laid down procedures were followed logically and transparently. The time frame from the issue of the RFP in August 2007 to announcement of the selected aircraft in January 2012, less than four and a half years later has been uncharacteristically swift. Political and bureaucratic interference has been conspicuous by its absence. Those competitors who perhaps depended on their professed political champions rather than addressing the shortfalls of their product, only deluded themselves. The decision to select the Rafale has amply proven that India and its Air Force have full faith in their own ability to make an independent decision.

So what if the Rafale has not been selected by any other country? We are fully competent to become the leaders and let others be followers. The Indian Air Force inducted the Mirage 2000 even before it went into service with the French Air Force. Promoters of 'follow the leader' may like to look back into the history of the Mirage 2000 in the IAF, before decrying the latter's professional acumen. What we now need to do is move swiftly ahead and complete the CNC in minimum time and resolve inter-ministerial reservations, if any, to ensure that the credibility that we have now established, does not get eroded at this final stage.

Induction of the MMRCA is a critical step in revamping the IAF into a new generation, 45 combat squadron Air Force.

Parvez Khokhar

# Airbus

# The affordability

of Air

### MMRCA, FGFA, LCA: a potent mix

fter decades of neglect in modernising the military aircraft fleet of the IAF, the recent past has shown a welcome awakening, with future plans looking promising. At a recent meeting with private aerospace industry CEOs, the CAS was quoted as saying that between 2006 and 2011 the IAF had concluded 271 capital acquisition contracts worth Rs. 112,000 crore. One can safely assume that the major cost component of this commitment is towards aircraft purchases.

Since finalisation of the MMRCA, the FGFA, LCA Mk2, attack helicopters and the medium transport aircraft are in

different phases of planning, these must fall outside this figure. This possibly explains a senior acquisition official being quoted in the same report of another Rs. 224,000 crores estimated for further aircraft purchases during the forthcoming Plan 2012-2017. This is further corroborated by the statement in Parliament by Minister of State for Defence Pallam Raju when he stated that the last of the MiG-21 squadrons would be phased out by 2017, which will be replaced by the Su-30MKI, MMRCA, LCA and the FGFA. In general it is estimated that Rs. 336,000 crore are planned to be spent on aircraft purchases alone over a period of 10-11 years.

It is perhaps worth putting these figures in the larger context of the Defence and IAF budgets. For FY 2011-12, the Defence Budget was around Rs. 164,415 crores (constituting 1.83% of the GDP) with the capital element being around Rs. 69,199 crores. Of this the IAF budget is around Rs.46,152 crore with the capital element being Rs. 30,224 crore. Since the IAF remains the most capital-intensive service, its annual share of the MOD's capital budget cake over the last few years hovers around 42-43%.

Within the broad framework outlined above, it would appear that just military aircraft purchases would consume the





entire IAF capital budget for the next 11 years, all at current price and budget levels. Sure, budgets will increase as there is a strong case for the defence budget to inch towards the 3% GDP figure, but so will future costs and also escalation on current liabilities in the future. What then happens to the other equally capital intensive IAF requirements, namely space based systems, precision guided weapons, airborne reconnaissance and electronic systems, the air defence network consisting of an elaborate radar network, a supporting command and control communications system, surface to air missile systems amongst many others?

Where will resources for these and other systems to keep the IAF a balanced force come from? Since these and similar questions must be exercising the minds of not just the IAF planners, but those in other service headquarters and the MOD as well, perhaps it is prudent to see what is the emerging trend elsewhere in the world.

Since the United States is at the forefront of military aviation technology and boasted of a 2010 defence budget of \$ 680 billion–which exceeds the total defence spending of the next 15 countries of the world put together–perhaps it is instructive to look at two of the USAF's recent combat aircraft programmes, both of which point to financial road blocks and plans not going according to script.

The USAF initially wanted 750 F-22 Raptor fighters the latest of its in-service combat aircraft. Just the engineering and manufacturing development cost of the F-22 programme, without going into production, has been quoted as US \$ 11 billion. The overall programme cost was estimated at US \$ 69 billion (Rs. 333,615 Cr). This would amount to nearly twice the Indian defence budget for 2011-12, just for one aircraft programme. Not surprisingly, the F-22 programme was curtailed based on the 2010 US *Quadrennial Defense Review*.

The earlier figure of 750 F-22s progressively declined to 442 then 381,then 243 and then 183 before increasing by a measly 4 to 187. The unit cost of the F-22 is being quoted at US \$ 143 million (Rs. 691 crore). That even the subject of single digit increase or decrease in the order of these aircraft has involved political debate at the highest levels in the US clearly

endorses the fact that high unit costs of combat aircraft are now beginning to tell on decision makers even in the US defence forces. In the Indian context these figures must be a pointer to the type of resources that will be needed not just for the FGFA programme, in which we are participating as a junior partner with Russia, but other more modest programmes earlier mentioned.

The current debate in the US over the F-35 Joint Strike Fighter programme, dubbed as "the biggest military programme in US's history" is also very interesting. At the time it was launched, there were huge expectations as it was expected to form backbone of the US fighter fleet for decades or more. Some 2443 were planned to be ordered by the US alone for the USAF, USN, the US Marines and for export, resulting in economies of scale and reduction in support costs through standardising on a uniform type.

Today the reality is more somber. Programme cost has risen sharply and from initial unit cost estimates of US \$ 75 million (Rs.362 cr); the average over a production run of 2443 aircraft is now estimated at US \$156 million (Rs.754 cr). Operating costs have increased and the programme is behind schedule. In February 2011, the Pentagon put a price of US \$ 207.6 million (Rs.1004 cr) for each of the 32 aircraft to be acquired in FY 2012 rising to US \$ 304.15 (Rs. 1471 cr) each if its share of RDT&E was included. Not surprisingly, Senator John McCain has dubbed the programme as a "train wreck"!

Under pressure from the White House, to reduce defence spending the then Defence Secretary Gates had in January





2011 announced substantial cuts in US Defence programmes amounting to US \$ 78 billion over five years. Amongst the programmes affected was limiting the F-22 production to 187 aircraft, as mentioned earlier, and putting the Marine version of the F-35 on a 2 year "probation" owing to cost overruns and delays.

In August 2011, the deal that led to raising the US federal debt ceiling mandated cuts of US \$350 billion in security spending over the next ten years. The agreement between Congress and the White House also called for a bi-partisan committee to find \$1.2 trillion in additional government spending cuts over the same period. If no agreement could be reached on this, the US Department of Defence would be slapped with an additional \$ 500 billion cuts over the next decade. Commenting on the \$350 billion cuts, the USAF Chief of Staff Gen. Norton Schwartz said that this would inevitably prompt the Air Force to reduce end strength and make other serious and painful choices.

In an article Coming Up Short-The Future of Joint Strike Fighter, the 'Economist' of 14 July 2011 stated " for all its sophistication, against a 'near peer' opponent the F-35 may not be able to do the job for which it has been intended nearly as well as the next generation of pilotless armed drones and hypersonic cruise missiles. Indeed, it could be obsolescent only a few years after it enters service. At a time of shrinking defence budgets, the F-35's huge cost and the affection of service chiefs for fast jets flown by brave chaps should not be allowed to crowd out the development of more capable weapon systems. Cut back the F-35s and spend the money there."

A 2008 RAND report prepared for the US Navy and the US Air Force titled 'Why has the cost of Fixed Wing Aircraft risen' and authored by Mark V. Arena, Obaid Younossi, Kevin Braisato, Irv Blickstein and Clifford Grammich, provides some useful insights to the planners of today. To symbolically drive home the problem of continually increasing costs of aircraft it quotes from Augustine Norman Laws published by Viking Penguin in 1986: "In the year 2054, the entire defence budget will purchase just one aircraft. The aircraft will have to be shared by the Air Force and Navy 3½ days per week except for leap year, when it will be made available to the Marines for the extra day."

Both the *Economist* article and the Rand Report point to the time fast approaching when world air forces will need to "get real". Pessimists may well conclude that the F-22 and F-35 programmes are a pointer on the shape of things to come and whilst the 'one aircraft' theory may be a bit far fetched, attitudes all around have to change as not just military aircraft, but military hardware costs are showing a disproportionate rate of increase. The warning is best exemplified by General Schwartz's statement of having to reduce end strength and making other serious and painful choices.

In the UK when the Conservative-led coalition government took office in May 2010, it found that the MOD had for over the next ten years 'unfunded' liabilities of US \$ 60.6 billion. It followed up with an 8% cut in the defence budget towards helping repair government finances. Following calls for a review of national security, it came out with a paper on National Security Strategy and another on Strategic Defence and Security *Review*. Setting out his plans for a radical reorganisation of the MOD Secretary Liam Fox then set up a review committee under Lord Levene, Chairman of Lloyd's of London, on "how to make the MOD more efficient, cut red tape and reduce inter-service rivalry."

Accepting the recommendations of this report Liam Fox said this was a radical new approach to the management of defence. He said the report describes a "department bedeviled by weak decisionmaking and poor accountability where there is insufficient focus on affordability and financial management." In a speech prior to this report being presented in Parliament he described the MOD as having "overly bureaucratic management structures, dominated by committees leading to indecisiveness and a lack of responsibility." He further said that the Levene committee had identified a handful

# Saab

of recommendations that were not new and had troubled similar reviews going back one hundred years!

The report itself states that its recommendations were designed to "help prevent the Department from getting into such a poor financial position in the future." Some significant recommendations are:

- Financial and performance management throughout the MOD should be strengthened to ensure that plans are affordable and personnel accountable.
- The three service chiefs should be given control of their own budgets, covering items like equipment, training and manpower, giving them the freedom to flex where they spend money.
- A four star-led Joint Forces Command should be created to strengthen the focus on joint enablers and on joint warfare development and other issues.
- The Permanent Joint Headquarters (PJHQ) should become part of the command and a number of other unidentified military organisations should come under its control. PJHQ should become responsible for all military operations.
- The MoD should review whether joint or potentially joint capabilities and functions could be rationalised.

Observers of the Indian defence management scene will no doubt recognise that much of what has been said of the UK MOD could be applied to the Indian context as well—and perhaps more! Whilst periodic exercises at looking at defence management and defence expenditure (Arun Singh's *Committee on Defence Expenditure* and post-Kargil *Task Force on Management of Defence* readily come to mind) have been conducted, there has been perceptible reluctance to change. What little has been achieved has at best been patchy and without any sense of strategic direction.

Whilst of late there has been long delayed but welcome emphasis on modernisation of India's armed forces, emphasis continues to be on shopping lists of each of the services and inter-service rivalries and non- rationalising of roles and missions continue as ever before. In the context of the helicopter forces, the traditional IAF-Army battle has only



intensified. The Army and Navy, which have modest air assets as compared to the IAF continue to maintain separate training, repair, overhaul and support facilities rather than synergise with the IAF for economies of scale leading to efficiency.

Addressing the Combined Commanders Conference recently, the Prime Minister stated: "The Government will never fight shy of finding the funds for the modernisation of our forces. At the same time we have to recognise that resources are not unlimited. I would urge upon you to optimise the use of scarce resources. You are the best judges of how this can be done, but advance and long term planning and the creation of common institutions, communication networks and infrastructure are some examples of how this could be achieved. We should keep this in mind particularly when we build new capacities for meeting emerging threats".

Whilst what the Prime Minister has stated is unexceptionable, one must differ on his prescription of "you being the best judges of how this can be done." As the UK example shows and indeed would be ours if an objective study of the problem was to be conducted, the problem is



precisely the way our higher defence management is structured with authority and accountability not being harmonised, and there being a vested interest by various stake holders in the status quo. Something that the Kargil Review Committee had pointedly brought out. The challenge as identified by the UK Defence Secretary and equally applicable to India is precisely how to make the MOD "more efficient, cut red tape and reduce inter-service rivalry".

The above examples are a pointer of the shape of things to come. If the IAF, as indeed the other services, fails to look at integration and affordability, as essential ingredients to their future operational and equipment planning, then the day is not far off when ad hoc cuts in budgets driven by economic reality will be thrust upon them. It will then be too late to remodel forces to meet national security objectives within national social and economic realities. If this sounds like a doomsday scenario, let our planners talk to their counterparts in the US and British armed forces!

In 2000, in a paper *IAF 2020* presented to the Arun Singh Task Force on Management of Defence, emphasising on the need to look at integrated and

affordable defence planning, this writer had said "Criteria of affordability must now guide the very basis of national security planning. A top to bottom integrated approach rather than a distributive 'do with what you get' approach."

In these times of significant social, economic and security challenges, the best contribution that our MOD and armed forces can make towards effective and affordable defence is to plan jointly, wisely and with foresight. The choice is to swim together—or sink individually!

Air Marshal (R) Brijesh D. Jayal

### Commencement of MMRCA Contract Negotiations



Defence Minister AK Antony has announced that the acquisition process had begun for the Dassault Rafale which on 31 January 2012 was selected to meet the IAF's MMRCA requirement. The Contracts Negotiations Committee (CNC) reportedly began their deliberations on the programme at South Block in New Delhi on 13 February. The Minister also added that "the entire process will stretch over months and that transparency would be maintained over the eight stages in the acquisition process". The Minister also cautioned local officials and the foreign vendors against "any malpractice in the process which can derail the MMRCA contract".

As for the procurement process itself, the Defence Minister stated that "once the CNC had done its bit, the Defence Ministry would analyse it and get the documents examined by its financial wing". The CNC will conduct a two-stage negotiation. The first will deal with details such as contract language and deliverables, and the second with pricing. These would then be forwarded to independent monitors of the Central Vigilance Commission. Following these, the documents would go to the National Security Council, Finance Ministry and finally the Cabinet Committee on Security for approval.

According to sources, while evaluating the commercial bids, a new system was followed that not only took into account the unit prices but also calculated the 'life cycle costs'. The life-cycle costs takes into account the cost of maintenance and spares for the period (40 years and 6000 flying hours) that the aircraft would remain in frontline service.

However, some disquiet has already emerged with media reports on two MoD members of the CNC questioning the "low life-cycle costs" that were worked out by the joint committee. According to well informed sources, "there is no unanimity among the CNC members... and failing a unanimous decision, the Rafale acquisition could well get pushed back".

Meanwhile, the company Dassault have begun detailed discussions with vendors, including those of the powerplant, avionics and weapon systems "for more clarity on various offset possibilities" and a formal proposal on the same is expected to be completed by April-May 2012.

### Akash SAM and TAL Torpedo handed over

The indigenously developed advanced light-weight torpedo (TAL) and the Akash surface-to-air (SAM) missile system were handed over to the Navy and the Indian Air Force respectively at a ceremony in Hyderabad on 3 March 2012 in the presence of Defence Minister AK Antony.

Bharat Dynamics Limited (BDL), Hyderabad, is the production agency for both the torpedo and the missile. The Naval Science and Technological Laboratory (NSTL) Visakhapatnam, has designed and developed the TAL while the Defence Research and Development Laboratory (DRDL), Hyderabad, developed the Akash surface-to-air missile.



The Akash which has been developed to supplant the existing SAMs with the Indian Air Force and Army, is a new generation air defence missile which can simultaneously engage several targets. It has a warhead weighing 60 kg and a maximum interception range of 25 km. The Rajendra surveillance and guidance radar developed by the Electronics and Radar Development Establishment (LRDE), a DRDO laboratory situated at Bangalore, forms vital part of the Akash system which has been under development for a considerable time. In fact the Akash was originally expected to enter IAF service in 1994 (see *Vayu* Issue *1/1994*) wherein it was to replace the Pechora SAMs which comprised bulk of the IAF's air defence missile systems which were first inducted in 1974.

The TAL anti-submarine torpedo is 2.75 metres long, weighs 220 kg and has 50 kg of explosives and can be launched from ships, helicopters and aircraft.

SV Rangarajan, Director NSTL stated, "We have indigenously developed the TAL from scratch when no technology from outside was available for us to build it. The TAL is a totally indigenous missile except for a few integrated circuits and sensors. It has a speed of 33 knots an hour and can operate at a maximum depth of 540 metres."

# Ruag

### Lt Gen Bikram Singh is new COAS

L t Gen Bikram Singh, presently GOC-in-C Eastern Command, has been appointed as the next Army Chief from 31 May 2012 to succeed General V K Singh.



Lieutenant General Bikram Singh was commissioned into the Sikh Light Infantry Regiment on 31 March 1972. During his career, spanning nearly 40 years, he has served in a variety of Command and Staff appointments, besides commanding a Corps in the Northern Command. The General had served as Deputy Force Commander of a multi-nation UN Peace Keeping Mission in the Congo and had also served as UN Observer in Nicaragua and El Salvador during the early 1990s. Lieutenant General Bikram Singh has studied with distinction at the Defence Services Staff College, the Army War College and the US Army War College, Pennsylvania.

He also holds an M.Phil in Defence Management from Indore

University and is a recipient of the PVSM, the UYSM, the AVSM, the Sena Medal and the VSM.

### Concern on light helicopter delays

A ccording to credible sources, Eurocopter have expressed "concern" over continuing delays in finalising the programme for procuring 197 light helicopters for the defence forces. In this second round of evaluation, Eurocopter's AS 550 C3 Fennec is competing with Russian Kamov 226 Sergei for the Indian Army and Air Force in a project expected to be worth over \$1.5 billion as replacement of the ageing fleet of HAL Cheetah and Chetak helicopters. These are critical for providing support to troops deployed in extreme high altitude areas including the Siachen Glacier.





In their letter, made public, Eurocopter have expressed their concern regarding the time frame for this very important programme, for which the RFP was issued in July 2008. "The technical evaluation process has now taken over 38 months and has not yet been concluded due to reasons which are unknown to us."

Extensive trials of the competing helicopters were completed in December 2010 and the Army Aviation Corps (AAC) reportedly submitted the trial reports to the Defence Ministry thereafter, this being accepted by the MoD in October 2011 and approved by the Technical Oversight Committee (TOC) for the project in January 2012.

### IAF Chief visits Panagarh and Kalaikunda

A ir Chief Marshal NAK Browne has recently visited Panagarh and Kalaikunda to inspect the planned infrastructure development by the IAF in Eastern India. Addressing the station personnel, the Air Chief said, "Our focus should always be on high operational readiness, empowering our people and capability enhancement. We are at the cusp of change. We will see a major change in the IAF by the next planned period. Infrastructure upgradation is an operational imperative and our endeavour is to complete all our infrastructure projects on time to ensure speedy operationalisation of the new inductions, which is our priority area. During this transition phase we should continue to maintain high operational readiness".

The visit is significant in view of the planned location of the next C-130J Super Hercules squadron which will be at Panagarh, a small town in the Burdawan district of West Bengal, situated between the rivers Damodar and Ajay. Panagarh airfield was built by the United States Army Air Force during the Second World War as a repair and maintenance depot for B-24 Liberator heavy bombers. Panagarh also has one of the largest vehicle and ammunition depots of the Army.

#### Exercise 'Pralay' in the North East

The IAF's Eastern Air Command carried out a 4-day joint Exercise codenamed 'Pralay' (deluge) on 29 February 2012 in the Brahmaputra valley and North Eastern India. The exercise involved joint Army-Air operations by the IAF's Eastern Air Command and Eastern Command of the Indian Army, planned by the Fort William-headquartered Eastern Army Commander, Lt General Bikram Singh, and the Eastern Air Commander, Air Marshal S. Varthaman at Shillong.

This annual exercise was aimed at testing combat potential of the Air Force in various roles including air defence, ground support operations, counter air operations, electronic warfare, joint operations with the Army including special operations by day and night. Su-30s, Mirage 2000s, MiG-29s, Jaguars, MiG-21bisons, Mi-17s, An-32s, C-130Js, AWACS, II-78 FRAs as well as UAVs from the Army took part in the exercise.

"This time we focused on the Brahmaputra Valley, Arunachal Pradesh, Sikkim and Mizoram to exercise our entire capabilities in all roles in conjunction with the army to disrupt any enemy intrusion and take the battle to the adversary," stated Air Marshal M. Matheswaran, SASO Eastern Air Command. "This exercise is bringing out the net-centric capabilities that we are developing," he said and the exercise culminated with concentration in a few unspecified areas in Assam and Arunachal.

The Army's 33, 4 and 3 Corps, headquartered in Sukna (north Bengal), Tezpur (Assam) and Rangapahar (Nagaland) respectively participated in the exercise.

### Presidents Standards for No. 24 Squadron and No.111 HU

The President of India Pratibha Patil presented 'Standards' to No. 24 Squadron and No.111 Helicopter Unit at a



President Pratibha Patil inspecting the parade at AF Station Bareilly on 6 March 2012

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ceremonial parade at Air Force Station, Bareilly on 6 March 2012. The ceremony was attended by Air Chief Marshal NAK Browne CAS, Air Marshal Arup Raha, AOC-in-C Central Air Command, Air Marshal AP Garud, Commodore Commandant No. 111 Helicoper Unit and Air Commodore Shreesh Mohan, Commodore Commandant No. 24 Squadron. There was a fly past by various aircraft including the Dhruv ALH Mk.III, Jaguars and Su-30MKIs.

No.24 Squadron (*Hawks*) was formed on 16 February 1962 and have operated various fighter types including the Gnat and MiG-21before converting to the Su-30K, being the first on type, and commanded by then Wg Cdr Shreesh Mohan. They are today equipped with the Su-30MKI.

No. 111 HU (*Snow Tigers*) was raised in January 1963 and took part in various operations including the Indo-Pak conflicts of 1965 and 1971. They are now equipped with the HAL Dhruv ALH Mk.III. No.111 HU created a world record for the highest landing by a Cheetah helicopter at an altitude of 23,250 ft.

Interestingly, both No.24 Squadron and No.111 HU took part in the historic heliborne operations at Sylhet in December 1971 when the Mi-4s of the latter were supported by Gnats of the former, operating from Agartala (see Vayu Issue 1/2012)



The President presenting the 'Standard' to No. 24 Squadron, flanked by Air Chief Marshal NAK Browne and Air Commodore Shreesh Mohan



The President presenting the 'Standard' to No. 111 HU

# AVIATION & DEFENCE

### RIL and Dassault Aviation in partnership

Dassault Aviation has entered into an agreement with Reliance Industries for partnering in defence and homeland security areas. The MoU comes in the wake of selection of the Dassault Rafale as the MMRCA. As part of the contract, Dassault is to invest 50% of the total amount as offsets in the Indian defence sector.

"Dassault Aviation, a major player in the global aerospace industry, has entered into an MoU with Reliance Industries, for pursuing strategic opportunities of collaboration in the area of complex manufacturing and support in India," stated officials of the two companies.

The Aerospace and Security Division of Reliance Industries is headed by Vivek Lall, who was closely associated with the MMRCA deal while heading Boeing in India. In the recent past, there have been efforts by the Mukesh Ambani-headed RIL to position itself in the defence, internal security and aerospace sector.

### IAF plans 71 additional Mi-17 helicopters

Following the recent induction of the first Mi-17V5 helicopters, the Indian Air Force is planning to procure 71 more Mi-17 V5 helicopters. Of these 59 would be for the IAF as Mi-8 replacements and the balance for the Border Security Force. (*See article in this issue*)



### **Exercise Milan-2012**

Milan-2012 was the largest naval exercise since its inception in 1995, with representatives from Australia, Bangladesh, Brunei, Indonesia, Malaysia, Myanmar, New Zealand, Philippines, Singapore, Sri Lanka, Thailand, Maldives, Mauritius and Seychelles participating. Of these, Maldives, Mauritius and Seychelles are first-timers at the event, which ended on 6 February 2012.

Chief of the Naval Staff Admiral Nirmal Verma stressed the Indian Navy's commitment to ensuring a stable and secure regional environment for the "economic development and social uplift of the masses" in India's neighbourhood. "We carry out coordinated patrols with some of our neighbours. We have also been undertaking EEZ [exclusive economic zone] surveillance on request from some governments."



"Oceans today are not expanses of water that divide continents, but maritime highways that link nations," Admiral Verma told delegates from 14 countries who were participating in Milan-2012, the eighth edition of a biennial initiative of the Navy to forge working-level jointmanship and interoperability among Navies of the region. The aim is to ensure faster humanitarian assistance and disaster relief response, better counter piracy and anti-poaching measures and prevention of contraband smuggling and human trafficking.

Referring to the Indian Ocean Region as a "critical economic highway" for a predominant amount of its oil, cargo and container traffic, Admiral Verma cautioned that any challenge to this energy and trade seaway could lead to major conflict. That would hit regional and global economies. "Ensuring energy security is, therefore, a major maritime issue of common concern," he said in his keynote address at a seminar on 'Capacity-building through Maritime Cooperation.'

The pervasive enemy today was not "some belligerent nation-state," but malevolent non-state actors. "There is more to fighting piracy than military action," he added, calling for a collective initiative to combat the menace, which was a "spillover of governance deficit, myriad socio-economic issues and lawlessness."

### Nexter Systems consortium with L & T

N exter Systems of France and Larsen&Toubro Limited (L&T) of India have signed an agreement announcing the formation of Nexter Systems-led consortium for co-producing 155 mm howitzers to meet the Indian Army's towed gun requirement. Under the proposal, Nexter will field its Trajan 155 mm/52-calibre weapon system, which offers enhanced firepower through "quicker response, longer range and improved accuracy". Nexter has provided 145 towed guns systems to the French Army and other armed forces.

"Joining forces between Nexter and Larsen & Toubro will bring about fruitful cooperation, the development of an innovative 155 mm towed gun that will better meet Indian Army needs" said Philippe Burtin, Chairman and CEO, Nexter

# Boeing



Systems. Larsen & Toubro, in association with Nexter Systems, will manufacture critical subsystems for the Trajan, integrate the systems and provide required support to the Indian Army. "L&T brings to the Consortium its fine record of developing various weapon systems with the DRDO for the Indian armed forces, land, naval and air applications."

#### OFB to produce 155 mm howitzers

"The Army has placed orders with the OFB for procuring one hundred 155mm 52 calibre howitzers and this will be developed on the basis of Transfer of Technology (ToT) as received from Bofors," Minister of State for Defence M M Pallam Raju has said. He said indigenous development of new howitzers would continue alongside production by the OFB and that the programme would not affect the OFB production.

#### AAD-05 intercepts ballistic missile



n a recently conducted test, the Air Defence Missile AAD-05 developed by DRDO "successfully intercepted" an incoming ballistic missile at a height of 15 kilometres off the Orissa Coast near Wheelers Island. A modified Prithvi missile, mimicking the hostile ballistic missile was launched from ITR Chandipur and tracked by radars located at various points to track the incoming missile. Computers continuously computed trajectory of the ballistic missile and then

launched the AAD-05 interceptor missile at a precisely calculated time to destroy the 'enemy' ballistic missile.

Avinash Chander, Chief Controller R&D (Missiles) and P Venugopalan, Director DRDL were responsible for flight readiness review of both the target missile and interceptor missile.

#### "Exercise Shoorveer"

The Indian Army is to conduct one of its biggest war games - *Shoorveer* – in Rajasthan between March and June 2012. The exercise, involving the Army's 1 Strike Corps and 10 Corps under the Jaipur-based South Western Command, will deploy more than 200 tanks and over 20,000 troops.

"All formations and units under South Western Command will participate to validate doctrines in a joint service environment" according to Army Spokesperson Col Jagdeep Dahiya. The war game comes soon after the army's exercise *Sudarshan Shakti* in Pokharan to validate its new battle-fighting concepts developed after the transformation studies carried out under army chief General VK Singh. The exercise, one of the biggest manoeuvres ever based on the Integrated Theatre Battle Concept, will be held in the deserts of Bikaner and Sri Ganganagar. "It will enable the army to validate its war fighting concepts while working towards a 'capability- based approach', relying on a series of transformational initiatives, concepts, organisational structures and absorption of newage technology," Dahiya said.

The joint synergy will be enhanced by active participation of the IAF with air assets of the army and air force being employed in an integrated manner. Western and South Western Air Commands are to deploy frontline aircraft, including the Su-30MKI, Mirage 2000, Jaguar and AWACS, for the war game. Battlefield transparency and operational plans based on realtime situational awareness will be enhanced using intelligence, surveillance and reconnaissance (ISR) inputs from unmanned aerial vehicles, new generation radars and satellites.



AVIATION & DEFENCE

# Alenia

### Joint Indo-US Exercise Exercise 'Yudh Abhyas' 2011-12

Exercise Yudh Abhyas 2011-12 commenced at the Mahajan Ranges in Rajasthan with unfurling of the National flags of both Countries to the strains of their respective National Anthems. Indian and US troops paraded together with their Infantry Combat Vehicles and Armoured Personnel Carriers. The US contingent was led by Colonel Thomas J Roth, Commander 2nd Engineer Brigade, US Army and Brigadier BS Dhanoa was the Indian commander.



### CNS visits extreme tip of Nicobar Islands

A dmiral Nirmal Verma, Chairman Chiefs of Staff Committee visited the Andaman and Nicobar Islands on 12 February 2012. From Car Nicobar, he proceeded to Naval Air Station Campbell Bay, established on the Great Nicobar Island, the southernmost island in the Nicobar chain of islands which strategically located bay dominates the six degree channel. Admiral Verma reviewed the progress made to augmenting the infrastructure before visiting INS *Kardip*, located on Kamorta Island, part of the Nancowry group of Islands. Commissioned in 1973, INS *Kardip* provides operational support to IN and CG ships operating in and around the Nicobar Islands.



### Raytheon delivers first APY-10 for Indian Navy P-8I

Raytheon has delivered the first international version of its APY-10 surveillance radar to Boeing for installation on the P-8I Poseidon for the Indian Navy. To meet specific requirements of the Indian Navy, Raytheon has added an air-to-air mode, to provide detection and tracking of airborne targets to detect threats in the air as well as at sea. In addition, an interleaved weather and surface search capability has been added to provide the cockpit with up-to-date weather avoidance information while performing surveillance missions.

With reduced weight and power consumption, the APY-10 radar has improved the average mean time between failures by six times over earlier generation radars. In addition to the new capabilities, the design can accommodate significant future growth. Raytheon is under contract to produce eight APY-10 radars for the Indian Navy.

"Our APY-10 radar will provide the Indian Navy with proven, low-risk technology built on generations of successful Raytheon maritime radar systems," said Tim Carey, Vice President for Intelligence, Surveillance and Reconnaissance Systems at Raytheon's Space and Airborne Systems business. "Adaptable and configurable, the APY-10 radar is a premier example of Raytheon's ability to meet key customer requirements."

### DCNS India delivers equipment to MDL

Mazagon Dock Limited (MDL) has received the first Indianmade equipment for the Scorpene submarines programme (P75). In June 2011, DCNS India had signed a contract with Flash Forge India Pvt. Ltd. under the Scorpene submarines programme (P75). "We are providing our Indian partners with know-how and technical assistance to manufacture equipment which will be installed onboard the Scorpenes. Together with MDL, we are qualifying the suitable companies which are meeting the rigorous specifications needed for the submarines", recalled Bernard Buisson, Managing Director of DCNS India. The Factory Acceptance Test (FAT) for the first locally made Scorpenes' equipment (for the large scale piping system) was successfully performed at Flash Forge premises in Vishakapatnam in January 2012.

MDL is producing six SSK Scorpene submarines (P75) under transfer of technology (ToT) from DCNS. Simultaneously, DCNS India, DCNS Group's subsidiary in India, is working at the selection and qualification of Indian companies as partners for local production of the Scorpenes' equipment.



# **Beretta**

### GoAir to double frequency by 2014

G o Airlines, the leading Indian low-fare service airline flying to 21 destinations within India with 160 daily flights, has no plans to increase the number of destinations as of now but will double the frequency of flights over the next two years. Owned by the Wadia Group, GoAir commenced operations in 2005. According to Giorgio di Roni, CEO GoAir, "We recently launched double daily flights between Delhi and Ranchi and Delhi and Kolkata. We are also strong in North West India. We currently operate around 160 daily flights and will double this by 2014 with continued focus on high aircraft utilisation and on-time performance."

In 2006, GoAir had placed an order for 20 A320s of which 10 have been delivered. In June 2011, it had placed an order for a further 72 aircraft worth Rs.32,000 crore. Mr. di Roni said that before the large order from Airbus started getting executed, the previous order would be completed. "We will receive two aircraft in 2012, four in 2013 and another three aircraft in 2014."



### Go Airlines selects PW1100G-JM for their A320neo

G o Airlines (GoAir) has selected Pratt & Whitney PurePower PW1100G-JM engines for its 72 Airbus A320neo aircraft. The agreement involves 144 firm PW1100G-JM engines and is anticipated to include a PureSolution maintenance package with deliveries scheduled to start in 2016.



"We selected the Pratt & Whitney PurePower engine because we are confident that its performance advantage will deliver significant savings in operating costs, as well as considerable reductions in emissions and noise," said Jeh Wadia, MD of GoAir. "The PurePower engine is the best long-term solution for GoAir's growing fleet." Each Airbus A320neo family aircraft of GoAir will be powered by two PurePower PW1100G-JM engines with benefits including double-digit reductions in fuel burn, environmental emissions, engine noise and operating costs when compared with today's engines."

The PurePower engine uses an advanced gear system allowing the engine's fan to operate at a different speed than the low-pressure compressor and turbine. The combination of the gear system and an all-new advanced core delivers fuel efficiency and environmental benefits.

### Air India freighter sale re-examined

Minister of Civil Aviation Ajit Singh has directed Air India to reexamine its plans to sell six Boeing 737-200 cargo aircraft following complaints of "irregularities."

The Airline's regional subsidiary, Alliance Air had floated a global tender in December 2011 to sell these six aircraft plus spares but this reportedly "was against norms as it did not mention any reserve price for these aircraft," said a senior civil aviation ministry official. These aircraft had been converted from the passenger to cargo configuration five years ago after undergoing massive engine overhauling and a total expenditure of nearly Rs 300 crore, according to sources.

"These aircraft were hardly used for 4-5 months and remained grounded. The engines alone for these aircraft can fetch Rs 15-20 crore each," the source said. "Absence of a reserve price makes the auction process arbitrary. The tender can be manipulated to benefit a certain party," said a ministry official. While four are these aircraft are stationed at Delhi, two are at Kolkata. The spares include eight engines, aircraft seats and rotables.

### Prof. R Narasimha protests ISRO treatment

Publicly upset over the treatment meted out to four top scientists including former ISRO chairman G Madhavan Nair, Prof. Roddam Narasimha has resigned as member of the Space Commission, as "he felt action taken against the scientists could demoralise the scientific community and affect its ability to take technology initiatives".

The renowned aerospace scientist, Prof. Narasimha, was part of the B K Chaturvedi Committee that had probed the 2005 agreement between ISRO and Devas Multimedia for lease of Sband spectrum, over which action has since been taken against ISRO scientists.

While bringing out some shortcomings and "gaps" in the agreement, the Chaturvedi Committee had categorically stated that it was "difficult to find fault with the procedure". It had also

debunked the theory of loss to the national exchequer owing to spectrum sale.

Prof. Narasimha regretted this, as "most ISRO scientists have committed their professional lives to the pursuit of technological challenges." His committee, he added, had also identified a few lapses and recommended reforms. "These reforms have also included some concerning the Space Commission... it has seemed most appropriate that the proposed reforms... are carried out best by a commission of which I am no longer a member," he said. The Space Commission is the highest decision-making body on space matters.

#### Mounting losses of Indian air carriers

**R** ising ATF prices and severe fare competition have taken their toll in the Indian aviation industry, which, despite a robust passenger growth of around 18% in the past one year, has witnessed major losses. Five of six major carriers are losing money and if auditors are believed then Indian carriers currently have accumulated losses of over Rs 30,000 crore.

While this is a grim scenario for all the airlines, Kingfisher Airlines is under particular difficulties owing to its "faulty business model". Even though airline-promoter Vijay Mallya blames government policy for his company's downfall, industry insiders hold his frequent change of plans and unplanned acquisitions, all driven by an ambition to become the number one company, is responsible for the carrier's situation." The fact that Mallya is the one who largely holds control means he is responsible for all the changes affected by the airline, "whether it was beginning as an all-economy, single-class configuration aircraft with food and entertainment and shifting focus to luxury or discontinuing Kingfisher Red brand and completely converting fleet to a dual class, full-service configuration," industry analysts feel.

In fact, most of the airlines are suffering from "wounds that are self-inflicted." Despite registering strongest annual growth in the Asia Pacific region with demand up by 16.4%, Indian carriers reported losses due to excess capacity as one of the reasons.

According to the Geneva-based International Air Transport Association, India had the strongest annual growth with demand which went up by 16.4%. But capacity rose 18.6% and the load factor was 74.7%. "Deterioration in load factors generated by this excess capacity is one of the factors behind the losses being reported by Indian airlines in contrast to the current situation in China," IATA reported.

In contrast, the Chinese domestic demand rose 10.9% for the year on a 7.8% lift in capacity, strengthening load factors to

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82.2%, thereby helping the profitability of the country's airlines. Capacity and economy conditions are among the issues that will continue presenting turbulence for carriers worldwide. "Cautious improving business confidence is good news. But 2012 is still going to be a tough year," is what Tony Tyler, IATA Director General & CEO recently advised.

The Indian aviation industry has really two things to look forward to: the hope of 49% FDI being permitted in aviation and direct import of ATF fuel. Meeting a key demand of the cash-strapped airlines, the government has formally allowed private airlines to import jet fuel directly.

### Rs 5,000cr support for Air India

A ir India, the ailing public sector airline, may get Rs 5,000 crore in the next FY budget to support its restructuring plans while banks will be given Rs 10,000 crore for recapitalisation as non-performing assets. On 7 February, a group of ministers (GoM), headed by finance minister Pranab Mukherjee, cleared the financial restructuring plan for Air India. The GoM planned that the 21 lending banks would be paid back through a Rs 7,400-crore government-guaranteed bond issue.

Air India is planning to prune six long-haul international flights apart from taking a relook at its domestic network, aiming to cut its daily fuel bill of Rs 17 crore by Rs 2-3 crore through this move in the subdued travel period that will last till April 2012. Apart from fuel bill and oil PSUs regularly cutting off supply to AI, the delay in induction of the Boeing 787 Dreamliner into the fleet also triggered this route-cut move. The twice daily Delhi-London flight would be brought down to once daily and the frequency of Delhi-Toronto and Delhi-Frankfurt flights will be reduced.

"With its 250 seats, the Dreamliner is the ideal size of aircraft for us. In the current season, it may not be possible to fill an over 300 seater (that the B-777s are) to a break even point. So the frequency of flights using this plane on sectors like Delhi-London and Delhi-Toronto is being reduced. The Dreamliner is now expected to make its debut in late summer and be used to launch flights to Australia," said a senior official.

Airline sources say that the steps taken by AI's new chief Rohit Nandan (under the watchful eye of aviation secretary Nasim Zaidi) have led to a substantial improvement in two areas: revenue increase and cost-cutting. In January 2012, AI reported a 30% rise in revenue, the highest ever month-by-month increase.

Meanwhile, the US airline industry has sued the Export Import Bank (Exim) alleging that its financial support to Air India, which itself is in deep red, will harm the American airlines.





In a revised complaint filed before a US court in mid february, the Air Transport Association of America, Delta Air Line and Air Line Pilots Association International, alleged that Exim Bank's decision to provide a loan guarantee of USD 3.4 billion to Air India, to help it buy 30 aircraft from Boeing, would badly affect several US airlines, Delta in particular.

Arguing that without the financial support from Exim Bank, Air India, which in itself is in deep red, would not have purchased these aircraft and thus would deploy them on those routes where it gives a tough competition to US airlines.

### Air Works is EASA–approved General Aviation MRO

A ir Works India Engineering Pvt Ltd, India's leading third party MRO has become the first independent General Aviation MRO to obtain EASA Part 145 approval in its Delhi Facility. Air Works, over the past two years, has constantly been focusing on enhancing capabilities through accreditations and services to make the company a one-stop shop for all aircraft maintenance work.

This certification supplements EASA approvals already held by the Air Works facility in Hosur, where it maintains Airbus A320 family, Boeing 737 Classic/NG series and ATR 42/72 series aircraft and by SAAW, Air Works joint venture with Scandinavian Avionics which has an EASA–approved avionics shop in Delhi.

### Quikjet Cargo Airline gets AOC approval

The all-cargo airline Quickjet Cargo have received the Air Operating Certificate from the DGCA prior to launch of commercial services. Farnair Switzerland AG, a European cargo airline, has bought a substantial stake in Quickjet Cargo Airlines Pvt. Ltd in which Tata Capital Ltd is one of the key investors. Quickjet Cargo is also backed by investors including Infrastructure Leasing and Financial Services Ltd, Infrastructure Development Infrastructure Development Finance Co. Ltd and AFL Pvt Ltd.



### Naval Acquisition of MRMRs approved

To boost its maritime surveillance requirements, the Defence Ministry has approved the Navy's proposal to procure nine medium range maritime reconnaissance (MRMR) aircraft which are expected to cost over \$1.5 billion. This was formally granted by the Defence Acquisition Council (DAC) on 27 February 2012.

The nine MRMR aircraft will be in addition to the 12 US-origin P-8I Posidon long-range maritime reconnaissance (LRMR) aircraft being acquired by the Indian Navy at \$3.1 billion and could well be augmented by three times as many of the selected type.

With an operating range of over 350 nautical miles from base, the MRMR aircraft will augment the Indian Navy's present inventory which comprises Tupolev Tu-142Ms and Ilyushin II-38SDs for long range maritime surveillance and ASW tasks. The HAL-Dornier 228 serves in relatively large numbers for both maritime reconnaissance and information warfare (see *Vayu Issue III*/2011). The Navy also employs Heron and Searcher-II UAVs for coastal and near-shore surveillance tasks.

### Invision Air launches business aviation operations

Vinit Phatak and Jayant Nadkarni have formally launched Invision Air, India's first entry level business jet service using a fleet of light jets. Speaking at the launch, Vinit Phatak, Founder and Managing Director said "We feel this is the right time to launch our service as our target market has no real pan-India operator with a fleet of business jets. Our plan of six bases in India with two aircraft in each base will create many cost and logistical advantages which we shall pass on to our customers."



Jayant Nadkarni, Co-Founder and Chief Operating Officer, added that "Our new generation jets have extremely fuel efficient engines and an ease of maintainability that allows for low cost of operations and a long product lifecycle. Their advanced avionics and safety equipment facilitates have increased pilot awareness providing a high level of safety for our passengers."

# Eurocopter

# AVIATION & DEFENCE

### R.K. Tyagi has taken over as Chairman HAL

First announced in the *Vayu* Issue I/2012, Mr. RK Tyagi took over as Chairman Hindustan Aeronautics Limited (HAL) on 2 March 2012 at Bangalore. He was previously Chairman and Managing Director of Pawan Hans Helicopter Ltd.

RK Tyagi is an Engineering Graduate in Electronics and

Telecommunication (1975) from IIT Roorkee and possesses a Degree of Master in Business Administration. Subsequently, he attended an Advanced Leadership course on Public Sector Management for 15 months at Indian School of Business (ISB Hyderabad) in the years 2004-05.

He joined the ONGC as a Graduate Trainee in the year 1976 and through various assignments rose to the position of General Manager in 2003 and continued serving ONGC upto May 2007.

His has been Vice President, Aeronautical Society of India, Member CII National Committee on Civil Aviation and Member, Task Force Committee constituted by the Ministry of Civil Aviation (MoCA) to facilitate growth of helicopter operations in India.

### HAL, BEL and OFB amongst top 100 arms manufacturers

T wo Indian companies - Hindustan Aeronautics Limited (HAL) and Bharat Electronics (BEL) - and one entity - the Ordnance Factories Board (OFB) – are listed in the top 100 list of arms manufacturers as released by SIPRI (Swedish International Peace Research Institute). HAL is placed  $34^{th}$  with total sales of \$2.7 billion. OFB was ranked  $46^{th}$  with turnover of \$2.4 billion and BEL as 71st with total turnover of \$1.2 billion. Interestingly, HAL is one notch above the highest-ranked Israeli company - Elbit Systems - which is at 35, with a turnover of \$2.6 billion.

### HAL urged to "strengthen itself"

Defence Minister AK Antony has encouraged Hindustan Aeronautics Limited (HAL) to strengthen itself with strategic alliances and joint ventures and to invest more in R&D so as to remain globally competitive.

There is increasing conviction that HAL, the Bangaloreheadquartered, Rs 13,000 crore, defence public sector undertaking is "under-prepared" for the major new programmes it is to undertake which includes ongoing projects to design and build the Light Combat Helicopter (LCH); Light Utility Helicopter (LUH); the Intermediate Jet Trainer (IJT); the

# MAJOR CONFLICTS WORLDWIDE: SOLDIERS IN ACTION: 530,000 ONE PARTNER FOR SECURITY SO

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#### **DEFENDING WORLD SECURITY**



# AVIATION & DEFENCE

Medium Transport Aircraft (MTA); Basic Trainer Aircraft (BTA) and the Fifth Generation Fighter Aircraft (FGFA) with Russia. In addition, HAL is required to set up new production lines for the Tejas Light Combat Aircraft (LCA) and the Rafale Medium Multi-Role Combat Aircraft (MMRCA).

In particular, the Parliamentary Consultative Committee for Defence has criticised HAL for production delays in the Tejas LCA, which had led to the MiG-21 remaining in service beyond its service life and for HAL's singular lack of success in the export market. Addressing these concerns, the

LUTIONS

MoD has confirmed that an expert group, under BK Chaturvedi, a Planning Commission Member, would shortly recommend measures "to restructure HAL."

The expert group will suggest ways of involving the private industry in assisting HAL to meet its massive commitments and in creating synergy between HAL, private defence players and non-defence private industry. The expert group is also required to assess HAL's future technological and human resource requirements. Mr. Antony told the Parliamentary Consultative Committee on Defence that HAL needs to partner with design laboratories from the DRDO and CSIR in developing indigenous aircraft, engines and systems. He also urged HAL to adopt global



best practices in project management, quality control, vendor deployment and supply chain management.

The Defence Minister informed the Consultative Committee that permitting the private sector into defence production, as also the defence offset policy, would bring the private sector into military aerospace. In fact, the private sector has made only tentative forays into aerospace, even though its entry was permitted in 2001 and the offset policy has been in place since 2005. At the same meeting, Minister of State for Defence, MM Pallam Raju said that HAL would increasingly play the role of a system integrator, which would bring in the private sector as Tier 1 and Tier 2 suppliers to HAL.

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AN EADS COMPANY

### T. Suvarna Raju is Director (D&D) of HAL

T.Suvarna Raju has taken over as Director (Design & Development) of Hindustan Aeronautics Limited (HAL). He had joined HAL on 26 June 1980 as a Management Trainee in the Technical XV Batch and later rose to the position of General Manager of HAL's Aircraft Division in the Bangalore Complex.



His has been involved in various segments of aircraft production including the

licence production of Hawk Mk.132s, earlier production of 17 Jaguar twin-seaters and 20 single-seat Jaguars, plus establishing production facilities for the Lakshya Unmanned Aerial Vehicle.

He was involved with the major inspection of 42 Mirage 2000s at the Overhaul Division and was Member of the study team for life extension of Mirage 2000 calendar life. He also established 3rd and 4th line workshop facilities for the Jaguar, Mirage LRUs and was associated with Elbit Systems of Israel in the development and prototype testing of *Project Legend*.

### Lieutenant General Ramesh Halgali, Deputy Chief of Army Staff (IS&T)

Lieutenant General Ramesh Halgali has been appointed as Deputy Chief of Army Staff (IS&T) on 11 February 2012. He was commissioned on 24 December 1972 into 1st Battalion Sikh Light Infantry and has held many important staff and Instructional



assignments, commanded an Infantry Brigade and Division in J&K and a Corps in the Western Sector. Till recently he was Director General of Military Training.

### Lieutenant General Anil Chait is GOC-in-C Central Command

t Gen Anil Chait has taken over as GOC-in-C Central Command, having been commissioned into the Armoured Corps in December 1973. He commanded an Independent Armoured Brigade, an Infantry Division and a Corps in the Western sector. As Commandant, Army War College, he is credited with the setting up of Study Centre(s) for domain specialisation and transformation of the College into a Centre of Excellence for training leaders which has been his steadfast contribution.

### Air Marshal Rajinder Singh is AOC-in-C Training Command

A ir Marshal Rajinder Singh took over as AOCin-C Training Command, Bangalore on 1 March 2012. Commissioned in the Indian Air Force in December 1974, he has flown a variety of combat and trainer aircraft during his career of over 37 years with over 3100 hrs on the Hunter, Marut, all variants of MiG aircraft and Kiran. A Qualified Flying Instructor, he is a graduate of the Defence Services Staff College, Wellington.



Earlier, he was Assistant Chief of Integrated Defence Headquarters and Senior Air Staff Officer (SASO) at Training Command.

### New CEO of HATSOFF

Major General (Retd) Ajit Hari Gadre has become CEO of the *Helicopter Academy to Train by Simulation* of Flying (HATSOFF) at Bangalore. "I am pleased to join an organisation established by HAL and CAE, two of the world's leading and most reputable aerospace and defence companies," he said. "Since its opening in 2010, HATSOFF has set the standard in India for advanced helicopter simulator training, and I am convinced that simulation-based training will continue to grow and prove to be one of the best approaches for improving safety, operational efficiency and mission readiness."

An accomplished helicopter pilot and a qualified flying instructor with over 5,000 hours of accident/incident free flying, Gadre served with the Indian Army for 37 years before retiring in June 2009 as the Additional Director General of Army Aviation.

Currently, HATSOFF is offering training on the Bell 412, Eurocopter Dauphin and civil/conventional variant of the HAL Dhruv helicopter. An additional simulator for the glass cockpit variant of the HAL Dhruv is to be added to the HATSOFF training centre later in 2012.

# HP

### **Strategic plans for Sikorsky in India**

ichael Maurer, President of Sikorsky Military Systems and Steve Estill, Vice-President for Strategic Partnerships at Sikorsky were in India recently to review Sikorsky's plans for the country. Joining them was Air Vice Marshal (Rtd) Arvind Walia, Executive Vice President, India & South Asia, Sikorsky. While Michael Maurer is responsible for addressing military aircraft requirements of the US and governments across the world, as well as product line management and delivery, Steve Estill is responsible for identifying and developing partners globally for new product development, supply chain members and after-sales support.

"Helicopter requirements in India are estimated to equal US\$ 21.4 billion over the years. The Planning Commission estimates acquisition of 250 helicopters by non-scheduled operators over the next five years to address rising demand. The company will be bringing the S-92 helicopter to India in March as part of its global 'Legacy of Heroes' tour, to celebrate the number of lives Sikorsky helicopters have saved, in both civil and military spheres.

The helicopter itself has its origins in Igor Sikorsky's 1939 design and development of an aircraft with a single-

next 20 years. Out of this, US\$ 14.4 billion will be for military and the remaining US\$ 7 billion for civil aviation. Sikorsky has been responding to a number of RFIs

and RFPs of the Indian Army, Navy and the Coast Guard. We have been short-listed for the Indian Multi Role Helicopter programme, and are preparing for helicopter trials with the Indian Navy. We have also submitted an unsolicited proposal to upgrade the H-3 fleet of the Indian Navy", stated Steve Estill.

"Sikorsky has forged partnerships in India for support of its fleet, both in India and globally. Sikorsky has partnered with Tatas to create a global manufacturing hub for S-92 cabins (the manufacturing was shifted from Japan to India) and seven cabin sets have been delivered so far. From 2013 onwards we plan to produce 3 sets a month for a total of 36 a year from the manufacturing facility in Hyderabad. The JV employs 250 people at present and we are in the process of forming a company 'Tata Sikorsky'. We are extremely pleased with the progress of this venture. Sikorsky is currently in partnership talks with several other Tata group companies including Tata Advanced Materials, Tata Consultancy Services and Tata Elxsi for partnerships in IT and engineering services'', continued Air Vice-Marshal (Rtd) Arvind Walia.

Sikorsky has recently delivered one S-76C++ helicopter to the Government of Maharashtra, and has delivered six S-76 helicopters to corporate houses in India over the last few main rotor and a tail rotor for vertical take-off. Igor Sikorsky had founded Sikorsky Aero Engineering Corporation in 1923 in the USA, which became a subsidiary of United Aircraft in 1929. United Aircraft later evolved into United Technologies Corporation, which is today a Fortune 50 company.



(L-R) Air Vice-Marshal (Rtd) Arvind Walia, Executive Vice President, India & South Asia, Sikorsky, Michael Maurer, President Sikorsky Military and Steve Estill, Vice-President for Strategic Partnerships, Sikorsky during an interactive session with Indian trade media at New Delhi on 10 February 2012.

(Main photo): Tata's have become a global manufacturing hub for cabins for the S-92 helicopter.
AVIATION & DEFENCE In India

## DCNS

xercise Sudarshan Shakti, was one of the largest military exercises conducted by the Indian Army in the 'Southern Sector' and held from 5 December 2011 onwards "to validate the concept of an enhanced Theatre offensive in a Joint Service environment, as well as operational and transformational effectiveness of XXI or the Sudarshan Chakra Corps." This was conducted under the backdrop 'Studies on transformation of the Indian Army', for which the Army Chief Gen VK Singh and Lt Gen AK Singh, General Officer Commanding-in-Chief Southern Command were the main proponents.

"A sense of transformational initiatives spanning operational, conceptual and structural aspects, as also organisational structures for absorption of new age technologies particularly in the fields of precision munitions and targeting, advance surveillance system, space and network centricity were fielded and trial evaluated during the exercise." In this exercise, new structures like the Strike Corps Aviation Brigade were tried out and validated for the first time. The complete spectrum of operations from mobilisation to execution of battle to include operational logistics was tested.

What made this Exercise quite different was not just the huge magnitude but also that force and technology were employed in perfect synergy to reap "unprecedented dividends". While quick and deep offensive thrusts into an enemy's heartland using armoured formations, surface to surface missiles and artillery rockets has always been the Strike Corps doctrine, enhanced battle field transparency and situational awareness achieved by an array of surveillance devices and various force multipliers has ushered an era of technological revolution in the Sudarshan Chakra Corps.

As part of the joint exercise, large scale air transport operations were undertaken by the Air Force to drop elements of a Parachute Battalion in the simulated/exercise war zone. The operation was jointly planned between the SWAC and the Army, the operation undertaken by An-32s, and IL-76 transport aircraft of the Air Force, escorted by Su-30MKI air dominance fighters as cover against simulated enemy Air Force fighters. The execution was deemed "flawless" and the paratroopers were dropped over the Drop Zone as planned. The entire operation was launched from the Air Force Base at Jodhpur.

The President of India Pratibha Patil along with the Defence Minister and the Chief of Army Staff Gen VK Singh visited the exercise area on 5 December, while others present on the final day of the exercise were GOC-in-C South Western Command, AOC-in-C Western Air Command and AOC-in-C South Western Air Command. A delegation of Parliamentarians also visited the area and gained first-hand experience by visiting the operational tactical level units to understand nuances of operational level activities and to interact with troops.

The Sudarshan Chakra Corps have lived upto their name, starting with its aggressive and inspiring war cry 'Agrasar, Aakramak, Vijayee'.







VAYU

# 'Sudarshan Shakti'





Main picture: T-72 tanks in fast attack mode in desert terrain. Clockwise from above: Insignia of XXI Corps; paratroopers await boarding in An-32s; camouflaged tank; BMP entering canal; BMP mid-stream across canal



# Aakramak, Vijayee

# **Scenes of the Battle Space**

Well camouflaged BMP-II infantry combat vehicle carrying Mechanised Infantry troops.





Lt. Gen. AK Singh before flight in Mi-25 attack helicopter





## Elbit





Special Forces with National Flag after "seizing" objective



Army Dhruv ALH with Gypsy vehicle underslung



The President and Supreme Commander of the Armed Forces Smt Pratibha Devisingh Patil with Defence Minister AK Antony and Army Chief Gen VK Singh witnessing the exercises.



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# Soldiers in the Sky

Army Aviation's HAL Dhruv

## An Integral Aviation Arm

A-1108

These relate to directions given by military leaders based on the threat perception of India. Whilst numbers may not seem to be relevant on first thought, they have to be in consonance with the desired capabilities that the Indian armed forces seek to achieve. Overall numbers would preferably conform to a requirement that fulfils the total helicopter force that would be required by the armed forces, keeping in mind, of course, that some specialised type of aircraft may also be required.

India's national policy does not support aggression in any form and, currently, we do not envisage deployment of expeditionary forces to any country. Whilst we do have missions under auspices of the United Nations that are deployed and maintained by us, full scale support of foreign land forces in an out-of-area contingency is not currently envisaged in India's plans. The role and employment of rotary-wing aircraft has also undergone certain changes. Technology has contributed immensely both to, and as, a force multiplier. The helicopter forces of the Indian armed forces should, hence, be augmented and modernised with this background.

Classic set-piece wars between states seem to have become a thing of the past, and over the years, have been influenced by many forms of warfare. These developments give us reason to rethink all our theories not only of war and peace but also of the role and employment of the different corps and branches of the armed forces. What has been realised is that a comprehensive build-up of capability of an integral aviation arm of the land forces must eventually cater for all possible contingencies.

Reminiscing on the ways to confront a changing world, General Dwight David Eisenhower had said that "one cannot face the future simply by walking backwards into the past". Since Army Aviation requires being at the forefront in the development of new methods for overwhelming adversaries of the future, incorporating the lessons learned, adjusting force structures, evolving procedures and continued absorption of technologies will become very essential to enable Army Aviation to meet the current and future demands. Issues that will have focus and a major share of attention, as a prelude to the current expansion phase of Army Aviation, are the nature of developments having a bearing on current trends with respect to operational and technological advances and the requirements for adaptation.

### **Operational Trends**

US Army helicopters were deployed in Vietnam to increase mobility and provide supporting fire, as also improve the concept of holding static defensive positions. Developments in guided missiles led to an increasing combat role of helicopters, which was concurrent with providing the infantry with a platform to operate from the third dimension.

### HAL

The war in Afghanistan during the decade of the 1980s had the Soviets relying heavily on aerial tactics, with airborne troops and extensive use of armed helicopters. However, night and adverse weather operations were almost never attempted, even when air support was desperately needed by ground troops. These were also used in conjunction with conventional weaponry consisting of tanks (T-72) and artillery guns (152 mm selfpropelled howitzers). Russian experience in Chechnya was somewhat different where helicopters were increasingly utilised mainly for noncombat missions and approximately 90 per cent of the casualties were evacuated by helicopters. This gave enough evidence of the inherent potential in execution of combat support operations, including medical evacuation duties, plus combat search and rescue.

Rotary-winged aircraft bring in the advantage of close combat operations in confined spaces and close aerial observation. However, mere target acquisition by air observation posts lost their relevance soon after World War II. Artillery ranges had increased and it was evident that observation, with optical aids, was not meeting expectations. With increased pace of operations, the bulk of artillery forces cannot match the movement of armoured formations and where it has matched the pace, with technology and ingenuity, the observation capability to direct artillery fire was becoming secondary and almost irrelevant except perhaps in the mountains where suitably placed observation posts are still needed. This is because of the extraordinary ranges at which the artillery can reach with accuracy.

There are enduring images of the Korean War when helicopters evacuated the wounded and landed at Mobile Army Surgical Hospitals (MASH)). In sharp contrast, Chinese and North Korean medical evacuation efforts nearly collapsed by early 1951 because they relied on road and rail which was delayprone and immensely time intensive. Today, an enormous amount of air effort is dedicated by the Indian Army Aviation in evacuating stricken soldiers in the Siachen, in Jammu and Kashmir and the insurgency-prone north eastern states.

The concept of air mobility has remained attractive to armies the



Infantry troops before embarking in IAF II-76 heavy lift transport aircraft.



The IAF has acquired six C-130J-30's from Lockheed Martin (under a FMS sale) and are based at the Hindon Air Force Station near Delhi. There is an additional requirement for six more of the type.

### Lockheed martin

world over. The concept of tactical mobility is cardinal feature of any military doctrine and requires extensive use of helicopters to transport both commando and infantry units, together with supporting equipment, either across or along the edges of the battlefield. Armies all over the world have directed substantial efforts in improving their rotary-wing inventory and resources. The US Army regards chief function of the medium-lift helicopter as carriage of equipment and weapons, Germany has worked at trooplift operations of an entire battalion in one single operation. Attack helicopters have been designed with the anti-tank role as foremost to counteract any overwhelming numerical superiority of armour on the battlefield, apart from the infantry support role. However, in mountainous terrain, the entry, route and exit of helicopters can be predicted with a fair degree of accuracy because when valleys are followed, dangers

The Boeing CH-47F Chinook has been evaluted by India to meet its heavy-lift helicopter

requirement.

from ground fire increase, as also from the terrain in attempts to remain close to mountains for camouflage. Future battles could have a mix of irregulars and conventional forces. Therefore, low and slow flying operations over hostile terrain against an adversary, whether in the plains or mountainous terrain, will have to be weighed adequately against the vulnerabilities of helicopters.

### Technological Advances

The use of rotary-wing aircraft is obviously constrained by battlefield safety concerns. This becomes ever more acute with rapid urbanisation and in the context of conditions under which future warfare is going to be contested. While survivability will be a paramount requirement, a high level of attrition may be a reality. During Operation *Iraqi Freedom 2003*, over Karbala, 32 AH-64D Longbows were attacked, in a classic ambush, by the Iraqi *Medina* Armoured Division. The outcome was significant as nearly all helicopters were hit by ground fire. The United States Army also lost more than 120 helicopters in this 'war on terror,' about 25 percent of them from enemy engagements, or about 5.5 percent of the total American casualties since the conflict began in March 2003.

With technological advances, it is becoming exceedingly necessary to utilise aircraft simulators to impart training on certain critical skills before launching man and machine in actual operations. Rapid development in sensor and information technology is transforming Intelligence, Surveillance and Reconnaissance (ISR) capabilities, leading to greater effectbased operations. Reduced pilot workload, increased lift, better protection and enhanced survivability figure prominently in the technological trends. The upgrades include fly-by-wire flight controls, full authority digital engine controllers, enhanced cockpit displays, while adding



more engine power for additional lift during external lift (sling load) operations.

Flying under the cover of darkness is the preferred mode of operation. Thus there has been pressing need for increased and more effective means of battlefield target acquisition by night and all weather conditions. As as a result, night vision systems, both Night Vision Goggles (NVG) and Forward Looking Infra Red (FLIR) systems, have become commonplace requirements. These devices offer the ability to 'see' down to levels of illumination two orders of magnitude below the capability of the human eye and, thus, contribute towards target acquisition by night. However, the high cost of purchase and the operative and maintenance costs of rotary winged types means that use of fixed-wing aircraft by Army Aviation is increasingly favoured. Staff transportation, communication, special force movement and photo missions are





key applications for such fixed-wing assets. This has led to the evolution of 'tilt rotors' that aim at harnessing the advantages of both fixed and rotarywing aircraft. Experience with the tilt rotor V-22 Osprey were encouraging till weighed against their slow descent, limited protection, manoeuvrability and cost at \$100 million per unit, which puts this type out of reach of most countries at least for the present.

#### **Requirements and Adaptation**

Army Aviation is gaining on several material fronts as concern current and future platforms, the focus being on acquiring new platforms to replace the present obsolescent fleet. These acquisitions will perform for a minimum of two to three decades with suitable upgradation and the incorporation of Army digital network-centric connectivity. With this, Army Aviation will be fully integrated into the joint battlefield environment.

Optical recognition and non line-of-sight communications are key areas which will determine the way Army Aviation is able to play its role in the future. Self-protection suites, observation and targeting systems to include high definition imaging turrets, enhanced day and night capable helmet mounted displays, and night vision goggles are the key.

Management of dense air space will remain a complex challenge. Air defences over the battlefield environment necessitate tactical data links over voice control. Ground-based air defence batteries and aircraft should exchange digital information sufficiently and rapidly to fight the air-land battle. The multitude and capability of air defence systems to detect and engage low flying aircraft has achieved formidable success. The large scale deployment of anti-aircraft weapons by both field units and fixed installations by own troops and the adversary will lead to a highly intensive and 'saturated' air space where the Identification, Friend or Foe (IFF) system and coordination of air movements will increase exponentially. These will have a direct bearing on the aspects of survivability, target acquisition and engagement of hostile elements for neutralisation.

The Indian Army's modernisation and expansion plan had envisaged a dedicated aviation wing for the Special Forces back in 2001. An internal exercise to examine various proposals from different agencies to get the maximum advantage however seems to have been truncated—or perhaps shelved ?

Low-cost fixed-wing aircraft operating with ground troops have their advantages. However, operations from the field must be concerned with tactical



dispersion, camouflage, assembly area security, ground-to-ground as well as ground-to-air communication issues, and the maintaining of aircraft in a field environment. Factors that contribute to the operational attractiveness of these aircraft include air base infrastructure and potential threats near forward aircraft landing grounds, while existing ones will need activation and some additional ones created.

Modernisation and technology will catapult the demand for additional expertise. Multi-track training programmes should be formulated where, within each individual aircraft qualification courses, there is a hierarchy of required skills, levels of simulation and individual training aids. As advanced electronics and systems packages get incorporated, the workload on the aircrew increases in terms of acquiring qualification and maintaining currency in the advanced expertise. So, either a new discipline of aircrew needs creation or the present methods of specialised training need to be reworked to achieve the desired level of proficiency. This will have to be balanced with the state of availability of aircrew in units, their operational familiarisation and utilisation.

Armoured carriers with Nuclear, Biological and Chemical (NBC) protection have been considered and evaluated but the ability to transport both troops and weapons in a nuclear battlefield with speed and ability to concentrate from dispersed landings is a feature to be acknowledged while considering tactical mobility in affected areas. Troop movement and application in a nuclear battlefield has been thought best with helicopters when time is at a premium. There will be a requirement to focus on this aspect given the fact that India has two neighbouring countries which are nuclear states. The aviation logistics system must reach a level of automation that allows commanders to meet the logistics demands, movement and set conditions for success. To achieve 24x7 operational capability of a combat arm, the flexibility to plug into, and exit from, a dedicated logistics network will be required. This

may become more sustainable with the introduction of a modular maintenance package as it eliminates the handicaps of centralised and multiple level structures but retains the ability to meet the pace of modern warfare.

Army Aviation in India is undergoing one of the most significant transformations in its history. This is an extremely crucial but exciting time as it tackles numerous challenges in its endeavours for modernisation and transformation. Its capability to restructure, leverage technological improvements in current and future systems will allow the Army to respond better in more effective and sustainable manner. Areas of special focus and structures have certainly been given due thought and action initiated in a highly professional manner but the workable recommendations have to be deliberated upon more deeply to complete the ambit of true and real integral aviation support to the Army.

> **Col. Rajiv Ghose** Courtesy : Defence and Diplomacy

### TURBOMECA AD

# The 'V' Force

## Mi-17V5s formally inducted into IAF

uring a ceremony at the technical area of No.3 Wing at Palam airport on 17 February 2012, the Defence Minister AK Anthony formally handed over the first batch of Mi-17V5 medium-lift helicopters to the Indian Air Force. The Government of India had signed an agreement with Russia in 2008 for the procurement of 80 Mi-17V5 helicopters for "high altitude air maintenance operations, humanitarian assistance, disaster relief missions and general air transportation."

The Mi-17V5s are being steadily airlifted from Russia to India (Chandigarh) in massive Antonov An-124s, every aircraft carrying three helicopters in CKD condition which are then assembled and test flown at No.3 BRD. The first batch was received on 27 November 2011 and by February 2012, 27 Mi-17s had been delivered. On an average it takes one week from arrival at Chandigarh to first test-flight, with Gp Capt Ajay Shukla as officer in-charge.

The last of these Mi-17V5s would be received by March 2014, with a total of six helicopter units to be equipped with the type, being Nos. 154, 155, 156, 157, 158 and 159.

The first HU with the Mi-17V5 is No.155, commanded by Wg Cdr AK Verma to be based in Bhatinda, followed by No.154 at Srinagar and No.156 at Bagdogra.

As per the IAF, the Mi-17V5 is equipped with state-of-the-art avionics and onboard navigation systems. It is a glass cockpit variant, the first of its kind to get inducted into the IAF, has onboard weather radar, state of the art autopilot and is compatible with the latest generation (Gen-III) night vision goggles. With this, the helicopter can undertake all-weather, day and night operations in any kind of terrain. The helicopter is also equipped with a 'Bambi-Bucket' that can be used for fire fighting. It is also fitted with a powerful winch, a feature useful in the disaster relief operations in restricted areas where landing is not possible.



Defence Minister AK Antony handing over the symbolic key to CO, No.155 HU



Defence Minister AK Antony, flanked by Air Chief Marshal NAK Browne (CAS) and Air Marshal KK Nohwar (VCAS), Air Marshal DC Kumaria (AOC-in-C WAC) and Air Marshal RK Sharma (DCAS) with the AOC Palam, CO and officers of No.155 HU



Mr. RK Ghose, Joint Secretary and Acquisition Manager (Air) in 'glass cockpit' of the Mi-17V5

The Mi-17V5 has a modified loading ramp for rapid loading and off-loading different from the traditional rear clamshells. A starboard door and a 'Dolphin' shaped nose section give this type a unique identity. The entire airframe has a high degree of ballistics tolerance and is crash-resistant, and also comes equipped with an emergency flotation system. Its internal cabin volume is sufficient for transporting 36 fully-equipped infantry soldiers for specialised operations.

In his address, Mr.Anthony stated that "this day was special for the Indian Air Force... the multi-purpose Mi-17V5 helicopters will add to the flexibility and operational muscle, as well as capabilities of the Indian Air Force. It will help the IAF in meeting its growing mandate."



Mi-17V5 seen with rear ramp deployed and 57 mm rocket pods installed. Up to 36 troops can be disembarked in 15 seconds

"On behalf of the Government, I wish to place on record our appreciation for the initiative taken by officials of Russia to work in tandem with the Indian officials. I also extend my heartiest congratulations to the Defence Ministry and Air Headquarters for the success of the project."





n August 2011, an ITAR-TASS report stated that pre-delivery trials of the Russian Project 971A Schucka-B (NATO: Akula-II) Class nuclear-powered attack submarine (SSN), the K-152 'Nerpa' was expected to be complete by Augustend after which it would be handed over on a ten-year lease to the Indian Navy (IN). Although back in 2008 then Chief of Naval Staff (CNS) Admiral Sureesh Mehta put stress on the training of IN personnel for operating nuclear reactors and platforms and other systems, an India Today report stated that "the impending acquisition of the Akula (to be named INS Chakra in Indian Navy service) gives India the long-awaited third leg of the nuclear triad...widely regarded as the most survivable mode of launching nuclear weapons." The story also quoted Indian analyst Bharat Karnad as saying that the leased submarine would be "the most crucial strategic capability...after (India's) testing (of) nuclear weapons in 1998." The India Today report further asserted that the Chakra would be armed with "indigenously built nuclear-tipped cruise missiles with a range of over 1,000-km."

Conflicting media (both Indian and Russian) reports however indicate that the IN is in fact all set to get two *Akula*-II class third-generation multipurpose

nuclear-powered hunter-killer submarines (SSN) on lease, with the obvious option to buy them, from Russia. Concurrently an international training centre was "expanded" in Sosnovy Bor, situated 70-km west of St. Petersburg, with the initial aim of imparting training to 300 Indian Naval personnel selected for operations aboard Akula class SSNs. The training was reportedly started sometime in 2001 and now stands completed as the Indian Naval officers were reported to have returned to India in early 2007. The centre incidentally trains Russian naval officers and houses working marine nuclear reactors and is used to test nuclear fuel and other technologies applicable to nuclear submarine reactors. Thus the accommodation of Indian naval officers at the Centre indicates far-reaching consequences beyond leasing of the Akula-II SSNs and possibly aimed at imparting sufficient training and expertise to enable the Indians to develop their own nuclearpowered submarines which includes the Arihant Class 'Ship Submersible Ballistic missile armed Nuclear-powered' (SSBN) that appears to share technology of the Akula Class SSN. Although initially, and decades ago, the IN requirement for SSNs was to acquire the only credible counter to United States Navy (USN) presence in

the Indian Ocean, in recent times its value as multipurpose "stealthy and mobile thus invulnerable" strategic platform has taken predominance in response to rapidly shifting geo-political scenario, with new equations.

Efforts of the IN to secure SSNs in its fleet may be traced back to 1984 with reports of discussions with then Soviet Union on the supply of more advanced, possibly nuclear-powered submarines and the training of IN crews in the Soviet Union. Admiral Ram Tahiliani then Vice-Chief of Naval Staff, took a leading role at the talks in Moscow in September 1984, after which official sources stated that the defence relationship had taken on "a new dimension" indicative of possible access to nuclear-powered submarines. This was followed by the formal agreement to lease a Charlie-II class customised for export (Project 670M/06709) nuclear-powered cruise missile armed submarine (SSGN) from the Soviet Union sometime in 1985. In January 1988, All-India Radio announced that the Soviet Union had leased a nuclearpowered submarine to India with IN taking delivery of INS Chakra in the Soviet port of Vladivostok. Initially reported to be of Victor I Class SSN, published photographs clearly identify INS Chakra as a Charlie Class SSGN designed to carry eight P-70 Ametist (SS-N-7 'Starbright') Anti-Ship Cruise Missiles (ASCM), those capable of being launched even while the SSGN remained submerged. Leased for a period of three years from January 1988, the SSGN was based at Visakhapatnam Naval Base and was returned in January 1991. In the aforesaid period the submarine travelled 133,000-km with the reactor active for 430 days and fired five Ametist ASCM and forty-two torpedoes. Thirty Soviet instructors maintained key posts on the SSGN and forty Soviet industrial specialists were involved in servicing it. Unsubstantiated rumours of a second IN operated SSGN INS Chitra, was never officially confirmed. Interest continued in buying modern SSNs from Russia and the opportunity came aftermath breakup of Soviet Union and the follow-on financial crisis.

The Indian Navy was swift enough to "target" the two third-generation Akula SSNs, with Nerpa (Baikal Seal) 70 to 85-percent complete and another 40 to 60percent complete and awaiting completion at Komsomolsk-on-Amur Shipbuilding Plant. Drastic Russian defence budget cuts in the past decade meant completion of the projects required massive "foreign investment". An article in the September-October 1999 issue of Yadernyy Kontrol, journal of the Moscow-based Centre for Policy Studies in Russia, alleged that after having been shown Akula-II SSNs in the summer of 1998, an Indian delegation placed acquisition of these vessels on the agenda of the November 1998 meeting of the Indian-Russian Intergovernmental Commission for Military and Technical Cooperation (IRIGC-MTC) with India pledging to finance their completion and Russia agreeing to provide training for two set of crews of Indian submariners. By the time the final contract was signed in 2005, Nerpa was 86.5-percent technically ready. The total value of the agreement with India for the completion and lease of the two SSNs was estimated at \$1.8-billion, including US\$650-million for the Nerpa contract. Russian daily Kommersant reported on completion of construction of Akula-II K-152 Nerpa on 4 July, 2006.

#### **The Prime Role**

The *Akula* SSNs in Indian Navy service may be assigned the prime role of Anti-Submarine Warfare (ASW) in company

with Indian Navy aircraft carrier battle groups (CVBG) sailing some distance in front of advancing CVBG as vanguard while another SSN follows-up to protect the rear quarter. In fact, an improved Akula I K-461 Volk (Wolf) of the Russian Navy during 1995-1996 was closely working with the Russian CVBG headed by Orelclass aircraft carrier Admiral Kuznetsov providing ASW cover in their out-ofthe-area deployments. The Akula SSNs in Indian Navy service will have a more critical role, that of being the naval arm of the 'Nuclear Triad' to complement Arihant Class SSBNs effectively spreading the "strategic punch" aboard multiple undersea platforms. The spreading of naval strategic assets are of vital importance as SSBNs in concept represent a concentrated cluster of strategic capability and the possible loss of even a single platform will have abnormally high negative impact on the nation's strategic posture. Thus a wide spectrum of nuclear-assets aboard multiple SSBNs and SSNs represent a more formidable deterrent in combination. Also in accordance to Indian Maritime Doctrine, which "jotted down" the IN desire to "pursue a more competitive strategy aimed at developing

followed by around five Type 095 Class and SSBNs of the *Jin* (Type 094) Class around five of which may be operational post 2015, although the last mentioned programme have run into persistent difficulties.

To further complicate the problems of their adversaries, the Akula II with a dived displacement of 13,800-tons nevertheless sports a maximum submerged speed of at least 35-knots, thanks to the main machinery that consists of a VM-5 pressure water reactor with a model OK-650B high-density reactor core rated at 190 to 200MW with a GT3A turbine developing 35MW driving a seven-bladed fixed-pitch propeller. The operational diving depth is reported to be 520-metres that extends to the maximum diving depth of 600-metres. Thus if deployed in a more offensive role, the high underwater speed along with a deep diving capability enables the Akula SSN to evade a considerable spectrum of enemy ASW defences by passing beneath them. Surface-launched ASW weapons such as homing torpedoes would take a long time to reach the operating depth of the Akula SSN that the later by then would have passed out of range of their acoustic homing device.



a credible minimum nuclear deterrence, generating a littoral warfare capability and dominating the Indian Ocean Region", the acquisition and development of *Akula* Class SSN and *Arihant* Class SSBN are meant to secure parity with Navy (PLAN) current nuclear-powered submarine programmes. This include SSNs of the two presently operational *Shang* (Type 093) Class to be Significantly, the *Akula* retains the capability to approach permanent thermo cline layers in the oceans, and in case of *Akula* II to exploit its formidable MGK-540 *Skat-3* (Shark Gill) sonar suite with additional flank array extending for about one-third of the hull. The sonar suite provides automatic target detection in broad and narrow band modes in active mode

while in passive, listening mode hostile enemy sonar face risk of detection. The sonar signal processor is flexible enough to detect and automatically classify targets as well as reject spurious acoustic noise sources and compensate for variable acoustic conditions. The "thermo cline" thermal layer in oceans has a major influence on ASW operations as it affects the velocity of sound and in permanent thermo cline (found at depths of 300 to 400-metres in equatorial areas and 500 to 1,000-metres in sub-tropical areas) the velocity reaches minimum. In addition, in later Akula submarines a number of prominent non-acoustic sensors appear on the fin leading edge and in the forward casing capable of carrying out wake tracking of the enemy surface units under surveillance. To complement the formidable sensors Molniva-M/Pert Spring Satellite Communications (SATCOM) provides greater situational awareness, critical in pursuit and interception missions of hostile fleet.

The MGK-540 *Skat-3* sonar suite enables *Akula* II SSNs to enjoy considerable stand-off distance against enemy submarines and such a capability

enjoy the choice of a 200-kt warhead or a Type 40/45 torpedo in response to tactical circumstances. Wake homing torpedoes, if deployed will inherently be less dependent upon accurate targeting solutions as they need to be fired at target's wake rather than at the target itself. In Indian Navy service the 91RE1 variant of the in-service Novator Alfa (Klub) family of cruise missiles may be an option. The 91RE1 is designed to be launched from a 533-mm torpedo tube at depths of up to 150-meters while the launch submarine is travelling at up to 15-knots. At the maximum launch depth, target engagement can be at a range of up to 50-km.

An ideal torpedo armament for Indian Navy- operated Akulas would be Whitehead Alenia Sistemi Subaquei (WASS) Black Shark wire-guided heavyweight torpedoes fitted with Astra active/passive acoustic head and a multi-target guidance and control unit incorporating a countercountermeasures system obtained as a part of Franco-Spanish Scorpene SSK deal. In addition, the deadly VA-111 Shkval (Squall) rocket-propelled heavyweight torpedo, an astounding implementation of



is duly complemented by their plunge-flyplunge ASW missiles consisting of Novator RPK-2 *Tsakra* (SS-N-15 'Starfish') and the Novator *Vodopad* (SS-N-16 'Stallion'). The Starfish, fired from the six 533-mm tubes, has a target range (inertial flight) of 45-km while the Stallion, fired from the four 650-mm tubes, has a longer range of up to 100-km. Both the Stallion and the Starfish supercavitational technology, if integrated will be capable of crippling even a 100,000ton vessel with a couple of successful hits. *Shkval* has been typically characterised as a "revenge" weapon, which would be fired along the bearing of an incoming enemy torpedo forcing the enemy submarine to conduct sharp and drastic manoeuvre and thus cut the guidance wire to its own torpedo, yet incapable of manoeuvring out of the danger zone. The torpedo runs at a speed of 200-knots up to 7-km guided by an auto-pilot while the tactical nuclear warhead is initiated by a timer. A simplified Shkval-E export variant exists. More importantly, development of the Shkval has continued through decades to culminate to guided Shkval II. With a top speed of around 720-km/h and a range of 100-km the "monster" supercavitates, slows down to reacquire its target if necessary, before speeding on and homing in for the kill. The precision attribute of Shkval II may enable it to arm itself with interchangeable nuclear/conventional warhead depending upon mission parameters.

Known countermeasures are the standard gas-producing decoy units, a holdover from the German Pillenwaffer, sonar jamming, and an ingenious acoustic decoy commonly referred to as the 'Nixie' cunningly emulating the sound signature of the parent sub while veering from the submarine's track at three knots effectively obscuring the actual noise generated by the parent submarine. While the tracking submarine is deceived into tracking and launching on a decoy, the Akula may silently alter course and counterattack as also, a Nixie will force opposing submarines to track multiple targets, uncertain which is the Akula.

#### The Challenge

The challenge to the Indian Navy will be to retain the "strategic arm" of the Akulas it inducts in its fleet. The Project 971 design attained a strategic nuclear deterrence role around 1978-80 as the design was improvised to accommodate up to twelve 3,000-km ranged plus 200-kt nuclear-tipped RK-55 Granat (SS-N-21 Sampson) 'Tomahawkski' strategic Land Attack Cruise Missile (LACM) for precision strike against high-value coastal installations and on specific targets further inland. The guidance system combines inertial-Doppler navigation and position correction based on comparison of terrain in the assigned regions with images stored in the memory of an on-board computer (TERCOM). The propulsion system is a dual-flow engine located underneath the missile's tail. The Circular Error Probable (CEP) is respectable 150-metres. The missile flies at a height of 200-metres at Mach 0.7 to complicate enemy interception procedures. However because of Missile

Technological Control Regime (MTCR) restrictions, reportedly the tactical variant of the RK-55, 275-km ranged 3M-14E (SS-N-30) which is already in Indian Navy service will arm the INS *Chakra*.

The 3M14E LACM has been designed to destroy ground-based targets and consists of a booster stage and a subsonic low-flying sustainer stage. The 3M14E is intended for use against stationary ground targets such as administrative and economic centres, weapon and petrochemical storage areas, command posts, seaports, and airports. Once the mission data needed by the mid-course navigation system has been prepared, it is loaded into the missile's onboard computer prior to launch. The missiles are launched under the power of a tandem solid-propellant rocket booster fitted with four small lattice stabilisers. Once the missile has reached flying speed, it is powered by a small turbojet engine.

For most of the flight to the target area, the missile flies autonomously, following the pre-programmed route and turning points. Once over land, it uses a terrainfollowing flight path that will make it a difficult target for enemy air defences. This low-level flight mode poses a higher load on the wings and missile structure than flight over the sea surface, so the land-attack missile variant has slightly redesigned wings of shorter span and deeper chord, plus a stronger structure.

At the terminal stage of the flight the guidance is effected by the 'Korrelatsionaya' system. This guidance system employs a Scene Matching Area Correlator package, which guides the missile to a set of coordinates within a pre-programmed image surrounding the target and is similar technology to the Digital Scene Matching Area Correlator (DSMAC) as in the BGM-109 Tomahawk. European sources claim this guidance package can hit completely hidden targets with 400-kg high explosive providing their location is well known relative to visually prominent features surrounding the aim point. As written earlier, INS Chakra would be armed with "indigenously built nucleartipped cruise missiles with a range of over 1,000-km" in due course.

For enemy surface units the Akula submarines are a potential menace in their own right. To attack and wreak



havoc among enemy shipping the Akula submarines in Indian Navy service are likely to be armed with PJ-10 BrahMos Anti-Ship Cruise Missiles (ASCM), with low Radar Cross Section (RCS) and an active radar homing seeker to facilitate fire-and-forget launch. Varieties of flight trajectories including sea-skimming or terminal pop-up followed by a deadly dive are meant to complicate the task of the adversary. Mid-course guidance is inertial, developed and refined by Indian scientists. A 290-km long flight range with high supersonic (Mach 2.8) speed will lead to lower target dispersion and quicker engagement and higher destructive capability aided by the large kinetic energy of impact. The BrahMos has been widely discussed in several past issues of Vayu Aerospace &

Defence Review notably in Issue II/2009 and Issue VI/2009 and thus need not be further elaborated. However, deploying the BrahMos would require modification of the missile to enable it to be launched from 650-mm torpedo tubes of the Akula-II SSN.

While surfaced, the *Akula* SSN has an air defence capability provided by a shoulderfired Strela SA-N-5/8 portable missile launcher with 18 missiles. Limitations are obvious here and an anti-aircraft/ helicopter missile system that can be fired at hovering ASW helicopters and slow moving turboprop powered Long Range Maritime Patrol (LRMP) platforms at cruise from submerged submarines seems to be obligatory, as breakthroughs have reportedly been made in these spheres.

Sayan Majumdar

# The Use of Force and the

Iconic photograph of Sikh troops charging with the bayonet, Burma Campaign, 1944.

## Excerpts from the Cariappa Memorial Lecture delivered in New Delhi by the National Security Adviser Shivshankar Menon.

E have all heard the statement that "war is diplomacy by other means" attributed to Clausewitz. The actual statement was more nuanced but this will serve for our present purpose. We are also familiar with the corollary that "diplomacy is war by other means". Each contains enough truth to justify the cliché. That

truth is that war and diplomacy, military force and international relations, are Siamese twins, joined together at birth for life.

Militaries have always provided states with an instrument for effective diplomacy, mainly through the threat of the use of force or, in the case of a militarily weaker state, the ability to withstand military attack or engage in attrition. The actual use of force in most, if not all, cases demonstrate the failure of diplomacy.

The issue is, therefore, not whether militaries and force are important in international relations but how important they are, and their role.

# **Indian Way**

### The role of force

Force is an inescapable factor in international relations, whether through its actual use or in the threat of its use. It is much more so in international society than within the nation states in which we have organised our societies. This is because alternative forms of legitimacy are much less developed in international society than in our domestic societies with their complex systems of laws and domestic political legitimacy. International society is only now beginning to arrive at commonly accepted definitions of laws for some activities. Where such laws exist, such as the laws of war or the law of the sea, they are underdeveloped, or not universally accepted, or not always respected in practice.

In other words, while domestic societies have evolved or are evolving towards rule of law, international society is still much closer to primeval anarchy, where to a very great extent "the strong do as they will and the weak do as they must."

The last sixty years have seen a dramatic increase in the frequency of conflict and its intensity, between and within societies. This is a result of new technologies of force and their widespread dissemination. In fact we seem to be entering a phase of increasing militarisation of international relations. Look at recent developments in the Middle East, where conventional air power, covert and Special Forces and internet social media have been used in new tactical combinations with old fashioned propaganda and international institutions to change regimes and create political outcomes.

Secondly, as technology has developed, newer forms of power also have increasing effect. For instance today cyber actions in virtual space have kinetic effects that were once only possible through the use of traditional military force.

The state no longer has a monopoly of violence, and technology has empowered small groups and individuals to the point where they can pose credible threats to society, if not the state itself. We have only to think of the recent lethality of terrorist groups and their attacks.

#### Limits on use of force

Paradoxically, though military force is the ultimate and preponderant sanction in international society, and its use is more widespread than ever, it is less and less the preferred option. This is due to the paradox of conflict. The higher the effect of force, the less likely it is to be used. If the emergence of nuclear weapons and other weapons of mass destruction changed international relations fundamentally, they also highlighted the use of force for deterrence rather than as an actual sanction, as a means of influencing an adversary's behaviour through the threat of force rather than its application.

Today there are limits to the utility of force in international relations. As Sun Tzu said two millennia ago: "To fight and conquer in all your battles is not supreme excellence; supreme excellence consists in breaking the enemy's resistance without fighting" (Sun Tzu: *Art of War III.2.*).

Order, justice and resolution are the normally desired outcomes of any conflict. Force has a pivotal role in restoring order. But it can do very little on its own in ensuring justice and a final resolution of the causes of conflict.

Other limits come from recent factors such as technologies and their widespread dissemination.

Taken as a whole, the experience of using military force against terrorism and extremism since September 11, 2001 reveals these limits under today's conditions. In many cases the strategic outcomes created by the post 9/11 use of force have been the opposite of those originally intended.

And in today's situation, in a world of weapons of mass destruction, it becomes essential that the basically anarchic practice of international relations with the powerful calling the shots be regulated or moderated. This could be achieved by evolving new norms of international behaviour and by democratising international governance and its mechanisms. In fact such a process is now a compelling necessity. As experiences of 9/11, Iraq and Afghanistan show, a different approach to international relations is long overdue. As power is more and more diffused internationally, this different approach to international relations will become all the more necessary.

### Role of the Military

These developments make it necessary to re-examine the role and utility of the conventional military as traditionally configured and organised. What is the conventional military's relevance when the spectrum of conflict is wider than ever before and when force is widely held and used in international society outside the military?

It can be argued that as traditionally configured, the militaries of most powers are irrelevant to large portions of today's broader spectrum of conflict. The traditional military is no longer the sole or major instrument to deal with the wider spectrum of conflict, a spectrum that is wider than ever before in history, in new domains like cyberspace and outer space and extending to the economy, society and social and political psychology. Cyberspace as a domain is an example where rigid hierarchies and structures go against the nature of the domain and the technology itself, which is best handled by small groups or individuals, often acting on their own. We have shown the capacity to adapt to such challenges before. For instance, every democracy that has a developed Special Forces capability has kept it outside the traditional military command structure and uses it to activate the sub-conventional spectrum of conflict.

The expanded spectrum requires that we seek jointedness, that much used but less practiced word, not just between services but with the other instruments of state power. Today's spectrum requires a holistic integration of all the instruments of state power, the armed forces, the intelligence agencies, our scientific and technological resources, soft power instruments and others.

In other words we need much closer coordination between civil and military power. In my experience. even minor actions by the military have foreign policy consequences. The military is therefore both an important adjunct and component of diplomacy. There is also a need to restructure militaries to learn the lessons of a decade or more of counter-insurgency and counter-terrorism. While different doctrines and theories have been applied in the last decade, their results in practice can at best be described as mixed. In fact some of the best results are those that we have developed from our own experience in India in dealing with insurgency and cross-border infiltration and terrorism.

Militaries today are faced with a choice: they can stick to what they know and do best, at the risk of reduced relevance. Or else they can reorder themselves to deal with the new challenges that face us, rethinking doctrines and practices from the tactical to the operational to the strategic and even the grand strategic level.

At this stage, I can imagine some of you thinking that this is all very well in theory but what about the use of the military in diplomacy. Should India not be doing much more military diplomacy, particularly when armed forces play such an important role in the internal politics of countries in our neighbourhood? Of course we must, and we do so where we can. The Indian armed forces' increasing contacts with the world have been a very useful adjunct to our diplomacy and have

> brought our armed forces, and by extension the country, respect for professionalism and competence.

But we must also remember that when the military is in power in a country, as it has been for an extended period in some of our neighbours, they behave as politicians do, with their primary purpose changing to staying in power. Secondly, if they respond to your diplomatic approaches it is because of what you represent, the strength and capacity of your country, not individual brilliance or attractiveness or professional fellow feeling. When you speak for a strong, prosperous and united India you will be listened to and are effective, in or out of uniform.



### The Indian Experience

Is there an Indian doctrine for the use of force in statecraft? This is not a question that one normally expects to ask about a power that is a declared nuclear weapon state with the world's second largest standing army. But India achieved independence in a unique manner; through a freedom movement dedicated to truth and non-violence, and has displayed both ambiguity and opposition to classical power politics. In the circumstances posing the question is understandable and legitimate.

While India may have achieved independence after a non-violent struggle, it was a struggle that Gandhiji described as non-violence of the strong. As far back as 1928 Gandhiji wrote, "If there was a national government, whilst I should not take any direct part in any war, I can conceive of occasions when it would be my duty to vote for the military training of those who wish to take it.... It is not possible to make a person or society non-violent by compulsion."

Faced with the tribal raiders sent by Pakistan into Kashmir in October 1947, Gandhiji said that it was right for the Union Government to save the fair city by rushing troops to Srinagar. He added that he would rather that the defenders be wiped out to the last man in clearing Kashmir's soil of the raiders rather than submit.

In saying so, Gandhiji was entirely in keeping with a long Indian tradition which has regarded the use of force as legitimate in certain circumstances, namely, if there is no alternative way of securing justice. This is in essence a doctrine for the defensive use of force, when all other avenues are exhausted.

The lesson that comes through very clearly in both the major Indian epics, which deal with wars of necessity, is also apparent in Kautilya, the original realist, and in Ashoka, the convert to idealism. Ashoka and Kautilya were both products of a highly evolved and intricate tradition of statecraft which must have preceded them for centuries. A simple reading of the Arthashastra suffices to prove how in Indian strategic culture, as early as the third century before Christ, the use of force was limited both by practical and moral considerations.

In the Indian tradition the use of force is legitimate not just if it is in a good cause and its results will be good. Instead, this was a doctrine that saw force as necessary in certain circumstances, to obtain justice, when all other means are exhausted, and which also recognised that force was not always the most effective or efficient means to this end.

The other lesson that Indian thinkers have consistently drawn from history is of the perils of weakness. The colonial narrative of India's history, stressing "outside" invasions and rulers had as its corollary the conviction that India must avoid weakness at all costs lest that history be repeated.

### India as a Nuclear State

This strategic culture is also reflected in the Indian nuclear doctrine, with its emphasis on minimal deterrence, no first use, and its direct linkage to nuclear disarmament. We have made it clear that while we need nuclear weapons for our own security, it is our goal to work for a world free of nuclear weapons. We are ready to undertake the necessary obligations to achieve that goal in a time-bound programme agreed to and implemented by all nuclear weapon and other states.

#### In sum, there is an Indian way, an Indian view and an Indian practice in the use and role of force.

How do we apply this approach in today's complicated situation of multiple threats, rapid shifts in the balance of power and growing Indian interests abroad? We are now in a world where the geopolitical centre of gravity is shifting to Asia and its surrounding oceans. In Asia itself, several strategic rivalries contribute to uncertainty. We are in the midst of a global shift in the balance of power and in a time of great change, far from the certainties of the Cold War or other eras. And the global power shift has immediate consequences in our immediate vicinity.

In grand strategic terms the primary purpose of Indian military power remains the defence of India's territorial integrity (on land, sea, air and in space), and to prepare for the threats of war that exist. This task on the Asian landmass does not change.

We should now also be leveraging our geopolitical potential to develop our maritime capabilities, fulfilling our responsibilities and contributing to maritime security in the Indian Ocean littoral, critical as this is to our ability to transform India and ensure her security.

### Work in progress

The role of militaries in international relations will continue to be influenced by the changing character of the threats that we face, but the essential role of the military to protect and further a country's interests is likely to endure, even as the means adopted to apply or threaten force continue to evolve.

India as a society and nation has by and large made wise choices in the past on matters relating to the use of force, showing strategic restraint and realism. We have contributed force to internationally legitimate uses such as UN peacekeeping, while limiting its domestic deployment. Today we are in a position to make a greater contribution to global public goods in areas such as maritime security.

At the same time we are moving towards an Indian doctrine for the use of force, though this is a work in progress.



Shivshankar Menon, National Security Adviser.

## Strategic Moves



A-1103

A file picture of Indian Army Dhruv ALHs and a single Lancer (similar to the Cheetal)

n the first indication that India was prepared to take its role in Afghanistan beyond developmental programmes, a leaked US cable released by WikiLeaks has revealed that India was preparing to offer HAL-built light attack helicopters to the Afghan government. Revelations have it that the helicopter offer was initially not taken forward given the "adverse reaction" in Pakistan to any sort of military aid by India to Afghanistan. The leaked cable pertains to a January 2009 conversation between Afghan President Hamid Karzai and General David Petraeus, who was then heading the US Central Command that oversees all operation in Afghanistan and Iraq.

In a separate cable, it was revealed that a month before three Indian Army officers in Kabul died in an attack by suicide bombers, India agreed to brief US on its training of Afghan Army personnel



Eighteen officers from the Afghan National Army after commissioning at the Officers Training Academy (OTA) at St. Thomas Mt. near Chennai, seen with General VK Singh, COAS Indian Army.

## and Cheetals for Afghanistan ?



Afghan Army troops at a ceremonial parade

in India after the matter was raised by US Special Representative Richard Holbrooke during his visit to New Delhi. The leaked cable was referring to a conversation between then Indian Foreign Secretary Nirupama Rao and Holbrooke where the latter requested a detailed briefing on the issue. "Rao readily agreed to Holbrooke's request for a briefing on Indian training for Afghan security personnel, emphasising that this engagement was completely transparent. She supported her argument by noting that the GOI had previously provided a detailed briefing on this at the US-India Defence Policy Group meetings. 'We have nothing hide', she declared".

The documents reveal that the US did not discuss any expansion of India's military role in Afghanistan but subtly encouraged India to focus on cooperation in agriculture "because it produces the quickest payoff". He noted that investment in mining, power and other sectors was important but the gestation and payback periods are longer. Besides, he observed, Afghanistan has traditionally been an agricultural export country, with India as its biggest market.

As per the Ministry of External Affairs, "India has played a significant role in the reconstruction and rehabilitation of Afghanistan... India has undertaken projects virtually in all parts of Afghanistan, in a wide range of sectors including hydro-electricity, power transmission lines, road construction, agriculture and industry, telecommunications, information and broadcasting, capacity development, humanitarian assistance, education and health, which have been identified by the Afghan government as priority areas for development. All the projects are undertaken in partnership with the Government of Afghanistan (GoA), and in alignment with the Afghanistan National Development Strategy and with focus on local ownership of assets".

Major projects include the construction of transmission lines from Pul-e-Khumri to Kabul and a sub-station at Kabul under the North-East Power System project

> Afghan soldier after heliborne drop during an exercise in Afghanistan.



**Transport aircraft:** C-27A (12), Cessna 208 (5, 21 more on order) **Helicopters:** Mi-8/17 (46+, 35 on order), Mi-35 (9), UH-1H (9) **Training types:** MD530 (6, 48 more on order), Cessna 182T (6)

which will bring power from neighbouring countries to Kabul; humanitarian food assistance of 1 million tonnes of wheat in the form of high protein biscuits under School Feeding Programme in Afghanistan supplied through World Food Programme; construction of the 218 km road from Zaranj to Delaram that will facilitate movement of goods and personnel from Afghanistan to Iranian border; reconstruction and completion of the Salma Dam Power Project (42 MW) in Herat province; construction of Afghanistan's Parliament Building; reconstruction of Indira Gandhi Institute for Child Health in Kabul in various phases including reconstruction of surgical ward/polyclinic/ diagnostic centre; reconstruction of Habibia School; digging of 26 tube wells in north west Afghanistan; gifting of vehicles (400 buses, 200 mini-buses, 105 municipality and 285 army vehicles); setting up of toilet-cum-sanitation complexes in Kabul; telephone exchanges in 11 provinces to connect them to Kabul; national TV network by providing an uplink from Kabul and downlinks in all 34 provincial capitals; rehabilitation of Amir Ghazi and Quargah Reservoir dams, solar electrification of 100 villages, and so on.

30 Indian civil servants have been deputed under the GoI/GoA/UNDP Tripartite MoU for *Capacity for Afghan Public* 



*Administration* programme envisaged to build capacity in various Afghan Ministries. Other major skills development projects include the CII project for training 3,000 Afghans in the trades of carpentry, plumbing, welding, masonry and tailoring.

15 Indian doctors and 15 paramedics have been deployed for Medical Missions

According to a report titled – 'Security Trends in South Asia'–and in context of Afghanistan post–2015, India has proceeded with caution even while extending aid to build up the country's infrastructure and provide training in both civilian and military areas.

India could well expand its current



(IMMs) in Kabul, Kandahar, Jalalabad, Mazar-e-Sharif and Herat. Each IMM treats several hundred patients daily. In addition, patients are also provided free medicines supplied by India.

The Government of India pledged an additional US \$ 500 million of assistance to Afghanistan during the Prime Minister's visit to Afghanistan in May 2011, bringing India's total pledged assistance to Afghanistan since 2001 to around US \$ 2 billion. India and Afghanistan also signed the Strategic Partnership Agreement in October, 2011 which reiterates India's longterm commitment for the all-round development of Afghanistan.

assistance in training and building the Afghan National Army and police forces. An option would be to arm the Afghan National Army and police with military equipment. The report further has it that, "Similarly assistance in capitalisation of the armed forces through provision of helicopters, heavy weapons and equipment is another option which could well be exercised. The Dhruv and Cheetal helicopter for instance have demonstrated excellent capability at high altitude with difficult meteorological conditions, (similar to those experienced in northern Kashmir and Ladakh) and would be ideal for the rough terrain in Afghanistan which would be available at much lower costs. This facet could be explored."

On the military training front, and according to international defence analysts, some 20,000-30,000 Afghan military personnel, including about 500 officers will be trained over the next few years. Afghan army personnel will get 4 to 6 weeks courses to cover basic military skills, use of weapons, infantry tactics and counter-insurgency military operations, some of these at the Rajputana Rifles Centre. Selected Afghan troops will be trained in counter-insurgency and jungle warfare at Indian Army schools while Afghan Army officers have been attending specialist courses involving armoured fighting vehicles, military engineering, communications and other tactical areas.

As for equipment, the Government of India may well provide 5.56 mm assault rifles and other infantry weapons for the Afghan National Army as also rocket launchers, light artillery and perhaps retrofitted T-55 tanks, now phased out from Indian Army frontline service.

The Afghan Air Force is presently building up its medium-assault helicopter and gunship helicopter inventory, and as both the Mi-17 and Mi-35 are in frontline service with the IAF, as also in Afghanistan, air crew training on Mi-17 and Mi-35s could well be undertaken at IAF training bases as also maintenance training.

A "stable Afghanistan" is necessary for India which faces regular threats from China and Pakistan and as the report concludes, "alternative security assistance patterns would have to be evolved which are acceptable by the international and regional community for Indian engagement in this sphere".





## Admiral Nirmal Verma, Chief of Naval Staff, Indian Navy



# Charting an Increasing Role

**VAVU**: Charting an increasing role for the Indian Navy, Defence Minister AK Antony has recently emphasised that India's economic growth is "inextricably linked to the seas". Please review for our readers the time bound modernisation process which will make the Indian Navy a realistically blue water one.

**CNS:** The world has acknowledged India's economic prowess and future economic potential. As the country continues to progress on the path of its sustained economic growth, there is a growing acceptance of the fact that the maritime domain is the prime facilitator of our economic growth. More than 90% of our trade by volume and 77% by value are transported over the seas. Over 97% of our energy needs of oil are either imported or produced from offshore fields. Consequently, our economic growth is inextricably linked to the seas. The role and responsibility of the IN to protect our maritime interest will grow with the requirement to safeguard our expanding economic interests as also the responsibilities associated with being a mature and responsible regional maritime power.

In terms of force accretions in the immediate future, we are acquiring ships in accordance with the Navy's Maritime Capability Perspective Plan. Our preferred choice of inducting

INS Tabar (F44) stealth frigate ships and submarines has been through the indigenous route and of the 49 ships and submarines presently on order, 45 are from Indian shipyards. The induction programme is continuing apace and over the next five years we expect to induct ships and submarines at an average rate of 7-8 ships per year, if the yards deliver to expectations. These include aircraft carriers, stealth frigates, destroyers, corvettes, amphibious ships and submarines. The IN is also in the process of inducting state-of-art aircraft and helicopters to augment our surveillance and integral aviation capabilities.

up-liftment of our citizens. The Indian Navy's roadmap is driven by the *Indian Maritime Doctrine*, which mandates four roles for the Navy : Military, Diplomatic, Constabulary and Benign. Therefore, its force structure should be adequate to address any form of threat to India's Maritime security.

The probability of risk of war between major countries may appear to be remote, but it cannot be entirely ignored. Where conflict threatens our national interests, the Navy will be ready to respond alongside other elements of national power, to give political leaders a range of options for deterrence, escalation coastal security and efforts are in hand by all stakeholders to collectively deal with emerging challenges.

Whilst ensuring combat readiness of our force will remain our primary focus, we are also prepared to undertake benign and humanitarian tasks in our region, whenever required. These endeavours shall be underpinned by continuous upgradation of our human skills and a well defined and charted route for transformation, as required.

**VAYU**: In your recent address to the Naval Commanders, you have given the primary challenges as "balancing



#### **VANU**: What is the focussed range of issues relevant to the Navy's preparedness and plans to develop a definitive roadmap for the future?

**CNS:** Each nation has a vision for itself and for what its maritime forces must achieve under different sets of circumstances. India's national objectives lie in ensuring a secure and stable regional environment which will permit the economic development and social and de-escalation. The Navy would, therefore, need the requisite capabilities to operate across the full spectrum of conflict, from Low Intensity Maritime Operation (LIMO) to conventional war fighting to nuclear deterrence. Our force planning process, accordingly, takes into account the "effects" that are required to be delivered in order to accomplish the Navy's roles and missions. The Navy has also been made overall in charge of

### of resources and building human capital". Could you elucidate on these?

**CNS:** The last few years have witnessed a sustained focus on enhancing our operational, technical and administrative infrastructure. Phase I of the Naval Base at Karwar, under *Project Seabird*, has been completed this year. We are now pursuing Phase II A of the project, which caters to construction

### **Elettronica**

of additional piers to accommodate the ships and support craft planned to be based there. We are also moving ahead to establish a full-fledged Naval Dockyard to cater for maintenance of the large number of vessels planned to be based at Karwar. Lastly, a Naval Air Station for operation and maintenance adequate number of trained personnel. We are upgrading the technical capabilities and the number of personnel to man new facilities, as well as the new acquisitions to keep up with the latest technology being inducted in the Navy. All officer candidates are being trained as B.Tech in our Naval Academy at Ezhimala and over the past few years due to the limited sanctions accorded between 1986-1996, on account of the 'financial crunch' in those years. However, due to sustained efforts by all stakeholders, our present strength is 132 ships and submarines. As mentioned earlier, 49 ships and submarines are currently on order and the



of shipborne helicopters and medium range maritime surveillance aircraft is also under development. The IN is also in the process of setting up Operational Turnaround Bases/ Forward Operating Bases and two Naval Air Enclaves along the coast, to cater for additional requirements of the Service especially with regard to coastal security. Special focus is also being accorded to develop our infrastructure and facilities in our island territories.

The ability to maximize material resources, maintain high operational readiness and meet national tasks is critically dependent on the availability of the minimum qualification for sailors to join the Navy is now 10 + 2 (Science). The biggest strength of our Navy is our well trained and motivated *Human Resource* who derive their strength from the fine traditions inherited from our predecessors.

**VAVU**: In 1964, the Cabinet Committee accepted a force level of 138 Warships for the Indian Navy. What is the fleet strength today, some 48 years since then? Is this dichotomy a matter of national concern?

**CNS:** The IN has maintained a force level between 125 to 130 ships/submarines

IN would be able to attain its envisaged force levels in the coming years.

**VANU**: According to a plan formulated in 1999, the Indian Navy is to acquire 24 modern conventional submarines, indigenously produced by 2030. What is the status in 2011 and what progress is being made towards achieving this target?

**CNS:** The Indian Navy has a programme for construction of submarines under Projects 75 and 75I. Six submarines are presently under construction at MDL Mumbai under Project 75 in collaboration with DCNS, France. Approval of the GoI

### Sikorsky



also exists for construction of another six submarines, under Project 75I. To meet our projected requirement, more submarines will be constructed with the experience gained from the present projects.

**VAVU**: Six Scorpene-class submarines were scheduled to be delivered to the Indian Navy between 2012 and 2017. We understand the first submarine will be delivered in 2015. How does this delay adversely affect the operational preparedness of the Navy? What alternatives are being considered to maintain the required force level?

**CNS:** The first submarine of the Scorpene class is expected to be delivered in 2015 and the remaining five would be delivered at regular intervals thereafter till 2018. This delay would lead to a temporary erosion of submarine force levels, but the numbers are still adequate to cater for any situation.

**VAVU**: Aviation arm of the Navy is set to grow in the years ahead and a major transformation is unfolding. However, even as new generation fighters, maritime reconnaissance/antisubmarine warfare aircraft, modern ship-borne helicopters and others are being acquired, the basic flying training aspects have not been fully addressed. What are the Navy's plans to become self-reliant in flying training?

**CNS:** Flying training of Naval pilots is traditionally conducted by the IAF at the *ab initio* stages. Subsequently, naval pilots are trifurcated into various streams (fighters, fixed wing and helicopters) and undergo 'in-house' training for IN specific aircraft. To cater for 'arrested' recovery in our new aircraft carrier, a few Indian pilots are also undergoing training in the USA as such facilities do not exist in India. In addition, helicopter conversion as well as training of Observers is undertaken by us at our training squadrons.

**VAVU**: Commissioning of the aircraft carrier INS *Vikramaditya* has been for long delayed and would have impacted on operational plans. What is the present status of its delivery schedule and that of the indigenous aircraft carrier (IAC) under construction at Cochin? **CNS:** The immediate impact of the delayed induction of the INS *Vikramaditya* will be the requirement to nurture INS *Viraat* and maintain her at current operational capability longer than planned. Fortunately, the material state and role-worthiness of INS *Viraat* continues to be excellent, primarily due to the unflagging efforts put in by successive ship's crews, the Naval Dockyard and Cochin Shipyard, all of which have been sustaining a tempo of the work and commitment that is nothing short of remarkable.

Consequent to signing of new Supplementary Agreements to the contract of 2004 with the Russian side in March 2010, the Repair and Modernisation works onboard Project 11430 (*Vikramaditya*) have progressed in an earnest manner and significant progress has been made. The structural work has been completed and almost all the equipment and systems have been installed onboard the ship. The Sevmash Shipyard at Russia is concurrently progressing 'Setting to Work' and 'Harbour Trials' of the equipment. The Russian side intends to commence sea trials (with an entire Indian Naval crew)
## Sagem

which would culminate into delivery of the ship by December 2012.

The indigenous aircraft carrier is a giant leap towards indigenisation and is testimony to India's self reliance in the defence sector. The overall design configuration of the IAC has gone through several iterations to take care of foreseeable requirements of Navy over the next 25-30 years. Fabrication and erection of the hull structure of the IAC is in progress and so is ordering of major equipment fit. We are looking at ways to expedite the pace of construction.

#### **VANU**: The second IAC is reportedly to be much larger in size and heavier. Would this logically be built at an alternative site, such as at the Pipavav shipyard?

**CNS:** The second IAC is presently on the design board and various key concepts are being examined. The type of aircraft dictates the launch and recovery systems and the flight deck configuration, which are key parameters in the evolution of the carrier. Examination of various types of propulsion packages is also being progressed. The exact size of the second IAC is expected to evolve as the design progresses. The buildability options would be reviewed after the broad configurations emerge.

**VANU**: With its force levels set to increase by at least 15% over the next five years the Indian Navy must commensurately develop its operational and technical infrastructure. Which are the major naval bases which will receive priority? In which geographical regions would these new forward naval bases, operational turnaround bases and naval air enclaves be situated?

CNS: The last few years have witnessed a sustained focus on enhancing our operational, technical and administrative infrastructure. Phase I of the Naval Base at Karwar, under Project Seabird, has been completed this year. We are now progressing the case for Phase IIA of the project, which caters to enhance the facilities and infrastructure. In addition, the IN is also in the process of setting up Operational Turn Round (OTR) bases, Forward Operating Bases and Naval Air Enclaves along the coast, based on the operational requirements of the Service. Special focus is also being accorded to develop our infrastructure and facilities in the A&N and L&M islands.

**VANU**: The Navy has been conducting overseas deployments, intra-navy exercises and bilateral exercises for some time. According to news reports, India and Japan will conduct their first ever bilateral naval exercises in 2012. What about exercises with other key East-Asian Navies such as those of South Korea and Taiwan? Are exercises with the Vietnamese and Philippine Navies also planned for the future?

CNS: Yes, we do plan to hold a bilateral exercise with the Japanese Navy which, as you are aware, is called the Japan Maritime Self Defence Force or the JMSDF. During the recent visit of the Raksha Mantri to Japan, India and Japan have agreed to undertake a joint naval exercise between the two Navies in 2012. Accordingly, the initial planning process will commence between the IN and the JMSDF. As far as Taiwan is concerned, we have not conducted any exercises with their Navy. With regards to Vietnam, Philippines and Korea, IN sends its ships on overseas deployments to the East Asian region. An important constituent of these visits are the short duration exercises, called PASSEXes, which are undertaken at sea by IN ships with the Navies of these countries. Also the time in harbour is gainfully utilised to foster a greater understanding of operating procedures and best practices of each others' Navies.

**VANU**: The Defence Minister has cautioned that the Indian Navy's presence in the South China Sea is related to exercises and for "uninterrupted passage of ships and trade". In view of the July incident where the INS *Airavat* was "quizzed" by the PLA Navy about its presence there, have there been any ramifications on future passage of IN warships in these waters?

CNS: INS Airavat had paid a friendly visit to Vietnam in July 2011. On 22 July, the ship sailed from the Vietnamese port of Nha Trang towards Hai Phong, where it was to make a port call. At a distance of 45 nautical miles from the Vietnamese coast in the South China Sea, it was contacted by a caller identifying himself as the 'Chinese Navy' stating that "You are entering Chinese waters". However, no ship or aircraft was visible from INS Airavat, which proceeded on her onward journey as scheduled. There was no confrontation involving the INS Airavat. India supports freedom of Navigation in international waters, including in the South China Sea, and the right of passage in accordance with accepted principles of international law. These principles should be respected by all.



## **Northrop Grumman**

# **TROPEX 12**

## The Navy's annual Theatre Level Readiness and Operational Exercise

efence Minister AK Antony spent two days with the Indian Navy on 7-8 February 2012 and was given a review of the expansive scope and scale of the Indian Navy's annual Theatre Level Readiness and Operational Exercise (TROPEX), overseen by the Chief of Naval Staff Admiral Nirmal Verma and the FOC-in-C, Eastern Naval Command Vice Admiral AK Chopra.

As backdrop were two completely networked fleets, widely dispersed across the Indian Ocean, operating in a dense electronic environment to match their professional and technical proficiency. New platforms, weapons sensors, communication systems and tactics were being tested and tried to optimise net combat power of the Naval fleets. Over forty surface combatants of various classes, submarines and a large number of aircraft, including UAVs, participated in the exercise. As would be the case in any operation of the twenty first century, the Exercise was of jointmanship, with the Indian Air Force deploying its top of the line aircraft including the AWACS, Sukhoi Su-30MKIs, Mirage 2000s and Maritime Jaguars, these being mid-air refuelled as required by IL-78MKIs.

The Defence Minister witnessed the stealth frigate INS *Shivalik* (F47) execute a 'surface gun shoot' and then jackstay with the fleet tanker INS *Shakti* (A57), both of which were part of the PFR 2011

The supersonic Brahmos missile launched from an upgraded Ranvir-class destroyer, during the Naval Exercise TROPEX-2012, off Vishakhapatnam on 8 February 2012



(see *Vayu* issue I/2012). For the record, the Defence Minister had commissioned INS *Shivalik* on 29 April 2010 and Admiral Verma had commissioned INS *Shakti* on 1 October 2011. The employment of INS *Shivalik* and INS *Shakti* as fully operational components of the Eastern Fleet in a short span of time "reflected the efficiency and professionalism of Indian Navy's training and operational methodology".

The carrier INS Viraat demonstrated the power of a networked force even as operational plots and pictures from remote sensors were received and collated to present a comprehensive view of the battlespace, with and effective use of weapons from various ships. IN Sea Harriers operated along side IAF Su-30MKIs, Mirage 2000s and Maritime Jaguars directed by an IAF AWACS, operating over sea for the first time which tested air defence capabilities of the INS Viraat even as the ships were operating in a multithreat scenario. The Defence Minister witnessed, first hand, the potency of the upgraded Sea Harriers (LUSH) in the networked environment.

The Defence Minister was on hand to see the successful interception of a fast, sea-skimming missile by a quick reaction surface-to-air missile. However, the climax certainly was the dramatic launch of a Brahmos supersonic long range



MARCOS naval commando slithering onto deck from a Sea King helicopter, during TROPEX 12





The Defence Minister AK Antony on board INS Viraat, flanked by the Navy Chief, Admiral Nirmal Verma and the C-in-C, Eastern Naval Command, Vice Admiral Anil Chopra, with Sea Harriers of INAS 300 in the background.

anti shipping missile, from a recently up-graded *Ranvir*-class destroyer.

Whilst on board the INS Viraat, Mr AK Antony witnessed demonstrations of vertical landings by various aircraft types embarked, including Sea Kings, Sea Harriers and Chetaks as also demonstrations by MARCOS naval commandos using Combat Free Fall techniques.

Addressing the naval personnel, Antony said he was "very happy to be on India's most prestigious warship" and added that by early next year the Indian Navy was likely to operate another aircraft carrier, the INS *Vikramaditya* with the first Indigenous Aircraft Carrier (IAC-1) joining the fleet some years later.

Stating that '26/11' had changed the security matrix of the country, he said that the entire nation acknowledges the critical requirement of maritime security and the important role of the Indian Navy. Complementing the men on their professionalism, the Minister added "... wherever we go (abroad), Indian Navy is the most sought after service...numerous countries want more cooperation with the Indian Navy".

Acknowledging the difficult working conditions afloat, the Defence Minister

said "I know that having more ships alone is not enough, your welfare is also very important. I assure you that we are improving your service conditions and living conditions". On completion of his two day visit, Antony said "The Indian Navy is increasing its capability to meet their ever increasing challenges and responsibility successfully. The country is proud of the capabilities and dedication of the Indian Navy." He expressed his confidence in the IN : "We can be confident that maritime security including coastal security of our country is in the safe hands of the Indian Navy".

Sukhoi Su-30MKI of No.30 Squadron IAF in-flight refuelling Jaguar A LOW

### **Brahmos**

# Amphibious Ops – Back in the Lead

Richard Gardner reports from HMS 'Bulwark' on how the Royal Navy and Royal Marines are gearing up to maintain a global amphibious capability.

ate in 2011 the UK's impressive amphibious capabilities were shown off to invited international guests, MPs and the media. Unusually fine weather for the time of year in Southern England allowed helicopters and surface ships of the Royal Navy to provide a variety of demonstrations depicting how its marine forces provide cost effective capabilities that are held at very high readiness levels, able to deploy anywhere in the world.

The UK's Strategic Defence and Security Review (SDSR), which emerged in 2010, imposed severe cuts in spending as a result of the need to plug a procurement hole in the defence budget which had expanded to no less than £35 billion. While the resulting cuts in the number of aircraft and ships in service has caused major controversy in Britain, with many retired Service Chiefs and many observers campaigning that this harsh medicine has gone too far in culling front-line



capabilities, one area that has emerged relatively unscathed has been the UK's amphibious warfare capability, which comprises probably the most flexible mix of specialist ships and helicopters in NATO.

While comprising just 4.4% of UK military manpower, currently the Royal Marines provide 43% of front-line



'badged' Special Forces. Their ability to deploy and operate using helicopters, fast boats, hovercraft and landing craft, as well as land vehicles, gives them a combat agility and command capability that is ideal for expeditionary operations that are such a feature of today's warfighting and peacekeeping tasks. The so-called 'Arab Spring', last year, and the growing threat to world trade from pirates, has only served to underline the uncertain nature of modern military operations and the need to retain capability to deal with shortnotice as well as more strategic threats. Providing purpose-built warships with large helicopter decks and boat-launching docks that can operate and sustain operations in all climates and for extended periods, requires not only the right mix of ships and aircraft, but also the training and logistical support that will allow safe and successful operations thousands of miles from fixed facilities, and with highly trained and skilled personnel. The added command and control functions that must accompany these global missions means that every aspect of deployment



must be planned and provided for, so that truly self-contained force levels can become established and protected with minimum delay. This extends into such areas as taking sophisticated, networked, satellite communication-equipped command centres into remote locations, building 'beachhead' refuelling depots and HQ facilities for forward helicopter detachments, and providing the shipboard repair and maintenance facilities needed to keep them serviceable.

HMS *Bulwark* is currently the RN's Flagship and its commander, Captain Alex Burton RN, told *Vayu* that this Landing Platform Dock (LPD) is available at 2-days notice to deploy, or five days to sail anywhere overseas for continuous operations lasting up to four years. With 350 crew, the 20,000ton ship can carry over 300 fully equipped troops (with over 300 more in a surge state) and over 60 heavy vehicles. A maximum of up to 900 people can be sustained for nine months. The ship has extensive de-salination facilities to produce drinking water each day, hospital and catering facilities,

massive internal accommodation spaces and on-board workshops. He said that the ship could deliver to an overseas theatre of operations the equivalent cargo capacity of 100 C-130s or 33 C-17s. The rear flight deck, which covers the rearloading boat dock, is capable of operating three Merlin helicopters, two Chinooks, or more Lynx, but it does not have an aircraft hangar and so protected maintenance would normally be provided aboard an accompanying ship such as the carriers HMS Ocean or HMS Illustrious, or Fleet Auxiliaries. A Rubb portable hangar could be erected on the Bulwark's flight deck for helicopter maintenance protection from the heat or cold, but this would be for use with the ship at anchor rather than underway on the open seas. HMS Albion is the sister ship to HMS Bulwark and both ships are relatively young, having been introduced in 2003 and 2004, and are exceptionally well equipped with all the necessary communications to direct a major deployed coalition operation.

The class of two ships has a twin role: amphibious warfare and command and control. They can be used as battle headquarters, interfacing with other ships, land forces and airborne air assets, and are the platform of choice for UK Joint Headquarters. The onboard command centre is fitted out with video conferencing facilities as well as large multi-screen command and control areas where a detailed tactical or strategic picture can be displayed, with the ability to show real-time imagery collected from airborne, radar and satellite sensors giving commanders the maximum situational awareness for timely decision-making to take place in rapidly evolving campaign scenarios. Alternatively, these facilities can be put to good use co-ordinating relief efforts over a wide area in time of natural disasters, when much local communications and transport infrastructure may have been destroyed.



HMS *Ocean* does not have a built-in dock for landing craft, which are carried externally, but it can carry and support up to18 helicopters, with a large hangar available. HMS *Illustrious* is nearing the end of a major re-fit and will replace HMS *Ocean* at sea while that helicopter carrier (LPH) has her re-fit. Capt Burton heads down" or, if necessary, destroy a hostile vessel. RM Commandos are trained to board ships from Sea King Mk.4s, or Lynx, a role in which they have been active since before the Falklands War, almost 30 years ago. The Westland SK4s, universally known as 'Junglies', have given outstanding service and were given helicopters work closely with other UK joint-force helicopter assets, depending on the requirements. This can include RAF Chinooks and Army Apaches, but clearly, training for these operations requires considerable investment in exercises working up the special skills needed for flying safely off ships at sea. No.848



describes HMS Bulwark as "the Swiss Army Knife" of amphibious capability as it can be used for just about any major role from deploying armour and troops by using helicopters and landing craft, to acting as a floating hospital or humanitarian relief HQ ship. He said, "Bulwark defines global expeditionary capability. She is very adaptable and we have true global reach. We have been to Malaysia recently and can deploy on our own for four months if need be. If we need to remain in an area for longer we can be re-stored. We can feed the ship for five months and our capacity of producing 150 tons of water a day gives an indication of this flexibility. We can also carry a huge amount of cargo including vehicles, fuel and ammunition."

Increasingly, the ship is active in the anti-piracy role, as demonstrated in the Solent, when Royal Marines used fast boats launched from the LPD to intercept and board a "suspect" pirate ship, while a Lynx provided reconnaissance and an overwatch gunship capability to "keep a comprehensive upgrade before being deployed to Afghanistan. This included additional self-defence measures, new rotor blades (increasing performance in hot temperatures) upgraded communications and avionics. Loved by their crews, they are extremely tough and reliable and pilots claim they can deliver underslung loads and troops and return to the air faster than any other tactical helicopter in service. The decision has been taken to replace them over the next few years with Agusta Westland Merlin Mk.4s. Royal Marines aircrews will continue to fly alongside RN crews on both the Merlins 4s and the new Agusta Westland Lynx Wildcats that will replace the current shipboard Lynx. Today the Lynx HAS Mk.8 remains the standard light general purpose helicopter in the Royal Navy, also serving in AH7 form with the Royal Marines as a reconnaissance and utility helicopter.

When setting up Forward Operating Bases (as with Air Groups at sea) the RN



Naval Air Squadron is the RN training squadron for the SK4 squadrons, Nos.845 and 846. No 847NAS operates the Lynx AH7s. Oshkosh tactical aviation refuelling tankers, carrying 15,000 litres of fuel each, are carried aboard HMS *Bulwark*, and are deployed to the beach-head aboard large landing craft (LCUs) or Mexi-

floats loaded inside the ship's dock or in accompanying amphibious support ships. Large air portable fuel bladders can also be set up at the FOBs and an SK4 can carry two as an underslung load. The recent demonstration day showed a range of specialist vehicles and beach command and support facilities set up after arriving by VSTOL F-35B Joint Strike Fighters from the US, the UK decided in late 2010 to switch its production orders to the naval version, the F-35C to replace its Harriers. This has more range and weapons capacity, but it requires a conventional angled deck carrier design, so the new carriers are being fitted out with suitable launch and





LCUs and helicopters. A complete beachhead command and control headquarters can be set up very quickly, complete with satellite equipment and local area radar and radio communications. Wide area airborne surveillance, warning and control can be provided by Sea King Mk.7 helicopters fitted with the advanced Searchwater radar, which although designed for air defence early warning are now used for overland as well as overwater surveillance and target tracking, being capable of multi-target identification and tracking of moving surface vehicles and small vessels, as well as UAVs and helicopters. They have a key role in providing coordinated airborne data to surface forces and can be based on land or on suitable ships. The UK has used them extensively in Afghanistan.

The Royal Navy is looking forward anxiously to reaching the point in a few years time when it can call on the support of its new aircraft carriers, the biggest ever to serve in the RN at 67,000 tonnes. Although it had already ordered a small batch of recovery systems. The RN has stated that it sees a long-term requirement to operate remotely-piloted aircraft from carriers, and the conventional carrier deck design will allow for this. This will also allow a large number of helicopters to be operated, including the Chinook, Merlin Apache and Lynx Wildcat. In the meantime, the Royal Navy intends to use its comparatively young fleet of amphibious warfare ships, which include many additional vessels with rear loading and unloading access to landing craft. It retains a fleet of hovercraft, which can be used to great advantage by Royal Marines and other Special Forces to cross coastal or river areas where there are sandbanks and mudflats, and ice-covered expanses in the Arctic.

There can be little doubt that amphibious operations are becoming more important than ever, but to operate to maximum effect requires considerable investment in specialised ships and equipment, and most important of all, specialist training.

## BOLTS FROM THE BLUE Air Commodore Jasji't Singh, Director CAPS writes on 'Air Power in the Foreign Policy of Nations'

Consider the following:

India's demography would have been different if the IAF Dakotas had not landed troops at Srinagar airfield on 27 October 1947, before Pakistani raiders could capture it. MiG-21 fighters scored direct hits on the building in Dacca where the meeting chaired by the Governor of East Pakistan was in progress directly leading to the decision of the Governor to immediately surrender and so end the war in December 1971.

Four commercial airliners hijacked by terrorists changed the sole superpower's foreign policy postures after 'nine-eleven' in 2001.

hese and hundreds of other examples exemplify the role that air power plays in the foreign policy of nations. On the face of it, just the theme of 'air power in the foreign policy of nations' might appear to be strange. This is partly because we have not paid attention to this issue, especially from the perspective that I am going to position. But the roots of this concept lie in the basic precept that military power is an instrument of the state and must (when properly employed) serve a rational political purpose. Clausewitz had argued that war-an activity undertaken by military forces-is an instrument of politics by other means. If the essential role of military power is to serve rational political goals, then those goals will need to be viewed under the headings of defence of the state, its sovereignty and territorial integrity at one level and to support the country's foreign policy to safeguard and sustain national interests through international relations, at another. The last is undoubtedly pursued through diplomacy. But diplomacy gains in strength and substance when it can rely on the availability of usable credible force which may or may not be actually employed. Most modern nationstates normally treat military power as part of the total diplomatic package

available for the pursuit of foreign policy.

An examination of the subject of foreign policy of nations would indicate that its primary objectives are the pursuit and servicing of national interests. These interests can be broadly categorised under two themes: those related to economic interests, and/or, those concerning the security and safety of the country. The first aspect, of pursuit of economic and trade interests as a major component of foreign policy, has been assuming greater salience in recent decades largely due to the globalisation processes going on in the world. Many countries, in fact, name their foreign policy establishments as 'foreign and trade'

the right to exploit them for the national good. Interestingly, it was military power that was used to expand and control the empires in order to draw the maximum economic benefit. The problem has been that we in India have tended to look at military power almost completely in the context of military goals, roles and missions and have paid scant

departments. Geo-economics has always been a key component of the foreign policy of nations. Colonial empires were established across the world with military power in search of economic resources and attention to the foreign policy linkage that military power and its employment has. This is in spite of the fact that military power, especially air power, has actually played a crucial role in support of foreign policy goals and objectives over the past six decades.

For example, take the case of UN peace-keeping operations across the world

since the Korean War five decades ago. India has firmly believed that promotion of international peace and security, and peaceful resolution of conflicts, wherever they take place, are in India's national interests. More and more UN peace-keeping operations now include air power components, making it more effective and efficient, especially in developing countries and regions where transportation infrastructure is far from satisfactory. The classical case of UN peacekeeping operations, including combat air power in the early years was the operation in Congo in 1961-62 where No. 5 Squadron of the Indian Air Force An IAF Su-30MKI, which will be spearhead of the long range strike force over the next decades.

> Technological changes in recent decades have led to the situation where air power (and space capabilities) has become the prime instrument of military power. This thinking is deeply embedded in US policy and performance. The Chinese Central Military Commission, the ultimate authority for employment of military power, for example, has concluded that air power and precision strike are now the primary means of conducting warfare, with ground operations remaining secondary. It is inevitable, therefore, that the comprehensive national power of nations would give increasing importance to building and using air power and space capabilities in the coming years.

> Similarly, international air exercises among air force of countries not only train allies, but have increasingly become a foreign policy tool to support better relations and confidence building among nations. At the same time, exercises like those conducted by the IAF with the United States Air Force in February 2004 (Cope India 04) also demonstrated to the Americans the high quality and professional capability of the IAF. This has resulted in greater respect for the country in the corridors of power of the world, while no doubt making the USAF rethink its operational evaluation of our Air Force. The ability of IAF fighters to fly across these continents for an exercise in Alaska in July 2004 clearly demonstrated the strategic reach of our air power, as also the professional acumen of our officers and men. Another classical case of our air power being employed in support of

equipped with Canberra interdictor bombers was deployed 8,000 km from home base after rebel factions decided to seek separate nationhood and the UN ordered a peacekeeping mission to ensure the integrity of the state.

#### **Instrument of National Power**

The foreign policy of nations requires that all instruments and components of national power be employed in an optimal way and synergised to pursue national interests. Historically, there are a number

of elements that go to make up a country's total national power: size, population, economy, geography, military power, etc. It is inevitable, therefore, that each of them would have an influence and role in the optimisation of the foreign policy of nations. Military power today is composed of many components, depending largely, though not entirely, on technological strength and any competitive advantage it confers on the nation, and the reach of the military. The greater the reach, the greater is its ability to influence events farther away from homeland. This is the reason why the United States maintains a military capability that has a global reach in keeping with its definition of its global strategic and national interests.

#### Rarest of rare images of what saved the Kashmir valley for India in 1947

our foreign policy goals without firing a shot was the strategic airlift of Indian expatriates from the Gulf in 1990-91. Nearly 300,000 Indian citizens living and working in Iraq and Kuwait inadvertently became hostage to the 1990-91 War in Kuwait and the Gulf region. It was obvious that our national interest required that at least all those who were willing to be evacuated could be transported by road to Jordan and accommodated in refugee camps while a massive airlift plan for their evacuation was put into place. In the threeodd weeks during which the airlift operation was going on, 171,824 persons were airlifted by the IAF transport fleet without a single incident. This was perhaps the biggest strategic airlift since World War II. More important, it demonstrated that India could airlift such a large number of its citizens from a very difficult war zone in an extremely efficient manner with indigenous capabilities. Not surprisingly, this attracted more attention in the West than in India!

There is also an obvious role for air power that becomes critical for foreign policy: access to landlocked countries like Afghanistan. For most of six decades, the only physical contact to pursue bilateral relations between Afghanistan and India has been by air. The main method of contact between the Central Asian states and India continues to rely on aircraft, some of which have been gifted by the Indian government to Afghanistan for the purpose. There are also negative



C-47 Dakota of No.12 Squadron RIAF lands at Srinagar airfield on 27 October 1947...



...men of the Ist battalion, Sikh Regiment disembark....



... and rapidly deploy to defend the airfield from the raiders.

sides which actually prove the rule.

Intelligence in all its diverse dimensions constitutes a key foundation for all foreign policy measures. In the recent past, we have witnessed the impact of intelligence failures with respect to the Iraq War, severely complicating the UK's and USA's foreign policy goals of stabilising the country after the war since the intelligence failures had deprived them of any legitimacy for having launched the war in the first place. Much of the national intelligence relies heavily on air power and space assets.

#### Air Power as a coercive instrument

There are numerous occasions and requirements when foreign policy goals may require coercion to be applied as an instrument of state policy. Coercion, of course, is a fairly common term without an agreed meaning. Perhaps the best definition of the term comes from a RAND study which stipulates, "Coercion is the use of threatened force. including the limited use of actual force to back up the threat, to induce an adversary to behave differently than it otherwise would" (emphasis in original). And very often, air power becomes the prime instrument of coercion because it has some unique attributes that allow it to play a major role in three salient areas, contributing to successful coercion: achieving escalation dominance, defeating the adversary's military strategy and magnifying third party threats. Going

## Irkut



back in history, one can find numerous examples, the most widely applied being the use of air power after the end of World War II when air power was employed by Great Britain for surveillance and air control of huge territories in the Middle East and in the northwest of India with minimal ground forces. This was a period when air power was still a fledgling force, but it also had the advantage of its psychological shock effect since the tribals on the ground were helpless against the 'bolt from the blue'.

According to a seminal study, the US employed coercive military force without necessarily leading to war in 215 incidents between 1946-75. The Soviet Union employed it for nearly as many. In the case of the United States, land-based air power was used in 103 incidents. Naval forces were used in another 100 incidents (which in most cases included the employment of naval air power). And even when naval

power and land forces were used, air power constituted a key element in that process. The sailing of the mega aircraft carrier USS Enterprise (Task Force 74) into the Bay of Bengal was a notable example of the attempt at coercion, targeted this time at India during the 1971 War for the liberation of Bangladesh. Ground combat forces were used by the United States over three decades for a coercive role in only three incidents of the total 215 incidents recorded for the period. India has itself used air power to coerce another country in pursuit of its foreign policy goals. As the Enterprise task force was sailing toward the Bay of Bengal, the IAF engaged in heavy attacks against all the airfields in East Pakistan, making them unfit for possible use for landing US forces which would have complicated India's policy choices. The air strikes by a formation of MiG-21 aircraft on the residence of the Governor

of East Pakistan in Dacca when he had called a meeting to discuss the current situation during the 1971 War is another case. The highly successful strike led to an immediate decision by the Governor to surrender.

Sixteen years later, the escalating ethnic conflict in Sri Lanka had led to a situation where the Sri Lankan forces had practically laid a siege to Jaffna in the north and the people, many of them Indian citizens among the majority Tamil population, had started to suffer heavily due to food shortages and lack of other amenities caused by a virtual economic blockade by the Sri Lanka military. Relief supplies were despatched by a flotilla of the Indian Coast Guard. But its progress was blocked by the Sri Lankan Navy, narrowing the Indian option where a direct military conflict with Sri Lanka was not in our interest. Finally, rice and food supplies were dropped from the air by An-32 transport aircraft escorted



IAF II-76s at an airbase overseas in support of IAF's Su-30MKIs on long range deployment.

by Mirage 2000 fighters in June 1987 in an operation that came to be known as the 'rice bombing' of Jaffna. This led directly to the July 1987 Indo-Sri Lanka Accord and withdrawal of the Sri Lankan Army from the northern region and Jaffna.

#### Supporting friendly regimes

Air power has been invaluable in emergencies, whether man-made or triggered by natural disasters, requiring rapid response both within the country as well as outside it. India has pursued a foreign policy to support friendly countries and to provide assistance to eliminate threats to the sovereignty, integrity and viability of legitimate governments. One of the incidents which led to the defining of the framework of future bilateral relations is the now almost forgotten incident arising out of the Ranas' revolt in Nepal in the late 1940s. The King of Nepal sought Indian assistance when things became untenable for him in 1950 and even his life was in danger. A single DC-3 Dakota transport aircraft was despatched to evacuate the King which was done successfully and peacefully, even though there were some tense moments during the process. The revolt died down and the King was restored to his throne. Therein lies the genesis of the Indo-Nepalese Treaty of Friendship which has guided the bilateral relations and foreign policy of the two countries since then. The immediate support to the Maldives in 1988 in restoring the rule of the legitimate government threatened by terrorist groups is another example.

#### **National Defence**

In almost every war that we had to fight, air power tilted the balance of success between victory and loss in our favour except in one. Our land forces (and naval forces in 1971) have performed admirably in wars often against severe odds. But we need to recognise that air power played a key role in each and every one of them, mostly providing the critical factor that created the opportunities for land forces to defeat the aims of the enemy. This reality is often ignored even by the Air Force itself. In most cases, this role was performed not so much by combat air power, but by airlift. One only has to look at the empirical evidence to grasp the reality that the defence of Srinagar

(and, hence, Jammu and Kashmir) would not have been possible if transport aircraft had not managed to put troops down on the airfield on 27 October 1947. Whether this was made possible by the delay of Pakistani forces in reaching the airfield is not the issue here. If they had understood the role of air power, or bothered to read the history of World War II, the airfield at Srinagar would have been their first objective. If the airlift had not made the landing of the troops possible, Kashmir would have been lost before we gained it. It is quite likely that the course of history of the subcontinent and our foreign policy would have run a different course.

The subsequent airlift to Leh only repeated the same scenario except under even more exacting circumstances. Poonch was another crucial episode where transport aircraft flown by young pilots landed in the restricted airstrip constantly under hostile artillery fire. Attempts to support Skardu unfortunately remained weak for a variety of reasons. But it also proves the point that adequate airlift could have made the crucial difference in saving Skardu and today's map of J&K would have been totally different. Chushul in 1962 is another case in point of successful defence in the nick of time. Similar situations arose in the defence of Siachen and its maintenance since 1984 till date.

#### **Combat Air Power**

Combat air power came to play a key role in the 1947-48 war in J&K. Its use does not seem to have been seen as escalatory or in any way inviting adverse reactions from any quarters. One can even argue that unless we look for it, the use of combat air power in that longest war that we fought might even go unnoticed! Very often, we need to look at failures to arrive at valid reasons for future policy. During the 1962 Sino-Indian War, we used air power only The IAF helicopter fleet of medium lift/ assault helicopters is being augmented by some 140 new Mi-17V-5s.

for transportation of troops and logistics and the very small helicopter capability for casualty evacuation. Combat air power was not employed in the war. The actual reasons have not been easy to discern. But one thing is clear: a major factor for not employing combat air power was the concern that our cities could not be defended (due to paucity of air defence capabilities) in case China used its airpower. The realities of the limitations on the Chinese Air Force operating from airfields on the Tibetan plateau, the limited payload that the short range combat aircraft of their air force could carry, etc. do not seem to have received the professional attention they deserved. The overall failure of the higher defence system to cope with the dynamics of the war added to the problems where the fighting men paid for the failures of planning and higher direction of war. In substance, India was self-deterred by the assumed air power of China and failed to use available capabilities to at least reduce the negative impact of the Chinese use of force.

What emerges from studies of the history of air power is that this makes a definitive contribution to the foreign policy of nations, though in negative terms in some cases where it has not been employed appropriately. For far too long we have focussed almost entirely on the kinetic shock effect of air power to the detriment of a better understanding of its psychological shock effect. Kinetic effect is unquestionably crucial. Without it, the political psychological shock effect itself would lose much of its impact since it provides the physical evidence of the impact. Management of the public information system and embedded media may enhance the psychological impact, but if the kinetic effect is at very low levels, it would be difficult to create the impressions merely by manipulating information.

# Indian Army modernisation

# ..... heeds a major push

The Indian Army, with its personnel strength of 1.1 million soldiers, has kept the nation together through various crises, including decades of insurgencies in Jammu & Kashmir and in many of the north-eastern states, ever since independence. It is a first-rate army with large-scale operational commitments on border management and in counterinsurgency operations. However, many of the Army's weapons and equipment are obsolescent and need to be modernised.

Lt Gen JP Singh, former Deputy Chief of the Army Staff, had said in an interview that "the critical capabilities that are being enhanced to meet challenges across the spectrum, include battlefield transparency, battlefield management systems, nightfighting capability, enhanced firepower, including terminally guided munitions, integrated manoeuvre capability to include self-propelled artillery, quick reaction



T-72s of the 2nd Lancers on display



surface-to-air missiles, the latest assault engineer equipment, tactical control systems, integral combat aviation support and network centricity."

While the Army has drawn up elaborate plans for modernisation and qualitative upgradation of its capabilities, the pace of modernisation has been rather slow owing to the lack of adequate funding support and timely decision making. India's defence budget remains pegged at less than 2.0 per cent of the GDP at present. According to Defence Minister AK Antony, "new procurements have commenced... but we are still lagging by 15 years." Unless immediate measures are taken to speed up the pace of modernisation, the present quantitative military gap with China will soon become a qualitative gap as well. Also, the slender conventional edge that the Indian Army has had over the Pakistan Army will be



eroded further as Pakistan is spending considerably large sums of money on its military modernisation under the head of fighting radical extremism.

Main Battle Tanks are the spearhead of India's conventional deterrence in the plains. Pakistan had earlier acquired 320 T-80 UD tanks and is now acquiring *Al Khalid* tanks that it has co-developed with China. The Indian armour fleet is also being modernised, but gradually. The indigenously developed Arjun MBT has entered serial production to equip two regiments while 310 T-90S MBTs have been imported from Russia and a contract has been signed for 347 additional T-90 tanks to be assembled in India.

A programme has been launched to modernise the T-72 M1 Ajeya MBTs that have been mainstay of the army's strike corps and the armoured divisions since the 1980s. The programme will upgrade the night fighting capabilities and fire control system of the tank. Approximately 1,700 T-72 M1s have been manufactured under licence at the Heavy Vehicle Factory (HVF), Avadi. The BMP-1 and, to a lesser extent, the BMP-1I infantry combat vehicles, which have been mainstay of the mechanised infantry battalions for





The Indian Army's ageing fleet of HAL Cheetah light observation helicopters are to be replaced by modern types, a process that is taking extended time.

long, are now ageing and replacements, capable of employment for internal security duties and counter-insurgency operations in addition to their primary role in conventional conflict, need to be procured soon.

Despite the lessons learnt during the Kargil conflict of 1999, where artillery firepower turned the tables, modernisation of the artillery continues to lag behind (see companion piece on artillery modernisation). The Corps of Army Air Defence is also faced with problems of obsolescence. The vintage L-70 40 mm AD gun system, the four-barreled ZSU-23-4 Schilka (SP) AD gun system, the SAM-6 (Kvadrat) and the SAM-8 OSA-AK need to be replaced by more responsive modern AD systems that are capable of countering current and future threats. The indigenously developed Akash surface-toair missile has not yet been inducted into service. The modernisation of short-range and medium-range SAMs also needs to be speeded up.

The modernisation plans of India's cutting edge infantry battalions, aimed at enhancing their capability for surveillance and target acquisition at night and boosting their firepower for precise retaliation against infiltrating columns and terrorists holed up in built-up areas, are moving forward, but at a slow pace. These include the acquisition of shoulder-fired missiles, hand-held battlefield surveillance radars (BFSRs), and hand-held thermal imaging devices (HHTIs) for observation at night. Protective gear also needs to be acquired to reduce casualties in war and counterinsurgency operations. Stand-alone infrared, seismic and acoustic sensors need to be acquired in large numbers to enable infantrymen to dominate the Line of Control (LoC) and detect infiltration of Pakistan-based terrorists.



The Indian Army has continuously been committed in the defence of Jammu & Kashmir for over six decades. (Above) troops in the Kupwara region, still the major infiltration route from across the LOC.



Camouflaged soldier with new equipment seen during exercises in the desert.

Similarly, the operational capabilities of army aviation, engineers, signal communications, reconnaissance, surveillance and target acquisition (RSTA) branches need to be substantially enhanced so that the overall combat potential of the army can be improved by an order of magnitude. Modern strategic and tactical



level command and control systems need to be acquired on priority for better synergies during conventional and sub-conventional conflict. Plans for the acquisition of a Tactical Communications System (TCS) and a Battlefield Management System

(BMS) need to be hastened. Despite being the largest user of space, the army does not yet have a dedicated military satellite to bank upon.

Brig (retd) Gurmeet Kanwal

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# Indian Artillery remains 'the arm of decision'

# .... but is lagging behind !

espite the lessons re-learnt during the Kargil operations in 1999 about the battle winning role played by firepower in modern war, modernisation plans of the Regiment of Artillery have been stagnating for too long. The last major acquisition of towed gun-howitzers was of about 400 pieces of 39-calibre 155mm FH-77B howitzers, having a range of 30 km, from Bofors of Sweden in the mid-1980s. Although the Ministry of Defence (MoD) has issued several global tenders to revive longdelayed plans to modernise the Indian artillery, for one reason or the other, the acquisition process has not made headway.

Since the Bofors 155mm howitzer was introduced into service, the indigenously designed and manufactured 105 mm Indian Field Gun (IFG) and its lighter version, the Light Field Gun (LFG), have also joined the inventory of guns and howitzers now heading for obsolescence. Approximately 180 pieces of 130mm M46 Russian medium guns have been "up-gunned" to 155mm calibre with ordnance supplied by Soltam of Israel. The new barrel length of 45-calibre has enhanced the range of the gun to about 40 km, with extended range ammunition.

The probability of the next conventional war breaking out in the mountains is far greater than that of any war in the plains. With this in view, Indian Army artillery recently conceptualised a requirement for an ultra light-weight towed howitzer of 155mm calibre for employment in the mountains. In January 2008, the MoD had floated a Request for Proposal (RfP) for 145 pieces of such ultra-light 155mm towed howitzers for use by the Indian Army's mountain formations. These 145 howitzers will equip seven medium artillery regiments and will cost approximately Rs 3,000 crore. This howitzer, manufactured by BAE Systems, has been trial evaluated and is likely to be acquired through the direct Foreign Military Sales (FMS) route from the US government.

The MoD has also issued a global tender for the purchase of 180 wheeled self-propelled 155mm guns for around Rs 4,700 crore for employment by mechanised forces in the plains and semidesert sectors. An RFP has also been issued for 400 155mm towed artillery guns to be



followed by indigenous manufacture of another 1,100 howitzers, in a project worth approximately Rs 8,000 crore. The RFP was issued to eight prospective bidders including BAE, General Dynamics, Nexter (France), Rheinmetall (Germany) and Samsung (South Korea).

Indigenous efforts to manufacture 155mm howitzers include that by the Ordnance Factories to produce a 45-calibre 155mm howitzer based on the designs for which 'Transfer of Technology' (ToT) was obtained from Bofors in the 1980s, but not utilised. It has been reported that the Defence Acquisition Council has approved a proposal for the OFB to manufacture 414 howitzers of 45-calibre provided the prototypes successfully meet the army's GSQR in user trials. Meanwhile, the DRDO has embarked on



The 12-tube Pinaka MBRL weapon system, developed by the DRDO, Larsen & Toubro and the Tata Group.



The 300mm Smerch multi-barrel rocket launcher (MBRL) system with a 90 km range has been acquired from Russia.

its own venture to design and develop a 155mm howitzer in partnership with a private sector company. Bharat Forge is one company known to be interested in the indigenous design and development of modern artillery systems.

There has been notable progress on the rocket artillery front. A contract for the acquisition of three regiments worth of the 12-tube, 300mm Smerch multi-barrel rocket launcher (MBRL) system having a 90 km range has been signed with Russia's Rosoboronexport. This weapon system is a major boost for the long-range firepower capabilities of the Army. Extended range (ER) rockets are being introduced for the 122 mm Grad MBRL that has been in service for over three decades. The ER rockets will enhance the weapon system's range from 22 to about 40 km. A contract worth Rs 5,000 crore has also been signed for two regiments of the 12-

tube Pinaka MBRL weapon system, developed by the DRDO, Larsen & Toubro and the Tatas. The 214mm Pinaka rockets will have an approximate range of 37 km. Two more regiments of Pinaka MBRL are likely to be added.

Efforts are also underway to add ballistic as well as cruise missiles to the artillery's arsenal. Two regiments of the BrahMos supersonic cruise missile (Mach 2.8 to 3.0), with a precision strike capability, very high kill energy and range of 290 km, have been inducted into the Army. Block-I and Block-II versions of the missile have successfully completed trials. This is an extremely versatile missile that can be launched from TATRA mobile launchers and silos on land, aircraft and ships and, perhaps in future, also from submarines. 50 BrahMos missiles are expected to be produced every year. These supersonic missiles are virtually immune to counter measures owing to their high speed and very low radar cross section and are far superior to sub-sonic cruise missiles like Pakistan's Babur. Two more regiments of BrahMos are likely to be inducted into service, including one specially designed for effective target engagement in the mountains.

Counter-bombardment capability is also being enhanced but at a slow pace. At least 40 to 50 weapon locating radars (WLRs) are required for effective counterbombardment, especially in the plains, but



only a dozen have been procured so far. In addition to the 12 AN-TPO 37 Firefinder WLRs acquired from Raytheon, USA under a 2002 contract worth US \$200 million, Bharat Electronics Limited is reported to be assembling 28 WLRs. The modernisation plans of tube-artillery alone are likely to cost approximately Rs 15,000 crore. The Shakti project concerning command and control systems for the artillery, earlier called Artillery Combat Command and Control System (ACCCS), has successfully completed user trials and is now being fielded extensively. Gradually it will be fielded up to the Corps level and the two Artillery Divisions will be equipped with these.

Despite the increasing obsolescence of present artillery guns, mortars and rocket launchers, it has not been possible to conclude contracts for their replacement. The failure to modernise the Indian artillery is likely to have adverse repercussions on national security. If there is any field of defence procurement in which the government must make haste, it is this one!

Brig (retd) Gurmeet Kanwal



Brigadier (retired) Gurmeet S. Kanwal, Director Centre for Land Warfare Systems) (CLAWS) is an artillery officer.

### DRDO

VAYU ON-THE-SPOT REPORT

# Air Show by the **Efficient, Energetic and Eclectic!**

Vayu was at the Singapore Air Show 2012 in force: five members of the editorial board covered the events at Changi first hand for readers of the Journal.



General view of aircraft on static display.





he Singapore Air Show drew a record number of trade and public visitors at this year's edition of the biennial event. Over the six-day period from 14 February, the Air Show at Changi, along the Singapore Straits, welcomed some 145,000 visitors from 128 countries over 30% coming from overseas. The show also played host to the largest ever number of top level delegations, with 266 from over 80 countries. Tickets for the public day weekend over 18 and 19 February, were completely sold out and the Changi Exhibition Centre had some 100,000 visitors over the two days who thronged the grounds where they were treated to some excellent aerial displays and had the opportunity to view an impressive array of aircraft at the static display.

The show witnessed number of deals worth over US\$31 billion. Major announcements included contracts for Boeing, Airbus, Pratt & Whitney, CFM,



Singapore's Minister for Defence Dr Ng Eng Hen and Minister for Transport Mr Lui Tuck Yew at the opening ceremony of Singapore Airshow 2012.

### Airbus showcases latest products, launches A330P2F with ST Aerospace

irbus brought both its commercial and military transport products. Centre-stage at the Airbus exhibit, located at the stand of parent company EADS (H23), was a large scale model of the all-new A350 XWB. Also on display was a model of the A320neo. Visitors to the stand were also be able obtain information on the products offered by Airbus Military. These included the A330 MRTT multirole tanker which first entered service last year as well as the new A400M airlifter, on track for delivery on the turn of the year 2012-2013. The company's range of light and medium



transport aircraft were also highlighted with a C295 surveillance aircraft model.

Airbus exhibited an ACJ318 on static display for the first time in Singapore. This corporate version of Airbus's smallest aircraft model features an attractive



interior with a lounge area and a private office / sleeping area with en-suite bathroom.

Airbus is working to market the A330 passenger to freighter programme with ST Aerospace, with the aircraft to enter service in 2016. Both the A330-300 (to come first) and -200 (due a year later) will be part of the P2F programme which also includes EADS' EFW unit. ST Aerospace will have the development lead, with EFW performing the modification and marketing.

Bombardier and ATR, a threefold increase over the total value of deals announced in 2010.

Highlights of the aerial display had the Republic of Singapore Air Force's F-15SG and F-16C in a first of its kind integrated aerial display showcasing the skills and capabilities of its pilots and aircraft, while making their Singapore debut were the Royal Malaysian Air Force's MiG-29N aerial display team, the 'Smokey Bandits'. Australian pilot Tony Blair of Blair Aerosports flew the Rebel 300 single propeller aircraft in the first stunt aerobatic performance in history of airshows in Singapore. Also thrilling audiences were the 'Roulettes' from the Royal Australian Air Force.

The Boeing 787 Dreamliner took pride of place on the tarmac at the static display, making its first appearance at Singapore as part of the third segment of the 787 "Dream Tour". The A330 MRTT multi-role



At a signing ceremony during the Singapore Air Show when BOC Aviation Pvt Ltd (Bank of China's leasing company) signed a launch customer agreement on 14 February for 20 C919 airliners from Commercial Aircraft Corporation of China (COMAC). The total 'sales' of the new airliner from China now totals 235 aircraft

tanker from Airbus Military was on display for the first time in Singapore and in addition, Airbus exhibited the ACJ318 corporate jet.

"Singapore Airshow 2012 has been a success for everyone. We have set a new record for the value of deals announced, as well as the number of visitors on both trade and public days. As a testament to the show's achievements, over 70% of exhibitors have already reaffirmed their commitment to take up exhibition space in 2014. The response from the record crowd that visited the event over the two public days was also overwhelmingly positive. We are looking forward to the next show and hope to deliver a more enhanced experience for all our visitors in 2014," concluded Jimmy Lau, Managing Director of Experia Events, organiser of Singapore Airshow. The next Singapore Airshow is planned from 11 to 16 February 2014 at Changi Exhibition Centre.

#### **Major highlights**

Airbus Military could be one of the main beneficiaries of the Singapore Air Force's next round of procurements, with aerial refueling tankers, strategic airlifters and anti-submarine warfare fixed-wing aircraft on top of its procurement list, purchases that will have the island State continue to be, for the next few years at least, the biggest spender on new defence equipment in Southeast Asia. The most dominant presence in the main hall of the Singapore Air Show was that of ST Engineering, with 3,500 sqm of display area and more than 50 exhibits in two main sections: Aerospace and Integrated Defence,



the latter comprising several capability clusters.

As articulated by Mr. Patrick Choy, Executive Vice President, International Marketing, ST Engineering, "In light of uncertain economic climate and

> constrained budgets, it is imperative that an established defence playerlikeSTEngineering demonstrates our understanding of the changing landscape, and its impact on our customers' needs."

> ST Engineering showcaseditsinnovative solutions and new ideas in engineering expertise, including a live demonstration on its integrated network centric solutions and a presentation on the Group's vision on future technologies.

Singapore's 2011 defence budget was SG\$12.1 billion (\$9.6 billion), accounting for 26% of the government budget and about 5% of gross domestic product (GDP). Some analysts estimate that Singapore, with a population of over five million, spends more on defence per capita than any country - after Israel. Aerial refueling tankers are "a priority" because the RSAF needs to replace its four Boeing KC-135Rs. An important requirement is that the new tankers be able to assist the air force's Boeing F-15SGs flying between Singapore and its overseas detachment at





awker Beechcraft Corporation (HBC) and its international distributor, Hawker Pacific, displayed a Hawker 4000, Hawker 900XP and special mission Beechcraft King Air 350ER at the Singapore Airshow. "The Singapore Airshow continues to be an important venue to showcase Hawker Beechcraft products and services to

the Asia-Pacific region," said Dan Keady, HBC vice president, Asia Pacific and India. "From the customisation of the King Air to the large cabin of the Hawker 4000 to the performance of the Hawker 900XP, our exhibit demonstrates that HBC has the breadth of products with the right capabilities to fit the needs of owners and operators in this growing region."

### NGC highlight global security capabilities

he company featured its family of Q-4 High Altitude Long Endurance aircraft such as the MQ-4C Broad Area Maritime Surveillance **Unmanned Aircraft System (BAMS** UAS), and E-2D Advanced Hawkeye. Based on the RQ-4 Global Hawk UAS. the BAMS UAS is a versatile maritime intelligence, surveillance and reconnaissance system to support a variety of missions while operating independently or in direct collaboration with fleet assets. The E-2D Advanced Hawkeye programme couples a newly designed electronically scanned radar with a matching suite of sensors, avionics, processors, software and displays to provide the "most technologically advanced command and control capability available worldwide". The AN/APY-9 radar with a twogeneration leap in capability is the backbone of this aircraft.

Mountain Home AFB, Idaho. Analysts feel that the front-runner in this competition is the Airbus Military A330 Multi-Role Tanker Transport (MRTT). Singapore Technologies Aerospace is also familiar with the A330, because it does the heavy maintenance work on Singapore Airlines' (SIA) fleet of leased A330 passenger aircraft.

Military airlift is another requirement and currently the RSAF operates five Lockheed Martin C-130Hs; the country is considering the Airbus Military A400M and the Boeing C-17.

Besides strategic airlift and aerial refueling tankers, Singapore has a requirement for fixed-wing aircraft for anti-submarine warfare (ASW), to replace the air force's nine Fokker 50 maritime patrol aircraft. ASW contenders include the Alenia ATR 42MP, Boeing P-8A Poseidon and an IAI/Elta Systems offering, which uses a Bombardier Q400. RUAG Aerospace are offering the Dornier 228NG, an example of which was on static display at the Show.



A lexander Mueller, Managing Director of RUAG Aerospace Germany with Dornier Do-228NG on static display at the show



Viking Air announced, at the Singapore Airshow, sales of eight Twin Otter Series 400 turboprop aircraft, of which two are for Papua New Guinea's OK Tedi Development Corporation, and the remaining six are floatplane variants that will be operated by Turkey's Seabird Airlines. The first aircraft for OK Tedi was delivered at the Airshow itself.

# Malaysian 'Smokey Bandits' in Singapore Debut

Appearing for the first time in the Skies above Singapore, the Royal Malaysian Air Force's aerobatic display team, the 'Smokey Bandits' (named for their characteristic exhaust from the MiG-29's Klimov RD-33 engines) flew across the Straits to put on a scintillating 5-aircraft performance.

Led by 41-year old Lt. Col. Mior Badrishah (callsign 'Smokey 1') from No. 17 Squadron RMAF, based at Kuantan, the other pilots were Capt. Mohd Azizi



(Smokey2), Maj. Razali Ahmad (Smokey3), Maj. Nasruddin Khalid (Smokey 4) and Maj. Azri Hj Ahmad (Smokey 5/solo).

The team usually performs at national occasions in Malaysia, including the Formula 1 Petronas Malaysia Grand Prix and the biennial LIMA airshow.

### Boeing showcase the 787 Dreamliner and other products



The Dreamliner comes in to land a day before the event.

The Boeing 787 Dreamliner made its Singapore debut as part of a lineup of Boeing commercial and defence products. Exhibits included the new 737 MAX, the newengine variant of the 737; the 747-8 Intercontinental in distinctive "Sunrise" livery; the F-15 advanced cockpit



simulator; and the Virtual Maintenance Trainer, which integrates advanced multimedia technology for training in support of fixed- and rotary-wing platforms. The range of Boeing platforms on static display, and in service with the Republic of Singapore Air Force, included the F-15SG fighter, the CH-47 Chinook heavy-lift helicopter, the AH-64D Apache combat helicopter, and the KC-135R Stratotanker. A US Air Force C-17 Globemaster III highlighted its capabilities during demonstration flights at the show.

### New Rolls-Royce facilities opened in Singapore

**R** olls-Royce officially opened its largest facilities in Asia, at Seletar Aerospace Park in Singapore. Constructed on a 154,000 square meter site it is the first of its kind to bring advanced aerospace highvalue manufacturing technology to Singapore. The Rolls-Royce Seletar Campus includes an Assembly and Test Unit; a Wide Chord Fan Blade manufacturing facility; an Advanced Technology Centre; and a Regional Training Centre. The Rolls-Royce

Seletar Campus represents an investment of over S\$700 million and will significantly increase the Group's manufacturing capacity and proximity to customers in the Asia Pacific region. The investment will create over 500 new jobs, bringing the number of people employed by Rolls-Royce in Singapore to over 2,000. It is expected that the Group's value-added contribution in Singapore will increase from 0.3% of GDP currently, to 0.5% of the GDP projected in 2015.

#### Productive week for Bombardier Aerospace

B ombardier Aerospace wrapped up its participation at the Singapore Airshow after an exciting and busy week during which was revealed the identity of two key airlines that had placed orders for its CRJ1000 NextGen regional jet and Q400 NextGen turboprop as well as announced an order for two Q400 NextGen aircraft.

Bombardier and Indonesian flag carrier PT Garuda Indonesia (Persero) confirmed that the airline was the unidentified customer whose order for six CRJ1000 NextGen regional jets and 18 options was announced on 10 February 2012. Garuda also announced that it plans to acquire an additional 12 CRJ1000 NextGen aircraft from a lessor.

This was followed the next day with the confirmation that Ethiopian Airlines, one of Africa's leading airlines, was the customer that placed a firm order for five Q400 NextGen airliners.

## Rockwell Collins showcase full spectrum

R ockwell Collins demonstrated a broad range of next generation avionics and communications systems spanning military and commercial applications. The show marked the first time that the company has displayed the PAVES 3 inflight entertainment system (IFE) in the region. Airlines can select from a variety of overhead and in-seat monitor combinations throughout the aircraft.

The company's Pro Line Fusion integrated avionics system, which is installed on a commercial aircraft, as well being selected for Embraer's new military KC-390 tanker, was on display. Set to debut this year, and already selected on more than ten new aircraft platforms ranging from light jets to regional airlines to military tankers, Pro Line Fusion will be bringing numerous firsts to the industry including synthetic vision on a head-up display, touchcontrol primary flight displays and autonomous backup modes. "The Singapore Airshow is the leading aviation and aerospace event in Asia, and we are excited to demonstrate our latest innovative technologies to customers in this increasingly important region," said Exelis Government Relations Vice President Bob Durbin. "As Exelis continues to expand our presence in high-growth countries, deliver technologically-advanced, proven technologies to existing and new customers, and align investments with evolving customer priorities, we look forward to strengthening existing relationships and

### ITT Exelis and aerospace/ defence technologies

developing new ones during this important event." The Singapore Airshow is the first official international event for Exelis, following its spin-off from ITT Corporation in October 2011. As a new standalone company, Exelis is more agile in anticipating customers' evolving needs and in providing capabilities such as C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance), and technical and information services. In addition to introducing the new company brand, Exelis highlighted its AIDEWS, Air Warfare Destroyer, ALQ-136 Self-Defence Electronic Warfare System, Automatic Dependent Surveillance – Broadcast (ADS-B) and the Generation 3 and i-Aware Night Vision technology.

#### Eurocopter sells EC 130 B4 to Bangladesh

n agreement was signed with AR&R Aviation on last day of the Singapore Airshow for two new Eurocopter EC130 B4, marking Eurocopter's breakthrough into the Bangladesh market with its first new civil helicopter sale. To be delivered in September 2012 and first half of 2013 respectively, the two rotary-wing aircraft will be used primarily for emergency medical services, and can be reconfigured for corporate passenger transport when the need arises. Eurocopter signed deals for a total of six new helicopters at the Show from the lightest EC120 to the heaviest EC225, to fulfill various types of missions.

### Sikorsky S-92 'Legacy of Heroes' demo helicopter on display



**S** ikorsky Aircraft Corp.'s S-92 "Legacy of Heroes" (LOH) demonstration helicopter was on static display at the Singapore Airshow. The tour's stop in Singapore followed a series of successful visits in Malaysia where customers and community residents welcomed the aircraft and celebrated

the exemplary and heroic actions of those who fly and maintain Sikorsky products around the world. Among the highlights of the tour to date were the LOH static display at the Langkawi International Maritime & Aerospace Exhibition (LIMA) air show and the presentation of approximately 70 rescue awards to members of the Royal Malaysia Air Force.

"The Legacy of Heroes tour has been logging an exciting journey for Sikorsky Aircraft since the tour launched. With each stop, visitors to the helicopter have had a chance to step inside, interact with our pilots and crew, and even sign a portion of the aircraft, thus becoming part of an interactive 'postcard' to the world," said Marc Poland, Sikorsky Director of Marketing & Communication.

The 'Legacy of Heroes' helicopter was customised by employees at Sikorsky Global Helicopters' main facility in Coatesville, Pa., U.S.A. It is a utility-configured S-92 aircraft bearing a unique gray and black paint scheme with a silhouette of first responders depicted on each side. The aircraft is fitted with sidefacing seats, a triple-litter kit, cargo hook, Search-and-Rescue Automatic Flight Control System, and night sun capabilities.

S-92 helicopters perform search and rescue (SAR) missions as well as a variety of transportation missions for VIPs including Heads of State, offshore oil and gas crews, utility and airline passengers. The worldwide fleet of 151 S-92 helicopters has accumulated more than 370,000 flight hours since deliveries began in 2004. The S-92 helicopter was certified to FAA/EASA harmonised Part 29 requirements, as amended through Amendment 47. The S-92 helicopter remains the only aircraft to have been certified to this rigorous airworthiness standard without exception or waiver.

## **RSAF transformation** to 'Third Generation AF'

he region's most powerful air force is well into its transformation toward becoming what they call a 'third generation force.' According to Chief of Air Force Maj. Gen. Ng Chee Meng, "The RSAF has completed its reorganisation



from an airbase-centric structure into a task-oriented force anchored by the five operational Commands [Air Combat, Air Defence & Operations, Air Power Generation, Participation, and UAV] and a Training Command."

The new structure will "allow for increased operational tempo, better capability to assimilate new technology and closer integration with the rest of the SAF (Singapore Armed Forces) with a view to more decisive RSAF participation in SAF operations across air, sea and land domains."

Besides the organisational changes, Maj. Gen. Ng said that the RSAF had "achieved good progress in [their] force modernisation efforts." The recently concluded (December 2011) *Forging Sabre*  live-fire exercise conducted in Phoenix, Arizona saw the RSAF plan and execute 'integrated strike operations' against a variety of targets in diverse conditions. Fixed and rotary-wing aircraft such as the F-16C/D, F-15SG (an F-15E Strike Eagle variant) and AH-64D delivered advanced strike munitions including the laser JDAM (Joint Direct Attack Munition) for the first time from an F-15SG. Additionally, Maj. Gen. Ng stated that "the RSAF's focus going forward would be on the operationalisation of recently announced acquisitions such as the IAI Heron 1 UAV and the SPYDER (Surface-to-air PYthon-5 and DERby) air defence system."

Another key area in the revitalisation of the RSAF is training. To meet modern operational requirements, the RSAF is replacing legacy training platforms with more capable and cost effective ones like the Pilatus PC-21 for basic flight training and the Alenia Aermacchi M-346 for advanced/lead-in jet training. A groundbased training system has also been acquired and is scheduled to be delivered sometime in 2012.

Maj. Gen. Ng was also keen to stress that the RSAF's transformation is a comprehensive one – and was focused on human resources development as much as organisational changes and equipment modernisation. "The RSAF has consistently proved its ability to



deliver in operations, exercises and long-term force development initiatives," he said. "Such successes would not have been possible without the commitment, hard work and professional competence of our people."













AH-64D Apache, the RSAF this year paired its workhorse combat aircraft, the F-16 with it's newest fighter, the F-15SG, the Singapore variant of the F-15E Strike Eagle. The display is a mixture of combat and show manoeuvres, closed out with an 'opposing pass' where the two aircraft pass each other at 1000 knots before climbing and exiting the area.

#### The RSAF's new jet trainer: Alenia Aermacchi M-346

n 2010 the RSAF announced selection of the Alenia Aermacchi M-346 'Master' as its advanced jet trainer (AJT) of choice for the future. The 12-aircraft contract has ST Aerospace as the prime contractor with Alenia Aermacchi providing the aircraft and Boeing the ground-based training system. At the Singapore Airshow Alenia Aermacchi confirmed that the first aircraft contracted for is scheduled to be delivered by the end of the year, along with the ground-based training system.

Destined to replace the RSAF's TA-4SU Skyhawk aircraft currently stationed at Cazaux in France, it is not clear where the newly delivered aircraft will be based. Students will transition to the M-346 from the Pilatus PC-21 turboprop trainer, itself a relatively new RSAF acquisition.

Republic of Singapore Air Force Inventory		
Туре	In Service	On Order
Combat Aircraft		
Northrop F-5S	26	
Boeing F-15SG	18	6
Lockheed Martin F-16C/D	60	
Combat Helicopter		
Boeing AH-64D	19	
Eurocopter AS332/532	31	
Boeing CH-47D/SD	16	
Sikorsky S-70	6	
Bell 412	1	
Special Mission		
Northrop Grumman E-2C	4	
Fokker F.50 (MPA)	5	
Gulfstream G550 CAEW	3	1
Tanker		
Lockheed KC-130B/H	5	
Boeing KC-135R	4	
Transport		
Lockheed C-130H	5	
Fokker F.50	4	
Training Aircraft		
Northrop F-5T	9	
Alenia Aermacchi M-346		12
Pilatus PC-21	19	
ST Aerospace TA-4SU	22	

SOURCE: Flightglobal MiliCAS, HeliCAS

## **Indian participation at Singapore**



Large Scale model of the Tejas LCA in foreground with (L-R) Capt.Vineet Samuel McCarty (Defence Advisor), Mr. Manoj Saunik JS (Aerospace) MoD, Vice Admiral Shekhar Sinha (CISC), Air Chief Marshal NAK Browne (CAS) and Rear Admiral K.S. Namballa (Technical Manager Maritime & Systems, MoD).

he India Pavilion at the Singapore Airshow was organised by the Society of Indian Aerospace Technologies and Industries (SIATI) and highlighted capabilities of some Indian entities. These included the DRDO, Bharat Dynamics Ltd, Aeronautical Development Agency (ADA), Titan Industries, Sheorey Digital Systems Ltd and Hindustan



Lt Gen Myat Hein, C-in-C Myanmar Air Force with Vice Admiral Shekhar Sinha, CISC.

*Civil Aviation in India and Opportunities; Development of Airports and Infrastructure and Investments in the Sector;* and the *Vision Plan of National and International Airlines,* including the role of Low Cost Carriers. It was 'house full' with every seat taken and long queues outside of people wishing to participate.

The High Commissioner of India in Singapore Mr. TCA Raghavan inaugurated the India Business Forum and speakers included Mr. SM Kapoor of TAAL, Mr. Ankur Gupta of Ernst & Young and Mr. Babu Peter of Go Airlines (India) Ltd.

The India Pavilion was well located and relatively large in size. Dominant in the ADA section were large-scale models of the Tejas Light Combat Aircraft (LCA) which evoked considerable interest. In fact *Vayu* met with Col. Micheal 'Tomba' Tarlton, test pilot with the US Air Force Test and Evaluation Group from Nellis, AFB who was particularly interested in the Tejas LCA trainer variant which he felt



Models of the Tejas LCA at the India Pavilion; the trainer variant on the left evoked considerable interest from visitors.

University. Conspicuous by its absence was Hindustan Aeronautics Limited.

The India Business Forum on 15 February was chaired by Dr. CG Krishnadas Nair, Head of SIATI which focused on three key topics: the *Growth of*  was "perfect" as a potential replacement for the T-38 Talon which is currently in service with the USAF.

Also, displaying interest in the LCA was the Commander-in-Chief (Air) of the Myanmar Air Force, Lt Gen Myat Hein
### **Airshow**

who engaged in discussions with Vice Admiral Shekhar Sinha, CISC who was part of the high level Indian delegation at the Show, led by Air Chief Marshal NAK Browne, the Chief of Air Staff alongwith Manoj Saunik Joint Secretary (Aerospace) and Rear Admiral Devinder Sudan, the ACNS (Air).

Air Chief Marshal NAK Browne with General Jean-Paul Palomeros (Chief of Staff of the French Air Force), holding a copy of the Vayu Aerospace and Defence Review with the Rafale on cover. The French Air Chief had interviewed with Vayu during his visit to India in the third week of September (see Issue V/2011). General Palomeros enthused about the Vayu and said how he wished there was a French edition as well!







### "Full and complete solution" Israel Pavilion displays wide range of technologies

The Israeli National Pavilion at the Singapore Airshow 2012 organised by SIBAT - the Defence Export and Cooperation Division of the Israel Ministry of Defence (IMOD) – showcased a wide range of technologies developed by nine companies, together representing "a complete solution for the aviation and defence industries."

As the Director of SIBAT Brig. Gen. Shmaya Avieli said, "This is the first time that SIBAT is organising the Israel Pavilion which assembles a wide range of Israeli technologies in the aviation, space and defence sectors, that together create a full and complete solution. As part of Israel's Ministry of Defense (MoD), we have in-depth knowledge of the Israeli defence industry. This knowledge together with our close ties with the Israel Defence Forces (IDF) and an understanding of the relevant technological concepts, enables us to tailor an ideal solution for every customer." He went on to say, "the systems developed by the Israeli industry are field-proven both in fighting terror as well as in conventional battles. The close connection between the IDF and the industry creates a situation whereby the development - and the response to needs - is one of the fastest in the world."

Elbit Systems: displayed a wide variety of next-generation systems which included the first appearance in Singapore of the Hermes 900 Unmanned Aircraft Systems (UAS) equipped with multiple payloads; the C-Music Dircm System; helicopters and transport aircraft protection systems such advanced EW capabilities, Radar Warning Receivers, Laser Warning Systems, Passive Approach Warning, Self Protection Jammers, etc; comprehensive communication array in a special demo room providing a 'live demonstration' of highly advanced Software-Defined Radios (hand-held and mounted). Personal Network Radios for individual soldiers. Tactical voice over IP radios, Tactical Video Data Links and additional products and systems on display that included avionics products and systems; the



Dominator Integrated Infantry Combat System and more.

Israel Aerospace Industries (IAI): IAI presented itself in three separate locations: the IAI chalet, a large external display, and an indoor display booth. *Total*  *Connectivity* was IAI's leading theme at Singapore, this new Total Connectivity Solutions being the technology enabling optimal communication management and real-time data transfer between control centres and operators of ISR (Intelligence,





Surveillance and Reconnaissance) and UAV systems, multi-layered defence systems and precision strike systems.

IAI's leading defence solutions utilise total connectivity to provide integrated system-of-systems capabilities for "the most demanding of operational needs – to know, to defend and to strike". IAI exhibited



various systems that can be integrated into a complete operational system which included ISR platforms, Heron TP UAS, Heron-1 UAS, Panther UAS and the hovering ETOP, Alpha Radar, Barak 8 and Arrow 2 and Arrow 3 anti-ballistic missiles, plus strike capabilities such as the HAROP loitering strike weapon, Jumper tactical rockets and Multi-Mission Tanker Transport (MMTT) were on display.

**IMI- Israel Military Industries:** This Defence Weapon System house, specialising in the development and manufacture of offensive and defensive solutions for the modern battlefield and Homeland Security. The company showcased various air-to-ground weapon systems, advanced aircrew and aircraft survivability solutions and land applications "developed to meet the challenging demands of the modern battlefield". The company presented air-to-ground weapon systems such as the MPR500 Multi-Purpose Rigid Penetration and Surface Attack Bomb and the WHIP SHOT small-size precision-strike weapon. It also displayed aircraft survivability capabilities such as the ATALD (Advanced Tactical Air Launched Decoy and Aerial Target) and Advanced Spectral Flares, capable of defeating most modern MANPADS. Also on display were several advanced Active Protection Systems (APS) for ground forces and included the Iron Fist (an advanced soft and hard kill APS aimed

IAI in contract to supply ELM-2032 fire control radars



O n eve of the Singapore Airshow, IAI announced that its Elta Systems had been awarded a contract worth \$150 million to provide fire control radars (FCR) for installation onboard a foreign customer's fighter aircraft. After an evaluation process of several possible solutions, the customer selected the ELM-2032 FCR made by Elta Systems Ltd., an IAI group and subsidiary. The modern ELM-2032 radar system implements advanced technologies that greatly enhance surveillance and fire control capabilities in air-to-air, air-to-ground and air-to-sea operation modes. The ELM-2032 is critical to the fighter aircraft's weapon system effectiveness and accuracy. It detects and tracks maneuvering targets while employing advanced techniques to lock on the target. The light-weight compact radar was developed while incorporating operational feedback of fighter pilots. Modular hardware design, software control and a flexible avionic interface ensure that the radar can be installed in different fighter aircraft and can be customised to meet specific user requirements.



at enhancing self-defence capabilities of armoured platforms, from light to heavy Armored Fighting Vehicles (AFVs), against modern battlefield threats), *Bright Arrow* (a combined soft and hard kill APS and Remote Controlled Weapon Station (RCWS) for light to medium armored vehicles) and Shock Absorber (an APS aimed at protecting infantry dismounts and stationary posts from enemy guided missiles and other threats). Additional solutions on display were two of IMI's 120mm tank cartridges, developed for the Israel Defence Forces (IDF) Merkava Mk3 and Mk4 Main Battle Tanks (MBTs).

**Plasan:** an international company engaged in the design, development and manufacture of state-of-the-art, lightweight, ballistic armour protection products and integrated survivability systems. Plasan provides customised survivability solutions for tactical wheeled vehicles, aircraft, naval platforms, civilian armoured vehicles and personal protection for military, police and law enforcement applications. The company also provides ballistic armour solutions to protect all types of tactical transport, assault and cargo helicopters, including the Blackhawk, Chinook, Bell, Puma Super and Mi-17. "The complex armour solutions for the Chinook project answer all the needs relevant to the Chinook's deployment on

#### IAI contracted for advanced EHUD

srael Aerospace Industries (IAI) has been awarded a \$35 million contract to supply the next generation of its EHUD Autonomous Air Combat Manoeuvering Instrumentation (AACMI) system to a "foreign customer." The system will provide a significant leap in performance to modern joint training capabilities for air, ground and naval forces. The new EHUD AACMI system incorporates advanced technologies such as wireless communication with aircraft avionic systems, new simulation concepts, improved and flexible data link,

greater processing power and increased data security. The system is designed to meet future concepts of military training which include complex weapon systems and distributed mission-training through Live-Virtual and Constructive (LVC) simulations.



diverse missions and in disparate battle scenarios." The company also offers a number of applications for the Hercules C-130 series aircraft.

Rafael Advanced Defence Systems: displayed its "system of systems" concept for dual use (defence and security) of persistent Wide Area Surveillance.

Systems displayed were the Iron Dome (defence system against short

range artillery rockets), *Spyder* SR/MR (short and medium range air defence system), *Derby* (beyond visual range airto-air missile and air defence missile), *Stunner* and the *Spike* family (electrooptic, tactical, precision, guided missile systems like the *Spike*-LR/ER/NLOS) Furthermore, the company exhibited the *Spice* 1000 Autonomous Precision Guidance Kits.





# Depexpo



The first batch of Dassault Mirage 2000H/TH digital delta fighters for the IAF touched down at their permanent home station at Gwalior in India on 28 June 1985 and were formally inducted by the then Defence Minister PV Narasimha Rao, the next day.

No.7 Squadron ('Battle Axes') commanded by then Wg Cdr Ajit Bhavnani was first on type, followed by No.1 Squadron ('Tigers') commanded by Wg Cdr PS Ahluwalia. It was on 31 March 1986 that the Squadrons received their new establishment orders, some 25 years ago.

The Mirage 2000H was to introduce many 'firsts' to the IAF: first pure delta-winged aircraft, first fly-by-



The 'Battle Axe' insignia shining bright at the entrance to No.7 Squadron Headquarters



The hosts : Air Cmde Pankaj Sinha AOC Gwalior and his wife Anita



Air Marshal Arup Raha, seated at the centre, with serving and retired officers of the Mirage 2000 fraternity, with a Mirage 2000 duet infront of No.9 Squadron hangar

wire system, first aircraft of extensive composite construction to go into service. The Mirage 2000 provided quick-reaction interception capability with its rapid climb to height, excellent manoeuvrability and instantaneous turnrates and once the advanced weaponry selected for it was fully integrated, became a highly potent addition to the IAF's air defence system. Most aircrew seconded to the Mirage 2000 were former MiG-21 or Ajeet pilots and conversion to the new type was extremely smooth. The Mirage was attractive to fly, most forgiving in handling while landing, even at high angles of attack and above all, far less demanding than the MiG-21.



Wg Cdr Ajit Bhavnani became the first IAF pilot to fire a BVR missile and No.7 Squadron also pioneered all-aspect close combat missile tactics with the Magic 2 and these tactics were subsequently disseminated to the entire Air Force to become *de rigueur* tactics.

Earlier, a Mirage Project Team (MPT) had been formed in Paris to coordinate induction of the Mirage 2000s into the IAF led by Gp Capt AY Tipnis (later Air Chief) with eight technical officers to oversee contract implementation and liaise with various French organisations and vendors. The MPT came directly under the then Air Attache in France, Air Cmde Tirlochan 'Tango' Singh with Air Chief Marshal Idris Latif as India's ambassador in Paris. It was a 'unique constellation of stars' which were to oversee the Mirage 2000 conversion and induction into the Indian Air Force.



Back in India, feverish preparations had begun to upgrade the air station at Gwalior in central India, considered in the 'backwaters', still then housing No.2 BRD and No.11 Squadron with a few Avro 748s. No.40 Wing was formed at Gwalior on 28 November 1982 with Air Headquarters' decision to make Gwalior the Mirage 2000 base. A siting board for induction of two Mirage 2000 Squadrons was instituted and under the dynamic leadership of then Air Cmde



At the grand evening celebrations, Air Marshal Denzil Keelor and Flg Offcr Sandeep Khokhar cutting the Mirage Silver Jubilee cake

Denzil Keelor, the Maharajpur airbase at Gwalior was transformed on time to house the new fighters. (*This will be the* subject of a comprehensive history being compiled for publication by The Society for Aerospace Studies later in the year.)

A quarter century later has No.40 Wing housing not only the three Mirage 2000 squadrons (No.9 'Wolf Pack' Squadron was re-equipped with the type after phasing out its MiG-27s) but also the Tactics and Combat Development Establishment (TACDE) which moved to Gwalior from Jamnagar. TACDE produces 'top guns' of the Indian Air Force and with the routine fly-in of detachments from other Squadrons including Jaguars, Su-30s and MiG-27s, Gwalior is now truly India's 'Fighter Town'.

Back to the Silver Jubilee Celebrations at Gwalior on 25-26 February 2012: Welcomed by Air Cmde Pankaj Sinha, AOC Gwalior were Air Marshal Arup Raha, AOC-in-C Central Air Command and scores of former Mirage 2000 pilots and engineers, many of whom had risen to 'command heights' including Air Marshals Denzil Keelor and Ajit Bhavnani. Very unfortunately, just a day before the events began, Air Marshal Anil Chopra, currently AOP at Air Headquarters and Commodore Commandant of No.1 Squadron had to eject from a Mirage 2000 trainer along with the CO No.1 Squadron Wg Cdr G Ram Kumar. Fortunately, there were

no serious injuries to the aircrew nor casualties on the ground where the aircraft crashed near Bhind (MP). Air Marshal Anil Chopra was amongst the first batch to convert on the Mirage 2000 in France and is a test pilot with flawless flying record. The Mirage engine had flamed out and inspite of several attempts did not relight. A Court of Inquiry was immediately instituted.

The programme on 25 February began with a seminar on 25 Years of the Mirage





2000 at No.9 Squadron's briefing hall, followed by a massive 'Bada Khana' in the HS-4 Hangar. The more intrepid went off for golf in the afternoon while others had time off before they reassembled at the Residency Officers Mess for what turned out to be a truly magical evening. The officers and their ladies had planned on a befitting programme which included a professionally choreographed sound and light show, presentations of mementos and symbolic cutting of the Silver Jubilee cake by Air Marshal Denzil Keelor accompanied by the youngest Mirage 2000 pilot, Flg Offr Sandeep Khokhar, with barely 10 hours on type.

The evening carried on late into the night with the bar overflowing, music overwhelming and the fare varied and sumptuous.

Breakfast next morning was at No.7 Squadron tarmac, some Mirage 2000s neatly parked under a special canopy to protect them from the sun (Gwalior summer temperatures can exceed 50°C on the tarmac) as guests watched the Air Warrior Drill Team's meticulous display. Officers and their families visited their erstwhile Squadrons amidst much nostalgia before a quick lunch and departure from Maharajpur.

With the IAF's fleet of Mirage 2000s being extensively upgraded, (see *Vayu IV/2011*), the Digital Deltas will soon enter their golden phase!





Air Marshal Arup Raha AOC-in-C Central Air Command, flanked by Air Marshals Ajit Bhavnani and Denzil Keelor at No.7 Squadron breakfast morning.



Arjun main battle tanks on parade at New Delhi : now in series production, this 'heavy' main battle tank has performed well in comparative trials against imported MBTs.

Licence-produced at the Heavy Vehicles Factory (HVF) Avadi until 1998, some 1950 T-72M1 'Ajeya' main battle tanks remain the backbone of the Indian Army MBT fleet. The T-72 introduced the excellent 125mm smoothbore gun in the Indian Army while the combat weight of 41.5-tonnes reflected Russian advances in metallurgy technology, to develop a relatively "lighter" Main Battle Tank (MBT), with formidable

firepower alongside robust armour and self-protection devices. The 780-hp V-12 air-cooled, multi-fuel injection, engine with 1600-litres (with extra tanks) fuel has permitted rapid cross country capability, a primary component of the Army's 'Shock & Awe Doctrine'''.

The 1990s witnessed severe budgetary constraints and therefore limited inductions of military hardware in branches of India's armed forces. However Pakistan managed to surprise Indian defence planners by their purchase of T-80UDs from the Ukraine, forcing the Indian Army to "rush for" 310 customised 47.5-tonne T-90S MBTs from Russia with formal agreement signed on 15 February 2001. The T-90S is export version of the T-90M and features a welded turret, the 1,000-hp V-92S2 four-stroke diesel engine and an ESSA thermal viewer. More acquisitions were to follow especially in context of repeated delays in induction of the indigenous Arjun MBT. In July 2006, it was reported that the Ordnance Factory Board (OFB) was awarded a US \$2.5billion deal to produce 1,000 customised T-90S tanks for the Indian Army. Yet



The T-72 'light' main battle tank is the backbone of the Indian armoured force, with an excellent 125mm smoothbore gun and robust armour and self-protection devices.

again, it was reported on 27 October 2006, that the Indian Army had signed another deal worth US \$800-million for 330 T-90S MBT.

The T-90S's 125-mm 2A46M smoothbore gun is stabilised (Zhasmin 2E42-4 system) in two axes and is fitted with a thermal sleeve. The gun fires a total of forty-three (43) various ammunition including Armour Piercing Fin Stabilised Discarding Sabot - Tracer

(APFSDS-T), High Explosive Anti-Tank (HEAT), High Explosive Fragmentation (HE-FRAG) as well as shrapnel projectiles with time fuses. In addition it can also fire a special HE-FRAG projectile that can be detonated over the target using the tank's fire-control system. Maximum rate of fire is at 7-rounds per minute. The gun can also fire the semi-automatic laser beam riding 9M119/9M119M Refleks (AT-11 Sniper-B) Anti-Tank Guided Weapon (ATGW) with a hollow charge warhead at a range between 75 to 5000-metres and is designed to engage tanks fitted with Explosive Reactive Armour (ERA) as well as lowflying helicopters.

### Rafael AD



The hull and turret are protected by both conventional armour-plating and the latest generation Kontakt-5 ERA as protection against APFSDS and HEAT projectiles. In addition to being fitted to the hull and turret, ERA panels are also fitted either side of the hull front to provide lateral protection to each side of the driver's compartment. The customised T-90S 'Bhishma' features the Kaktus K-6 bolted ERA package on its frontal hull and turret-top. The tank also has Nuclear, Biological and Chemical (NBC) protection. The 1A45T Integrated Fire Control System (IFCS) is automatic, but has manual override for the commander. The tanks are equipped with the French Thales-built Catherine-FC thermal sights and Saab LEDS-150 Land Electronic Defence System active protection system will be integrated. The first batch of 10 licence built (at HVF at Avadi) T-90S 'Bhishma' was inducted into the Indian Army on 24 August 2009, which Service plan to have 1,640 T-90S tanks in service by 2018-2020.

Designed and developed by the Combat Vehicle & Research Development Establishment (CVRDE) to provide "initial breakthroughs" in critical enemy sectors, the indigenous 58.5-tonne Arjun MBT entered service with the Indian Army in 2004. The tanks were first inducted into the 43rd Armoured Regiment which was later built up to full regiment strength in 2009. The latest induction has been to the 75th Armoured Regiment on 12 March 2011. In March 2010, the Arjun was pitted against the T-90S in comparative trials and performed surprisingly well. Indian Army placed an order for an additional 124 Arjun Mk.I MBTs on 17 May 2010 and 124 Arjun Mk.II MBTs on 9 August 2010. The engine and transmission are provided by German companies MTU and Renk respectively. The MTU 838 Ka-501 ten cylinder, watercooled diesel engine generates 1,400-hp and is integrated with an Indian turbocharger and epicyclic train gearbox with four forward and two reverse gears.

The Armament Research & Development Establishment (ARDE) has developed the 120-mm rifled gun made of ESR steel and fitted with a thermal sleeve and fume extractor. The thermal sleeve prevents irregular temperature distribution on to the tube due to the weather influences. The 120-mm rifled gun will fire APFSDS, High-Explosive Squash Head (HESH),



Initially imported, the T-90S main battle tank (named the 'Bhishma') is to be licence manufactured by the OFB and become mainstay of the Indian Army for the next decades.

High-Explosive Anti-Tank (HEAT) and smoke rounds at the rate of 6 to 8-rounds per minute and the Israeli semi-active laser guided LAHAT gun-launched missile designed to defeat both enemy armour and combat helicopters. The thirty-nine (39) rounds of ammunition are carried in special blast-proof canisters. A new high energy propellant is used in the 120mm rifled gun to give a higher muzzle velocity and therefore greater penetration characteristics. A 7.62-mm machine gun is coaxial with the main armament and a 12.7-mm anti-aircraft (AA) machine gun is fitted for AA defence.

The Bharat Electronics AL-4421 Mk.1B integrated digital Fire Control System (FCS) installed in the Arjun Mk.1 MBT consists of a laser rangefinder, ballistic computer, thermal imaging night sight, meteorological sensor and stabilised panoramic sight for the tank commander, stand-by (articulated) sighting telescope, Global Positioning System (GPS) and an electronic gate to ensure a first round hit probability. The third generation director type, fire control system with a 120-mm gun electronically slaved to the sights, enables the gunner to locate, identify, track, range and engage moving targets while in movement. The gunner's main sight consists of a day sight, thermal sight, laser rangefinder and stabilised head common to all three channels. The common sighting head mirror is stabilised in elevation and azimuth. The day sight has dual magnification while the thermal imager provides a night vision facility to the gunner and the commander to observe and engage targets under conditions of total darkness and smoke.

The laser rangefinder is integral with the gunner's sight. The panoramic sight enables the commander to affect an all-round surveillance on the battlefield without moving his eyes from the sight and without being disturbed by motion of the turret. The field of view is stabilised with the help of a two-axis rate gyro mounted on the platform of the head mirror. The sight has dual magnification. The ballistic computer computes the gun laying data based on information provided by a number of sensors mounted in the vehicle and on manual inputs and provides the signals corresponding to the tangent elevation and azimuth offset. To increase accuracy of the firing, the fire control system has a coincidence window that allows firing of the main armament only when it reaches the desired position as dictated by the computer.

Production Arjun MBTs will also have new composite laminate armour called Kanchan produced by Mishra Dhatu Nigam Limited (MDNL) to defeat APFDS or HEAT rounds that will be a vital component in hands of defensive 'holding' Corps besides providing 'initial breakthroughs' in critical enemy sectors complementing the T-90S in the process. The tank also has a NBC system that is designed & built by Bhaha Atomic Research Centre (BARC) and a night vision device built by Instruments Research & Development Establishment (IRDE). To further enhance combat survivability, the tank has an auto-fire detection & suppression system. A Mobile Camouflage System has been developed and integrated into the Arjun MBT as part of the 'Development of Defensive Aids System' project in collaboration with Barracuda Camouflage Limited, to reduce the vehicle signature against all known sensors and smart munitions. An Advanced Laser Warning Countermeasure System (ALWCS) developed jointly with Elbit Systems Limited of Israel consists of a laser warning system, Infra-Red (IR) jammer and aerosol smoke grenade system.

Sayan Majumdar

### Alenia Aermacchi's C-27J in the Indian Context

Proven as the Indian Air Force's transport fleet is to be modernised, the twin aim is to develop an indigenous aerospace industry involving, for the first time, private industries. The Avro 748 replacement is starting point for this ambitious project which will be an essential requirement of the Request For Proposal to be issued shortly.

According to Alenia Aermacchi, "we shall respond to the RFP that foresees the acquisition of 56 aircraft, 40 of which will be built in India with an Indian partner, by offering our C-27J Medium Tactical Transport aircraft."

Alenia Aermacchi is part of the Finmeccanica Group, one of the major players worldwide in technology and defence. Finmeccanica is supporting the Alenia effort to enter in the Indian market.

The Alenia C-27J has excellent handling qualities with its performance well-suited for the Indian theatre that includes operations in high mountains, in hot weather and over long distances. The C-27J has proven capability, being used in similar terrain in Afghanistan, with excellent results in terms of availability (more than 90%), performance and safety. Performance from unprepared strips, short take off and landing performance with high technology, accurate navigation system amongst characteristics most appreciated, which allows for safe and effective operations in all weather conditions, day and night.

The C-27J's high cruising speed is comparable with the IAF's C-130J and the wide flight envelope that gives a service certificate of up to 30,000ft, safely above high mountains, makes it suitable for the Indian Air Force inventory.

Equipped with radar, laser, infrared and missile warning defensive aids, having fast climb and descent rates and segregated systems, the C-27J can operate in hostile environment with a high degree of safety.

The C-27J is designed to carry 11 tonnes of cargo within its wide cargo area or 60 fully-equipped soldiers or up to 46 paratroopers. In the medevac configuration, 36 stretchers and 6 medical assistants can be accommodated which



makes the C-27J most effective for humanitarian relief operations. On the ground, both cargo floor height and nose attitude can be adjusted to ease the loading of cargo and vehicles. The cargo area's large cross section (a clean box 2.45x2.25 meters with a max height of 2.60 meters) is combined with floor strength capable to support loads of up to 4,900 kg/m.

The C-27J is endowed with new generation technology that optimises

maintenance costs and allows continuous monitoring of the fleet. Furthermore, commonalities with the Lockheed Martin C-130J are extensive which reduces acquisition of spares, training and life cycle costs. The Rolls Royce engine, Northrop Grumman radar and more than 60% of avionics are common.

The C-27J has been ordered by the Air Forces of Italy, Greece, Bulgaria, Lithuania, Romania, Morocco, Mexico and the USA.

### **Maritime Patrol Aircraft developments**



#### Finmeccanica support for ATR 72 MP

Finmeccanica, through its company Alenia Aeronautica, has been awarded a Euro100 million contract by the General Directorate of Air Armaments of the Italian Defence Ministry for logistical support services for the four ATR 72 MP (Maritime Patrol) aircraft ordered by the Italian Air Force in 2008. The contract envisages the supply of technical and logistic support services for five years and the implementation of a series of configurations designed to improve capabilities of the aircraft when deployed on maritime patrol and surveillance activities.

The ATR 72 MP, based on the ATR 72-600 regional transport aircraft platform, is a maritime patrol version specifically developed by Alenia Aeronautica. The Italian Air Force's ATR 72 MP aircraft are equipped with the Airborne Tactical Observation and Surveillance System (ATOS) built by SELEX Galileo, also a Finmeccanica company, which includes an electronic scanning radar and a sensor for the visual identification of seagoing vessels and people in any weather conditions.

#### IAI Elta, Bombardier team on Q400 MPA

The Elta Systems Division of Israel Aerospace Industries (IAI) has teamed with Bombardier to offer a maritime patrol aircraft based on the latter's Q400 twin-turboprop.

Avishai Izhakian, deputy general manager of Elta's airborne systems and radars division, has said that the Q400 was being offered as a direct replacement for the Lockheed Martin P-3 Orion. "This aircraft has very low operational costs and gives the crew a very comfortable working environment," he stressed.

The maritime patrol, anti-submarine warfare and search-and-rescueconfiguration aircraft is being offered by Elta/Bombardier in co-operation with Canada's Field Aviation. Its main sensor is the Israeli company's EL/M-2022 maritime surveillance radar, with the package also including optical payload and signals intelligence-gathering equipment. The partners are using the experience gathered in adapting Bombardier's Q300



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for maritime patrol applications with the Elta radar for nations including Iceland and Sweden.

Izhakian said the Q400 version has a "very big" market potential, as countries are more aware of the need to monitor seas for multiple threats, including piracy. The Israeli Navy is among those to have expressed interest in a Q400-based maritime patrol capability, although budget problems have so far delayed formal negotiations. The Service currently uses the legacy IAI 1124 Westwind, although Israel is also now using IAI Heron unmanned air systems for closerange maritime surveillance.

#### Indra develops light maritime surveillance aircraft

Indra is working on development of a new maritime surveillance light aircraft in collaboration with Italian aircraft manufacturer Tecnam, plus SELEX Galileo, FLIR Systems and Remote Sensing and Sensor Integration company Airborne Technologies.

The five partners seek to develop an aircraft equipped to provide state-of-the-



art surveillance at a more competitive cost in terms of acquisition and operation. The aircraft will engage in rescue missions, protection of fishing fleets and environment and surveillance against illegal trafficking. The aircraft will be cleared to enter service by end 2012, and be deployed in those maritime zones usually under surveillance with mediumsize helicopters but at considerably reduced cost and more efficient equipped with maritime surveillance system (radar, AIS vessel ID system and electro-optical device). The participation of Indra, SELEX Galileo, FLIR Systems and Airborne Technologies contribute knowledge and experience to this project. Indra will undertake the implementation of the mission system, the key element to control embarked sensors, integrate collected data and present them to the operator.

The aircraft will be equipped with SELEX Galileo's Seaspray 5000E radar which is capable of detecting vessels or small objects at sea. It will also carry a state-of-theart electro-optical camera of large format and high definition of FLIR Systems.

100% maritime awareness and protection.

Surface and underwater surveillance is critical to ensure the safety and security of coastal borders and offshore zones. SELEX Galileo's ATOS system combines the latest generation AESA radar, EO and Sonic sensors in a field proven mission system that is operated daily by customers across five continents.

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#### Airbus Military contract with Indonesia for nine C295s

Airbus Military has signed a contract with PT Dirgantara Indonesia (PT DI) to supply nine C295 military transport aircraft for the Indonesian Ministry of Defence, the contract witnessed by Minister of Defence, Prof. Dr. Purnomo Yusgiantoro, and the Chief of Armed Forces, Admiral Agus Suhartono, at the recent Singapore Airshow. The Indonesian designation of the aircraft will be CN295 and operated by the Indonesian Air Force. The aircraft will perform a variety of roles including patrol, logistical, humanitarian and medical evacuation missions. The first delivery is in 2012 and by summer 2014 all aircraft will have been delivered.

Additionally, the industrial plan involves substantial collaboration between PT DI and Airbus Military for the C295 programme including manufacturing of the tail empennage, rear fuselage and fuselage panels, as well as work packages for the development of Computer Based Training systems and the creation of a service and delivery centre plus final assembly line (FAL) in Indonesia.

#### **ITT SLS for P-8 Poseidon**

ITT Corporation have completed initial qualification testing on a new, environmentally friendly Sonobuoy Launching System (SLS), a high-tech ejection system for the US Navy's P-8A Poseidon aircraft. The SLS enables conducting of anti-submarine/ anti-surface warfare or intelligence, surveillance and reconnaissance missions with release of more sonobuoys, the improved design of the SLS eliminating use of electro-explosive cartridges that had to be discarded and replaced after every single release. Instead, the SLS uses compressed air in the release process, an innovative method designed to reduce wear and tear to the launching system and decrease the amount of maintenance needed, thereby lowering life cycle costs and reducing impact on the environment. With successful completion of these tests, the SLS will move into low rate initial production and will be installed on the US Navy's P-8A and the Indian Navy's P-8I variant being built by a Boeing-led industry team.



## IAI Elta



## Indian UAV programmes



#### Lakshya II PTA demonstrated

Flying at sea skimming height of about 12 meters at a DRDO's test range near Balasore, the Lakshva-II advanced version of DRDO's Pilotless Target Aircraft (PTA) demonstrated its full capability on 25 January 2012. In a flight lasting over 30 minutes, the Lakshya was made to come down from an altitude of around 800 m to just 12 m and maintain the required altitude for a specified time before demonstrating an auto climb-out. The entire flight was pre-programmed and "was totally successful". It demonstrated various technologies and sub-systems including software correction to auto rudder scheme done to prevent loss of mission, engaging and flying in way point navigation mode while carrying 2 tow targets. During the flight, one of the tow targets was released and the other deployed while way point navigation was on. This was the 10th flight of the Lakshya-II PTA and the first time

that the "ultimate capability" of the Lakshya-II was demonstrated. Lakshya-II has been designed and developed by the Bangalore-based Aeronautical Development Establishment, specialising in UAVs and flight control systems.





#### Micro and mini air vehicles

The Aeronautical Development Establishment has conducted flight trials of micro and mini air vehicles (MAV) at Hoskote, near Bangalore, the flight demonstrations being witnessed by Dr. Subhananda Rao, Chief Controller, R&D (Aero) and P S Krishnan, Director of the ADE. These products are being developed jointly by ADE and NAL and supported by private vendors to meet many requirements including counter terrorism and for rescue operations during natural calamities. These micro vehicles would be in full autonomous mode, transmitting live day and night video to portable Ground Control Station (GCS) in real time.

Three MAVs - Black Kite, Golden Hawk and Pushpak with varying sizes ranging from 300 to 450 mm, and a maximum all up weight of 300 gms to 500 gms, have been flight demonstrated with an endurance of 30 minutes carrying a miniature daylight video camera as payload to relay the imagery of gaming area to the GCS during its flight. The video and telemetry range is about 2 kms.

Another two mini UAVs - *Imperial Eagle* and *Sly Bird* -which are categorised as under 2 kg class vehicles and having an endurance of one hour, were also demonstrated and these vehicles carrying either a daylight camera or thermal, night vision camera as payload with capability



for both day and night surveillance. These vehicles are hand-launched and recovered through soft landing with a service ceiling altitude of 15000 feet. These vehicles are fully autonomous with programmed way point navigation and the way points can also be changed through tele-command during the flight. The video and telemetry range is about 10 km with a ground tracker system capable of providing continuous imagery irrespective of attitude of the aircraft. Logistics support and skills required for operating these vehicles are very minimal and these can be easily deployed and also be carried as a soldier's back pack.

Interestingly, involvement of private industry has been from the development



phase itself. The autopilot, developed indigenously by Idea Forge Mumbai, has been integrated with both mini and micro air vehicles, which firm also had the responsibility of integrating the gimbal mounted thermal camera. Another Group, Aurora Integrated Systems was also associated in the development of autopilot and production of MAVs. They also integrated their auto pilot with ADE's data link and single axis tracker developed by Badave Engineers, Pune. Seagull Technologies, Bangalore was involved with the fabrication of carbon composites based airframes.

VS Chandra Shekar, Programme Director, National Programme on Micro Air vehicles (NP-MICAV) has said that "a number of projects have been initiated under this programme across various R&D labs and academic institutions". He reiterated that it is possible in due course, to demonstrate cooperative missions using multiple heterogeneous air vehicles possibly acting as a force multiplier. Dr Ramesh of NAL and BP Shashidhara, Project Director, Mini UAV have highlighted the technical capabilities and salient features of these air vehicles.



### **UAVs in Afghanistan**

There is high demand for the RAF's Reaper unmanned aerial vehicles (UAVs) as being "eyes in the sky" keeping tabs on the insurgency in Afghanistan. Capable of providing persistent presence over an area of interest and relaying intelligence to commanders on the ground in the form of clear, full-motion video or verbally over the radio, it is little surprise that the Royal Air Force's cutting-edge Remotely Piloted Air System and the specialists who fly it are in such continuous demand.

Introduced in the Afshan theatre in October 2007 to meet an urgent operational

requirement, the UAVs have gone on to notch a landmark 25,000 flying hours over Afghanistan. Equipped with an array of hi-tech sensors, including radar, that collect real-time information on the battlespace day and night, Reaper can carry out a wide variety of tasks in support of ground units, from gathering pre-raid intelligence on target compounds to providing surveillance for routine patrols and supply convoys. If necessary, the UAVs can also strike at insurgent forces with precision-guided weapons. With a maximum altitude of 50,000ft (15km) and powered by a Honeywell engine that offers a low noise signature for discreet operations, the Reaper routinely provides front line troops and commanders with an unblinking eye in the sky.

The Reapers are launched and recovered from Kandahar Airfield; however, once airborne, missions are remotely flown by crews from No.39 Squadron RAF via secure satellite communication data links from a ground control station at the Creech Air Force Base in Nevada, USA. The three-man team charged with flying this sci-fi-style surveillance system consists of a qualified pilot, sensor operator and mission intelligence coordinator (MIC).

With a small contingent of seven Intelligence Corps personnel bolstering the 130-strong, tri-Service squadron stateside, it is from the 'cockpit's' third seat that the Army is playing its part in the Reaper success story. "During a mission, the MIC's role is to manage intelligence-collection to meet the supported unit's requirements, to monitor the feeds and inform the pilot of any relevant information," said Major Simon, second-in-command of mission support flight.

"To simply look through sensors with no situational awareness would be like looking at a scenario completely blind - it is all that other information which puts what Reaper can see into operational context."

### The UAVs of Israel: marking 40 years

On 2 October 2011, the Israeli Air Force (Is.A.F) marked 40 years since establishment of its first Unmanned Aerial Systems (UAS) Squadron No.200, located at Palmachim. Israel Aerospace

Industries (IAI) has led the UAS development over the past 30 years, since fielding the Is.A.F's first ever operational UAS, the Scout and on till the Heron Turbo Prop' UAS. The Scout UAV entered operational service in 1981 and excelled in the 1982 *Operation Peace for Galilee* (First Lebanon War) being retired only in 2004.

IAI's Searcher UAV became operational in 1992 and underwent an upgrade in 1998 with entry of the Searcher II that included better engine performance and advanced navigation and communication systems. In addition to the Is.A.F, Searcher is in service with 10 different operators worldwide, including the Spanish Air Force that operates this UAV in Afghanistan.



In 2005, the IAI Heron UAS, named Shoval, was inducted and IAI maintenance teams support the Shoval UAS and its high operating tempo all year round. The Heron MALE UAV weighs one ton and has a wingspan of 16.6 meters, designed to carry out both strategic and tactical missions at an altitude of up to 30 thousand feet with the ability to loiter for

up to 24 hours.

This latest addition to the Is.A.F is the largest and most sophisticated UAS: the Heron Turbo Prop (TP) that was inducted by Squadron 210 in February 2010 under the name 'Eitan'.

The Heron TP can perform long range missions of over 1,000 km and can remain airborne for over 24 hours.

The UAV has a powerful turbo-prop engine (1200 horsepower), allowing it to reach altitudes of over 41,000 feet, higher than normal commercial aircraft flight operations.

### IAI Malat





DCNS and Thales have announced the launch of a supplementary phase for technology demonstration of a system for automatic landing and deck-landing of UAVs (D2AD). Sea trials of the demonstrator are planned for 2012 using a French Navy frigate and a Boeing H-6U Unmanned Little Bird rotorcraft.

This notification follows the successful landing and deck-landing trials conducted in the United States last summer using a moving platform. This new design study is to be conducted in the context of risk reduction for future tactical UAV programmes to be managed by the DGA on behalf of the French Navy and the French Army.

Further trials are for demonstrating automatic deck-landing of a UAV on the deck of a frigate even in high sea state and low visibility. The system must demonstrate its capability for integration of all the operational constraints inherent in deck take-offs and landings, similar to those of piloted helicopters, but in fully automatic mode. This automatic system for take-off, landing and deck-landing of UAVs results from the joint expertise of Thales and DCNS. Thales is responsible for the positioning system and its interface with the UAV system, the supply of a UAV demonstrator system and slaving of the flight path along a trajectory.

DCNS is responsible for predicting the vessel motions, the harpoon system as well as the interface and integration with the vessel. The D2AD automatic deck-landing system constitutes a key stage in run-up to the use of UAV rotorcraft by naval forces, for operations over both land and sea, and provides innovative high-performance solutions which meet operational needs. "The availability of an automatic on-board take-off and landing system, without the need for an external pilot, opens up the possibility of intensive use of UAV rotorcraft, at minimum cost and a high level of safety."

#### Weapons for NGC-built Fire Scout unmanned helicopter

Northrop Grumman Corporation are outfitting the US Navy's MQ-8B Fire Scout unmanned helicopter with a weapons system. The Advanced Precision Kill Weapons System laser-guided 70mm rocket - in production for the Navy since 2010 - will allow ship commanders to identify and engage hostile targets without calling in other aircraft for support.

"By arming Fire Scout, the Navy will have a system that can locate and prosecute targets of interest," said George Vardoulakis, Northrop Grumman's vice president for tactical unmanned systems. "This capability shortens the kill chain and lessens the need to put our soldiers in harm's way."

Northrop will develop and deliver the equipment needed to control the weapons system under a \$17 million contract awarded to the company by Naval Air Systems Command. Final delivery of an operational system is expected by March 2013.

Fire Scout will become the US Navy's first sea-based unmanned system to carry weapons. Its ability to operate at low ground speeds makes it particularly well suited for



supporting littoral missions such as drug interdiction, antipiracy actions, search and rescue, reconnaissance and port security.

The Fire Scout features a modular architecture that accommodates a variety of

electro-optical, infrared and communications payloads. These payloads provide groundand ship-based commanders with high levels of situational awareness and precision targeting support. **S** agem (Safran group) has successfully completed a series of flight tests of its long endurance surveillance drone, the Patroller. 14 test flights, carried out at the Istres air force base in southern France from 19 September to 21 October, met the objectives of qualification of the aircraft in-flight performance, including automated landings at a steep glide slope, integration

immigration. Sagem will be able to deliver a complete, fully operational Patroller system within 12 to 18 months.

# Sagem's Patroller passes qualification milestones

of a new data link for taxiing and a new, higher-performance imaging chain for target identification and qualification of new flight control functions supporting degraded operating modes, as well as automated touchdowns in case of actuator or propulsion system failure.

The redundant avionics suite has shown significant improvement in flight safety, enabling the Patroller to receive authorisation from French authorities to overfly densely populated zones in controlled airspace. The Patroller drone was also operated over the Mediterranean Sea to test operational The Patroller is a medium-altitude, long-endurance (MALE) drone in the 1-ton class, based on an EASA-certified (European Aviation Safety Agency) aircraft. It capitalises on technologies already developed by Sagem for the Sperwer Mk.II tactical drone and field experience in Afghanistan. Patroller has a modular design, allowing it to carry different pod-mounted payloads, and offers flight endurance of 20 to more than 30 hours, at a maximum altitude of 25,000 feet. Designed for a wide range of defence and homeland security long-endurance surveillance missions, it also keeps operating costs "under control".

### Thales and Aerovision's UAV for border control

The hales and Aerovisión have conducted a real flight demonstration of the UAV 'Fulmar' for the European Agency Frontex, the organisation in charge of coordinating border control operations of the European Union member states.

Fulmar is a wholly Spanish project that uses Maritime Surveillance Systems of the Thales Group. These systems supply images and video in real time and integrate the information in a security system, as is the case with border control. Such systems facilitate surveillance and control of maritime and border traffic to provide inestimable support to rescue operations.

The UAV Fulmar is a small-size vehicle (3.1 metres) weighing only 19 kilos that can operate till a height of 3,000 metres at a speed of 150 kilometres per hour, with an 8-hour flight range that would allow it to fly up to 800 kilometres without having to refuel.

The demonstration for border authorities organised by Frontex was was held at the Aktio Air Base in the Greek locality of Preveza. For three days, several international UAV manufacturers performed test flights patrolling the west coast of Greece, with Fulmar being the only Spanish product, demonstrating its capacities in a market dominated by unmanned aerial vehicles from the United States and Israel.

The demonstration confirmed the ease of operating Fulmar, as it does not require a runway for takeoff and landing, being In the demonstration for border authorities organised by Frontex, the UAV Fulmar flew for two hours, detecting information sent from different points established for the flight and sending images and video in real time, being viewed at the ground base. The Fulmar



launched from a catapult and recovered by means of an impact-absorbing net. Both elements are simple to install in a short time and in different places. This facilitates the assembly and handling of the system and differentiates it from other models on the market. displayed its capacity to integrate with maritime surveillance systems including radars, which is a crucial aspect in this type of surveillance system.

The Fulmar is currently operative in Malaysia, where it performs border surveillance tasks in the Strait of Malacca.



### **Elbit awarded Hermes 900 contract**

Elbit Systems has been awarded a contract valued at approximately \$50 million, to supply Hermes 900 Unmanned Aircraft Systems (UAS) to a "governmental office in the USA". The UAS will be operated in a variety of perimeter security missions. The project will be performed over approximately one year and the UAS

will include systems such as the Universal Ground Control Stations (UGCS), Elbit Systems Electro-Optics Elop's DCoMPASS payload systems, as well as satellite communication systems.

The Hermes 900 UAS builds on the vast operational experience accumulated by the Hermes 450, backbone of the Israel

Defence Forces' UAS operations. Hermes 900 offers a range of enhanced capabilities, from higher flight altitude (up to 30,000 ft) to longer endurance and larger payload capacity. The system's structure enables it to carry a variety of payloads in different shapes and sizes for quick "conversion" between payload configurations.



eneral Atomics Aeronautical U Systems, Inc. (GA ASI), the leading manufacturer of Unmanned Aircraft Systems (UAS), tactical reconnaissance radars and electro-optic surveillance systems, has announced successful flight of a second multi-mission jetpowered Predator C Avenger aircraft. "The first flight of our second Avenger aircraft is a significant achievement as it refines the first prototype design to an operational capability," said Frank Pace, President, Aircraft Systems Group, GA-ASI. "Avenger provides the right capabilities for the right cost at the right time and is operationally ready today. This aircraft offers unique advantages in terms of performance, cost, timescale and

adaptability that are unmatched by any other UAS in its class."

First flight of the second aircraft in the Avenger fleet occurred on 12 January at Palmdale, California. "Tail 2 met all performance objectives in its first flight". The aircraft features a longer fuselage than the first Avenger aircraft, increased by four feet to accommodate larger payloads and fuel. Avenger can carry up to 3,500 lb internally and its wing hard points are capable of carrying weapons ranging from 500 lb to the 2,000 lb class.

Production of a third and fourth UAS in the Avenger series is also underway, with Tail 3 expected to fly by late summer and Tail 4 by early 2013.

With avionics based upon the battleproven Predator B/MQ-9 Reaper, Avenger is designed to perform high-speed, longendurance, multi-mission Intelligence, Surveillance, and Reconnaissance (ISR) and precision-strike missions over land or sea. The aircraft has a 44-foot long fuselage, a 66-foot wingspan, is capable of flying at over 400 KTAS and has an endurance of over 16 hours. The Avenger can carry a wide array of sensors and weapons loads and has been designed to carry an all-weather GA-ASI Lynx Multimode Radar, an Electro-optical/ Infrared (EO/IR) sensor, and a 2,000 lb Joint Direct Attack Munition (JDAM), delivering an optimal balance of long loiter ISR and precision-strike capability.



### Tata Nova



**Poseidon Watch** 

## he Future is Now

IN 320 नौरोना

n 3 November 2011, Boeing received a \$1.7 billion Low-Rate Initial Production (LRIP)-II award from the United States Navy (USN) for seven additional P-8A Poseidon Multimission Maritime Aircraft (MMA) as follow-on to an initial LRIP-I contract awarded in January 2011 to provide six P-8A MMA. Overall, the USN plans to purchase 117 Boeing 737-based P-8A MMA replace its 196 P-3C Orion fleet. The Indian Navy (IN) will be the first export customer as on 1 January 2009 when New Delhi and Boeing had inked a \$2.1 billion contract for the delivery of eight P-8I Poseidon MMA, essentially Long Range Maritime Patrol/Anti-Submarine Warfare (LRMP/ASW) platforms with further options for four to eight more.

A further four P-8I MMA platforms have been cleared for acquisition pushing up the contract to \$ 3.1 billion. Reports suggest that first delivery of the P-8I to IN would be by end-2012 or early-2013, with the remaining deliveries being made in a phased manner through 2015-2016. More acquisitions for the IN is theoretically possible as IN reportedly have an optimum requirement of thirty MRMR platforms.

Boeing was awarded the System Development & Demonstration (SDD) contract for the MMA specialising in long-range ASW, Anti-Surface unit Warfare (ASuW), Intelligence, Surveillance & Reconnaissance (ISR) in mid-2004 at the end of a long and fiercely fought competition against Lockheed Martin. The Boeing 737-800ERX MMA design received the United States Navy (USN) military designation P-8A and the name 'Poseidon'.

Boeing completed assembly of the first P-8A at its production facility in Renton, Washington in summer of 2011 with the 737 fuselage built by Spirit AeroSystems in Wichita, Kansas and then sent to Renton where all aircraft structural features unique to the P-8 were incorporated in sequence during fabrication and assembly. The aircraft subsequently completed a successful first flight on 7 July 2011 from Renton Field to Boeing Field in Seattle marking its transition from fabrication and assembly to mission system installation and aircraft quality and performance acceptance flight testing checkout in Seattle.

The first Boeing P-8I MMA derivative for the IN completed its initial test flight on 28 September 2011 that also took off from Boeing Renton Field in Washington State and landed about two-and-a-half hours later at the Boeing Field in Seattle. During the flight, Boeing test pilots checked performance of the airborne systems, including engine accelerations and decelerations and autopilot flight modes, and took the P-8I to a maximum altitude of 41,000-feet prior to landing. The P-8 is based on Boeing's 737-800 commercial jet with the wings of the 737-900ER (Extended Range), with the design of the P-8 wingtips changed from the blended winglet to a backswept wingtip to improve performance at low-level flight.

The P-8A is designed to operate in the targeted area within the Network Centric Warfare (NCW) concept especially alongside the maritime Northrop Grumman MQ-4C Broad Area Maritime Surveillance (BAMS) Unmanned Aircraft Systems (UAS). In addition to its formidable ASW equipment, the P-8A is also equipped with upgraded Raytheon APS-137D(V)5 maritime surveillance radar redesignated AN/APY-10 used to facilitate advanced reconnaissance missions over an area of 600-nautical miles. Featuring a colour weather display in the P-8A, it will also feature improvements such as "joint technical architecture" compliance, better performance in Track-While-Scan (TWS) and target detection modes, and full integration with the Boeing mission system. The radar offers Synthetic Aperture Radar (SAR) mode for imaging, detection, classification and identification of stationary ships and small vessels and for coastal and overland surveillance, Inverse Synthetic Aperture Radar (ISAR) mode for imaging, detection, classification and tracking of surfaced submarines and



## Bel

small, fast moving vessels that operate in coastal waters and Moving Target Indicator (MTI) modes for long range surface search. The SAR provides multiple resolution strip map and spot SAR operation, and allows high resolution for target identification, battle damage assessment and for weapons targeting.

Periscope detection uses high scan speeds, high pulse repetition frequency and high resolution mode with advanced sea clutter rejection. In conjunction of AAW-13 data-link pod sharing of target data, control for friendly cruise missiles (SLAM-ER or Tactical Tomahawk) in addition of exchange of real-time imagery with other allied assets in the area is facilitated. Situational awareness is further enhanced by Raytheon Integrated Identification Friend or Foe (IFF), jam proof Global Positioning System (GPS) and Broadcast Information System (BIS) and plus secure Ultra High Frequency (UHF) Satellite Communications (SATCOM) capability. Additionally the "canoe" fairing under the aircraft is expected to house a mission bay to include the Raytheon-Boeing Littoral Surveillance Radar System (LSRS), later to be replaced by the Advanced Airborne Sensor (AAS), designed to provide targeting-grade tracking of moving targets on land and at sea, with performance standards that match or exceed the United States Air Force (USAF) Boeing 707-based E-8C J-STARS battlefield surveillance aircraft.

While two CFM56-7B27A highbypass turbofan engines (each providing

120-kN of thrust) provide higher cruise speed (490-knots) and service ceiling to reach its area of operation rapidly, P-8A will be capable of operating 1200-nautical miles from the base for an extended period of four hours besides arriving at station one hour earlier than any turboprop type. The aircraft have demonstrated a loitering speed of 180-knots over the sea at a low altitude of 60-metres. Moreover during re-deployment it can travel faster up to 5,000-nm and even further with Air-to-Air Refuelling (AAR). In the process P-8A will be capable of "silently" approach hostile shipping lacking integral air cover by constantly executing repeated shallow dives beneath enemy ships "projected radar lobe" as indicated by P-8A Electronic Support Measures (ESM) unit until the hapless enemy vessel falls well in AGM-84L Harpoon II anti-ship missiles range. The armament is carried by a total of four wing pylons, two fuselage pylons and an aft weapon bay for a total of 5,700-kg payload, controlled by Smiths Aerospace Stores Management System.

In USN service the weapons load for littoral missions will include up to four AGM-D/L Harpoon, AGM-65 Maverick anti-ship missiles or AGM-84 H/K SLAM-ER land-attack missiles. Additional stores comprise twelve Mk62, nine Mk63 or four Mk65 Quickstrike mines as also GBU-32 and GBU-38 JDAMs. Further options include AGM-154C JSOW and AGM-158 JASSM. The open architecture Mission System Avionics (MSA) includes five interchangeable multifunction workstations; two for the TACCO Tactical Coordinators and three for the sensor operators, and a very advanced and flexible man machine interface. Northrop Grumman developed Night-Hunter-II Electro Optical/Infra Red (EO/IR) sensor, located in a stabilised retractable turret below the fuselage forward part will retain the strike capabilities at night.

Northrop Grumman is also supplying the Electronic Warfare Self-Protection (EWSP) suite which includes Terma AN/ALQ-213(V) Electronic Warfare Management System (EWMS), Northrop Grumman Directional Infra-Red Counter Measures (DIRCM) set, Northrop Grumman radar warning system and BAE Systems countermeasures dispenser system. Northrop Grumman also provides the ESM, Radar Frequency (RF) decoy launchers, host of data-links (Link-11, Link-16, and Link-22 NILE) and mission planning. The P-8A will also be capable of exchanging data with Unmanned Aerial Vehicles (UAV) with an option for future control capabilities. However, in March 2008, Boeing selected L-3 Communications Wescam to supply the MX-20HD digital Electro-Optical and Infra-Red (EO/IR) multi-spectral sensor turrets for the P-8A Poseidon. MX-20HD is gyro-stabilised and can have up to seven sensors including Infra Red, CCDTV, image intensifier, and laser rangefinder, illuminator and target designator. Prior broadcast, L-3 Enhanced Local Area Processing (ELAP) improves imaging



clarity on board, extending both effective range and image clarity.

The Raytheon-developed Signal Intelligence (SIGINT) suite will be invaluable in detecting and declassifying enemy radar and voice frequencies and interception procedures thus formulating appropriate countermeasures and striking solutions. By means of calculated intrusions, (provisions for self defence Raytheon AIM-9X Sidewinder close-combat missiles and self protection towed decoy system seem to point at that) as well as interleaving passive "listening" and active jamming (to force the enemy to switch to emergency secret frequencies) along with transmitting spurious commands over the defence network, valuable details can be gained.

The P-8A crew of just nine will further strongly reduce the Multi-Mission Aircraft (MMA) fleet's overall manning requirements by some fifty-percent and can rely on private contractors to provide maintenance and logistic support. The aircraft in spite of being a derivative of a commercial airliner designed for constant cruise at high altitude has surprisingly displayed low-speed, low-altitude sharp manoeuvres required by LRMP/ASW operations with loiter speed of 180-knots over the sea at a low altitude of 60-metres as mentioned earlier.

For the ASW role, the P-8 will be fitted with the same acoustic processor as adopted for the British Nimrod MRA Mk4. Another sensor is the CAE AN/ASQ-508A Advanced Integrated Magnetic Anomaly Detector (MAD) in a much shorter "sting" tail although their effectiveness can be nullified by submarine hulls made up of titanium or non-magnetic steel. However CAE's AN/ASO-508A MAD system represents one of the most advanced MAD systems in the market that will be integrated with the P-8A's mission system and will be used operationally during ASW missions. Incidentally CAE's MAD system is being delivered and is widely used on maritime patrol aircraft for a range of global defence forces, including the Turkish Navy's CN-235 and ATR72, Canada's CP-140 Aurora, South Korea's P-3 Orion, Brazil's P-3BR, Chile's C-295 and the Japanese Defence Agency's indigenously developed XP-1 maritime patrol aircraft. The MAD system provides the capability to detect, locate, and confirm subsurface targets by identifying magnetic

variations or anomalies, such as those caused by a submarine, in the Earth's magnetic field.

The ITT/EDO reloadable rotary sonobuoy launchers with pneumatic ejection are installed with a capacity for 120 sonobuoys of different types. ASW load includes up to six Mk.46, Mk.50 or Mk.54 lightweight ASW torpedoes while up to twelve free fall Mk.82 bombs can be converted to ASW depth bombs by changing the fuse mechanism. With Initial Operating Capability (IOC) in 2016, Mk.54 lightweight torpedoes are projected to be equipped with the Longshot/HAAWC kit to turn the torpedoes into GPS-guided glide weapons that can be launched from high altitudes, which would allow the P-8A to remain within its preferred engaging short-range and medium-range ballistic missiles in the boost, ascent or terminal flight phases. The NCADE concept uses modified components of the existing Raytheon AIM-9X and Raytheon AIM-120 AMRAAM including the Imaging Infra Red (IIR) seeker from AIM-9X and the aerodynamic design, aircraft interface and flight control system of AMRAAM.

Combined with a first stage derivative of the AMRAAM rocket motor and control section, the second stage uses a new less toxic liquid propellant of Hydroxyl Ammonium Nitrate (HAN) fuel with very high density and specific impulse (125-lb of thrust for more than 25 seconds), for all upper-stage propulsion including axial, divert and attitude control



aerodynamic envelope of high-altitude cruise, and reduce the fatigue and corrosion associated with low-level flight.

Relatively less known yet an additional weapon for P-8 for interceptions of hostile ballistic missiles may emerge as the Raytheon Network Centric Airborne Defence Element (NCADE) air launched weapon system. Designed to be an integral part of Ballistic Missile Defence (BMD) system, the Raytheon NCADE air launched weapon system consists of netted launch aircraft, fire control, cueing and targeting sensors, and interceptors. The interceptors can be launched from manned or unmanned aircraft to provide a quick response to changing battle situations and mobile Tactical Ballistic Missile (TBM) launchers, plus being capable of system to provide endo-atmospheric and exo-atmospheric flight.

Thus the missile is capable of boostphase interceptions, with the launching aircraft as mentioned earlier only needing to penetrate to within about 160-km of the launch site with targeting provided by onboard or networked friendly radar and Infra Red Search & Track (IRST) sensors to enable a upwards steep angled high-altitude launch. At high altitude, the IIR seeker is programmed to acquire a target, subsequently using its long burning second-stage motor for the intercept. The missile is expected to enter operational service by 2013.

Sayan Majumdar

### Boeing speak : India's P-8I maritime reconnaissance fleet "on its way"

The Indian Navy's P-81 maritime reconnaissance aircraft made its first flight in September 2011 highlighting another successful year for the Boeing-led programme. Rear Adm. Devinder Sudan, Assistant Chief of Naval Staff (Air), Indian Navy, who was on hand for the flight, said "the P-81 programme is progressing well and we are excited that India will soon have this aircraft as part of its fleet."

The P-8I is the first of eight longrange maritime reconnaissance and anti-submarine warfare aircraft Boeing is building for India as part of a contract awarded in January 2009. An option for four additional P-8I aircraft was included in the contract.

"Boeing is committed to providing the best and most affordable product for our Indian navy customer," said Leland Wight, Boeing P-8I programme manager. "Assembly of the first airplane went smoothly and we continue to see advancements and increased efficiencies as the programme moves forward."

In early 2012 final assembly will begin on the second P-8I aircraft at Boeing's factory in Renton, Washington. There employees use a first-in-industry in-line production process and Boeing's existing Next-Generation 737 production system to efficiently design the P-8I for India as well as the P-8A for the U.S. Navy.

According to Wight, Boeing currently is completing mission systems installation on the first aircraft, which will begin formal flight testing in the summer.

"The programme remains on cost and on schedule and we're working hand in hand with our Indian customer," he added.

Boeing and its industry team of CFM International, Northrop



Leland Wight, P-8 India Programme Manager.

Grumman, Raytheon, GE Aviation, Spirit AeroSystems and BAE Systems are working "seamlessly" to develop a weapons system that provides unrivaled performance. The P-81 will provide the Indian Navy with speed, reliability, persistence and room for growth to satisfy its maritime reconnaissance and anti-submarine warfare requirements now and well into the future. The P-81 features open system architecture and advanced sensor and display technologies, and can rely on a worldwide base of suppliers, parts and support equipment.

The P-81 will offer India tremendous capability advances over legacy systems. Designed specifically to counter threats from enemy submarines, the P-81 also will be a formidable deterrent to surface and over-land threats. Commonality between the P-81 and P-8A will greatly enhance the interoperability and supportability objectives of both the U.S. and Indian Navies.

The Indian Navy's new aircraft also will share considerable commonality with the 737 Next-Generation fleet, thereby contributing to significantly lower total operating costs. The addition of extra fuel tanks and strengthening of portions of the aircraft give it the range, endurance, and hardiness to conduct military operations in an unsurpassed manner. The aircraft as configured has significant space, weight and power margins for growth systems as well.

The capacity for additional systems and growth make the P-8 aircraft an ideal platform for enabling other maritime and overland missions, and provide the ability for the system to adapt to more challenging requirements.





## Dornier Seastar



#### **Kevin J. Cosgriff, Senior VP,** International Business and Government, Textron Systems Corporation

**VAVU**: Please give a brief on Textron Systems and its presence in India. Can you also elaborate on key activities in India?

**KJC:** The larger Textron enterprise established Textron India Private Limited in 2004 with a state-of-the-art facility in Bangalore's Global Village. Its mission is to support Textron's many wellknown brands within the country through engineering expertise, sourcing and business development.

However, unto itself Textron Systems is likely best known in India currently as designer and manufacturer of the Sensor Fuzed Weapon (SFW), a combatproven, air-delivered area weapon. We are currently engaged in delivery of SFW systems to the Indian Air Force through a foreign military sale announced in December 2010. While highly precise and powerful, SFW also incorporates our proprietary safety features to prevent harmful unexploded ordnance.

### **VAYU:** What are the main technologies you will be showcasing at Defexpo 2012?

**KJC:** At this year's DefExpo, we will showcase:

The Spider Networked Munition System is a man-in-the-loop, networked munition area denial system designed to replace indiscriminate landmines. It consists of three major components: a communications system for man-in theloop control, a simple trip line sensor system to tell the operator of an intrusion, and a munition system that can provide both lethal and non-lethal responses.

The Scorpion Networked Ground Munitions System integrates sensors, munitions and networking technologies to detect, track, classify, report, engage and destroy light wheeled and heavy tracked vehicles. Continuous man-in-the-loop control, similar to the Spider system, allows operators to secure an area and protect friendly forces and civilians. The ruggedised system can be equipped with either lethal or non-lethal effects.

The Tactical Remote Aerial Munition (T-RAM) is a unique backpack-carried, tube-launched system designed to carry a variety of lethal warheads and sensors. With loitering capability and delivery from open or defilade position, the T-RAM provides precision lethal effects against personnel and light vehicle targets.

Unattended Ground Sensors (UGS): MicroObserver reliably detects, classifies and tracks personnel and vehicles in border and base security, critical infrastructure protection, perimeter security and force protection applications, offering low false alarm rates, a self-forming and selfhealing network, and a mission life of more than two years.

Common Unmanned Surface Vessel (CUSV): The Fleet-Class CUSV offers multi-mission capabilities with a reconfigurable payload bay, sliding autonomy, and high tow force capacity. It delivers proven command and control, adapted from AAI Unmanned Aircraft Systems' One System architecture, and provides power and performance while being self righting and operational through Sea State 4.

Landing Craft, Air Cushion (LCAC): Textron Marine and Land System' LCAC is a high-speed, over-the-beach, fully amphibious landing craft capable of carrying up to 75 tons of payload at speeds over 40 knots. Its a proven cornerstone of the U.S. amphibious programme, and a revolutionary means to land at more than 80 percent of the world's shorelines. Supporting military or humanitarian missions, LCAC is designed to function in extreme conditions ranging from Arctic cold to Sahara heat.

Armored Security Vehicle (ASV): Optimised survivability, all-terrain performance and battle-proven firepower describe the ASV. Its enhanced ballistic protection provides 360-degree defence



against direct and indirect weapons, mines and improvised explosive devices. While an actual LCAC or ASV will not be on display, we will feature them in our DefExpo 2012 booth (Hall 14.15D).

## **WAYU**: Which are the focussed customers in India? Please elaborate along with the specific offering to the various customers.

**KJC:** As mentioned, we are currently supporting the Indian Air Force through the Sensor Fuzed Weapon programme.

In addition, we are contributing to the Indian Navy's exploration of hovercraft technology. As the designer and manufacturer of the LCAC vessels used by the U.S. and Japanese navies,



BLU-108 submunitions

defexpo SPECIAL

we are uniquely skilled and experienced in this area.

Our intelligence offerings are another area in which we are able to support the broad spectrum of Indian Armed Forces and national agencies including the Ministry of Home Affairs, the Defence Research and Development Organisation and the National Intelligence Grid.

#### **WAYU**: What are your expectations from DEF EXPO 2012?

**KJC:** We look forward to the exhibition as an opportunity to connect with our existing customers and partners in the region, while establishing new relationships with potential customers



Scorpion intelligent munitions system

and partners. We are excited to introduce our family of ground products including Unattended Ground Sensors, the Spider and Scorpion Networked Munitions Systems and the T-RAM. In addition, we'll showcase our CUSV, which is a versatile, multi-mission maritime asset.

#### **EXAMPLE** : An update on the SFW being acquired by the Indian Air Force?

**KJC:** The Indian Air Force is acquiring 512 Sensor Fuzed Weapons from the U.S. government. We remain actively engaged in the delivery of the system at the current time.

#### **VAYU:** A brief please on LCAC and is this offered it to the Indian Armed Forces?

**KJC:** The LCAC is a high-speed, over-the-beach, fully amphibious landing craft designed to be deployed from a landing platform dock. Its design allows LCAC to access nearly all of the world's shorelines to safely execute military, humanitarian or rescue missions. For example, the LCAC was utilised to great



benefit following the devastating 2004 tsunami in South Asia.

Textron has provided technical presentations and price and availability data for delivery of LCACs to the Indian Navy via the US Foreign Military Sales. We look forward to working in the future with both the Indian Navy and Army to address their hovercraft requirements.

#### **WAYU**: What are the major areas for homeland security customers in India?

**KJC:** There are several, depending on the customer's needs. One of the most versatile products showcased is our MicroObserver UGS system, which is both easy to use and highly accurate. Our Unattended Ground Sensors are ideally suited for a variety of homeland defence missions including border control, waterway operations and protection of vital infrastructure from power plants to embassies. They are flexible, easy to use and a valuable capability multiplier anywhere persistent surveillance is required.

### **WAYU**: What does Textron offer to India in the field of unmanned aerial systems (UAS)?

**KJC:** We offer a mature, multimission-capable family of small and tactical unmanned aircraft systems (UAS). This includes the expeditionary Aerosonde Small UAS, which is designed to execute both shipboard and land-based operations in space-constrained areas. The Aerosonde aircraft provides persistent intelligence, surveillance and reconnaissance and offers high endurance. Our best-known platform is the renowned Shadow Tactical UAS, which is in service with the U.S. Army and Marine Corps, as well as several international customers.





Skorsky S-92

### **Budgetary pressures are forecast**

ew analysis indicates that the military helicopter modernisation, upgrade and retrofit market will reach a value of \$3.98bn in 2012, as the strains of recent operations combined with tighter budgets, create the need to upgrade and retrofit existing helicopter platforms. There are views that "modernisation and upgrade of older helicopter platforms presents a favourable option against new buys for many nations considering the current economic climate of pressurised defence budgets, while retrofit will also be used in tandem with new-buys by many militaries around the world." There are forecasts for the period 2012-2022 in terms of value (US\$) for the military helicopter modernisation, upgrade and retrofit market as well as for seven helicopter type submarkets that together form the overall market figure. In addition, the report quantifies, analyses and forecasts ten leading national military helicopter modernisation, upgrade and retrofit programmes from 2012-2022. The report provides profiles of fifteen leading companies operating within the market, and includes an exclusive interview with RUAG, the leading Swiss aerospace and military Group offering modernisation,

upgrade and retrofit of military helicopters, which provides expert insight alongside the analysis.

In another study it is projected that light commercial helicopter manufacturers will produce 16,860 rotorcraft worth approximately \$58.8 billion during the next 10 years. This forecast covers light commercial helicopters with maximum gross weights under 15,000 pounds (6,804 kg) and that "this total will include production of more than 5,900 pistonpowered and nearly10, 900 turbinepowered rotorcraft". There was reported stabilisation in the market during 2010,



### Penman





but annual production is forecast to remain under 1,300 units through 2012. The forecast assumes that economic growth in Europe and the United States, the two primary markets for rotorcraft, will be anemic through 2011 and most of 2012. Improved economic conditions thereafter will allow increased production by major manufacturers as demand recovers to its pre-recession level over the long term.

"The recession throttled demand for piston helicopters, but the turbine market held up relatively well in 2009 and 2010," notes Forecast International aerospace analyst Douglas Royce. "It is still a tough market for manufacturers, but we expect to see substantial improvement by the end of 2012." Production of piston-powered helicopters will account for about 35 percent of the total number of units shipped in the light commercial rotorcraft market over the period 2011-2020. The value of this production will reach over \$2.2 billion, which is only about 4 percent of the value of the light commercial rotorcraft market overall. The value of production of turbine-powered rotorcraft is forecast as \$56.6 billion over this timeframe. The turbine market will thus account for about 96 percent of the value of production of light commercial rotorcraft.

Manufacturers are forecast to ship 5,959 single-engine turbine helicopters and 4,973 twins. The value of production for the single-engine turbine market is projected to be \$14.6 billion. The value of production of twins is projected to reach \$42 billion, and high list prices of twins result in a far higher value of production even though they are produced in lower numbers. Thus, almost 75 percent of the value of production in the turbine segment will come from production of twin-engine rotorcraft.

*Forecast International* projects that 1,877 light military rotorcraft will be built

between 2011 and 2020. The value of this production is estimated at \$24 billion in constant 2011 U.S. dollars. The study defines a medium/heavy rotorcraft as one having a gross weight of at least 6,804 kilograms (15,000 lb). The light military rotorcraft production will increase through 2012, representing a continuation of the market's growth track of recent years. After 2012, however, the yearly production in the segment will enter a period of gradual, though erratic, decline through the 2018/2019 timeframe. The projections indicate that production will total 193 units in 2011 and 215 units in 2012, decline to 186 units in 2013, increase to 204 units by 2015, and then decline to just over 165 units in 2018 and

#### Chinook's half century

The Chinook celebrated its 50th year of service with the U.S. Army in end 2011. "To see the improvements and what we've done with this aircraft through the years gives me a lot of pride," said Maj. Gen. William Crosby, "That aircraft was designed to haul something we don't even have anymore, but it is still so valid. It is so versatile at all altitudes, with internal and external loads. It's an outstanding capability." Crosby has flown every model of the CH-47 Chinook and has experienced at firsthand the advancements and improvements made to the aircraft.

But those improvements are far from over. The U.S. Army has been working with Boeing to modernise the floor for on-load and off-load capability and to add ballistic protection, said Col. Bob Marion, project manager for cargo helicopters. "The CH-47F model was first delivered to Army aviators in 2009 and has already seen less maintenance needs than the CH-47D model that came before it", said Marion. "The frame experiences less erosion and cracking and the gas components are not full of a talcum-like dust from flying in Iraq and Afghanistan."




2019. Production in 2020 is projected at 185 units.

"Current military helicopter acquisitions are running their course, and very few major procurements of light military helicopters have emerged that could help grow, or even maintain, production levels in the market," felt Forecast International senior aerospace analyst Raymond Jaworowski. The market momentum of recent years will not be sustained. The U.S. accounts for a large portion of demand in the market, and the present modernisation cycle in U.S. military rotorcraft procurement is nearing an end. Meanwhile, defence spending is under intense pressure in the U.S. and many other countries that have contributed to much of the recent demand in the market.

The new study includes projections of manufacturer market shares. These indicate that Eurocopter will be the leading manufacturer of light military rotorcraft during the 2011-2020 time period. AgustaWestland is projected to be second in unit production during this timeframe, followed by Hindustan Aeronautics Ltd and Bell Helicopter. Each of these companies has a robust presence in the market but, as detailed in the study, pursue widely diverging strategies to protect and enhance their market share.

According to the 'International Military and Government Helicopter Survey', some US\$8.1 billion worth of contracts were placed in 2010 for 673 new and remanufactured helicopters. Military orders totaled 543 airframes at a cost of US\$6.8 billion or 84 per cent of the total. Of this amount, about 52 per cent or US\$3.5 billion was spent by the US on military helicopters. Government helicopter orders totalled \$1.3 billion or 16 per cent of the total and 130 airframes. The USA and Japan were the largest government customers. Orders for medium-sized helicopters have dominated both the military and government market with contracts worth more \$5.1 billion placed in 2010 covering about 376 aircraft. Defence will remain by far the largest market area for helicopters. Based on current contracts and requirements, it is forecast that 3,671 new and remanufactured military helicopters will be delivered in the period 2011-2015, potentially worth in excess of \$50 billion with 606 aircraft to be delivered in 2011 and 738 in 2012.

### Eurocopter : first flight of a hybrid helicopter

**E** urocopter has successfully tested a hybrid helicopter that combines a turboshaft internal combustion engine with an electric motor marking a new milestone in its innovation roadmap that opens the way for further enhancements in rotary-wing aircraft safety. For this initial breakthrough in exploring the hybrid concept, the supplemental electric system was used to increase manoeuvreability of a single-engine helicopter during an autorotation landing – which is performed by helicopters in the event of a main engine failure. The demonstrator helicopter is a production version of Eurocopter's light single-engine AS350, which has been equipped with a supplementary electric motor. In the event of an engine failure, the electric motor provides power to the rotor, allowing the pilot to control the helicopter easily during the descent to safe touchdown.





G E Aviation has been selected by Sikorsky Aircraft as a member of a newly-formed team that is building a next-generation helicopter for evaluation by the US military.

GE Aviation will provide the engine to enable the S-97 Raider helicopter to demonstrate state-of-the-art advancements in rotorcraft technology. Defined as a light tactical helicopter, the Raider will be of 11,000-lbs maximum gross weight. Following the X2 aircraft design, the S-97 Raider helicopter will feature coaxial counter-rotating main rotors and a pusher propeller to provide dramatic improvements in maneuverability, hover efficiency, high/ hot climate performance, and speed.

Sikorsky and its team suppliers are self-funding the design and manufacture of two S-97 Raider prototype aircraft for flight evaluation by the US military in 2014. The programme is currently at the advanced design stage.

GE will provide its YT706-GE-700R engines and engineering support for the Raider programme. The YT706 is part of GE's T700/CT7 engine family and is currently used in the MH-60M for the US Army Special Forces. The YT706 is a 2,500-3,000 shaft-horsepower powerplant that includes a FADEC.

The YT706 is ideally suited for the single-engine S-97 application and benefits from over 600,000 CT7-8 flight hours (50 million+ flight hours amassed by the entire T700/CT7 family). The engine's proven reliability, low risk and extensive military experience will allow the helicopter to demonstrate significant improvements in speed, hot/ high performance and maneuverability over a conventional rotorcraft.

GE is also developing the GE3000 for the Army's ITEP (Improved Turbine Engine Programme) initiative that is planned as the next-generation 3000-SHP-class engine for medium-lift applications. This technology could also be incorporated into future engines for the Raider helicopter.

### PZL-Świdnik contracts for five new helicopters and 14 upgrades

PCL-Świdnik, an AgustaWestland company, has signed contracts with the Polish Ministry of National Defence valued at approximately €90 million for the supply of five W-3WA Sokół helicopters and upgrade of 14 helicopters. The manufacture and upgrading activities will be undertaken at the PZL-Świdnik factory in Poland.

The five new W-3WA Sokół helicopters will be configured for VIP transport and





used by the Polish Air Force to provide transport services for senior military and government personnel. Separate contracts for the upgrading of 14 helicopters have also been signed, comprising upgrade of four W-3 Sokół helicopters to W-3PL Głuszec armed configuration, the overhaul and upgrade of eight Mi-2 helicopters and the upgrade of two W-3VIP helicopters with a FADEC (Full Authority Digital Engine Control) system.

#### Bell Helicopter delivers 4,000th commercial product

ell Helicopter has B delivered the 4,000th commercial product since it began production at its Mirabel, Canada, facility 25 years ago. During a small ceremony at Bell Helicopter's facility in Mirabel, long-time customer, Air Medical Group Holdings (AMGH), took delivery of the 4,000 aircraft which was a Bell 206L4. This 4,000th aircraft will add to the current fleet of 155 Bell products flown by AMGH. Bell Helicopter has delivered more than 6,300 Bell 206s, including all its variants, since it began the production in 1967.

# Forecasting the Military Market

\$24.6 billion Electronic Warfare Market

IAI's CAEW G-550.

MILLERNE I

According to *Forecast International's* "The Market for Electronic Warfare Systems" analysis, an estimated \$24.6 billion will be spent on the development and production of major EW programmes over the next 10 years. Some 35,702 electronic countermeasures (ECM), radar warning receivers (RWRs), electronic support measures (ESM), and other EW systems will be produced during 2011-2020.

"The counter-IED effort and the market for its various systems will especially warrant close monitoring in the years to come," said Andrew Dardine, Forecast International Electronic Warfare Analyst. "With the surge of U.S. troops into Afghanistan, there has been a corresponding proliferation in the use of IEDs. Major contracts are likely to be awarded for rapid procurement and deployment to troops in the field, as well as for RDT&E of new techniques." Still, the production of counter-IED systems is only one part of the EW picture and defence manufacturers will be busy fulfilling demand for a wide variety of systems. This analysis states that the top-ranked EW system producers in the next decade will be Northrop Grumman, BAE Systems, Raytheon, ITT, and Lockheed Martin.

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The next several years point at steady production of Northrop Grumman's APG-81 EW-capable radar for the F-35 and the AAQ 24 Directed Infrared Countermeasures (DIRCM) and Large Aircraft IRCM (LAIRCM) systems "for an international clientele." The Pentagon plans to spend well over \$1 billion through FY15 on LAIRCM procurement for various Air Force aircraft. Last year, the U.S. Navy's Advanced Tactical Aircraft Protection Systems Program Office purchased LAIRCM for the Marines Corps' CH-53E Sea Stallion aircraft.

The AAR-57 Common Missile Warning System (CMWS), the ALQ-212 Advanced Threat Infrared Countermeasures (ATIRCM) system, and the ALE-55 Fiber-optic Towed Decoy (FOTD) system are lined up to provide BAE systems with \$2.2 billion of its total market share, according to this analysis. Like Northrop Grumman, BAE Systems has heavily invested in the development of the NGJ. In June 2010, the Pentagon awarded BAE Systems a \$30.9 million modification to a previously awarded contract for low-rate initial production (LRIP) of the ALE-55 for U.S. Navy and Royal Australian Air Force F/A-18E/F aircraft.

ITT is well positioned to be a major player in the NGJ programme and has already taken a decisive lead in the all-important, counter-IED effort. This advantage is the result, in part, of years of success in providing proven, widely deployed EW systems like the ALQ-211 Suite of Integrated RF Countermeasures/ Advanced Integrated Defensive EW Suite (SIRFC/AIDEWS).

#### Global Airborne ISR Market 2011-2021

The latest defence report published on *ASDReports.com*, the Airborne ISR Market 2011-2021, examines a sector that must cope in an era of defence spending cuts but which is also expected to see robust demand as it is deemed essential to military operations. The new report assesses that the global airborne ISR market in 2011 amounted to \$17.3bn.

According to the report, "the US continues to account for a large part of global airborne ISR spending and, although its share will decline slightly, it is expected to continue being the leading market over the next decade. A number of countries in Europe remain key markets despite some spending cuts. Outside of Western countries, many of which are reducing or freezing defence spending, countries in Asia and the Middle East are expected to increase spending on airborne ISR."

"The airborne ISR market faces its own set of challenges but the capabilities it provides are important enough for the sector to continue to receive priority funding in many cases. This report examines the airborne ISR market over the next decade, providing detailed market forecasts for each of the leading national markets and at the local level. This report will describe how the airborne ISR market is likely to unfold over the next decade given current constraints along with country plans and needs."

#### Military Multimission Communications market

*Forecast International* projects that defence departments worldwide will spend approximately \$7.69 billion on 25 different multimission communications development, acquisition, and maintenance programmes over the next decade. More specifically, this dollar amount will be allocated for the

### Soldier Modernisation worth \$804 million in 2012

ew market analysis indicates that the soldier modernisation market will reach a value of 804.2 million dollars in 2012. Militaries around the world are investing in soldier modernisation programmes with the aim of ensuring that dismounted infantry are both operationally effective and fully integrated into the modern, digital, battlefield. Recent experiences, most notably in Afghanistan and Iraq, have demonstrated the continued vital role that infantry play in capturing and holding ground, a factor especially vital in contemporary counter-insurgency operations.

The report commented that "Soldier modernisation programmes and products are increasingly prevalent, with some large scale deployment of equipment suites already in progress. Whilst programmes at present are largely confined to NATO member states, by end of the decade ambitious soldier modernisation programmes embarked upon by countries, particularly China, India and Russia will be well underway. This will result in a fast-growing, dynamic and truly global market with manifold opportunities for investors."



development, procurement or maintenance of multimission communications systems or technology.

The Market for Multimission Communications Systems analysis further projects that over the next decade, defence departments throughout the world will purchase some 480,468 individual units from among the 18 multimission communications products covered in the analysis.

"The excessive costs of and setbacks in development of the U.S. Pentagon's Joint Tactical Radio System and the restocking of communications equipment used in military operations in Afghanistan and Iraq are the primary factors driving current expenditures for multimission communications systems," said Greg Giaquinto, *Forecast International* Senior Analyst.

According to the analysis, the Joint Tactical Radio System (JTRS), the Bowman Tactical Radio, and the Single Channel Ground and Airborne Radio System (SINCGARS) will significantly impact the market for multimission communications in the coming decade.

JTRS is a U.S. Department of Defence programme to develop and produce a single standard software-operated radio system for the United States armed services, currently in research and development. *Forecast International* estimates that the DoD will spend about \$2.15 billion from fiscal year 2011 to fiscal year 2015 on JTRS R&D activities.

The Bowman Tactical Radio programme of the U.K. Ministry of Defence seeks to purchase a family of multimission communications combat radios for the British armed services. General Dynamics United Kingdom Ltd is the programme's prime contractor. General Dynamics UK has chosen ITT Corp and Harris Corp to supply the bulk of the multimission communications systems to be purchased under the Bowman programme. *Forecast International* is estimating that the British armed services will buy approximately 16,000 tactical radios from 2011 to 2020.

The software-driven Single Channel Ground and Airborne Radio System constitutes a family of manpack, vehicular, and airborne radios manufactured by ITT's Communications Systems Division. The most popular member of the SINCGARS family of military radios is the PRC-119,

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which *Forecast International* expects the U.S. DoD to buy in sizable quantities over the next several years.

According to the analysis, Harris, General Dynamics, Rockwell Collins, ITT, and Thales will receive 46.42 percent of the total dollar amount that defence departments worldwide are forecast to spend on the 25 multimission communications products and programmes covered in the analysis. Harris will lead with \$1.99 billion in revenue. General Dynamics, Rockwell Collins, ITT, and Thales will follow with \$962 million, \$620 million, \$419 million, and \$294 million in revenue, respectively.

# Cyberwarfare market worth \$15.9 bn

Analysis indicates that the cyberwarfare market will reach a value of \$15.9bn in 2012, as governments around the world continue to invest in a range of cyberwarfare systems and solutions designed to offer protection against a wide range of cyber threats including protecting information and infrastructure from hostile states, as well as non-state actors both at home and abroad. The cyberwarfare market is likely to be driven by increasingly networked systems requiring increasing levels of protection from a continuing, persistent threat The global environment is characterised by ongoing tensions and conflicts among various countries around the world which is supporting demand for military aircraft. Historically, countries follow a policy of enhancing their military as a deterrent to hostile nations and consequently the military aircraft market is recording strong growth despite the commercial aircraft industry exhibiting a downward trend.

#### **Military Aircraft**

The global economic slowdown has reduced military expenditure worldwide, as a consequence of which a significant number of countries are establishing joint projects in order to share R&D costs. Partnerships between defence firms have also increased as a significant number of countries are investing in the development of their domestic military aircraft development capabilities, by establishing strategic alliances and technology-transfer agreements with global military aircraft manufacturers.

The global economic slowdown has reduced the defence budgets of most leading spenders in the world, including the US, France, Germany and the UK. Cuts to military expenditure have led to the cancellation and indefinite delays of various military aircraft programs, and are having a detrimental impact on the growth of the industry.

North America is expected to account for the largest share at 42.9% of the total global expenditure on military aircraft during the decade. The high demand in the region is primarily driven by the proposed production of 2,456 F-35 multi-role fighter aircraft as part of the Joint Strike Fighter programme and 452 V-22 Ospreys. Europe and Asia are also expected to account for a significant portion of the total military aircraft during the forecast period, with shares of 24.1% and 21.8% respectively.

Many countries are expected to replace their ageing military aircraft fleet. The wars in Afghanistan and Iraq has meant that the US, which is the biggest market for military aircraft and other allied countries in Europe, Asia-Pacific, Latin America and the Middle East, need to replace their aircraft which have been in continuous use over the last decade.

The market for advanced trainer aircraft across the globe is also growing, which is attributed to the significant number of countries involved in the process of upgrading to next-generation combat aircraft fleets. In meeting this growing demand, manufacturers are developing trainer aircraft that are able to perform a number of training roles for the armed forces of the countries involved in the procurement process.

Many nations around the world are involved in border disputes which have resulted in strained military relations. Some of these disputes could be resolved amicably while others have the potential to escalate into a military conflict. Therefore countries across the world are expected to invest in reconnaissance and surveillance aircraft.

In terms of categories, the multi-role combat aircraft is expected to account for the highest proportion of spending in the global military aircraft market. Following the budget cuts announced by various countries as a result of the global economic recession, the procurement of multi-role aircraft has increased significantly due to their ability to carry out various missions including attack, reconnaissance, rescue operations and transport.

To increase the capabilities of modern military aircraft, the global defence industry is investing significantly in R&D which has led to the development of technologies to enhance the speed, power, stealth capabilities, destructive force and takeoff and landing capabilities of the various types of military aircraft.



# **Missile Developments : India and globally**



### Lethal combination : Astra with Tejas

"S elf reliance" in air launched missiles and particularly in Beyond Visual Range Air-to-Air

Missile (BVRAAM) systems is of strategic importance. With the anticipated service entry (around 2016) of India's indigenous

hypersonic (Mach 4) active-radar homing Astra BVRAAM, the Defence Research and Development Organisation (DRDO) have reportedly produced a missile that is similar to contemporary class of missiles of United States, Russian and European origin. Prototype of the missile was first tested on 9 May 2003 from the Integrated Test Range (ITR) at Chandipur-on-sea area off the Orissa coast. Following further tests, dual-mode guidance was proved during May 2009 followed by captive flight tests on a Sukhoi Su-30MKI, carried out near Pune in November when several sorties were conducted. The latest series of tests initiated on 20 May 2011, also from the ITR at Chandipur, focussed on evaluating the performance of the smokeless non-metallised high specific impulse propulsion system, rocket motor, and the configurations of the vehicle and aero-dynamics evaluation.

Although the Astra BVRAAM is reportedly to be integrated with all frontline Indian Air Force fighters including the Sukhoi Su-30MKI, MiG-29, Mirage 2000 and eventually the Light Combat Aircraft, its lower weight and highly compact size also makes it the candidate for internal weapon bays of Indo-Russian Fifth

### The missile defence systems market

The missiles and missile defence systems market consists of seven categories : surface-to-surface missiles (SSMs), surface-to-air missiles (SAMs), air-to-surface missiles (ASMs), air-toair missiles (AAMs), anti-ship missiles, anti-tank missiles and missile defence systems. The value of the market is expected to increase at a CAGR of 2.41% over the next decade or so.

Current innovations are oriented towards increasing speed with hypersonic missiles, shooting down of missiles in mid-air with manned interceptors, enhancing anti-aircraft carrier capabilities, increasing payload capacity, facilitating navigation, and introducing stealth capabilities. The global defence industry is investing significantly in the development of technologies to enhance the speed, accuracy and destructive power of missiles. The global economic slowdown has however reduced military expenditure worldwide, as a consequence of which a significant number of countries are establishing joint projects in order to share R&D costs.

Despite budget cuts, North America is expected to account for the largest share of the total global expenditure on missiles and missile defence systems with a 35.6% share in the forecast period. High demand in the region is primarily driven by the country's five major missile defence programmes. A number of countries worldwide are planning to increase their nuclear capabilities and missile strike ranges.

The US and its allies believe that North Korea will develop an ICBM in the next five years. Taking into account the volatile relationship between the USA and North Korea, this development could pose a significant threat to the security of the USA, South Korea and many countries in Europe. The sinking of South Korea's Cheonan warship by North Korea in 2010, and the testing of its nuclear weapon in 2009, have further strained relations between the two countries.

Foreign OEMs seeking to enter a specific missiles market often enter into marketing agreements with domestic companies to gain an opportunity to market their products in a specific region. For example, in August 2011, Raytheon of the US and Israel's Rafael Advanced Defence Systems Ltd teamed up to market the 'Iron Dome' weapon system in the US.

# MBDA



Generation Fighter Aircraft (FGFA) based on Sukhoi T-50 that may well acquire the service designation of Sukhoi Su-50 and the NATO code name *Firefox*.

The project is guided and led by the Hyderabad-based Defence Research and Development Laboratory (DRDL). The single stage, smokeless, solid fuelled Astra with a length of 3570-mm, body diameter of 178-mm will weigh 154-kg, is powered by high energy lithium thermal batteries making it the lightest in its class and thus having a wide range of applications. The BVRAAM will be capable of destroying manoeuvring 9-g enemy targets at high altitude in the head-on mode at a range of 80-km and in tail-chase mode at 20-km, thanks to low drag low aspect ratio wings and capability to pull a lateral acceleration of 40-g in both yaw and pitch planes which means it should be able to engage non-manoeuvring targets well in excess of 100-km and capable of operating in the altitude bracket from sea level to 20-km altitude.

Although an initial range of choice included European MBDA consortium Ku-band (NATO: X band) RF '4A'ARH seeker (used in MBDA MICA BVRAAM with an autonomous homing range of 15-km), the Astra BVRAAM will use the Agat seeker (with an autonomous homing range of 25-km) sourced from Russia which will be produced in India through a "total transfer-of-technology process." Prior ARH homing during terminal stage, Astra follows Fibre Optic Gyro (FOG) based Inertial Navigation System (INS) during midcourse with high g accelerometers along with secure data link to allow such midcourse retasking. While autopilot and guidance software uses Artificial Intelligence (AI) for accurate guidance and optimised trajectory, the on-board Electronic Counter Counter Measures (ECCM) capability allows it to stay on course in spite of enemy Electronic Counter Measures (ECM) procedures. The 15-kg high explosive warhead is pre-fragmented with radar proximity fuse armed plus directional to enhance lethality and Single Shot Kill Probability (SSKP). Additionally the DRDO is currently working on a new laser fuse. The choice of an Agat seeker is interesting as the establishment is also highly reputed for development of infra-red seekers and

### IAI and Boeing mark 10 years of Arrow Weapon System

srael Aerospace Industries (IAI) has expanded its agreement with Boeing on the Arrow Weapon System (AWS). Leaders of both companies recently gathered at the IAI/MLM Division for a signing ceremony to celebrate the 10th anniversary of the partnership and to extend the commitment to work together. The IAI-Boeing Strategic Teaming Agreement aims to explore and develop new opportunities in the missile defence arena. During the past 10 years, IAI and Boeing have collaborated on the successful development, production and deployment of the AWS. As the world's first operational national missile defence system, AWS has become a vital, anti-ballistic missile defence strategy for Israel's national defence.

The event, hosted by the IAI MLM division, launched an expansion of the collaboration extended and enhanced the IAI-Boeing Strategic Teaming Agreement to explore and develop new opportunities in the missile defence arena. During the past 10 years, Boeing and IAI have collaborated on the successful development, production and deployment of AWS. "As the world's first operational national missile defence system, AWS has become a vital, anti-ballistic missile defence strategy for Israel's national defence."

IAI is the prime contractor for the AWS programme and has initiated, developed and deployed the in-service Arrow 2 programme and, together with Boeing, is developing the Arrow 3 system – a crucial asset in Israel's multi-tier anti-ballistic defence strategy.

"Boeing's relationship with IAI has produced an innovative, versatile and affordable advanced missile defence capability. We look forward to our continued partnership and the development of the next generation of Arrow interceptor," said Dr. Greg Hyslop, vice president and general manager of Boeing Strategic Missile and Defence Systems. The Arrow programme has been a cooperative effort between the U.S. Missile Defence Agency and the Israel Missile Defence Organisation since 2002.

may point to the possibility of an Imaging Infra Red (IIR) version of the Astra. As ARH is effective in one set of conditions and IIR in another, the open choice of different seeker heads complicates the defences of the adversary. Reportedly, Astra's Mk2 version will have a maximum range of 150km and tail chase range of up to 35km, propelled by a dual-pulse rocket motor. However no official statement has been issued regarding DRDO-

#### MBDA prepares VL MICA land systems for delivery

While the first VL MICA naval surface-to-air defence systems are being delivered to customers, the production of VL MICA land systems for an export customer is "in full swing" ready for deliveries starting in 2012. With this in mind the equipment produced and assembled in MBDA's facilities in France has been deployed at a French Air Force airbase, where the various vehicles will be networked to validate a standard operational configuration.

The French Air Force has already taken part in the VL MICA land programme in 2009 which carried out the technical and operational assessment of the VL MICA demonstrator. This activity was an element of the SALVE (Sol-Air à Lancement Vertical - or ground-to-air, vertical launch system) technology demonstrator programme notified to MBDA by the DGA (the French armament procurement agency) in 2005.



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developed solid-state lasers for use as super-high-speed ignition systems to arm missiles. DRDO is also looking at rocket/ramjet propulsion to provide greater range and enhanced kinematics performance to Astra. Adopting a rocket/ ramjet approach has certain limitations. The need for controlled airflow to the ramjet ducts means that the 'skid-toturn' manoeuvring of a conventional rocket-powered missile is not acceptable because it will risk masking an intake. Instead 'bank-to-turn' manoeuvring needs to be adopted resulting in a reduced instantaneous turn rate.

The emergence of top quality phased array radars in IAF service has made it possible to detect enemy fighter-sized targets at ranges well beyond 150-km, with only high-quality stealth platforms remaining 'invisible' at those ranges. Still, the primary concern of the IAF and the Astra development team will be positive identification of enemy targets at those extended ranges. IFF (Identification Friend or Foe) still remains a challenging complication as even while the United States Air Force tactics are BVR dominated, very few BVR shots occurred in combat prior to Gulf War I 'Desert Storm'. Even during 'Operation Desert Storm', United States Navy F-14 Tomcats were disallowed the use of their AIM-54 Phoenix BVRAAMs for IFF purposes at extended ranges, because they lacked two-sources of information. USAF fighters however possessed onboard systems to supplement data from Airborne Command Posts (ACP) like the E-3B 'Sentry' Airborne Early Warning & Control (AEW&C) platforms and were thus allowed to conduct BVR engagements.

Since IFF remains a problem because of incorrect and absent returns and 'spoofing', AEW&C platforms are presently deployed for reconfirmation of enemy airborne targets at extended ranges and in this respect the IAF will naturally be benefited by operation of A-50EI AEW&C platforms followed by indigenous types. No more do fighter pilots need to follow the risky 'eyeball/ shooter' sequence, where the flight leader comes unacceptably close to the enemy formation for positive identification to pass the data to other fighters to enable BVR launches. Hopefully in the long

### Saab unveils new RBS 70 NG; contender for the Indian Army



With its new sighting system, improved precision and increased all-target capability, the new RBS 70 NG is the latest air defence system from Saab of Sweden. With an integrated 24/7 all-target capability Saab's new RBS 70 NG VSHORAD system has been developed "for any combat situation." The

RBS 70 NG is a prime contender for procurement of Very Short Range Air Defence (VSHORAD) Manportable Air Defence (MANPAD) missiles by the Indian Army.

The integrated thermal imager and night sight capability combine to provide true 24/7 performance. Three-dimensional target designation and automatic target detection improve reaction times, while the auto-tracker aids the missile operator during engagement, increasing hit probability throughout the missile range.

According to Saab India Country Head, Inderjit Sial, "The RBS 70 NG is on offer to the Indian Army to fill a crucial need gap. The all-new RBS 70 NG VSHORAD system is a versatile battlefield game changer and will offer critical edge in the spectrum of deployment. We believe that the RBS 70 NG meets and exceeds the requirements of the Indian Army for a system that has multiple target seeking and tracking capabilities, multi-launcher capability, ability to deploy from high mobility vehicles, surface ship and submarine naval vessels, ability to engage aerial targets by day and night and aerial target detection capability."

With the latest generation of missile - the BOLIDE - the RBS 70 NG is directed at the complete air and ground threat spectrum, including those long range and also close to ground. "Everything from fixed and rotary wing aircraft and helicopters down to small targets such as cruise missiles, UAVs and armoured ground targets like APCs can be engaged. The RBS 70 NG has an effective intercept range of 8 km, with altitude coverage in excess of 5,000 m, making it the best-in-class air defence missile system. It is capable of operating in complex environments such as urban terrain and is well equipped for all environments, including tropical, desert and arctic conditions."





# MEADS demonstrates advanced capabilities in Integration test

The Medium Extended Air Defence System (MEADS) elements have successfully performed a simulated engagement against 'real-world' air and representative missile threats demonstrating MEADS' plug-and-fight capabilities. The lightweight MEADS launcher is easily transportable, is tactically mobile and is capable of rapid reload. It carries up to eight Patriot Advanced Capability-3 (PAC-3) Missile Segment Enhancement (MSE) missiles and achieves launch readiness in minimum time. Through improvements in range, interoperability, mobility and full 360-degree defence capability against the evolving threat, MEADS improves the capability to defend troops, both friends and allies. Using its 360-degree defensive capability, the advanced MEADS radars and MSE missile, MEADS can defend up to eight times the coverage area with far fewer system assets and significantly reduces demand for deployed personnel and equipment, which reduces demand for airlift.

MEADS International, a multinational joint venture headquartered in Orlando, Florida is the prime contractor for the MEADS system. Major subcontractors and joint venture partners are MBDA in Italy and Germany, and Lockheed Martin in the United States.

term, development of electro-optical seeker technology coupled with onboard threat database will let the missiles themselves determine legitimacy of the targets.

Astra is also well suited for the concept of 'Cooperative Fighter Operations' or Mixed Fighter Force Concept (MFFC) that is essential for future BVR engagements with optimum performance and results. Pairs of aircraft will be data-linked; allowing one fighter to launch missiles against the targets while it is illuminated by its companion. In such engagements a fighter like the Tejas LCA will be able to impart the greatest kinetic energy to the Astra by accelerating up to Mach 2 and then manoeuvring out of the engagement. An illuminator fighter such as the Sukhoi Su-30MKI with its powerful radar capable of performing like a mini-AEW&C would remain firmly subsonic keeping a decent distance from the target, so providing either command-guidance updates or illuminating the target.

Finally as the Tejas LCA is set to undergo further structural modifications to incorporate more powerful General Electric GE. 414 engines, it may be judicious to provide 'accommodation' for conformal recessed carriage of Astra underneath its fuselage to further lower the Radar Cross Section (RCS) already benefited by outstanding design and incorporation of composite materials, the lower dimensions and weight of Astra acting as boons. A lower RCS will ensure that the Tejas remains undetected at extreme ranges against other airborne detectors compelling enemy aircraft to come within Astra's engagement envelope under wide circumstances and especially during opening stages of operations.

Sayan Majumdar

Shinmaywa's US-2

# **New generation Seaplanes**

spiring to be a recognised regional maritime power, the Indian Navy must not only be able to address immediate security concerns of the country and counter enemies of the state but also able to contribute in benign and constabulary operations in its "area of interest and influence". From a maritime perspective, such power status contributes to burdensharing including the protection of global public goods and the oceanic commons to firstly achieve freedom of navigation and safety at sea; secondly, promote regional stability through an open and participative security architecture; thirdly, proactively alleviate suffering during disasters in the littorals of 'friendly' nations and finally have a constabulary capacity to maintain order at sea for the common good.

Development of such capabilities and induction of appropriate enabling systems not only signal a firm regional commitment towards continued regional stability and maritime safety but also is an affirmation of delivering natural responsibilities that come with great power status. Whilst surface ships, submarines and aircraft are all able, in some manner or the other in fulfilling the above missions, each of these platforms are also limited in some form. It is in this context that modern seaplanes make possible a range of options not achievable by any other platform. Beginning their debut on 28 March 1911 when the Hydravion took-off from water at Martinque, seaplanes had, by end of World War I, carried out transcontinental flights and in some instances, been refueled by ships and submarines at sea. After World War II seaplanes lost their military preeminence though commercial applications continued.

Recent technological advances have now resurrected seaplanes into becoming a veritable force multiplier for maritime operations. Seaplanes can provide the much needed logistic support to islands and protect offshore assets, carry out surveillance and intelligence gathering, transoceanic SAR and casevac, extended fleet logistic and maintenance support, long range Visit-Board-Search-Seizure (VBSS) operations, humanitarian assistance and disaster relief operations and for countering arms and drugs trafficking, human migration, poaching, toxic cargo dumping etc. Unlike conventional helicopters and aircraft, seaplanes can land at the location itself and enforce the will or the law of the country. A unique feature of the seaplane is that it combines the capabilities of rapid surveillance with prompt response, whether for relief or seizure in a single platform. Of particular significance is that "power of arrest" and the "right of hot pursuit" is accorded to

military aircraft which includes seaplanes under the UNCLOS. This is relevant for all constabulary operations.

The key requirement of seaplane operations out at sea is its ability to operate in rough water, with adequate range, payload, have STOL, shallow water operations and beaching capabilities. Of these, rough water operations are paramount. According to studies, only about 50% of all waves are of seastate 2 or lower (below 1.2 m in height). Seastate 5 encompasses some 95% of all waves likely to be encountered. The seaplane must therefore have full operational capability even in seastate 5 (3m waves). Equally important, in the Indian context, the seaplane's range must be adequate to conduct missions from the Malacca Straits on the eastern side to the Gulf of Aden on the western. For disaster relief operations, the seaplane must have capacity for onboard medical aid and a sick bay for at least ten patients. STOL features are also a must while payloads would vary with the mission but the aircraft must be able to carry 2-3 sections of rescue personnel with their equipment.

The Indian Navy has issued a RFI for induction of seaplanes and major contenders in this category are Bombardier of Canada, Beriev of Russia and ShinMaywa of Japan. defexpo SPECIAL

#### **VAYU** Interview with

## Anil Kumar, CMD, Bharat Electronics Limited (BEL)

### **WAYU**: What has been driving BEL's growth during the year 2011-12?

**AK:** BEL is a multi-product, multitechnology, multi-unit conglomerate with each of the Units / Strategic Business Units (SBUs) dealing with specific business segments. The major systems and products dispatched till end of the third quarter 2011 were in the segments of communication, radars, electronic warfare (EW), weapon systems, electro-optics, tank electronics and fire control systems.

Some of the non-defence projects like National Population Register and Socio Economic Caste Census, too, have contributed to BEL's overall performance. The Ministry of Rural Development placed an order for 6 lakh Tablet PCs to carry out the Socio Economic Caste Census and we rose to the challenge by supplying the required numbers in record time. With some major projects lined up, the company is confident of surpassing last year's turnover of Rs.5,530 crores. The order book at the end of January 2012 is around Rs. 26,000 crores as compared to Rs. 23,600 in the beginning of FY 2012.

### **WAYU** : What do you foresee in the next financial year?

**AK:** Going by the current order book of Rs.26,000 crores, we are expecting significant turnover for the next financial year. A major share of the turnover will come from weapon systems, radars, FCS, NCS, communication systems, EW, surveillance systems, tank electronics and smart cards.

Ever since the Company's inception, R&D has predominantly been the driving force behind BEL. Some of the key products which are currently under development are likely to make rich contributions to BEL's business in the coming years. The company has also initiated diversification activities in the areas of nuclear instrumentation, solar energy, airborne radars, etc. In a nutshell, execution of the current order book in line with customer requirements, thrust on R&D, diversification and enhanced focus on marketing, etc will be the growth drivers for BEL.

#### **VAYU**: What about the export front?

**AK:** The company is targeting US \$42 million of exports this year. The total order book for exports is about US \$63m. Countries in Africa, Latin America, Southeast Asia, SAARC, Middle East and CIS countries are the markets for export of BEL products. The identified products are HF and VHF communication equipment, battlefield surveillance radar-short range, opto-electronic products like eye safe laser range finders, night vision devices and solar products and components. Apart from products, contract manufacturing business from the USA and Europe is also being addressed.

BEL is also closely working with various foreign aerospace and defence companies to secure business under the mandatory offset clause in the RFPs for Indian defence procurement. These companies have visited BEL's facilities and based on their feedback, necessary action has been taken. Seven of our SBUs/ Units have got AS 9100 Certification to address the aerospace business. Further, efforts are being made to establish longterm supply chain relationships with global players.

# **VANU**: What will be BEL's areas of business interest in the MMRCA deal? What role do you foresee for BEL in the project?

**AK:** As per the provisions of RFP, the vendor has to undertake offset contracts to a minimum of 50 per cent of the value of foreign exchange component of the



Anil Kumar, Chairman-MD of BEL

commercial proposal. The total value of offset contracts in the area of BEL's interest (EW, avionics and radar) is expected to be around US \$800 million. BEL has initiated discussions with vendors to secure a significant part of the above opportunity and have signed MoUs with OEMs and their major suppliers.

# **VANU**: Can you name some of the projects BEL scientists are currently working on?

**AK:** Some of the ongoing R&D activities in BEL are in areas such as software defined radios, high capacity radio relays, tactical communication system, phased array radars, missile systems, doppler weather radars, eye safe lasers and laser target designators, uncooled and cooled thermal imagers, fire control systems, network centric warfare and C4I command control systems, new generation electronic warfare & avionics technologies and new generation sonars.

Some R&D projects which are under development or in advanced stages of completion include the weapon locating radar Aslesha, Bharani, doppler weather radar, software defined radio, routers, encryptors, 100W HF radio for BSS, VHF radio for coastal surveillance, electro optic fire control systems, coastal surveillance system, towed array sonar, track and wheel integrated EW system for the Army, integrated ESM and ECM systems for Navy, missile warning systems for the air force, combat management system for various ships, Akash for Army, L70 gun upgrade, eye safe LRF modules, multi function hand held thermal imager, high repetition LRF for air defence, NBC recce vehicle and sighting and fire control systems.

### **VAYU**: What is status of the Software Defined Radio programme?

**AK:** We are developing our own Software Defined Radio (SDR) for all the three Services; the radio will have around 16 variants. We expect the SDR to be available for trials by June 2012. SDRs can communicate with legacy radios existing with the armed forces. Since the Army uses BEL radios, they can use these sets with the same encryption. BEL has also developed suitable interfaces for the existing HF radio sets, which enable secure communication between these radios.

### **WAYU**: What are the new radars in the offing from BEL?

AK: Weapon Locating Radar (WLR) is one project which we are quite satisfied about. This project was jointly developed by BEL and Electronics Research and Development Establishment (LRDE), a DRDO lab. The indigenously developed WLR has met all the user requirements. We are also looking at a smaller and more compact version of this radar for mountainous terrain. Besides WLR, we have the 'Bharani' 2D radar for the Indian Army and 'Aslesha' 3D Radar for the Indian Air Force. These radars are portable and are meant for use in mountainous regions. BEL is working on long-range surveillance radars for all the 3 Services for use on coast, ship, mountains, etc.

### **EXAMP**: Does BEL have any plans to enter into any new Joint Venture?

**AK:** The amendments in DPP have given an opportunity to BEL to form JVs with leading global defence players and acquire the required critical technologies. The above approach will also put BEL in a position, wherein it can source stateof-the-art subsystems and products from such Joint Ventures and play the role of a system integrator for large strategic defence systems.

We are very actively pursuing a JV with Thales, France, for the manufacture

of civilian and select defence radars. This JV is at the advanced stage of finalisation.

Even though we will continue to focus on development of new technologies through in-house R&D, we will pursue JVs in specific areas where we do not have the technology.

We are in talks with Rafael for establishing a Joint Venture in the field of seekers and missile electronics. We are also in the process of identifying a third partner who can add value to the JVC and who is acceptable to both companies.

# **VAVU**: How do the new Government guidelines on defence PSUs, private sectors impact BEL?

given to indigenous design, development and manufacture of defence equipment if it can be developed within timelines required by the Defence Forces.

Also all equipment / weapon systems/ platforms required as per LTIPP will by and large be developed / integrated/made within the country. To take advantage of these policy decisions, BEL has renewed its thrust on indigenous development either through in-house efforts or in collaboration with DRDO/academic institutions. BEL has made significant progress in the development of major systems listed in LTIPP such as CCS, NCO for Navy, BMS, EW track and wheeled programme. BEL is also



**AK:** The Indian market scenario for defence and civilian electronic products and systems is rapidly changing. With the opening of the defence electronics market to private participation, the competition is likely to intensify. In this scenario, BEL is taking proactive steps to protect and further consolidate its leadership position in the Indian defence market while at the same time accelerating efforts to get into new business areas. As per the new production policy, preference will be exploring possibilities of joint ventures to take advantage of 'Buy and Make Indian' category of defence purchases.

BEL has been increasingly outsourcing its requirements to the private industry. At present about 30% of our requirement is outsourced to the private sector. We are also partnering with private players for development programmes in technology areas. BEL has been outsourcing a large amount of its hardware and software requirements, for projects like the Akash, WLR, CAR, etc.



VI-OIL has been supplying aeroengine oils, hydraulic fluids, greases, protective and specialties to the Indian Defence Services since 1994. For military applications these critical products are 'Type Approved' by the Centre for Military Airworthiness and Certification (CEMILAC), Ministry

of Defence. AVI-OIL is also registered with the Directorate General of Aeronautical Quality Assurance (DGAQA) Ministry of Defence, as an eligible manufacturer of aviation lubricants.

AVI-OIL India [P] Ltd. is a joint venture of Indian Oil Corporation Ltd. Balmer Lawrie and Co. Ltd. (both PSUs) and NYCO S.A. of France, established for the indigenous production / supply of aviation and allied high performance lubricants to the Defence Services, Civil Aviation and the industrial sector. The products of AVI-OIL include a wide range of lubricants, mostly synthetic, designed to meet the stringent requirements of operation in aircraft / equipment, over a wide temperature range and often hostile environment.

Until the emergence of AVI-OIL, such products were being imported and thus, to achieve self-reliance in this strategic area, the company was established in 1993 with Indian Oil Corporation providing the marketing infrastructure; manufacturing facilities were set up with the strength of Balmer Lawrie in project engineering and NYCO S.A. providing the technical know-how on a continuous basis. A wide range of products for aircraft and industrial equipment and synthetic ester basestocks are now produced at the plant located at Village Piyala in District Faridabad, Haryana, 45 kms. from New Delhi.

For supplies to the Civil Aviation sector, AVI-OIL is approved by the Directorate General of Civil Aviation (DGCA) under the CAR Series E Category D&E requirements. AVI-OIL of bio-degradable lubricants like special ester based fire resistant hydraulic fluids, non-flammable insulating liquids and oils for eco friendly refrigeration compressor systems. The company has implemented and maintained its Environmental Management System now certified to ISO 14001-2004.



has established a modern state-of-the-art laboratory at its plant for Quality Assurance of the products and to provide technical support to the customers. This service enhances the reliability of operation of the equipment and provides confidence to the users. Its Quality Management System is certified for compliance with the International Standards ISO 9001-2008 and the Aerospace Standard SAE AS 9100, Rev. C.

AVI-OIL is entirely dedicated towards the conservation and protection of the environment and markets a range Development of new products for the aviation and industrial sectors is a continuous process at AVI-OIL, through the efforts of its Research and Development Unit, which is recognised by the Department of Scientific and Industrial Research, Ministry of Science & Technology. The emergence of AVI-OIL complements the efforts of India's aerospace industry by providing the strategic products for self-reliance and the industrial sector's need for efficient, energy conserving and eco-friendly lubricants.

#### CAE meeting India's growing demand for simulation

Ananth Ramaswami, Managing Director,

CAE is expected to deliver a C-130J full-mission simulator to the Indian Air Force later this year. This image was generated by CAE's Medallion-6000 visual system which will be used in the simulator.

Interview with

#### **VANU**: An increasing dependence on modelling and simulation for cost effective and realistic training in India is being forecast. How is CAE gearing up to meet this growing demand?

**AR:** In India, synthetic training is at a nascent stage in the defence services. There is, however, increasing awareness about the numerous benefits that accrue from synthetic training and the demand for modelling and simulation seems to be growing at a rapid rate. Simulation improves the realism of training, lowers costs, reduces operational demands on weapon system platforms, lowers risk, is safe and environmental friendly, and allows for training that is too dangerous or not possible in the actual weapon system platform. The defence forces in India are acquiring some of the most advanced and capable platforms available on the market. However, they need to be able to 'train as they fight' and this is where simulation is invaluable. New RFIs and RFPs are indicative of a definite upward trend in the need for synthetic training in the three services, and CAE certainly welcomes the prospect of India's military extending their use of simulation.

#### **EXAMPLE** : As Managing Director of CAE India, how do you envisage the market for synthetic training in both the civil and military domains in India?

**AR:** Synthetic training is well structured and defined in the civil sector. CAE has invested a considerable amount of resources in terms of infrastructure, equipment and human resources in India to meet the requirement. In addition to two ab-initio flying academies in Gondia and Rae Bareli, CAE is running a state-of-the-art simulator centre in Bangalore at our new aerospace and defence complex. We are continuing to promote and showcase the benefits of CAE's world-class simulation technologies to India's defence community. The military lags behind their civil counterparts in the use of high-fidelity simulation.



CAE's Ananth Ramaswami expects the demand for simulation-based training solutions to grow substantially in India's defence sector as the country acquires new platforms.

#### **WAND**: What are your views on publicprivate sector partnership? What initiatives has CAE taken in India to forge partnerships with various entities?

**AR:** In India, we are actively involved in various partnerships and collaborations, such as our HATSOFF joint venture with HAL or our joint venture with InterGlobe to create an aviation training centre in New Delhi. We believe these types of relationships are extremely successful in delivering worldclass simulation and training solutions while expanding local capabilities and technologies here in India. We are always open to the idea of collaborating with suitable partners when the need arises to design and develop a solution to meet the needs of the customer.

#### **VARU**: Offset policies in India are designed to generate greater business opportunities in the country and assist in technology transfer from abroad. Has CAE in India initiated any steps to capture business generated by offsets?

**AR:** In fact, CAE has recently entered into a strategic partnership with Rossell India Limited in order to address the needs of the market generated by offsets. This special purpose company will be owned 74 percent by Rossell and 26 percent by CAE, and it recently received approval from the Indian Foreign Investment Promotion Board (FIPB). The special purpose company will be operational this year. We have also initiated steps towards having a rotary wing academy on the approved offsets list. We do wish to maximise business opportunities by leveraging CAE's breadth of simulation technologies in line with the offset policy.

**WAYCO:** HATSOFF is the first facility of its kind in India for providing training to rotary wing pilots. Please tell us about the experience so far. Considering the rising demand for helicopter pilots, do you foresee proliferation of similar facilities in the country?

**AR:** The Helicopter Academy to Training by Simulation of Flying – or HATSOFF – is the first and only facility of its kind in the country for rotary wing training. It is a state-of-the-art greenfield project in collaboration with HAL. This unique facility currently provides training for three types of helicopters -- the Bell 412, civil/conventional Dhruv and Eurocopter AS365 Dauphin. Later this year HATSOFF will add training for the military variant of the Dhruv. Utilisation of the facility is below the designed capacity right now, but we are continuing to promote the many advantages of helicopter simulator training.

The fact is that until HATSOFF, India had lacked adequate helicopter simulation training, so most operators have had to rely on training in the actual aircraft and the authorities haven't enforced the regulation that every commercial pilot - fixed or rotary-wing - must fly a minimum of 10 hours annually on a simulator. CAE is a strong proponent of global efforts by the International Helicopter Safety Team (IHST) to reduce helicopter accident rates by 80 percent by 2016. Considering the planned acquisitions and the growing demand for helicopters in the military and civil domains in India, there will certainly be a need to augment the existing capacity of helicopter simulators in the country. CAE is very open to expanding HATSOFF as well as establishing additional facilities in India.

# Interview with

### A Strategic Partnership with India

### Stefan Zoller, CEO of Cassidian

### **VAYU**: What is your evaluation of India's defence and security market?

**Zoller:** India's defence and security market is growing rapidly and the Indian Government is providing strong support to increase indigenous capabilities of its aerospace and defence industry. For Cassidian, India is a key market which offers attractive opportunities in the creation of strategic partnerships. India is growing and we would like to grow with it! Thus, we are committed to invest in Research & Development and establish long-lasting industrial cooperation with both public and private industry by plugging India into Cassidian's global value chain.

### **VAYU**: Which Indian companies has Cassidian partnered with?

**Zoller:** We enjoy successful partnerships with the Defence Research and Development Organization (DRDO), the DARE research institute and several Indian companies which have impressed us with their skills, particularly in defence electronics. Developing a closer relationship with Indian customers and local industry is vital for our success here and together with local Indian partners we want to drive more business to India to enable its industry to export high value defence and security equipment to global markets.

#### **VAYU**: Can you illustrate some projects that Cassidian has taken up with its Indian partners?

**Zoller:** Cassidian has signed a consultancy contract for India's Light Combat Aircraft (LCA) with the Aeronautical Development Agency (ADA) and was awarded a contract by the DRDO to supply consultancy services to the Indian Armed Forces in developing the system architecture of its Airborne Early Warning & Control (AEW&C) programme. Furthermore, we successfully developed a Missile Approach Warning System (MAWS) for Indian rotary winged and widebody aircraft which has been certified



as indigenous equipment by Indian authorities. We have also entered into a joint venture with Larsen & Toubro (L&T) in the area of defence electronics. In 2011, we opened our Engineering Centre in Bangalore,the first defence oriented engineering centre in India owned by a foreign company.

### **VAYU**: What are your plans in India in the next five years?

**Zoller:** We will explore new areas of business in India and offer value-added solutions from our extensive defence and homeland security portfolio to our Indian customers. We would like to contribute more to support the Government in its endeavour to increasingly indigenise India's defence and security capabilities. We plan to establish partnerships in cutting-edge technology areas similar to our joint venture with Larsen & Toubro. We are also integrating Cassidian's Engineering Centre in Bangalore into our global engineering organisation.

### **VAYU**: What services are Cassidian offering to India?

**Zoller:** As a major global defence and security player, Cassidian offers the latest integrated solutions for network centric operations whether they are sensors, platforms, missiles, fighter aircraft, secure fixed and transportable communication systems – Professional Mobile Radio (PMR) - or our versatile signal intelligence systems, Cassidian can equip India with the necessary means to meet a wide spectrum of defence and security needs. As a Lead System Integrator (LSI), Cassidian can also provide support in addressing threats coming from land, sea or air.

**VAYU**: The Eurofighter Typhoon was not selected in the Medium Multi-

### Role Combat Aircraft (MMRCA) competition in India. Please comment.

**Zoller:** We are disappointed that India selected our competitor as preferred bidder in the Medium Multi-Role Combat Aircraft (MMRCA) tender, although this does not yet amount to a contract signature. We respect India's decision. And we remain ready to support the creation of a cluster of world-class indigenous defence and aerospace companies in India.

#### **VANU**: Cassidian is not only manufacturing modern combat aircraft but also UAVs. Are you offering UAVs to India as well?

**Zoller:** Cassidian is strongly involved in developing the next generation of unmanned air systems. We have successfully demonstrated the light tactical UAV Tracker to the Indian Army. This mini UAV is dedicated to surveillance and intelligence and gathers close range high resolution image with secured realtime processing in day/night conditions. The system relies on advanced image exploitation and a mission control ground segment. In production for the French Army, the Tracker is easy to operate and can be deployed and hand-launched in a few minutes.

### **Wayu**: What can Cassidian offer India in the homeland security domain?

**Zoller:** Cassidian offers India a diverse portfolio homeland security solutions such as integrated border and coastal surveillance as well as effective security solutions for large events. Cassidian is already a leading supplier for Professional Mobile Radio technologies (e.g. TETRA) to India. We have been awarded India's first major public safety TETRA contract network by the police of the state of Andhra Pradesh to cover the region of Cyberabad (the high-tech hub) and have also deployed a modern TETRA radio network to secure the Indian Parliament.

### **VAYU**: What are your expectations at the Def Expo 2012?

**Zoller:** We are investing in India and are committed to increase our industrial footprint here. Events like the Def Expo 2012 allow us to interact with our customers and potential partners. I am looking forward to use this wonderful opportunity!



# **AVI OIL**





#### J-20 test flight on video

A video of the much speculated Chengdu J-20 has surfaced, undergoing flight-testing on 26 February at Chengdu, the capital of Sichuan province. The footage is of passable quality. Besides the J-20, there are numerous shots of various Chengdu J-10 aircraft taxiing (presumably as chase aircraft) and there is a brief appearance of the J-10B as well.

The J-10B has not been officially acknowledged by China, but from various inputs, appears to be a significantly upgraded J-10A, with a DSI (diverter-less supersonic inlet), IRST sensor, modified control surfaces, MAW and a redesigned nose that is speculated to house a new Chinese AESA radar. It is not clear whether the aircraft uses the Saturn AL-31 engine or the Chinese WS-10 turbofan.

The J-20 (with the number '2001' under the canopy) took off without reheat and flew through the duration in a 'clean' configuration, with landing gear retracted. The pilot executed a number of manoeuvres and while he succeeded in drawing some vapour from the air, the aircraft didn't seem to be pulling extreme g forces, likely as a precaution during this early phase of testing. After a wide loop, the pilot put the aircraft through a series of turns and an aileron roll before resuming a sequence of turns that quite clearly displayed control surface deflection, both of the canards and the all-moving V-tails. The engines did not appear to vector thrust during any phase of the flight but did, at some stages, trail a visible plume of smoke.

Also shown to good effect was the J-20's planform, with the wings and leading-edge extensions strongly reminiscent of the Saab Draken and canards that appear broadly similar to those found on the J-10. The fuselage is quite substantial and, unlike the Sukhoi T-50, appears to be free from any openings or abrupt angles. The video is not clear enough to make out any weapons bay doors.

The video comes to an abrupt end as the J-20 is on approach to land, so there is no footage of the flare angle, control surface deflection or whether a parachute was used to slow the craft down.

(Monitored by Angad Singh)



#### Avic, PAC developing JF-17 two-seater

A vic's combat aircraft subsidiary at Chengdu is developing a two-seat version of the JF-17 Thunder fighter in cooperation with the Pakistan Aeronautical Complex. The two-seater will be adapted for conversion training plus combat roles. The JF-17 is being built in a joint programme with Pakistan for the PAF (see *Vayu* issue I/2012). The programme, which began, unusually, without a conversion trainer, involves 150-250 JF-17s for Pakistan and the export market.





### Lockheed unveils C-130XJ, F-16V variants

Lockheed Martin has unveiled the F-16V, a new variant and an upgrade package that includes datalinks allowing the aircraft to operate alongside the F-35 and F-22. In a separate development, Lockheed Martin is developing new variants of the C-130, including the XJ.

The F-16V has datalinks which communicate with the F-35 and F-22, which new capability on the F-16 allows it to operate alongside US and other air forces' fifth generation fighters. This 'V' variant comes with AESA radar, upgraded mission computer and architecture and improvements to the cockpit.

Lockheed is also developing the C-130 platform further with the C-130XJ and SC-130J Sea Hercules. The C-130XJ initiative is significant because this variant will have a price 10-15% lower than the C-130J, according to Lockheed Martin. The XJ's airframe and engines are exactly the same as the J model, but Lockheed Martin has been able to reduce the sale price by stripping the aircraft of some systems deemed to be unnecessary, depending on the mission.

# Pakistan Air Force receives new, upgraded F-16s

The Pakistan Air Force received the last of 18 new F-16C/D Block 52 fighters from Lockheed Martin in early February 2012, this being flown to PAF Base Shahbaz near Jacobabad, which houses No. 5 Squadron. Accompanying the aircraft on its delivery flight were two PAF F-16A Block 15s that have undergone mid-life update process in the US. A few days later, the PAF also received the first of its F-16s undergoing an avionics and structure upgrade in Turkey.



Turkish Aerospace Industries (TAI) had been selected to work on 41 PAF F-16s, in a programme named *Peace Drive* II. Modification of the first aircraft began in October 2010 and the last should be finished in 2014. TAI is also providing training to 72 PAF technicians, so that they can subsequently work alongside its workforce on upgrading the F-16s.

Pakistan's 18 F-16 Block 52s are powered by Pratt & Whitney F100-229 engines, with other systems understood to include Northrop Grumman's mechanically scanned APG-68(V) 9 radar and ITT's ALQ-211(V) 9 advanced integrated defensive electronic warfare suite.

The proposed weapons package outlined by the US Defence Security Cooperation Agency in 2006 included 500 Raytheon AIM-120C5 advanced medium-range air-to-air missiles and 200 short-range AIM-9M-8/9 Sidewinders, plus 500 Boeing joint direct attack munitions, 1,600 enhanced GBU-12/24 laser-guided bombs and 700 BLU-109 penetrator bombs.

#### **Turkey orders F-35s**

On 5 January 2012, an announcement was made that the Turkish government has authorised the *Savunma Sanayii Müstesarliği* (SSM, Undersecretariat for Defence Industries) to initiate contract negotiations with Lockheed Martin for procuring two F-35A Lightning IIs after the meeting of Defence Industry Executive Committee. The order also marks commitment of the Turkish Government and aerospace industry to the Joint Strike Fighter project as Turkey is a Level III partner. The two F-35s will be used for training, test and evaluation and will be delivered in 2015.

The Turkish Air Force has a requirement for around 100 F-35s to



replace its McDonnell Douglas F-4E Phantom IIs, which will form the core of the air force's combat force from the next decade. Currently Turkey has around 210 Lockheed Martin F-16C/Ds, which are due to receive the Common Configuration Implementation Programme upgrade under *Peace Onyx III*, while a further 30 F-16C/Ds will be delivered under *Peace Onyx IV*. SSM has also signed a contract with Turkish Aerospace Industries for the conceptual design phase of the TF-X project to develop a combat and trainer aircraft to replace earlier blocks of F-16 and F-4Es in the 2020s.

#### Romanian MiG-21 Lancers ending service life

On 15 December 2011, after a meeting of the Romanian Supreme Defence Council in Bucharest, Romanian President Traian Băsescu, stated that when Romania's current force of IAR-upgraded MiG-21 Lancer fighters reach end of their service life, starting in 2015, the country will be unable to meet its NATO commitments. He said that a decision on combat aircraft force modernisation is required "in the shortest possible time".

However, he stated that Romania's current NATO commitment to procure 48 combat aircraft is "unaffordable." Concerning the absence of a decision on Romania's upgrade, he said, "I have already said we have no funding for such aircraft, but I cannot fail to inform the public that Romania is getting closer to a time when its air force will no longer be operational."



#### **Used Typhoons offered to Bulgaria**

The German Government is to offer Bulgaria used Eurofighter Typhoons, this matter reportedly discussed during the visit of Bulgaria's Prime Minister Boyko Borisov to Germany in mid-January, when he met Chancellor Angela Merkel. An agreement was signed covering co-operation between the German and Bulgarian Air Forces, including joint exercises and personnel training.

In January 2011, Bulgaria had forwarded requests for information to Sweden (offering Saab JAS39C/D Gripens), Germany (Typhoons), the United States (Boeing F/A-18 Super Hornet and Lockheed Martin F-16C/D Block 50/52 Fighting Falcon, as well as used F-16 Block 25s) and France (Dassault Rafale). In late 2011, Bulgaria's Defence Minister Anyu Angelov announced that the fighter competition will not start in 2012 as anticipated but instead will take place in 2013, if funding is available.



The price for used Typhoons will be considerably lower than that of newly manufactured aircraft. Cuts in the German armed forces announced in October 2011 call for reduction of the Eurofighter Typhoon fleet by 37 aircraft. Germany will also make similar offers to sell the Typhoons (most likely Tranche 1 aircraft) to other countries in the region seeking new combat aircraft, such as Slovenia, Croatia and Serbia. In addition to Germany, Bulgaria has already been offered used Typhoons by Italy.

#### F-35Bs for US Marines

O n 11 January 2012, the first production Lockheed Martin F-35B Lightning II aircraft for the US Marines (BF-06) was flown to Eglin AFB, Florida and was joined the same day by a second aircraft (BF-08). Both aircraft have been assigned to Marine Fighter Attack Training Squadron 501 (VMFAT-501) commanded by Lieutenant Colonel James B Wellons of the 2nd Marine Aircraft Wing, which is part of the multi-service F-35 Integrated Training Centre (ITC) grouped under the US Air Force's 33rd Fighter Wing at Eglin ARB. The other flying units of the ITC are the US Navy's VFA-101 (to operate F-35Cs,



delivery of which has yet to commence) and the Air Force's 58th Fighter Squadron flying F-35As. While F-35A deliveries are under way to Eglin, training has yet to start as the Lightning has not received its military flight clearance.

#### Y-8 transports for Venezuela

Two Shaanxi Y-8F-400 medium transports are to be delivered to the Aviación Miltar Nacional Bolivariana Venezolana (Venezuelan National Bolivarian Military Aviation) in October 2012. The aircraft are the first of eight purchased to augment the three Lockheed C-130H Hercules currently in service with the *Grupo Aéreo de Transporte* 6 (Air Transport Group 6) at Base Aérea El Libertador in Maracay. An initial group of Venezuelan technicians are being trained in China, to be followed by a cadre of pilots. Details of the purchase were announced in November 2010 and the aircraft were expected to be delivered in August 2012.





#### Mexico orders T-6C+ Texan IIs

In January 2012, Hawker Beechcraft signed a contract to supply six T-6C+ Texan IIs to the *Fuerza Aérea Mexicana* (Mexican Air Force). Two aircraft will be delivered in early 2012 to an "advanced training base in Mexico's northern region", believed to be the *Escuela Militar de Aplicación Aerotáctica de la Fuerza Aérea* (Tactical Air Training School) based at Chihuahua.

The T-6C+ is a new variant of the T-6C, itself an export version of the T-6B basic trainer supplied to the US Air Force and Navy and capable of carrying external stores. It is equipped with an Esterline CMC Cockpit 4000 avionics suite, head-up display, up-front control panel and has a hands-on throttle and stick interface.



Mexico was reportedly seeking an initial batch of ten T-6Cs and plans to acquire enough of the aircraft to replace its entire Pilatus PC-7 turbo trainer fleet in the training and counterinsurgency roles. A total of 88 PC-7s were delivered from July 1979, around 50 of which still remain active.

#### JMSDF orders Northrop Grumman's ALMDS

The Japan Maritime Self-Defence Force has purchased four helicopter-mountable, laser mine detection systems for protection of its coastline and the daily maritime traffic using the country's ports. This is the first direct commercial sale of



Northrop Grumman Airborne Laser Mine Detection System (ALMDS) to an international navy.

The mine detection system is laser-based and utilises streak tube imaging light detection and ranging (LIDAR) to detect, classify and localise near-surface moored sea mines. With high area coverage rate capability, the system transmits a fan-shaped beam of laser light to establish its swath width and then relies on the forward motion of the helicopter to sweep the light over the water in a 'push broom' manner. Four cameras are arranged to cover the same swath illuminated by the laser fan beam. As images are received by the system, an automatic target recognition algorithm picks out potential mine-like objects and stores their images for classification by shipboard Fleet operators, using computer-aided post-mission analysis tools. Northrop Grumman is working closely with its industry partners Kawasaki Heavy Industries and Fujitsu Limited on delivery and installation of ALMDS.

#### Korean ISR modernisation

**S** outh Korea will procure two Dassault Falcon 2000LX aircraft modified for intelligence, surveillance and reconnaissance (ISR) missions according to the Defence Acquisition and Programme Administration (DAPA), which announced the deal on 26 December 2011. The Falcon 2000s will enter service with the Republic of Korea Air Force (RoKAF) in 2017, replacing the Hawker RC-800 signals intelligence (SIGINT) aircraft. RoKAF currently has eight RC-800 ISR aircraft operational in two versions: four RC-800SIG SIGINT variants were procured under the *Paekdu/Peace Pioneer* project and delivered in 2001, while four RC-800RA imagery intelligence (IMINT) versions acquired under the *Peace Krypton* programme entered service in 2000.

As part of airborne ISR modernisation efforts, South Korea is taking delivery of Boeing 737-7ES airborne early warning and control (E-737 AEW&C) aircraft under the *Peace Eye* programme and negotiations are continuing with the US for the procurement of Northrop Grumman RQ-4 Global Hawk high-altitude long-endurance unmanned aircraft. The second E-737 was handed over on 13 December at Gimhae and was the first example modified into AEW&C configuration by Korea Aerospace Industries at its facility in Sacheon.





#### S. Korea to acquire various PGMs

The Republic of Korea has announced procurement programmes for a number of different air-to-surface precision-guided munitions (PGMs), including the 350 CBU-105 Sensor Fused Weapons (SFW) and Wind Corrected Munitions Dispensers (WCMD), either 177 Lockheed Martin AGM-158 Joint Air-Surface Stand-off Missiles (JASSM) or a number of Taurus KEPD 350 missiles, plus 150 GBU-28 laser-guided hardtarget defeat-bombs. These weapons will initially be used by the RoK Air Force's Boeing F-15K Slam Eagles and FAI/Lockheed Martin KF-16 Fighting Falcon tactical aircraft.



The SFW/WCMD procurement, reported to cost \$205 million, will be part of an agreement with the US for deliveries under the US Foreign Military Sales (FMS) programme in 2013. Deliveries are due to start in 2014 and be completed in 2017. They will replace the RoKAF's current CBU-87 and Mk20 Rockeye cluster bomb units.

The \$344 million stand-off missile requirement is a competition between the JASSM and the, with the winner expected to be selected in September 2012. Evaluation criteria "will include cost." Reports have suggested that it would be possible to procure more JASSMs, as the unit cost was reportedly less than half that of the Taurus. The extent of associated technology transfer to the RoK will also be a consideration in the competition.

#### **Oman to acquire additional F-16s**

O man has ordered twelve Lockheed Martin F-16 Block 50 Fighting Falcons under a \$600 million deal, involving ten single-seat F-16Cs and a pair of two-seat F-16Ds. Details of the sale were released by the US Department of Defence in late 2011 with work due to be completed by 30 November 2016.

Oman's original Foreign Military Sale (FMS) signed in 2010 included 18 aircraft, plus the upgrade of the 12 already delivered under an earlier contract. The new F-16s will be powered by General Electric F110-GE-129s and have the AN/APG-68(v) radar installed. Included in the FMS were four DB-110



reconnaissance pods and a targeting pod, either the AN/AAQ-33 Sniper or a similar system.

The Royal Air Force of Oman's F-16s serve with No.18 Squadron at Thumrait and the additional aircraft will mean a second unit would be formed.

#### Second batch of F-16s for Iraq

Iraq has requested a second batch of 18 Lockheed Martin F-16IQ Fighting Falcons. The approximate \$2.3 billion proposed Foreign Military Sale also includes a large batch of weapons and associated equipment along with the aircraft. Details of the request were forwarded to the US Congress by the Defence Security Co-operation Agency on 12 December 2011.

Air-to-air weapons include 100 AIM-9L/M-8/9 Sidewinders and 150 AIM-7M-F1/H Sparrows. Fifty AGM-65D/G/H/K Maverick air-to-surface missiles are listed in the FMS, along with laser guided bomb units, which comprise 50 GBU-10s and 200 GBU-12s, both variants of the Paveway II family, plus 50 GBU-24 Paveway IIIs. A total of 230 Mk84 907 kg and 800 Mk82 227 kg general purpose 'dumb' bombs are included in the package. AN/AAQ-33 Sniper or AN/AAQ-28 Litening targeting pods will be used to designate targets, while four F-9120 Advanced Airborne Reconnaissance Systems or DB-110 reconnaissance pods are also included in the proposed sale.

#### 'Fly Away' Typhoons for Saudi Arabia

**S** audi Arabia and BAE Systems are expected to negotiate on the sale of 48 Eurofighter Typhoons. Saudi Arabia had ordered 72 Typhoons under the 'Salam' contract, with the first 24 assembled by BAE Systems at Warton, Lancashire and delivered in July 2011. Under the original agreement signed in September 2007, the balance 48 were to be assembled in Saudi Arabia, but negotiations to change aspects of the programme have caused delays.

The changes under discussion involve location of the final assembly of the 48 aircraft, establishment of a maintenance and upgrade facility in Saudi Arabia, upgrade of the aircraft with Tranche 3 capabilities and the cost rises associated with the project. There is general agreement on all points except for the increased price.

Although it has not been confirmed, it is believed that the remaining Typhoons are also likely to be assembled at Warton, which will eliminate the need for an assembly plant in Saudi Arabia, thereby reducing costs.



#### **Anka MALE UAS ordered**

Turkey's Savunma Sanayii Müstesarliği (Undersecretariat for Defence Industries) will negotiate with Turkish Aerospace Industries (TAI) for serial production of the Anka 'Phoenix' medium-altitude long-endurance (MALE) unmanned aerial system (UAS). The initial batch will cover ten Anka UAS for the *Türk Hava Kuvvetleri* (THK, Turkish Air Force) and will be designated *Gozcu* 2 (Watchkeeper 2).

Anka made its first flight on 30 December 2010 and is powered by a Thielert Centurion 2.0 diesel engine, although Tusas Engine Industries is working on an indigenous diesel engine for the UAV. The UAS has completed most of its test programme with the automatic take-off and landing system tested successfully on 11 December 2011. The first ten will be equipped with the Askeri Elektronik Sanayii (ASELSAN) ASELFLIR-300T infra-red surveillance and target designation system, while the Anka B will also carry a synthetic aperture radar also developed by ASELSAN.

The THK currently has ten IAI Herons (designated *Gozcu* 1s) with three ground systems in its inventory. The service's airborne intelligence and surveillance requirements are also catered for through a deal with the US, which has four General Atomics Predators deployed at Incirlik AB in Adana.

#### Italy to reduce F-35B procurement

With the Italian government planning to slash \$1.9 billion from its defence procurement spending in 2012, its plan to acquire 131 Lockheed Martin F-35 Lightning IIs is likely to be affected. A total of 131 of the conventional take-off and landing F-35As and 62 of the short take-off and vertical landing variant F-35B were on order, but a reduction to the total numbers could mean that the F-35Bs would be particularly affected.

The procurement has come under criticism in the Italian parliament for its anticipated total cost of \$22.8 billion, with \$2 billion already spent on the programme. However, Italy remains a key stakeholder in the Joint Strike Fighter's industrial team.

Meanwhile, some 15 Lockheed Martin F-35s were grounded for about 10 days from late January while Martin-Baker repacked improperly installed parachutes in their US16E ejection seats. The F-35 programme office said the parachutes were installed "backwards" after the wrong packing instructions were sent to the company.

#### **Hungary extends Gripen lease**

Hungary is to continue operating its leased fleet of Saab Gripen C/D fighters until 2026. A government-togovernment contract signed by defence ministers Csaba Hende and Sten Tolgfors in Stockholm on 30 January 2012 will be extended by a further 10 years in a deal that has enabled the Hungarian Air Force to operate 12 single-seat Gripen Cs and two D-model trainers originally built for Sweden. Hungary selected the Gripen in November 2001 and took delivery of its first examples at Keckémet air base in 2006 under a lease-



to-buy deal. The entire fleet was operational by late 2008, with the type providing the NATO nation with a supersonic air policing capability to replace the MiG-29 interceptors, being phased out.

#### South Korean F-X III RFP

**S** outh Korea's Defence Acquisition Programme Administration (DAPA) has issued request for proposals for the nation's F-X III fighter requirement, involving the acquisition of 60 aircraft. Submission guidelines for the contest were issued during a meeting held on 30 January 2012 in Seoul, with contenders for the requirement including the Boeing F-15 Silent Eagle, Eurofighter Typhoon and the Lockheed Martin F-35 Lightning II.

Aircraft will be selected using four primary criteria, these being cost, capability, interoperability with South Korean forces and industrial benefits. Seoul is likely to require the F-X III winner to provide significant help with its indigenous KFX fighter programme. Offers on the F-X III competition are due by 18 June, with a decision aimed at late 2012. The selected type will replace the Korean Air Force McDonnell Douglas F-4 Phantoms.

#### Australian helicopter trainers

A ccording to informed sources, Boeing and Thales have selected the Eurocopter EC135 as the preferred platform in their bid for the Australian Defence Force's Air 9000 Phase 7 Helicopter Aircrew Training System tender.

Australia's Defence Materiel Organisation had issued a request for tender in late January to train helicopter pilots for the Royal Australian Navy and Australian Army. Other contenders for the requirement include BAE Systems/CAE/ AgustaWestland, plus Bell/Raytheon and Lockheed Martin/ Bristow Helicopter. Eurocopter's Australian Aerospace unit could also enter a bid.



#### **Brazil begins Super Cougar assembly**

E urocopter's Brazilian subsidiary Helibrás has received parts for the first EC725BR Super Cougar on 16 December 2011. The components were delivered to the Itajubá factory in Minas Gerais and will be used in the 50 Super Cougars ordered for the Brazilian Armed Forces under a \$3 billion contract. The first 16 helicopters are being built and assembled in France, while three of them have already been delivered. Four are due to be delivered from France during 2012, one each for the army, air force and navy, and another for the country's presidency. The helicopters assembled in Brazil will receive some locally produced components, reaching upto 50% of all parts in the final examples, which will be delivered in 2020.



Each of Brazil's armed forces will receive 16 EC725s, while the other two will be used as Presidential transports. The Army examples will be equipped with a forward looking infra-red unit, specialised sensors will be installed in those for the Air Force, while the navy's version will be equipped with anti-submarine warfare and anti-surface vessel systems.

#### EC225s for France, Japan and China

E urocopter has delivered two EC225s to Héli-Union of France in late December 2011. Configured for off-shore operations in support of the oil and gas industries, they are the first EC225s to join the French company's fleet of approximately 30 helicopters that includes AS332 Super Pumas, AS350 Ecureuils, AS365 Dauphins and EC145s. Héli-Union has also ordered four EC175s, deliveries of which are scheduled to start in 2013.

The Tokyo Fire Department has ordered a second EC225, which is scheduled to be delivered in 2013 to the Tachikawa Air Squadron. It will feature extensive mission equipment that includes a fire-fighting system with belly-mounted water tank, emergency medical interior accommodating stretchers and medical intervention kit, search and rescue equipment and avionics for all-weather operations. The latest order marks a 40-year relationship between Eurocopter and its predecessors with the Tokyo Fire Department, beginning with Alouette IIIs and continuing with a fleet that consists of Dauphin N3s, Super Puma L1s and an EC225.

CITIC Offshore Helicopter Co Ltd (COHC) of Shenzhen in the People's Republic of China has ordered seven EC225LPs that

will be delivered between December 2012 and the end of 2015. Those will be used in support of China's offshore oil and gas industry and join a fleet that currently includes AS365 Dauphins, EC155B/B1s and AS332L1 Super Pumas. Eurocopter said that the sale to COHC paves the way for future ventures involving the two companies in training and maintenance services to serve China's rapidly developing rotary-wing market.

#### Third Batch of Enstrom 480Bs to Thailand

Light helicopter manufacturer Enstrom Helicopters delivered a third batch of four Enstrom 480Bs to the Royal Thai Army in January 2012. Ten of the 16 Enstrom 480Bs ordered by the service in February 2010 have been handed over, with the first three being delivered in June 2011 and the second batch of three in August 2011. The final six will be shipped in the first quarter of 2012.



#### Philippine Air Force in major transformation



In 2012, the Philippine Air Force will officially announce the procurement of several new aircraft types, as the service reorients from counter-insurgency operations to air defence of the nation. A new capability upgrade plan calls for the acquisition of six aircraft to replace the air force's remaining Rockwell OV-10 Broncos, and between four and six lead-in jet trainer/attack aircraft. Also included are two maritime patrol aircraft, and one or two others which will be dedicated to command and control or intelligence, surveillance and reconnaissance (ISR) tasks.

The Philippines also plan to request acquisition of 12 ex-US Air Force Lockheed Martin F-16C/D Block 25 fighters, the proposal similar to the USA's granting last year of permission



to transfer 24 ex-Air National Guard F-16C/D Block 15s categorised as "excess defence articles" to Indonesia.

The Philippine Air Force has not operated jet fighters since retiring its Northrop F-5s in 2005, but has continued to operate the Aermacchi S-211 trainer. Potential types for the planned lead-in jet trainer deal include the Alenia Aermacchi M-346 and Korea Aerospace Industries T/A-50. Both companies have made proposals to the Air Force, which also foresees a light attack role for the selected type. Six other aircraft to be dedicated to counter-insurgency operations could come from a list of options including the Air Tractor AT-802U, Embraer EMB-314 Super Tucano and Hawker Beechcraft AT-6. Requirements for new maritime patrol and ISR aircraft are likely to be met by twinturboprop designs.

# F-35A in external weapons test mission

O n 16 February 2012, the first external weapons test mission was flown by an F-35A Conventional Takeoff and Landing (CTOL) aircraft at Edwards Air Force Base, California, further expanding the programme's flight test envelope. The weapons load for this mission involved carrying of two air-to-air AIM-9X missiles on the outboard wing stations. In addition, the F-35 carried two internal 2,000-pound guided bombs (GBU-31) and two advanced medium range air-to-air missiles (AIM-120) inside the two internal weapon bays. No weapons were delivered during the mission. The aircraft had also mounted four external pylons that can carry 2,000-pound air-to-ground weapons. The F-35A 5th Generation fighter is designed to carry up to 18,000 pounds on 10 weapon stations featuring four weapon stations inside two weapon bays for maximum stealth capability, and an additional three weapon stations on each wing.



#### US Defence Budget Cutbacks

Financial deficits in the United States have impacted on the defence budget and dramatic changes to US armed forces are planned over the next few years. The stated target is to cut \$500 billion in spending within the next decade. Secretary for Defence Leon Panetta's

budget request for the FY 2013 is set to save around \$260 billion by 2017. In his State of the Union address in January 2012, President Obama did not address any specifics but vowed to cut military spending and reduce personnel numbers while maintaining what he called "the finest military in the world."

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As for combat aircraft, the USAF is set to lose five A-10 attack aircraft squadrons (one active-duty, one reserve and three National Guard), one F-16 squadron (National Guard) and one F-15 training squadron (the 65th at Nellis AFB). These appear to have been planned with an aim at retaining multi-role platforms over ones with niche capabilities. The transport fleet has also been aggressively downsized, with the entire Joint Cargo Aircraft (Alenia C-27J Spartan) programme to be cancelled and the thirty-eight already-procured airframes sold. Twenty-seven Lockheed C-5As will be retired, while the remaining C-5Bs will be modernised to C-5M standards, resulting in a smaller, more modern fleet of 52 C-5Ms. Along with the C-5 retirements, sixty-five of the oldest C-130 Hercules transports will be retired, resulting in a fleet of 318 aircraft.

Also to be cancelled is the Next Generation Missile (NGM) designed to replace both the AIM-120D AMRAAM and the AGM-88 HARM anti-radiation missile, which is unusual, because as recently as December 2011, USAF officials had placed the NGM as a high priority, saying that not buying the weapon would create unacceptable operational risks.

Alongside a stated desire to increase focus on ISR platforms, procurements of the RQ-4 Global Hawk Block 30 will be cancelled, and the U-2 programme be extended instead. The Block 40 and the US Navy's Broad Area Maritime Surveillance variant (MQ-4) remain unaffected. The rate at which MQ-9 Reapers and possibly Avengers are purchased will slow down and the current Predator fleet will be maintained for longer.

The US Navy is to lose seven cruisers, one of which is in need of repairs and six of which do not have ballistic missile defense capability. A number of other ships will be retired early and procurement of replacement vessels will be slowed.



#### **New Airbus Military sales**

A irbus Military received five new orders for C295/CN235 tactical transports in 2011 while delivering a total of 29 aircraft from its product line during the year, bringing the business unit's overall backlog to 222 aircraft as of 31 December 2011. The 2011 deliveries were composed of 20 aircraft from its light and medium-sized airlifter families (10 C295s, seven CN235s and three C212s), along with six A330 Multi Role Tanker Transports (MRTTs) and three modernised P3 maritime aircraft.



In this photo taken over Spain recently, three Airbus Military A330 MRTT multi role tanker transports destined for different customers are shown in formation. The lead aircraft, furthest from the camera will join the UK Royal Air Force where it will be known as *Voyager* as part of the Future Strategic Transport Aircraft (FSTA) programme; the middle aircraft is the original development example which will eventually enter service with the Royal Australian Air Force and the aircraft nearest the camera is the second for the United Arab Emirates air force.

#### 250th C-130J Super Hercules delivered

The 250th C-130J Super Hercules built at the Lockheed Martin facility was delivered on 16 February 2012, which is the 15th C-130J delivered to the 317th Airlift Group at Dyess Air Force Base, Texas since 2010 and the second of 11 aircraft to be delivered to the base in 2012. Dyess will have the distinction of being home to the largest C-130J fleet in the world when it receives its 28th Super Hercules aircraft in 2013.

# "Gripen the preferred choice for Switzerland"

**S** wiss Defence Minister Ueli Maurer has reiterated that the Gripen E/F is the optimal solution for Switzerland. After an initial evaluation document reached the media, the Swiss Defence Minister Ueli Maurer called for a press conference to comment on the rumours that Gripen would not meet the Swiss Air Force requirements but the Swiss defence authorities have reconfirmed Gripen as the optimal solution for Switzerland. On 30 November 2011, the Swiss Federal Council had selected



the Gripen E/F as preferred candidate to replace their present F-5 aircraft. Saab and Sweden are now in negotiations with Switzerland, optimising the complete package and preparing for acquisition of the Gripen E/F.

The Gripen is in operational service with five air forces, being a new generation, multi-role fighter aircraft which uses state-of-theart technology and is capable of performing an extensive range of air-to-air, air-to-surface and reconnaissance missions employing the most modern range of weapons. Gripen has been part of NATO's QRA (Quick Reaction Alert) organisation since 2005.

#### S-92s for Korean Coast Guard

The Republic of Korea Coast Guard have ordered the Sikorsky S-92 helicopter as part of their Multi-Purpose Helicopter Programme, and scheduled for delivery in December 2013. Sikorsky has delivered 151 S-92 aircraft to operators worldwide since 2004, out of which 25 are engaged in SAR operations. The 151-aircraft fleet has accumulated a total of 370,000 flight hours. Aircraft availability stands at 95 percent.





#### Bond Aviation Group orders 16 S-92s

**B** ond Aviation Group, the British helicopter operator and subsidiary company of the World Helicopters Group, has signed a contract to buy 16 Sikorsky S-92 helicopters, the largest one-time acquisition of S-92 aircraft ever received by Sikorsky. The S-92 helicopter is one of the largest in the heavy offshore class, accommodating 19 passengers and their luggage. Since entering service in September 2004, the S-92 fleet has grown to more than 150 aircraft. Helicopter transport companies serving the offshore oil and gas industry operate approximately 60 percent of the fleet and currently account for 90 percent of the fleet's 380,000 total flight hours.

#### Bell Boeing's first Block C V-22 Osprey for US Marine Corps

The US Marine Corps has taken delivery of the first MV-22 Osprey produced with the new Block C suite in design upgrades of the Bell Boeing V-22 Programme, which offers a host of advantages over previous variants. A new colour weather radar system improves the crew's ability to navigate in poor weather conditions while a redesigned Environmental Conditioning System improves cockpit/cabin air distribution to enhance aircrew and troop comfort. Expanded capacity and effectiveness built into the Electronic Warfare system, including additional chaff/flare dispensers, increases the Osprey's ability to counter air-to-air and ground-to-air threats. The Block C design also improves cockpit and cabin displays, providing greater situational awareness.



#### First A400M for French Air Force in Seville

The first Airbus Military A400M for the French Air Force is taking shape in Seville (Spain), where its final assembly line (FAL) is located. The final assembly process for this aircraft (MSN7), began last November, with the nose and fuselage already integrated and the aircraft was recently moved, on its landing gear, to the workstation in which the structural assembly



is carried out. Integration works for the wing has begun and both the horizontal and the vertical tailplanes, which have already been mated, were moved to the final assembly station (Station 40) with the rest of the aircraft. The A400M will then be powered up for the first time before the aircraft is moved to the Ground System Tests area. This first series production aircraft will be delivered to France at the end of 2012.

#### OH-58 Kiowa Warrior Block II initiative

The US Army's OH-58 Kiowa Warrior helicopter fleet has accumulated 2 million flight hours, over 750,000 of these flown in combat. Future US Army plans for the OH-58 include a new F model, which will infuse technology into the Kiowa Warrior. The sensor moves from a mast mounting to the nose, the cabin receives new processors, avionics and new colour displays update the control panel.

Bell Helicopter is also funding a Block II initiative focused on performance enhancements which include a new engine, new transmission, new rotor and tailrotor and will enable the OH-58 to meet the 6K/95F operational requirements laid out by the Army.





#### US Navy contract for Ratheon AIM-9X

The US Navy awarded Raytheon a \$39.6 million contract for Fiscal Year 2012 production and delivery of the AIM-9X Block II infrared-guided air-to-air missile. The contract, which modifies a previously awarded contract, was announced on 31 January 2012 by the Department of Defence. The AIM-9X Sidewinder is an infrared-guided air-to-air missile that has demonstrated capability in the surface-to-air and air-to-surface missions. The AIM-9X Block II adds a redesigned fuse and electronics along with other enhancements to the AIM-9X Block I.



# Lockheed Martin contracts for PAC-3 Missiles

Lockheed Martin has received contracts worth \$921 million from the US Army Aviation and Missile Command for hardware and services associated with the Patriot Advanced Capability-3 (PAC-3) Missile Segment programme. The contract includes Fiscal Year 2012 (FY12) missile and command launch system production for the US Army and a follow-on sale of the PAC-3 Missile Segment to Taiwan. In 2009, Taiwan became the fifth international customer for the PAC-3 Missile Segment.



The contract includes production of hit-to-kill PAC-3 missiles, launcher modification kits, spares and other equipment, as well as programme management and services. Lockheed Martin is prime contractor on the PAC-3 Missile Segment upgrade to the Patriot air defence system. The PAC-3 missile Segment upgrade consists of the PAC-3 missile PAC-3 canisters (each of which hold four PAC-3 missiles, with four canisters per launcher), a fire solution computer and an enhanced launcher electronics system and launcher support hardware.

### Flight test of Su-35S fighter

The third series production Su-35S multi-role fighter piloted by test pilot Taras Artsebarsky has made its maiden flight from the airfield of the Komsomolsk-on-Amur Aircraft Production Association (KnAAPO). Various engine tests and those of the integrated control system as well as stability and controllability characteristics were conducted for more than two hours and were "flawless".





Su-35S fighters have already flown more than 400 flights in the flight test programme. The first two Su-35s were delivered to the 929th State Flight Test Centre (GLITS) for the State Joint Tests (SJT) and in August 2010 began to implement the test programme, which includes basic set of flight and technical specifications of the on-board equipment and super maneuverability, stability and control characteristics. The maximum speed attained was 2400 km/h at altitude and maximum ceiling of 18,000 meters. The radar's detection range in the 'air-to-air' mode is over 400 km, significantly higher than that of current systems, while the onboard OLS (optical locator station) can detect and track multiple targets at ranges exceeding 80 km. Radar signature of the fighter has been considerably reduced as compared the fourth-generation aircraft with coatings of electro-conducting compounds, applying of radio absorption coats and reducing the number of protruding sensors.

#### 39 UH-72A Lakotas for US Army

The US Army has awarded EADS North America a \$212.7 million contract to deliver 39 UH-72A Lakota Light Utility Helicopters (LUH) as part of its total acquisition plan. Thirty-two of these Lakotas will be produced in the Army's Security and Support (S&S) Battalion configuration. EADS North America has already delivered 198 UH-72A Lakotas to the US Army, on time and within budget, along with five H-72A versions to the US Navy for test pilot training. The current total programme calls for 345 UH-72A Lakotas to be delivered to the Army and Army National Guard through 2015, along with five already delivered to the US Navy.



# Additional CH-47F Chinooks for US Army

**B**oeing has received a US Army contract valued at approximately \$370 million for 14 CH-47F Chinook helicopters to support Foreign Military Sales efforts. The aircraft will be delivered to the US Army beginning in 2014, all but one intended for Australia and the United Arab Emirates. Seven of the new Chinooks will be delivered to the Australian Defence



Force and six to the United Arab Emirates under the terms of a previously announced Foreign Military Sales agreement between the US government and the two countries. An additional aircraft is to be delivered to the US Army to fulfill its own requirements.

#### PIA order five B-777-300ERs

Pakistan International Airlines have ordered five Boeing 777-300ER (extended range) airliners, valued at nearly \$1.5 billion at list prices plus an option for five additional 777-300ERs. Based in Karachi, Pakistan International Airlines has been renewing its long-haul fleet to meet increased demand for air travel as well as to introduce new routes.





#### **AC313 Certified**

O n 5 January 2012, the Aviocopter AC313 was certified by the Chinese Civil Aviation Authority, clearing the way for this heavy helicopter to enter service with civilian operators in that that country. The certification allows the AC313 to be used for roles including transport, offshore operations, forest-fire prevention and disaster relief. Around 200 hours were flown during the process, including flights in Tibet and over Mt. Everest base camps to evaluate its high-altitude performance. Chinese reports indicate that 32 AC313s have been ordered. B-1108L is the prototype, which made its first flight on 13 March 2010.



#### **ARJ21 nears certification**

The Commercial Aircraft Corporation of China (COMAC) is to begin type-inspection authorisation (TIA) of the ARJ21-700 regional jet. The aircraft completed a number of certification test flights in 2011 preparing it for the TIA, before the aircraft is handed over to the Civil Aviation Administration of China (CAAC) for type certification. First delivery of the indigenous Chinese jetliner to launch customer Chengdu Airlines was to have taken place by the end of 2011, but has been delayed by as much as a year because of the certification processes.

COMAC completed static tests on the aircraft on 14 April 2011, with crosswind tests finished on 24 May. Flutter testing, which was begun on 4 April, was completed in mid-August, but icing tests were not completed by the mid-2011 deadline and stalling-speed tests were also held up.



The baseline -700 version of the aircraft will seat 70 to 95 passengers and a stretched -900 version is also planned. 239 ARJ121s have been ordered, the vast majority being from Chinese airlines and lessors, although a handful of export orders have come from Myanmar Airways, Lao Airlines, Indonesian mining company Merukh Enterprises and even the US lessor GE Capital Aviation Services, which has ordered five.

### **Rolls-Royce Trent XWB first test flight**

The Rolls-Royce Trent XWB engine was airborne for the first time, powering an Airbus A380 test aircraft in Toulouse, France. The aircraft flew with one of its four Trent 900 engines replaced by a Trent XWB. "The Trent XWB is the most efficient civil aircraft engine on offer in the world and will power the new Airbus A350 XWB, which is the fastest-selling Trent engine with more than 1,100 already sold." At the 2011 Paris Airshow, Rolls-Royce also announced that it will be the exclusive engine supplier for the longer range A350-1000 aircraft.



### Cebu Pacific selects Rolls-Royce TotalCare

**R**olls-Royce is to provide Philippine airline Cebu Pacific with long-term TotalCare service support for Trent 700 engines on up to eight Airbus A330 aircraft. The contract will be worth up to \$280 million. Cebu Pacific will use the aircraft to launch long haul operations in the second half of 2013 and these will be the first Trent engines in the carrier's fleet. The Trent 700, the only engine specifically designed for the A330, is the market leader for the aircraft, with more than 1,400 in service or on order, representing 75 per cent of new orders over the last three years. Some 90 per cent of Trent engine operators have selected TotalCare support.

#### **Eurocopter unveils EC130 T2**

Eurocopter have unveiled their latest helicopter, the EC130 T2, which features "enhanced comfort, improved operational performance and increased versatility for this popular member of the company's lightweight single-engine product line". While retaining the EC130's existing external lines, approximately 70 percent of the EC130 T2's airframe structure has been modified.

New and updated features on the helicopter include the use of a more powerful Arriel 2D turboshaft engine and upgraded main





gearbox. The EC130 T2's increased performance is provided by its Turbomeca Arriel 2D engine, which provides 10 percent more average power than the EC130's current powerplant with lower specific fuel consumption. Based on the Arriel 2 engine family, the Arriel 2D benefits from such technology advancements as a new axial compressor and new blade materials and also provides a higher time between overhaul (TBO) intervals. The Arriel 2D is used at its full-power rating of 952 shp on the EC130 T2 and is the same engine that equips Eurocopter's AS350 B3e helicopter in a de-rated version.

# Bombardier Q400 NextGen Airliners for Ethiopian Airlines and Horizon Air

**B** ombardier Aerospace has confirmed that Ethiopian Airlines is the customer that placed the firm order for five Q400 *NextGen* airliners, which was announced on 13 February 2012. Two of the five aircraft will be operated by Ethiopian Airlines and three by its affiliate, ASKY Airlines of Togo. Ethiopian Airlines, the flag carrier of Ethiopia and one of Africa's leading airlines, serves 64 international destinations. The order announced will increase the number of Q400 NextGen airliners purchased by Ethiopian Airlines to 13.

Meanwhile, Horizon Air of Seattle, Washington has signed a firm purchase agreement for two Q400 NextGen airliners. Horizon Air, a wholly owned subsidiary of Alaska Air Group, is the largest operator of Q400 and Q400 NextGen aircraft in the Americas with 48 aircraft in service today.



#### Wings Air largest ATR operator

Indonesia's fast growing carrier Lion Air and European regional turboprop manufacturer ATR have signed a contract for the purchase of 27 additional ATR 72-600 aircraft. Once these aircraft will be integrated into the fleet of Lion Air's regional



subsidiary Wings Air, it will become the largest operator of ATR aircraft in the world, with a total fleet of 60 aircraft (20 ATR 72-500s and 40 ATR 72-600s). Wings Air introduced its first ATRs in January 2010 and currently operates a fleet of 16 ATR 72-500s across its domestic network in Indonesia.

#### Milestone Aviation order 16 Eurocopter EC225

Milestone Aviation Group have ordered 16 Eurocopter EC225s valued at €362 million which will be delivered over five years, starting in 2013. Eurocopter's partnership with Milestone on the EC225 is a major development for the helicopter industry. Since launching in August 2010, Milestone has provided over US \$500 million in finance to high quality operators around the world including Bristow, CHC and Inaer. "Milestone can deliver increased value to its customers through timely delivery slots for EC225 aircraft allowing its partners to bid on tenders."

#### 15 AW189s ordered by Gulf Helicopters

Gulf Helicopters of Qatar has signed a preliminary contract for fifteen AW189 helicopters, to be used to perform offshore transport missions. The AW189 was launched in response to the growing market demand for a versatile, affordable, multirole helicopter in the 8-tonne class and has rapidly found success for long range missions, especially in the offshore oil and gas market. Entering service in early 2014, the twin engine AW189 helicopter "is optimised for long range offshore transport and SAR missions." The spacious cabin is configured with 16 seats as standard with the option for a high density 18 seat layout or a long range 12 seat configuration.





# Bell Helicopter's 525 Relentless powered by GE CT7

**B** ell Helicopter has unveiled the world's first 'super-medium' helicopter, the Bell 525 Relentless, "which defines the new super medium product class, positioned at the upper end of the medium class and designed to offer best-in-class capabilities". It features superior payload and range, cabin and cargo volumes and crew visibility. The new Bell 525 Relentless will be powered by the GE CT7-2F1 engine which has emphasis on low fuel consumption, low cost of operation and other technical features "to ensure that the aircraft meets the requirements of long range, high payload missions." The CT7-2F1 engine includes a state-of-the-art Full Authority Digital Engine Control (FADEC) plus advanced materials, primarily in the turbine section. Capable of carrying up to 16 passengers, the Bell 525 Relentless is designed for various mission configurations including oil and gas, search and rescue, helicopter emergency medical services and VIP/corporate transportation.



#### Garuda Indonesia orders Bombardier CRJs with CF-34s

G aruda Indonesia has placed an order for six CF34-8Cpowered Bombardier CRJ1000 NextGen regional jets with an option to purchase 18 additional aircraft. The 100seater CRJ1000 NextGen aircraft is the largest member of Bombardier's CRJ family and is designed for high-frequency regional routes. Garuda Indonesia will be the Asia-Pacific launch customer for the aircraft.

#### Lion Air orders 737s with CFM LEAP-1B engines

Jakarta-based Lion Air have ordered 201 Boeing 737 MAXs and 29 Next-Generation 737-900ERs (extended range). The agreement, first announced in November 2011 in Indonesia, also includes purchase rights for an additional 150 aircraft.



With orders for 230 aircraft valued at \$22.4 billion, this deal is the largest commercial order ever in Boeing's history, by both dollar value and total number of airplanes. Lion Air will also acquire purchase rights for an additional 150 airplanes.

#### China Express Airlines for 11 CRJ900 NextGens

**B** ombardier has identified China Express Airlines as the "undisclosed customer" of the previously announced order for six CRJ900 NextGen aircraft and options on five CRJ900 NextGen aircraft. China Express, China's first private regional airline, is looking to expand its regional network as it currently provides regional passenger services with its fleet of five Bombardier CRJ200 aircraft.

# AVIC Leasing and Bombardier for aircraft financing

**B** ombardier has signed a memorandum of understanding (MoU) with Chinese lease financing company AVIC Leasing, which will provide increased opportunities for Bombardier and AVIC Leasing to grow their businesses by providing optimised aircraft and financing solutions in China and on a global scale, while meeting China's rapidly growing air transport infrastructure. More than 80 Bombardier aircraft are currently operating in China and the country's fleet is expected to grow as "the world's second largest market for new aircraft deliveries, with a forecasted demand of almost 2,400 commercial aircraft in the 60-149 seat segment over the next 20 years."





#### Air Nostrum receives 75th Bombardier airliner

**B** ombardier Aerospace and Air Nostrum of Valencia, Spain celebrated delivery of the airline's 75th Bombardier commercial aircraft at Bombardier's Mirabel facility in Québec, where the CRJ aircraft are manufactured. The aircraft, a CRJ1000 NextGen regional jet, was accepted by Miguel Ángel Falcón, General Manager of Air Nostrum. The 75th aircraft follows nine CRJ1000 NextGen, 11 CRJ900, and 35 CRJ200 regional jets, as well as 19 Q300 turboprops that have previously been delivered to Air Nostrum.



#### Norwegian orders 100 LEAP-1Bpowered 737 MAX airliners...

Norwegian's plans to build on the success provided by its fleet for its rapidly expanding operations.



#### ... and commits to 100 A320neo aircraft

Norwegian, one of the largest low-cost airlines in Europe, has signed a Memorandum of Understanding (MoU) with Airbus for 100 A320neo aircraft, which will feature a single class cabin layout, seating approximately 180 passengers. 'We are very pleased to welcome Norwegian as an all-new Airbus customer. Their A320neo commitment is a further demonstration of the



undisputable success of the A320neo's record-setting credentials. The A320neo sets new industry standards for eco-efficiency and passenger appeal.' said John Leahy.

# Airbus marks 2011 with record orders and deliveries

A irbus delivered 534 commercial aircraft to 88 customers (10 new) and booked 1,419 net orders in 2011, making it the most successful year in the company's history and the tenth in a row with a production increase. The 534 deliveries beat the previous record set in 2010 by 24 aircraft. Deliveries include a new record for 421 single aisle aircraft (401 in 2010), 87 A330 Family (87 in 2010) and 26 A380s (18 in 2010). December was a record month for the A380, with four deliveries in a single month. Airbus Military also delivered a record number of 29 aircraft (20 light and medium military and transport aircraft and 6 A330 MRTTs).

Airbus had a record order intake of 1,608 (1,419 net) commercial aircraft, worth \$169 billion gross (\$140 billion net) at list prices. The previous record was in 2007 (1,458 gross and 1,341 net orders). In value terms, Airbus' share of total aircraft sales (above 100 seats) in 2011, is 56 per cent gross (54 per cent net). Despite 'challenging markets', Airbus Military won five new orders for its light and medium aircraft (CN235 and C295).

Net commercial orders include 19 for the A380, 52 A330/ A350 XWB Family aircraft and 1,348 A320 Family aircraft. Of these, the A320neo won 1,226 firm sales confirming its title as the "the fastest selling airliner ever".





# CAE's Asian contract for five full-flight simulators

CAE have sold five Level D full-flight simulators (FFS) to customers in Asia, which includes an Airbus A320 and a Boeing 737 to Air China, a Boeing 737 to Shandong Airlines of China, an A320 to the new Cebu Pacific-CAE joint venture aviation training centre in the Philippines and an A320 for Alpha Aviation Group's flight training academy in the Philippines. CAE also received contracts for CAE Simfinity(TM) integrated procedures trainers and for simulator update services from several airlines, the contracts worth more than \$65 million at list prices which bring the total number of FFS sales that CAE has announced to date during fiscal year 2012 to 30.

#### **GECAS orders two ATR 72-600s**

GE Capital Aviation Services (GECAS), the commercial aircraft leasing and financing arm of General Electric and ATR announced an order for two additional ATR 72-600 turboprop aircraft and two options. This is a follow-on to GECAS' first-ever ATR order placed in June 2011 at the Paris Air Show and brings the total number of ATRs ordered by GECAS to 17 with 17 options. GECAS will begin to take delivery of the new aircraft in late 2012. GECAS has leased three of its newly ordered ATR 72-600s to Brazilian regional carrier TRIP Linhas Aéreas and has signed with Jet Airways in India for another five units.

# 2011 Record Year for CFM with \$51.7 billion orders/commitments

**C** FM International (CFM) had a record year in 2011, logging orders for 1,500 commercial, military and spare CFM56 engines and commitments for 3,056 LEAP engines for a combined value of \$51.7 billion at list price. CFM is developing a new engine family, under the brand name LEAP, which will enter service in 2016.



As the company logs record commitments, CFM is also achieving record production rates for the CFM56 product line. The company has built more than 1,000 engines per year since 2006, and the rate has grown steadily. In 2011, CFM delivered more than 1,300 engines, the highest rate in the industry, compared to 1,250 engines built in 2010. Current plans are to reach more than 1,600 engines per year by 2014. "2011 was an outstanding year for CFM across the board," said Jean-Paul Ebanga, president and CEO of CFM International. "By year end, we had solid orders for 1,500 CFM56 engines, which would make 2011 a good year in its own right. But we also received a significant number of LEAP orders in the last six months of the year."

#### PrivatAir order 10 Bombardier C Series airliners

Geneva-based PrivatAir has placed a firm order for five CS100 aircliners and has taken options on an additional five CS100 aircraft. Based on the list price for the CS100 aircraft, the firm order contract is valued at approximately \$309 million US and could increase to \$636 million US if the five options are exercised.



# Elettronica's ESM/ELINT systems for the ATR-72

The Italian Ministry of Defence has selected Elettronic S.p.A.'s ELT/800 system for the protection of its ATR-72 platforms. The contract was signed with Alenia Aeronautica and consists of equipping four ATR-72 platforms; delivery of the first system is scheduled between the end 2012 and early 2013. The ELT/800 features an innovative design concept for the ELINT systems equipping both fixed and rotary wing platforms. This high performance equipment is based on an advanced architecture that combines a Wide Open Receiver with

that combines a Wide Open Receive the unique capabilities of a Superhet Digital Receiver, implementing specific system design solutions and advanced technologies. The system consents Tactical Surveillance (ESM function) and fine detail data processing for signal analysis (ELINT function). The ELT/800 represents a compact and light weight solution with a high level of installation flexibility.





#### MBDA delivers the 500th Dual Mode Brimstone Missile

The 500th Dual Mode Brimstone missile has been delivered by MBDA at its UK-based factory in Lostock, England. This unique air to surface missile gives the Royal Air Force enhanced ability to attack and destroy targets with precision in difficult urban environments with low collateral damage that no other air force was able to achieve during the Libyan conflict.



The operational demand for the weapon by the RAF was such that MBDA had to 'surge' supply to both Libyan and Afghanistan theatres of operation. MBDA's Lostock production facilities achieved this by making deliveries four months earlier and with 50% greater output than the preliminary delivery plans.

#### DCNS conducts first helicopter deck landing trials on FREMM Aquitaine

**D**CNS has achieved formal qualification of the FREMM frigate *Aquitaine's* flight deck for operations with the Lynx helicopter, this milestone reached several months ahead of schedule after a successful deck landing campaign at sea, organised by the French defence procurement agency (DGA) in early February. Trials were conducted with a Lynx helicopter operated by the French Navy.

French Navy test pilots completed several series of approaches and as many as 50 deck landings with a Lynx fivetonne class helicopter. "The operations were a complete success." In particular, the pilots appreciated the absence of turbulence above the flight deck in all landing positions. Owing to the



concerted efforts of all the teams involved, FREMM frigate *Aquitaine* has demonstrated its ability to launch and land Lynx helicopters. The vessel's hangar area is designed to accommodate one of the NH90 Caiman heavy lift (10-tonne class) helicopters now in service with the French Navy.

# Cassidian's new SPEXER 2000 coastal radar for littoral surveillance

C assidian, the defence and security division of EADS, has introduced a new security radar with new opportunities for the wide-area protection of coastlines, maritime infrastructure and harbours against asymmetric threats.

The SPEXER 2000 Coastal is a security radar optimised for the surveillance of coastal areas and maritime infrastructure such as oil fields and harbours. With an instrumented range of 21.6 nm (40 km), its high Doppler and velocity resolution as well as its high sea clutter suppression, it is able to detect, track and classify even very small and slowly moving objects such as swimmers and rubber dinghies, but also fast objects such as speed boats. The radar is part of Cassidian's SPEXER security radar family which consists of several sensors, each optimised for specific applications in the fields of border, infrastructure, perimeter and coastal surveillance. A specific version for border surveillance, SPEXER 2000, is under production for a huge border surveillance system in the Middle East and a military version has been developed for the German Army.



#### AW609 Tiltrotor Programme

A gustaWestland, the Finmeccanica company, is now developing the AW609 tiltrotor programme following the completion of its acquisition in November 2011. The company will continue the certification process with the FAA targeting AW609 certification in the first half of 2016 and deliveries following immediately afterwards. The first two prototypes have achieved more than 650 flight hours so far and have validated the AW609's unique flight envelope including the ability to fly at altitudes of up to 25,000 feet and cruise at speeds up to 275 knots, all at the aircraft's maximum weight. The test programme continues to check the points of the flight envelope, 85% of which has been completed, as required by both the FAA and EASA.



# Northrop Grumman in contract for LITENING SE pods

Northrop Grumman has received two follow-on Low Rate Initial Production contract awards from the US Air Force to provide additional LITENING SE advanced targeting pods. These are part of an original, overall seven-year (5-year base with two 1-year options) \$920 million, indefinite delivery/indefinite quantity contract granted to Northrop Grumman in 2010, representing a continuation of the LRIP programme. LITENING SE recently completed an extensive flight test programme on the F-16 Block 40/50 and A-10C aircraft. "LITENING SE delivers the latest advancements in sensor, laser imaging and data link technology."

# Sagem's Sigma 30 for three European armies

**S** agem (Safran group) has won a contract from Cassidian (an EADS company) to supply Sigma 30 navigation and pointing systems to modernise the self-propelled M270 Mars MLRS (Multiple Launch Rocket System) artillery systems



deployed by the armies of Germany, Italy and France. Five artillery regiments in these three armies will be upgraded to the GMLRS (Guided Multiple Launch Rocket System) standard. Based on digital laser gyro technology, Sagem's Sigma 30 is a high-performance land navigation and artillery pointing system designed to operate "in the harshest environments." A component of the EFCS (European Fire Control System) integrated in the rocket launcher system, it is a critical part of today's artillery systems "enabling the very high-precision firing of new unitary warhead rockets to long ranges including in electronic warfare environment." The Sigma 30 system will be coupled to a hardened, latest-generation SAASM (Selective Availability Anti-Spoofing Module) type GPS receiver.

Sagem's selection in this tripartite programme further consolidates its offering of laser-gyro guidance systems for state-of-the-art artillery systems deployed by NATO, in Europe and the Middle East: Caesar (Nexter Systems) and Archer (BAE Systems) artillery systems, and 2R2M mobile mortars (Thales).

# ITT Exelis to design airborne mine countermeasure tow cable

TT Exelis has been awarded a \$1.9 million Naval Sea Systems Command contract to design and deliver an improved airborne mine countermeasure common tow



cable. The Exelis airborne tow cable solution for the US Navy's MH-60S helicopter provides the service with the capability to conduct mine countermeasure operations safely from the air. One end of the tow cable attaches to the Navy's multi-mission helicopter and the other connects to any of the following systems: the AN/ASQ-235 Airborne Mine Neutralisation System, the AN/AQS-20A Sonar Mine Detecting Set and the AN/ALQ-220 Organic Airborne and Surface Influence Sweep. These systems are towed at high speeds through the water during mine clearing operations.
## From Vayu Aerospace Review Issue II/1987

# **Years Back**

#### Rs 12,512 Crores for Defence

An expenditure of Rs 12,512 Crores (US \$ 9.8 billion) has been provided for in the 1987-88 Defence Budget, which is Rs 2,318 Crores more than the revised estimates for the previous financial year. The original provision for 1986-87 has been Rs 8,728 Crores.

The Army, as is customary, gets the major share of the allocation of Rs 6,608 Crores. The Air Force had been allocated Rs 1,648 Crores and the Navy Rs 615 Crores. The Defence Ministry itself gets Rs 713 Crores. Ordnance factories have been allocated Rs 66 Crores.

The Air Force is likely to get Rs 995 Crores for aircraft and aero-engines and the Navy Rs 318 Crores for the same purpose. No provision has been made for the Army on that score which has been interpreted as being indicative of no major expansion of the recently established Army Aviation Corps.

#### The LCA Programme

France has offered "help" to India on the Light Combat Aircraft (LCA) and Dassault had carried out an independent feasibility study, according to Arun Singh, Minister of State for Defence. The French firm also offered to provide consultancy assistance during project definition phase of the LCA programme currently under progress. It was also stated that India has signed a contract with General Electric for eleven F.404-F2J3 engines alongwith associated hardware.

Meanwhile, doubts are being expressed on the viability of the LCA project in the United States. While formal presentations by the US Government to India on the proposed US co-operation in the LCA project is imminent, Pentagon sources have expressed their misgivings on the scope and relevance of the programme which they feel will be "uneconomical and wasteful to extremely scarce Indian resources and that any participation may turn out to be a political liability down the road for the United States".

#### Al and IA earn profits

Air India and Indian Airlines have netted profits of Rs 66 crores and Rs 63.22 crores respectively in the year ending 31 March 1987 and are expected to make substantial profits during the new FY as well. Indian Airlines was expected to carry 10.07 million passengers in 1986-87 against 9.21 million in 1985-86, an increase of about 10 per cent over the previous year.

Vayudoot services this year were operating from 84 stations all over the country against 50 last year. As against nine stations operated by it in the north-eastern region during the last year, Vayudoot is at present operating 18 stations in the region.

#### 32 additional F-16s for PAF

During congressional testimony by a senior US administration official at Washington in early March, supply of an additional squadron of F-16s to the Pakistan Air Force was listed as a requirement "to help ensure the inviolability of Pakistan's borders." Robert H Pelletreau Jr., deputy assistant secretary of defence for Near East and South Asian affairs, said that "the exact definition of invoilability notwithstanding, we would estimate that with an effective and co-ordinated air defence network along the Pakistan-Afghanistan border, including an airborne system for the most mountainous stretches near Peshawar, Pakistan does not need additional F-16s to ensure its territorial integrity and air space. If the question is meant to deal with both Afghan frontier and the Indo-Pakistan border, and given the obsolescent Chinese F-6 aircraft and questionable performance of Mirage aircraft in Pakistan's inventory, an additional two squadrons (32 aircraft) would be needed to provide a degree of protection one might consider inviolable".

#### France seeks 130 percent as AWACS offset

The French Ministry of Defence has asked Boeing for 130 percent offsets on a buy of three E-3A AWACS with an option for an additional aircraft. France and the UK are expected to place AWACS orders within six months of each other which "would qualify as a joint procurement", US officials said, "the reduction in unit price would be 3% to 5%."

US officials added that Snecma of France will build the engines for the French and British E-3As. The CFM56, built jointly with General Electric, "is the engine being offered."

#### Stingers toll in Afghanistan

Shoulder-fired Stinger missiles being supplied to anti-communist guerrillas in Afghanistan are reportedly taking a heavy toll of Soviet and Afghan aircraft and helicopters. According to Western diplomatic sources, the missiles have forced changes in Soviet and Afghan flying tactics and provided the first guerrilla challenge to control of the air by the Soviets and the Kabul regime. The Stinger was introduced in Afghanistan in September 1986 and has been credited by the Pentagon with knocking down one aircraft a day in November 1986.

#### Abu Dhabi disagreement on Mirage 2000s

Commencement of deliveries of the first of two 18-aircraft batches of Mirage 2000s to Abu Dhabi, originally scheduled for September 1986, has been delayed pending the resolution of a disagreement with Dassault-Breguet concerning non-provision of certain weapons-related and communications equipment. It is understood that Abu Dhabi is insisting on compatibility with the AIM-9 Sidewinder missile and the communications equipment employed by other forces of the Gulf Co-operation Council.

#### Sea King Mk.42Cs for I.N.

Delivery of the first Westland Sea King Mk.42C for the Indian Navy was made at Yeovil on 5 February 1987, first of the helicopters to be completed in what Westland now describes as the Advanced Sea King configuration. The Indian Navy, having previously acquired 20 Mk.42s has on order six Mk.42Cs for the troop transport and support role, and 20 Mk.42Bs for the ASW and ASV search and attack role. The latter carries BAe's Sea Eagle missiles and has MEL Super Searcher radar. The first three Sea King Mk.42Cs will serve aboard INS *Viraat*, the previous HMS *Hermes* now undergoing refit at Plymouth before delivery to the Indian Navy.

## Vyomanauts' appetite: the north-south dilemma!

Food technicians at the Defence Food Research Laboratory (DRFL), working on India's first manned space mission, have started designing an Indian space menu keeping food weight and volume in mind. The real challenge: should the fare consist of a permutation of *dosa-idli-uttappam-bisi bele bath* or *parantha-khichdi-roti-sabzi?* The answer is crucially related to whether the Indian to be launched into space is from the southern states or the north !

"It all comes down to whom is the vyomanaut and what is appetising to that person". Vyomanaut is the indigenous coinage for astronaut, where 'vyoma' is the Sanskrit word for space or sky.



Fate of the manned flight ultimately hinges on the Union Budget. Substantial funding will boost the speed of the mission. Early estimates put the cost at over Rs 16,000 crore. ISRO will then come to the question of whether prospective vyomanauts will be picked from the armed forces - or would civilians qualify.

At DRFL, there is much excitement. When Wing Commander Rakesh Sharma blasted off aboard a Russian Soyuz joint mission, the DRFL had concocted only two food items, a mango bar and a fruit drink concentrate. This time around, they want a more satiated vyomanaut up in space!

### **Curry in a Hurry**

Rob Abdul, a café owner in London has started taking flying lessons. Nothing unusual about his passion for flying except that he has bought an unusual vehicle to ferry his curries around the world – a former Iraqi AF fighter jet.

Abdul hit upon the idea with a pilot friend and has earmarked  $\pounds$  35,000 for buying and restoring the fighter, which Abdul says is needed because his food is requested from all around the world by top celebrities. He is currently the only chef in



England capable of cooking vowl, a 3ft fresh water fish only found in East Bengal, which a popular rock band requested from their luxury hotel room. He has also sent over a meal to the English cricket team during the Ashes, perhaps the most ambitious delivery he has undertaken, a 8,998 mile journey to Australia for this long range curry.

Moreover he has plans for the jet too... when not in the air, it will be used at events such as air shows to promote 'Cafe Taj' and give children the chance to sit inside. All you foodies fans wherever...your curry is just a jet flight away !

## A bird ? A plane ? A supersonic skydiver !

'Fearless' Felix Baumgartner has jumped 2,500 times from aircraft and helicopters, as well as some of the highest landmarks and skyscrapers on the planet. He has leapt face-first into a pitch-dark , 620-foot deep cave in Croatia – his most dangerous feat yet, he says, but soon to be outdone.



In the summer of 2012, Baumgartner hopes to hurtle toward Earth at supersonic speed from a record 37km in the sky, near space, breaking the sound barrier with only his body. He has carried out a critical dress rehearsal, ascending from the New Mexico desert in a helium balloon and jumping from more than 21km up. Baumgartner tested the same pressurised capsule and full-pressure suit that he will use in a few months for a recordsetting free fall from 120,000 feet. We await this awesome feat – with breathlessness !

## A tale of bail outs !

One has a crashing airline, the other ejected from a crashing fighter.

One is a pilot, the other can't pay his pilots.

One is seeking a bailout, other was forced to bailout.

One is fond of good looking models, other simply tries to be a role model.

One has sounded a serious debt alarm, other is trying to recover his injured arm.

One owes landing charges, other has landing urges.

One is about to go belly up, other was lucky not to hit the ground belly up.

One is virtual king of spirits, the other has high intensity spirits.

One is chasing a mirage ; the other one flies a mirage.

While one owns 'Force India', India is a Force because of the other.

Contributed by a reader with reference to Vijay Mallya's Kingfisher Airlines and Air Marshal Anil Chopra's No.1 Squadron.



Cartoon by Manjul, from dnaindia



Image courtesy Dassault Aviation



Bombardier

## ShinMaywa