

VAYU

I/2012

Aerospace & Defence Review



*Rafale selected as M-MRCA
India's 'Look East' Policy
Israeli Missiles for India*

*No 14 Squadron turns 60
'Chinisation' of the PAF
MiG-21 Upgrade saga*

CFM



Cover : The Dassault Rafale
(photo courtesy Dassault)

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BUSINESS DEVELOPMENT MANAGER

Premjit Singh



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THE SOCIETY FOR AEROSPACE STUDIES

D-43, Sujana Singh Park,

New Delhi 110 003 India

Tel: +91 11 24617234

Fax: +91 11 24628615

e-mail: vayuaerospace@lycos.com

e-mail: vayu@vayuaerospace.in

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VAYU

Aerospace & Defence Review

I/2012

38 The 'Look East' Policy

Strategic importance of the Asia-Pacific region is examined by Lt Gen Kamal Davar, former head of the Defence Intelligence Agency, who reviews the challenges and opportunities for India, indeed also for the United States, in context of China's military growth. A significant aspect of India's LEP has been the enlargement of cooperation with ASEAN nations, even as there are new initiatives with Australia.



30 President's Fleet Review 2011

The Vayu Aerospace & Defence Review was invited to witness the President's Fleet Review 2011 and, like on previous such occasions, offers its readers a first hand account of this event at Mumbai Harbour on 20 December 2011. Plus exclusive images taken from the flotilla.



56 David's armoury : also defending India

Article by Sayan Majumdar examining six contemporary missiles developed by Israel for aerial supremacy and robust defence against missiles and other aerial threats. Rafael's Python 5 and Derby are reportedly weapons of choice for the IAF which will also arm the Tejas LCA. The Barak-8 robust area air defence surface to air missile system has been adopted by both the Indian Navy and IAF even as the Rafael SPYDER has been ordered.

46 'Chinisation' of the Pakistan Air Force

Shalini Chawla, Senior Fellow with CAPS writes on the modernisation of Pakistan's Air Force, primarily with assistance from China, which includes substantial numbers of 4th generation fighters, AEW&C aircraft and maritime patrol aircraft. The JF-17 Thunder will arguably become the most familiar shape in Pakistan's skies over the next decades, but, in a reflection of real politik, the PAF has also received new block F-16s, C-130s and P-3Cs from the USA.



A related article by Air Commodore Kaiser Tufail on 'The Sherdils', the PAF formation aerobatic team.

66 'Raging Bulls' Turn Sixty

No 14 Squadron of the Indian Air Force celebrated their Diamond Jubilee in December 2011, which was attended by a galaxy of serving and retired senior officers of the Indian Air Force. These included many of the 'famous twelve', pioneers on the Jaguar in 1979, including the present Chief of Air Staff who formerly released the illustrated history of 'The Fighting Fourteen' during an impressive ceremony at Ambala Air Force Base.



107 Voyager Underway at Cobham

Richard Gardner reports on Cobham's role in converting A330-200s into Voyager tanker/transporters for the RAF, which was the military launch



customer for the Airbus A330 MRTT. A Vayu exclusive.

76 The Tortuous MiG-21 Upgrade Saga

In his series on 'Testing Times', Air Marshal Philip Rajkumar recalls the evolution of the IAF's MiG-21 fleet from the early MiG-21F-13s to the present MiG-21bisons, which continue in frontline service nearly half a century from when the type entered IAF service.

120 'Operation Vijay'

December 2011 marked 50th anniversary of the liberation of Goa, Daman and Diu from Portuguese colonisation. A historical recollection of the brief action and the role and deployment of the IAF which quickly tipped the balance in India's favour.

74 The Daring Eagles !

Phil Camp and Simon Watson recently visited various IAF stations under Central Air Command, and write about No. 105 HU at Gorakhpur, which unit has a long and distinguished career and are presently committed on Operation Triveni.

110 Dubai Air Show 2011, LIMA'11

Reports on the Dubai Air Show 2011 and an interview with Alexei Fedorov of Irkut Corporation, followed by that on the Langkawi Show where the Malaysian's are looking at new fighters, their own M-MRCA competition.

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'Heliborne operations at Sylhet',
'Proliferation compounded',
'Countering insurgency, jointly',
'Converting to Harriers'.

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Smart ways to buy weapons

When nations buy advanced defence equipment like aircraft, capital acquisition costs can run into billions of dollars. Today, it is known that in the case of major platforms, the sustenance costs work out to be much higher than the one-time acquisition cost of these systems. In many cases, equipment that seemed to be the cheapest in terms of the initial capital cost, turns out to be more expensive over an operational lifetime.

There are charges like fuel or energy consumption, maintenance and replacement of equipment or parts, consumables and disposal, all of which add on to the lifetime cost of the equipment purchased. But traditional models of costing do not consider many of these charges when selecting a product.

Ultimately, the operations and support charges, added to the acquisition cost, is a better measure of the cost of a platform. Lifecycle costing (LCC) is a tool that allows acquisition and procurement managers to make more informed decisions by enabling them to incorporate costs and benefits into their procurement decisions. This LCC is a comprehensive assessment of the total financial commitment associated with the platform, and is an international best practice increasingly being used by governments to make more informed procurement decisions.

While the upfront acquisition costs are relatively easier to estimate and compare, getting an accurate estimate on how much the user shall have to spend in operating, maintaining and upgrading the equipment till its final disposal involve complicated projections and calculations.

Determining the useful life of a platform is generally difficult. If the duration in which an equipment wears out is taken as a measure of how long it will last, how do we make estimates for a new, untried platform? Accurate and dependable data essential for this purpose is difficult to come by for new equipment and technologies.

However, a combination of data from manufacturers, data from other operators and extrapolation from experience from similar equipment can help in making a reasonable assessment.

Since the Government of India has a major defence acquisition programme, it would be prudent to develop databases and analytical models to ensure cost effective long-term ownership. This would also ensure economic asset management during the life cycle of all equipment purchased.

A recent UK government report cautions on the risk of obsolescence and says the buyer should consider how to “oblige contractors to manage risk of obsolescence throughout the life of a project, which might include inbuilt flexibility for aircraft and other equipment to accommodate upgrades”. To mitigate LCC evaluation challenges, the next step would be to move towards a performance-based logistics (PBL) approach.

To reduce its overall cost of ownership while increasing serviceability of equipment, performance-based logistics can be an important tool for India’s ministry of defence, and should be made an established practice.

In conjunction with the defence offset policy, suppliers should be required to invest in setting up facilities in India, thereby increasing both service level assurance and help develop a trained indigenous workforce.

From: The Economic Times

Air Power against Maoists

India’s paramilitary forces, which until now had only nine helicopters for anti-Maoist operations, have been sanctioned six more Mi-17 helicopters by the Centre. The expanded fleet strength of helicopters will provide the paramilitary forces much needed agility in their ongoing battle against left-wing extremism, significantly reducing their vulnerability to ambushes while negotiating through jungles on foot or by motorised vehicles.

The cabinet committee on Security headed by the prime minister mandates that the IAF and BSF helicopters will be used only for air-mobile transportation and casualty evacuation and not for offensive action. The government in October-November 2009 permitted the IAF to defend itself from Maoist small arms fire and specified conditions for use of weapons in self-defence.

Consequently the IAF fitted sideward-mounted machine guns on its helicopters flying in Maoist-affected areas. The IAF ‘Garud’ commandos flying on-board these helicopters are trained to operate this weaponry. The IAF has drafted ‘Rules of Engagement’ to regulate such action, in order to avoid any ambiguity and damage to helicopters or injury to aircrew.

While helicopters fly the paramilitary or security forces to their target areas to ‘induct’ troops into operations and fly them back after their mission, these whirly birds are exposed for a few minutes to hostile fire while ‘landing’ or ‘taking off’. To effectively thwart such hostile attempts to open fire the time-tested solution is to ‘secure’ and ‘sanitise’ the landing zone against such threats.

Evidently the government’s decision to use air power to fight left-wing extremism implies a sense of helplessness against an elusive and hard-hitting foe. Now that New Delhi has opted to use helicopters it may as well use these rotary wing aircraft or helicopters, as weapons platforms against the Maoists. The advantages of airpower are primarily swift response, lower casualties, larger area of coverage, ease of access to hostile terrain, total destruction, day and night operations and lastly a psychological advantage against the foe.

The use of airpower against Maoists should prove to be a game changer in terms of a swift response by security forces. To that extent, the helicopter would now primarily be used as a transport platform for anti-Maoist operations and secondarily as a weapon platform only in the event the helicopter crew is compelled to open fire against the Maoists in self-defence.

Considering that the Maoists operate with stealth and surprise against security forces the only way to neutralise them is through ruthless use of airpower.

From: DNA

Dassault

'Look East'—really east

In the just-concluded elections in Taiwan, incumbent president Ma Ying-jeou triumphed with 51.5% of votes cast - while his party, the Kuomintang, also won a majority in simultaneous legislative polls. The most significant legacy of Ma's first term is his China policy. Ma effected a reconciliation with China, ending a ban on air, sea and postal links that had been in place since Taiwan's foundation. He also signed a quasi-free trade deal with China. The results have been dramatic. Currently there are 550 flights weekly connecting Taiwan and the mainland, while 1.3 million Chinese tourists poured into Taiwan in 2010. Trade between Taiwan and China has shot up to \$150 billion. Trade between Taiwan and India, by contrast, stands at a paltry \$6.5 billion. And thereby hangs a tale.

As one of the first Asian 'tigers' whose per capita income is now comparable to Japan in purchasing power parity terms, the Taiwan story is one that India ought to be following keenly for developmental lessons. There are many synergies between Indian and Taiwanese economies waiting to be exploited. For example, Indian strengths in software are well known, while Taiwan is a hardware powerhouse. If India wants to ramp up its capabilities in electronics hardware manufacture, Taiwan should be the first port of call. In general, rich Taiwanese investors are looking for opportunities abroad - which China is capitalising aggressively on. Yet Taiwan doesn't get much foreign policy attention from New Delhi. It remains a blind spot in India's 'Look East' policy, owing perhaps to some combination of India's fear of offending China and the MEA's terminal caution. But look at it this way. China itself is engaged in rapidly scaling up contact with Taiwan. The direction of future relations has been sealed by Ma's election triumph. Beijing, therefore, can't possibly take umbrage at New Delhi for adopting the same course on which it has sprinted ahead.

From : The Times of India

Energy and national security

Which should prevail, concerns of energy security or of national security? The row the Prime Minister's Office (PMO) is now confronted with is between the Petroleum and Defence Ministries over security clearance for oil and gas exploration in eight blocks off the east coast and in the Andamans. These blocks are among the 34 that the Petroleum Ministry awarded under the New Exploration Licensing Policy (NELP) last year to Indian and foreign companies. The blocks were auctioned only after securing clearance from the Naval headquarters, according to the Petroleum Ministry. Yet, after the blocks were awarded in early 2011, the Defence Ministry refused permission for exploration activity in three specific blocks as the Navy was using these seas for submarine manoeuvres and training. Though a truce was reached, with the Navy promising to review its stand and the Petroleum Ministry agreeing to demarcate no-go zones for exploration, the stand-off continued forcing the PMO to intervene. The Petroleum Ministry has complained that its credibility in the eyes of prospective investors in oil exploration is at stake.

Energy security is important but national security is paramount, and in any clash between the two, the latter has to prevail. If oil exploration activity encroaches into the Navy's training and operational theatres, there is absolutely no way that it can be permitted. That said, there was evidently a lack of application of mind by the Navy and the Defence Ministry in the first instance—that is, when the Petroleum Ministry referred the blocks to them before the auction. Having given permission, to retract it later and that too after the blocks were auctioned, is clearly not the right thing to do. The PMO has to question the Defence Ministry on this if only to ensure that such instances do not recur. As for the Petroleum Ministry, a lot of embarrassment could have been avoided if it had decided not to auction blocks that fall in defence-sensitive areas, such as the ones the Navy is now objecting to. The problem arises because after nine rounds of NELP, all the easy-to-tackle blocks have been contracted out and what remain are the difficult ones from a technological or security standpoint. Maybe it is time for the Petroleum Ministry to go slow on the auctions, which have not attracted much foreign investment anyway, and to focus on regulating the blocks that have been already contracted. Auctioning newer blocks is, after all, not the only way to increase oil and gas output.

From: The Hindu

Wield the stick

The audit of airlines done by the Directorate General of Civil Aviation (DGCA) is alarming. It shows that financial stress in airlines is impinging on air safety. Reports indicate that a reasonable case exists for even withdrawal of licenses to one private sector and another public sector airline, on grounds of being "unsafe to fly" Other airlines too could soon slip into a similar predicament. Airlines are now saddled with Rs 1,06,000 crore of debts and accumulated losses of more than Rs 30,000 crore. It's not just that some of them are unable to pay fuel bills and salaries, safety standards too are being compromised.

Last year had revealed another set of safety loopholes - like the procurement of pilot licenses with fake mark sheets, tampering of flying school records and conflict of interest issues because of hiring of relatives of officers of regulatory agencies by airlines. The DGCA must remember that its primary remit is air safety. It has to act without fear or favour in ensuring this, setting political or commercial considerations aside. If flying licenses need to be revoked and airlines grounded, it shouldn't hesitate. Meanwhile, industry issues are best tackled by the government through greater consolidation of the industry. If that should include closure of loss-making companies-including Air India, so be it. The government should also revive the profitability of airlines by taking steps such as reducing taxes on the sector - including on aviation fuel - and liberalising FDI norms. Concurrently, it must reverse heavy understaffing at the DGCA. Airlines too need to tweak their business models and cut costs, though never at the expense of safety.

From: The Times of India

Boeing Defence

A Different Kind of War



In 2009, the President of India, the supreme commander of its armed forces, created history by flying in an IAF Sukhoi combat aircraft. A gesture which, apart from being daring, communicated to the men and women in the armed forces her concern and empathy for the difficult tasks that they routinely perform in order to stay prepared to respond to the call of the nation. At the time, this writer had commented that this would “be perceived by every soldier, sailor, airman and veteran

as a great symbol of hope for the future of the institution of the armed forces of India. A future that in recent times has looked progressively fragile.”

As time has gone by, what was then perceived to be a fragile future for the armed forces seems to be turning into unfortunate reality. One would like to believe that it was this concern that prompted the supreme commander to don combat gear again and join the military exercise, *Sudarshan Shakti*, in Rajasthan

on India’s western border. She was reported to have witnessed the exercise from an IAF Mi-17 helicopter, before taking a ride on a T-90 tank. All this in simulated operations close to the sensitive border. Much like fitting into the cramped cockpit of a fighter aircraft, manning the cabin of a tank also requires courage and grit. That the supreme commander has again reached out to communicate directly to the soldiers she commands must continue to be a source of inspiration for the forces.

Sikorsky UT

Sandwiched between these two presidential forays into the field, much has taken place both within and outside the armed forces that must cause observers of national security some concern. Are the civil and service leaderships on the same wavelength, or are we closer to the abyss?

As if on cue, on the eve of the president's visit to the exercise, came the news of a dubious first in the annals of Indian military history. A three-star lieutenant general and an erstwhile military secretary in the army headquarters were found guilty of various charges relating to the 'Sukhna land case.' The court martial recommended that the accused be dismissed from service and stripped of rank, decorations, medals and pension. Earlier, another three-star general officer had also been found guilty in the case and punished.

At the time the armed forces were coming to terms with the unfolding Sukhna revelations, they were also hit by the 'Adarsh Housing Society' bombshell. A subsequent report by the Comptroller and Auditor General slammed military authorities for misappropriating prime defence land and commented that the entire episode revealed "glaring examples of dereliction of duty and severe lack of probity and accountability which needed to be investigated". That a housing society meant to benefit widows of the Kargil conflict had ended up benefiting politicians, bureaucrats and senior armed forces personnel merely added to the shame.

Whilst these remain individual aberrations, military culture enjoins sharing the pride of individual heroics and sacrifices with the wider fraternity. The collective moral ethic of the armed forces has been tarnished as a result of these incidents. The sheer lack of morality in the highest echelons of the administration and the military cannot but have left a permanent scar on the *izzat* and *iqbal* of the institution of the armed forces. For the first time in the nation's history, there are whispers that the military is lacking in moral fibre.

In normal times, these developments would have brought about a sense of disquiet and soul searching within the ministry of defence and the armed forces. They should have also drawn instant attention from the

highest political leadership, including the cabinet committee on security. But we live in times so numbed by corruption that the only reaction appeared to convey the following sentiment: '*Acha ab sab mil gaye hain*' ('So now all have ganged up'). To add insult to injury, it appears that this was seen as an opportune time by some to make a tactical move in the civil-military tussle, as the following examples indicate.

While the chief minister of Jammu and Kashmir was well within his rights to explore a political initiative to revoke the Armed Forces (Special Powers) Act from certain areas of his state, wittingly or otherwise, his target appeared to have been the army. Activists of various shades pounced on this opportunity, and it was again the army that was being projected as the villain and left to defend itself. The silence from South Block was both puzzling and deafening. It appeared that it wanted the army to stew in this discomfiture.

Even as the army chief was escorting the president to *Sudarshan Shakti*, one wondered whether she was aware that in yet another unfortunate first, the army chief himself was awaiting the defence minister's disposal of his statutory complaint. The complaint sought a review of his earlier appeal requesting the correction of his date of birth. Whilst a statutory complaint by a serving chief to the defence minister brings no credit to the internal functioning of the ministry of defence, to keep the chief waiting for months for an administrative decision speaks poorly of not just the inter-institutional relationship between the ministry and the services, but also of the lack of appreciation at the highest political level of how such treatment undermines the authority of the chief in the eyes of the entire force.

If this is the nation's attitude towards its armed forces and its leadership, one is not surprised at the fate of its veterans. That *dharnas* by veterans at the Jantar Mantar and memorials across the country are not even news anymore tell its own pathetic tale. The protests have not elicited a single parliamentary debate: this speaks of the priorities of the world's largest democracy. Since it is fashionable to talk of the largest and oldest democracies in tandem, it is

interesting to see what the latter's take is. On Veteran's Day, the president of the United States of America had this to say: "To all those who have served America — our forces, your families, our veterans — you have done your duty. You have fulfilled your responsibilities. And now a grateful nation must fulfil ours."

In contrast, just look at how an ungrateful India ignores its responsibilities towards its veterans. Little publicity was given to a rally held at Jantar Mantar by the *Defence Veterans Against Injustice*. Its press release talks of a peaceful protest that has been going on for over 40 months, of 22,000 gallantry and distinguished service medals having been surrendered in protest and of memoranda signed in blood by 150,000 veterans. If one were to pause and reflect, these numbers tell a disturbing story and can be ignored only at the nation's peril.

Whatever the merits of their demands, two aspects are worrying. If the leadership of a vibrant democracy like ours cannot find the strength to establish a meaningful dialogue and resolve issues with veterans who are loyal and disciplined citizens, then how can it claim to govern a diverse nation across political, ideological and many other complex divides? Secondly, whilst the more hard-nosed amongst those in the *babudom* may consider the veterans a spent force, those still in uniform are acutely conscious that they are tomorrow's veterans, and that a similar ungrateful fate awaits them. In *Arthashastra*, Kautilya has this to say to the emperor, Chandragupta Maurya: "The day the soldier has to demand his dues will be a sad day for Magadha for then, on that day, you will have lost all moral sanction to be King." One would not like to believe that the day is not far.

The supreme commander is striving to communicate with soldiers, sailors and airmen. Her next visit was to the Indian Navy when she reviewed the Fleet. It could have been used as an opportunity to invite cabinet ministers and service chiefs to a session in introspection. Far removed from the imperious South Block, ensconced in the bowels of a warship where the entire crew either fights or sinks together, it may have dawned on the wise men that for the Indian ship of State too, there is no alternative to this strategy.

Air Marshal (Retd.) Brijesh Jayal

Rouge

FLASH NEWS

DASSAULT RAFALE



Even as this issue was at the press, it was learnt that the Dassault Rafale had been selected to meet the IAF's medium-multirole combat aircraft (M-MRCA) requirement. Executives from both the short listed companies were reportedly invited to the Ministry of Defence in the afternoon of 31 January 2012 for the announcement which electrified all those who have followed the M-MRCA programme since 2004.

In their official press release, Dassault Aviation stated, "Following the announcement of the final selection of the Rafale in the frame of the MMRCA programme, Dassault Aviation and its partners are honoured and grateful to the

Indian Government and the people of India to be given the opportunity to extend their long-lasting cooperation. Dassault Aviation and its partners reiterate their commitment to meet the operational requirements of the Indian Air Force and underline their pride in contributing to India's defence for over half a century."

The first Dassault fighter type to serve with the Indian Air Force was the Ouragan, known in the IAF as the *Toofani*, which flew with a number of frontline squadrons from 1953 till its phasing out in 1967. *Toofanis* saw anti-insurgency action in India's north-east and in December 1961 were employed to support the Indian Army during

SELECTED AS M-MRCA

the brief campaign which brought an end to Portuguese colonies in India. (See article in this issue)

From the same stable, came the Dassault Mystere IVA in 1957 and this swept wing transonic fighter was operated by the IAF till 1973, including during the 1965 and 1971 wars with Pakistan where it was used to good effect in the anti-tank role. The last squadron with the Mystere IVA was No.31 which is today operating the Sukhoi Su-30MKI. (Flown over Rajpath on 26 January 2012)

The era of digital-deltas was ushered in when the IAF inducted the Mirage 2000s in 1985 when Nos.1 and 7 Squadrons were reequipped with this new generation

bi-sonic fighter. The Mirage 2000s presently operate with three squadrons and are currently being majorly upgraded with new avionics and weapon systems (see news item).

The M-MRCA requirement is for 126 aircraft, single and twin-seaters, the first 18 to be received 'fly-away' from 2014-15 with the balance 108 to be licence manufactured by HAL at a brand new facility in Bangalore. An option clause embedded in the contract, allows for an additional 63 aircraft which is likely to be taken, in which event some 200 Rafales will serve with the IAF in eight-ten squadrons for the next half century.

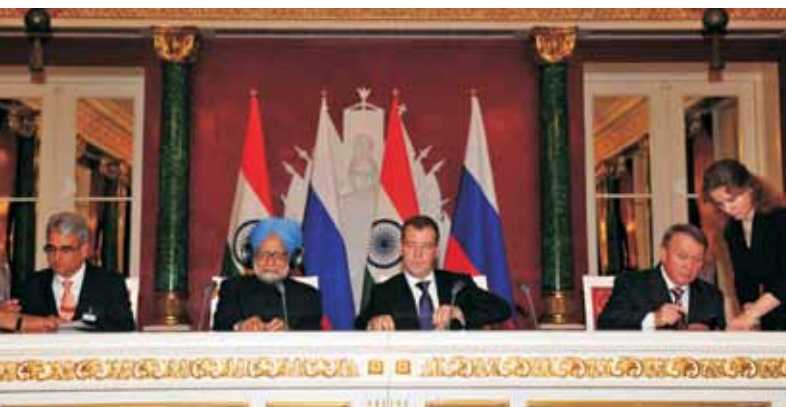
IAF to get 42 additional Sukhoi Su-30MKIs

During his visit to Russia, Prime Minister Manmohan Singh signed an agreement for the purchase of 42 additional Sukhoi Su-30 MKIs (also known as 'Super Sukhois') which will supplement the 230 already ordered and under license production by HAL at its Nasik division.



The agreement for the additional Su-30MKIs was signed by Defence Secretary Shashi Kant Sharma and Russian Federal Service for Military-Technical Cooperation Director MA Dmitriev in presence of the Indian Prime Minister and Russian President Dmitry Medvedev after their talks at the 12th annual Indo-Russian Summit at the Kremlin.

The 'Super Sukhoi' reportedly includes a new cockpit, upgraded airborne radar and will incorporate certain stealth features being developed for the T-50 FGFA. Significantly, the upgraded Sukhoi-30 MKIs will carry a heavier weapons load, particularly the air-launched version of the BrahMos supersonic cruise missile. The first delivery of the upgraded Sukhois is expected in 2014 and the last by 2018.



Secretary, Ministry of Defence Shashi Kant Sharma and the Director, Federal Service for Military-Technical Cooperation, Russia, M.A. Dmitriev signing the agreement in presence of Prime Minister Dr. Manmohan Singh and Russian President Dmitry A. Medvedev at Moscow on 16 December 2011.

Air Chief reiterates confidence in the Su-30MKI

Air Chief Marshal NAK Browne, Chief of the Air Staff flew an hour's sortie in a Su-30 MKI at Lohegaon Air Force Station (Pune) on 21 December 2011. With clear reference to the loss of an Su-30MKI from Lohegaon recently, the CAS addressed the station, "I wanted to be here to not only fly the



Air Chief Marshal NAK Browne, Chief of the Air Staff with Wing Commander Anurag Sharma, Commanding Officer of a Su-30MKI Squadron, before the sortie.

Su-30 MKI but also to meet all of you and assure you that our Su-30 fleet is in good and capable hands. Our boys have been doing an excellent job and the momentum of building up the new Su-30 squadrons needs to be maintained. Our people should remain our highest priority because it is then that a cohesive team translates itself in to a success story."

Sixth C-130J for the IAF

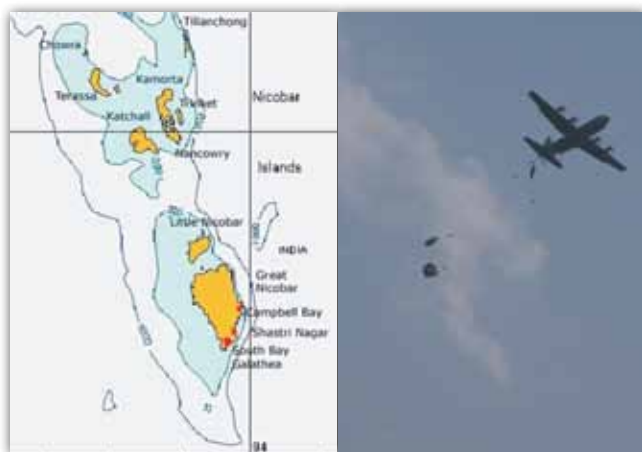
Number six of the initial six C-130J Super Hercules ordered by India, under the U.S. Foreign Military Sales programme, departed Marietta on 15 December, 2011 for Hindon Air Force base near New Delhi. This aircraft, like its five predecessors, "was delivered ahead of schedule and under budget".



Saab

IAF C-130J in long range special operations mission

On 12 December 2011, the Indian Air Force simulated an operational contingency over Campbell Bay in the Nicobar Islands (the furthestmost island territory of India in the Bay of Bengal). The mission required the launching of a Para Special Forces team into the objective area using the C-130J as airborne



platform. The objective was about 3500 nautical miles away from Hindon, the route via Kolkata and Port Blair to the simulated drop zone over Campbell Bay in Great Nicobar Islands. The round trip involved a staggering 12 hours of flying time.

Despite encountering inclement weather over the Bay of Bengal, the crew of No.77 Squadron flew the C-130J to Campbell Bay, achieved the planned objective and returned to Air Force Station Hindon after a non-stop mission of over 12 hours without refueling enroute.

Maiden flight of first Indian AEW&C aircraft



The first modified aircraft with an indigenously developed Airborne Warning and Control System(AEW&C) made its maiden flight on 6 December 2011 at Sao Jose dos Campos in Brazil with about 1000 mission system components provided by CABS (of DRDO). These include the critical AESA (Active Electronic Scanning Antenna) Radar Antenna developed by DRDO and certified from ANAC, the International FAR Certification Agency.

While this aircraft will now undergo full certification process over the next two year period, India will receive two such aircraft by mid-2012 when the mission systems developed by various DRDO laboratories will be integrated with these aircraft. Currently, these systems are undergoing ground integration and evaluation at CABS (Centre for Airborne Systems) at Bangalore. The IAF will receive two such aircraft integrated with systems in 2013.

\$1.2 billion missile deal with MBDA

In a quick start to the new year, the Cabinet Committee on Security (CCS), chaired by Prime Minister Manmohan Singh, cleared the acquisition of 500 MICA air-to-air missiles from European firm MBDA. This is part of the previously-announced package to upgrade the IAF's 51 Mirage 2000 fighters.

The overall \$2.4-billion Mirage upgradation package was approved in July 2011, with the French firms Thales and Dassault Aviation contracted for the work. The first two Mirage 2000s of the IAF have already been flown to France while the balance would be upgraded by HAL in India.

"Two aircraft - a single seater and a twin-seater - have flown out to France via Qatar, Egypt, Turkey and Greece before arriving at Istres in French Riviera, northwest of Marseille" confirmed Eric Lenseigne of Thales. "The upgrade will begin immediately. A 22-member project team from the Indian Air Force and Hindustan Aeronautics Ltd (HAL) will be associated with the project. This is what we call a middle-life upgrade. It will take a few years".



Rafael Derby BVRAAM for Tejas LCA

The Indian Air Force plans to equip the Tejas light combat aircraft (LCA) with Rafael's supersonic Derby beyond visual range air-to-air missile (BVR-AAM). The Government of India is to shortly sign a contract with Rafael Advanced Defence Systems (RADSL) to procure the Derby BVR-AAM to be fitted on the indigenous fighter.



Picture by B Harry.

The IAF has selected the Derby BVR-AAM over the indigenous Astra BVR-AAM to expedite the induction of Tejas into its inventory as "it is a tried and tested weapon" with the Indian Navy already having operationalised this in service with the Sea Harrier. Under the Limited Upgrade Sea Harrier (LUSH) programme, the IN's Sea Harrier fleet have been equipped with Elta 2032 multimode pulse doppler airborne intercept & fire control radars and the Derby missiles. The Tejas LCA will have a similar combination.

Pratt & Whitney engines contracted for IAF Boeing C-17s

Pratt & Whitney have received a contract to produce the first four F117-PW-100 engines to power the Boeing C-17 Globemaster III for the Indian Air Force. The engines will be delivered in the second quarter of 2012. Earlier the Indian MoD had signed a Letter of Offer and Acceptance with the U.S. government to acquire 10 C-17s, the first of which will be delivered in early 2013.



P&W engines on a RAAF C-17.

£59 Million Hawk spares contract for BAE Systems

BAE Systems' has secured a £59 million contract for the provision of spares and ground support equipment to support Hawk training aircraft operations which brings the total value of Hawk related contracts in India to more than £600 million in the last 18 months. Hawk is manufactured in India under license by Hindustan Aeronautics Limited with materials, parts and support services provided by BAE Systems.

Guy Griffiths, BAE Systems' Group Managing Director, International, said, "The Indian Air Force has one of the largest fleets of Hawks anywhere in the world, and this contract is vital to ensure the continued availability of the fleet. This new order strengthens the robust production platform established by our partner HAL for the aircraft, which remains the benchmark advanced jet trainer in service today."



INS Arihant to begin 'sea acceptance' trials

According to Ministry of Defence sources, the sea-acceptance trials (SATS) of the INS *Arihant* are to begin "towards end-February" after the completion of its ongoing harbour-acceptance trials (HATS). It will take at least six months of extensive SATS and missile trials before the boat is ready for commissioning into the Navy. With INS *Arihant*'s induction, India will brandish the most effective third leg of the nuclear triad, the ability to fire N-missiles from the land, air and sea.

Simultaneously, fabrication work on the three follow-on SSBNs (nuclear-powered submarines armed with nuclear ballistic missiles), identified as S-2, S-3 and S-4, is in full swing under the over Rs 30,000-crore advanced technology vessel (ATV) programme. The second SSBN after INS *Arihant* is to be named INS *Aridhaman*, both of which mean "potent destroyer of enemies". They are to be armed first with the 750-km K-15 and at a later stage with the under-development 3,500-km K-4 SLBMs (submarine-launched ballistic missiles). INS *Arihant* has four silos on its hump to carry either 12 K-15s or four K-4s.

The Indian Navy plans three SSBNs and six SSNs (nuclear-powered attack submarines) in the longer term, even as the Service is faced with a depleting conventional underwater arm, reduced to 14 ageing diesel-electric submarines.

'K-152 Nerpa' commissioned into Indian Navy as INS 'Chakra'

The Russian Akula-II class submarine 'K-152 Nerpa' was commissioned into the Indian Navy as INS *Chakra* on 23 January 2011 under a 10-year lease. India is the sixth country after US, Russia, France, the UK and China to operate a nuclear-powered submarine.

INS *Chakra* was commissioned at the Primorye region in far south-eastern Russia in a ceremony attended by top Indian and Russian officials and after arrival in India will be based at Visakhapatnam, close to where the indigenous nuclear submarine INS *Arihant* is slated to begin extensive sea trials in February-March after the ongoing harbour-acceptance trials.



INS *Chakra* will reportedly be armed with the 300-km range Klub-S land-attack cruise missiles, which India deploys on its *Kilo*-class conventional submarines as well as other missiles and advanced torpedoes. The Indian Navy will also use INS *Chakra* to train its sailors in the complexity of operating nuclear submarines.

SELEX Sistemi Integrati contracts

SELEX Sistemi Integrati, a Finmeccanica company has recently signed a contract with Cochin Shipyard Ltd to deliver an air surveillance naval radar RAN 40L and an IFF radar which will equip the new Indian Aircraft Carrier (IAC-1).



The RAN-40L is a 3D long range early warning radar with solid state active-phased array antenna for detection of aircraft up to 400 kilometers. The radar design is based on the land based 3D RAT-31DL, in service with the NATO Countries.

In the naval area, Finmeccanica Company has supplied three command and control systems in 1984 for the *Godavari* and *Brahmaputra*-class frigates, besides the relevant logistic support. More recently, following this long standing relationship, SELEX Sistemi Integrati also supplied radars and air traffic control systemst for airports at Bangalore and Hyderabad. The company is also providing the Indian Navy and Air Force with the PAR2080C system, a Precision Approach Radar.

India, Japan to enhance strategic ties

In reaffirmation of India's efforts to enhance strategic relationships with countries in Eastern Asia, Prime Minister Manmohan Singh and Yushihiko Noda reviewed the first-ever India-Japan-U.S. trilateral agenda prior to their summit meeting in late December 2011. This included a \$4.5-billion grant for an ambitious infrastructure project, participation in the forthcoming India-U.S. naval exercises and holding talks on moving ahead with India-Japan-U.S. trilateral cooperation. Such strategic moves will be demonstrated in Japan's participation in the next India-U.S. *Malabar* series of joint naval exercises off the Indian coast in April 2012.

Discussions were also held on a bilateral civil nuclear cooperation accord. Although Japan will shortly sign similar pacts with Russia, Jordan, Vietnam and South Korea, prospects of an accord with India, a non Nuclear Non-Proliferation Treaty (NPT) signatory, "are not bright".

However, the Government of India feels there should be no problem in Japanese companies supplying components to French and U.S. civil nuclear companies despite the absence of an India-Japan civil nuclear agreement. "Our understanding is that an agreement is required for a comprehensive partnership. But individual items can be sold by Japanese companies [which have a near monopoly on reactor vessels and their parts] to companies such as Areva under a licence from the government," said sources.

Pawan Hans

New Coast Guard ship

The Indian Coast Guard Ship *Rani Abbakka*, first of a series of five Inshore Patrol Vessels (IPV) being built at Hindustan Shipyard Limited (HSL), was commissioned at Visakhapatnam by MM Pallam Raju, Minister of State Defence on 20 January 2012 in the presence of Vice Admiral Anil Chopra, Flag Officer Commanding in Chief (East), Vice Admiral MP Muralidharan, Director General Indian Coast Guard and other senior officers.

The 50-metre Inshore Patrol Vessel has been designed and built indigenously and equipped with the advanced navigational and communication sensors and equipment and propelled by three MTU 4000 series Diesel engines of 2720 KW capacity, at 2100 rpm each coupled with three 71S II Rolls Royce Jets to a maximum speed of 31.5 knots. ICGS *Rani Abbakka* will be based at Chennai under administrative and operational control of the Commander, Coast Guard Region (East).

Meanwhile, three Indian Coast Guard ships *Vikram*, *Chandbibi* and *Ramadevi* were decommissioned from service on 19 January 2011.



Eighth flight of Rustom-1

The indigenously-designed and developed Rustom-1 UAV demonstrator made its 8th successful flight on 8 December 2011. It flew up to an altitude of 6000 feet and



at a maximum speed of 90 knots during its 30 minute flight near Hosur. Rustom-1 was test flown with the gimbal payload assembly carrying Daylight TV & Infrared Camera for the first time and good quality pictures were received from the camera in gimbal payload assembly.

PS Krishnan, DS and Director, Aeronautical Development Establishment (ADE) which has developed the Medium Altitude Long Endurance Unmanned Air Vehicle (MALE UAV) and weighs 661 kg said that the flight was successful as all the systems “worked well” and the overall performance was satisfactory.

175 Officers commissioned into the Indian Air Force

On 29 December 2011, 175 Flight Cadets including 30 Women Flight Cadets passed out of the Air Force Academy, Dundigal, Hyderabad as newly commissioned officers to join the Indian Air Force in respective branches.

General VK Singh, Chief of the Army Staff was Reviewing Officer for the Combined Graduation Parade which marked the culmination of basic as well as professional training of the flight cadets, who underwent training at Air Force Academy Dundigal, Hyderabad, Air Force Administrative College, Coimbatore, Air Force Station Hakimpet, Air Force Station Yelahanka and Air Force Station Begumpet.

Flying Officer Varun Agarwal commanded the parade and was awarded the President’s Plaque and Chief of Air Staff ‘Sword of Honour’ for standing first in overall order of merit in Pilots Course while Flying Officer Kamal Kumar Mishra stood first in the Ground Duties Branch and Flying Officer Prasun Kumar Singh in the Navigation Branch.

The parade was followed by formation flypasts by Hawks, An-32s, Dornier Do-228s and Kiran jet trainers with a Su-30 carrying out a low level aerobatic display as the finale.



Flying Officer Kamal Kumar Mishra being awarded the President's Plaque by General VK Singh for standing first in overall order of merit in the Ground Duties Branch.

Sikorsky delivers S-76C++ Helicopter to Government of Maharashtra

Sikorsky Aircraft Corp. have delivered an S-76C++ helicopter to the Government of Maharashtra for air transportation of senior leaders of the state and other government officials. Earlier in 2011, the Maharashtra Government had shortlisted Sikorsky's S-76C++ helicopter after a detailed and intense technical evaluation process and signed a contract for delivery of one S-76C++ helicopter.

The S-76C++ is the latest in-service model of the fleet and features a number of "advanced patented technologies enhancing the safety and comfort of passengers and crew." Air Vice Marshal (Retd) AJS Walia, Sikorsky Executive Vice President and Regional Head India & South Asia, stated that "this aircraft is recognised the world over for safety, operational performance, and comfort. The State Government has chosen the S-76C++ after an intense and transparent technical evaluation and it has been customised to meet their requirements of safe and efficient transportation."

Jet Airways confirms order for 17 Boeing 737s

Jet Airways has converted its options to buy 17 new Boeing 737-800 airliners. As per list prices, the contract is to be around \$1.4 billion.



Order on Aqeri from IAF

Aqeri, a Swedish supplier of computers and communication equipment designed for extreme conditions, has received an order from the Indian Air Force. Worth over SEK 2 million, this relates to rugged communication equipment based on Cisco products, and part of a radar system for the Indian Air Force.

Rolls-Royce and HAL's new manufacturing facility

Rolls-Royce and Hindustan Aeronautics Limited (HAL) have begun construction of a new manufacturing facility in Bangalore, which will be owned by International Aerospace Manufacturing Pvt Ltd (IAMPL) a joint venture between Rolls-Royce and HAL which was formed in 2010.



Offg. Chairman HAL, P.V. Deshmukh with Anil Shrikhande, President Rolls-Royce India during the ceremony.

This 7,200 m² purpose-built production facility will produce components for the technologically advanced Trent family of civil aeroengines, as well as for a number of marine and energy gas turbines. Located near the HAL airport, the facility will start production in 2012. IAMPL will incorporate the latest Rolls-Royce manufacturing techniques and will create job opportunities for highly skilled technicians and engineers in India.

Anil Shrikhande President, Rolls-Royce-India said, "This new manufacturing facility demonstrates our commitment to the long-standing partnership with HAL. We plan to develop IAMPL as a centre of excellence, with the latest manufacturing techniques and training programmes. IAMPL furthers our common objective of enhancing high value-added manufacturing in India and will also contribute to the country's growing aerospace and technology industry."

QuEST Global Engineering and GKN Aerospace

GKN Aerospace has formed a long-term relationship with QuEST Global Engineering wherein the latter has entered into a long-term agreement to provide the engineering skills and resources to support GKN Aerospace's long term growth strategy. This sale to QuEST creates adds 290 skilled engineering personnel to the 2,800 professionals already employed by QuEST across their 18 global 'delivery centres'.

HATSOFF Simulator for AS365N3 Dauphin

The *Helicopter Academy to Train by Simulation of Flying* (HATSOFF), the joint venture owned equally by Hindustan Aeronautics Limited (HAL) and CAE have announced that its simulator cockpit for the Eurocopter AS365 N3 Dauphin helicopter has been certified to Level D, the highest qualification for flight simulators, by the Directorate General Civil Aviation (DGCA) as well as the European Aviation Safety Agency (EASA).

Three other simulator cockpits - of a Bell 412, a HAL civil/conventional Dhruv, and the Eurocopter AS365 N3 Dauphin - have been certified as Level 2 (JAR)/Level 6 (FAA) flight training devices (FTDs) when used as fixed-base, non-motion simulators in the docking station installed at HATSOFF.



HATSOFF uses a CAE-built full-mission simulator 'mothership' that features CAE's revolutionary roll-on/roll-off cockpit design, which enables cockpits representing various helicopter types to be used in the full-mission simulator. When one cockpit is in full-motion, another cockpit can be connected to the fixed-based docking station and used as a flight training device.

Vice Admiral MP Muralidharan is Director General, Indian Coast Guard

Vice Admiral MP Muralidharan has been appointed as Director General of the Indian Coast Guard. The Admiral was commissioned into the Indian Navy on 1 January 1975, is a Navigation and Direction Specialist and a graduate of Defence Services Staff College, Wellington. His operational appointments include command of Indian Naval Ships *Chatak*, *Sharda* and *Ranvijay*, Fleet Operations Officer of the Western Fleet and Principal Director of Naval Operations.

His staff appointments include Director of Indian Naval Tactical Evaluation Group (INTEG), Naval Assistant to FOC-in-C (West) and to the Chief of the Naval Staff, Naval Attache at Moscow, Flag Officer Sea Training, Chief of Staff of Western Naval Command, Flag Officer Commanding Maharashtra and Gujarat Area. He was also the first Commandant of the Indian Naval Academy, Ezhimala. He was Chief of Personal at the IHQ MoD (N), prior taking over as the DGCG.



Lt Gen AK Choudhary takes charge as DGMO

Lt Gen A K Choudhary has taken charge as Director General Military Operations. The General Officer has had a distinguished career, in both Command and staff assignments, was commissioned into the Mahar Regiment and has had vast operational experience. He has commanded 12 Mahar in J&K, 8 Assam Rifles in Manipur, 10 Sector Rashtriya Rifles in J&K and IGAR (South) in Manipur, and was GOC of a Corps in the Western Theatre.



PS Subramanyam gets National Design Award 2011

The National Design Award 2011 was awarded to P S Subramanyam, Programme Director (Combat Aircraft) and Director, Aeronautical Development Agency (ADA), Bangalore for his "outstanding contribution in the area of design" by National Design and Research forum (NDRF) of Indian Institute of Engineers (IIE).



Avi Oil

Dr. Arvind Gupta is DG, IDSA

Dr. Arvind Gupta, an officer of the Indian Foreign Service 1979 batch has become Director General, Institute for Defence Studies and Analysis (IDSA) at New Delhi

He was earlier holding the Lal Bahadur Shastri Chair in Strategic and Defence Studies at IDSA since March, 2008. Prior to joining IDSA, Dr. Gupta was Joint Secretary at the National Security Council (NSC) Secretariat (NSCS) from 1999 to 2008. During his tenure at the NSCS, he dealt with a wide spectrum of national security issues.

Dr. Arvind Gupta has wide-ranging diplomatic experience while working in Indian missions abroad and has handled a number of assignments in the Ministry of External Affairs in different capacities.



Dean McCumiskey is CEO BAE Systems in India

Dean McCumiskey has been named as Managing Director and Chief Executive of BAE Systems India operations with effect from March 2012. Dean is currently Group Chief Information Officer based in the company's London headquarters and will succeed Andrew Gallagher who takes up new responsibilities as BAE Systems' Director of Audit, based in the United Kingdom.

Dean McCumiskey has long experience of the global defence, aerospace and security industry, having held senior management positions in both the US and Europe. Prior to taking up the role of Chief Information Officer, he was responsible for business activities in Europe, Canada and South America, leading multi-million dollar campaigns covering the air, land, maritime and security sectors.

Amongst the other programmes, discussions between the Indian and US Governments are ongoing in relation to a possible sale of BAE Systems' ultra-light M777 howitzer to meet the Indian Army's requirements.



Keskar to head new Boeing Commercial Airplanes Office in Asia-Pacific

Dinesh Keskar, President, Boeing India has been appointed as Senior Vice President, Sales Asia-Pacific and India for Boeing Commercial Airplanes. In this role, Keskar will head a sales organisation, including contracts, marketing, revenue management and other support functions.

"India is an important market and a priority for Boeing, and we will continue to grow and strengthen our partnership with customers we serve and the many communities in which we work and live. Dinesh will continue in his present role as Boeing India President until a successor is named," said Shep Hill, president of Boeing International.



CAS inspects Air Force Stations at Chabua, Tezpur, Gandhinagar and Jodhpur

Air Chief Marshal NAK Browne visited various Air Force Stations including those at Chabua and Tezpur on a tour to the North East from 12 to 14 December 2011, starting with Eastern Air Command Headquarters at Shillong.

Inspecting the Su-30 infrastructure at the two bases, the Chief interacted with squadron pilots and engineers besides the station personnel in key appointments. The CAS emphasised that the reason for his visit was "to see firsthand how things are at the bases. Your station is undergoing fair amount of transformation in terms of new inductions, keep operations upfront in your focus, but along with these changes that we



The CAS at Tezpur...

talk about, it is our people, our air warriors who must receive our highest attention, in terms of their quality of life, training, mentoring and grooming. We should be able to ensure that right down to the last man in our system understands what we are doing. We should be able to channel our energies to a common task and our endeavour should be to uplift the quality of everything we do, a notch higher.”



...at Jodhpur

Early in the New Year, Air Chief Marshal NAK Browne visited the air base at Jodhpur and then South Western Air Command Headquarters at Gandhinagar where he interacted with Commanders of all the bases under SWAC.



...and Gandhinagar

Republic Day Parade 2012

As always, the formation flypast by aircraft of the Indian Air Force over Rajpath in the heart of New Delhi was climax of the Republic Day Parade on 26 January 2012. Unlike previous years, the weather was perfect and the 32 aircraft flew past in clear visibility.

Four Mi-17IVs trailing the National flag and service ensigns, showered flower petals as the President of India took the salute,



Mechanised columns of the Indian Army lead the parade on 26 January 2012.

the Army's mechanised columns being followed by marching troops and tableaux even as three Army Aviation Dhruv ALHs flew over. The DRDO had four tableaux including one with the Agni-4 IRBM which dominated the parade in more than one sense (see following report).

After the cultural aspects and spirited performances by school children were showcased, all eyes were focused on the skies above Vijay Chowk as 3 Mi-35s of the Indian Air Force flew over in 'Chakra' formation. For the first time, the IAF



Women at the forefront: Flt Lt Sneha Shekhawat along with three other female officers Heena Pore, Anupam Chaudhary and Pooja Negi leading the Indian Air Force contingent.

publically flew a vic formation of 3 Lockheed Martin C-130J Super Hercules of No.77 Squadron which were followed by the 'Big Boy' formation consisting of an Il-78, flanked by pairs of An-32s and Do-228s.

The fighters were led by five Jaguars from No.5 Squadron in arrowhead formation followed by 5 MiG-29s of No. 47 Squadron. Three Su-30MKIs of No.31 Squadron followed in *Trishul* formation and the finale was a single Su-30MKI which carried out a 'Vertical Charlie' manoeuvre. Perhaps the only disappointment expressed by the millions watching the parade on ground and TV screens, was that there should have been more aircraft over the parade, considering that the Indian public gets to witness such flying displays just once a year.

DPS DRDO

DPS DRDO

Fiscal situation: impact on defence procurement?

The obvious fallout of a deteriorating fiscal situation in the country could mean slowing down of major defence purchases in the final quarter of this financial year, January–March 2012. Defence observers feel that a number of major decisions scheduled for clearance between January and March 2012 may not be given the ‘go ahead’ and could well be pushed to the next financial year.

All three defence services are faced with delays in programmes, exemplified by the finance ministry’s holding up the second phase of Army modernisation. This phase has involved a total commitment of Rs 65,000 crore over the next five years, including an increase in manpower by 90,000, primarily to bolster the northern borders.

As for the Navy, the ministry has not cleared the second phase of Project *Seabird* at Karwar port, whose development



North Block, which houses the Ministry of Finance.

is estimated at around Rs 13,000 crore including a dedicated naval facility for berthing the aircraft carrier *INS Vikramaditya*. The Air Force’s proposal for acquiring Basic Trainer Aircraft has been stalled, with delays in induction impacting on the already modified flying training schedules. The IAF has proposed the Swiss Pilatus PC-7 to be its basic trainer aircraft after forced grounding of the HPT-32 two years ago.

The greatly anticipated announcement on the M-MRCA selection has not yet taken place (till end-January 2012) leading to much speculation on the timelines, even as the Indian Air Force is extremely keen to move the programme forward in face of its depleting combat force. [FLASH News: the Rafale is declared ‘L-1’].

Besides these “big ticket” acquisitions, the Finance Ministry’s sanction and subsequent approval of the Cabinet Committee on Security, may not be forthcoming soon for other major programmes including those for ultra light howitzers and 197 light utility helicopters for the Army which have been pending for many years.

Given the Finance Ministry’s efforts “to go slow” on major defence acquisitions, there are indications that the MoD may well end up “surrendering” some of the capital budget amount allocated for the financial year 2011-2012.



Defending the northern frontiers.

Army Day – 15 January 2012



Special Forces with characteristic style, jog past the saluting dias.

Preceding Army Day on 15 January 2012, Lt Gen SR Ghosh, GOC-in-C, Western Command reviewed a Investiture Parade at the Delhi Cantonment Parade Ground and presented gallantry awards. The Army Commander congratulated all the troops for their exemplary turnout at the parade and extended his congratulations.

On the following day, Army Chief General VK Singh reviewed the ceremonial parade which included elements from the infantry, combat engineers, air defence artillery and army aviation corps.



The Pinaka unguided rocket system and area weapon system loaded on a multi barrel launcher.



Special Forces deploy from Army ALH.



Army Chetak drops Special Force Commandos at the Delhi Cantonment Parade Ground.



COAS General VK Singh inspects the parade on 15 January 2012, accompanied by Maj. Gen. Rajbir Singh of the Delhi Area.



Prahaar TBM on Rajpath.

Showcasing DRDO at the Republic Day Parade

The DRDO contingent at the Republic Day Parade 2012 was commanded by Lt. Col V S Thapa, a distinguished officer from the Regiment of Artillery and a certified 'external pilot' of UAVs. The officer is presently posted as External Test Pilot to ADE, Bangalore, a premier DRDO laboratory. He was awarded the Commendation certificate by the Director, ADE in January 2011 for conventionally directing India's first successful flight of the Rustom-1 UAV on 16 October 2010.

On Rajpath this year, DRDO showcased three of its latest products, accompanied by a tableau depicting innovative technologies for handling hazards of snow and avalanches, all symbolic of DRDO's contributions to nation building and self-reliance in critical defence technologies, through science and innovation.

The Agni 4, the most potent and technologically advanced among India's strategic arsenal, adds a new dimension to strategic deterrence. Capable of being

launched from a self-contained road mobile launcher from anywhere in the country, the two-stage surface-to-surface missile with solid-propulsion has a range of over 3000 km. A quantum leap in indigenous technology, Agni 4 incorporates composite rocket motor casing, highly accurate guidance and navigation system, modern and compact avionics, digital control system and many other contemporary and advanced technologies.

The Prahar missile, recently developed by DRDO is a Tactical Battlefield Missile

DRDO is the R&D wing of the Ministry of Defence, with its mandate to empower India with cutting-edge defence technologies and achieving of self-reliance in critical defence technologies and systems. This is by indigenisation and innovation, while equipping the armed forces with state-of-the-art weapon systems and equipment. Dr DS Kothari, the eminent scientist and educationist was the first to head the Organisation which has thereafter been led by illuminati of the calibre of Dr APJ Kalam, who later

became India's President. The current Director General is Dr. Vijay Kumar Saraswat.

There are 52 DRDO laboratories, based on their core-competence, classified into to nine clusters including Aeronautics, Armament, Combat Vehicles and Engineering, Electronics and Computer Sciences, Materials, Missiles and Strategic Systems, Micro Electronics & Devices, Naval Research and Development plus Life Sciences. The DRDO remains committed to make India strong and self-reliant and which has led to the design, development

and productionisation of world class weapon systems, equipment, and complex technologies associated with such systems. These include strategic and tactical missiles, combat aircraft and other aeronautical systems, unmanned aerial vehicles, combat vehicles, armament and ammunition, radars, electro-optic and acoustic sensors, electronic warfare systems, life support systems and materials. The production value of major DRDO systems inducted into the Services over the last decade is over Rs 120,000 crores.

based on solid propulsion and equipped with high precision inertial navigation system giving it capability to hit targets at a 150 km range with extreme accuracy. The missile is mounted on a road mobile launcher, carries significant payload and can be equipped with a variety of warheads. Each such high mobility launcher carries six missiles; multiple launchers can be interlinked to deliver a near simultaneous multi axis attack on target, an invaluable addition to the Armed Forces arsenal.

The Rustum-1 Unmanned Aerial Vehicle (UAV) takes-off and lands like a conventional aircraft; the 'external pilot' standing near the runway conducts take-offs and landings of the UAV, handing over control to the 'internal pilot', operating from a ground control station for rest of the mission. The 'payload operator' at the ground control station captures essential video pictures and data. The Rustum -1 is designed to be airborne for 12-15 hours, at speeds upto 250 km/hr and is intended for surveillance, reconnaissance, target acquisition, fire correction and battlefield damage assessment. The armed forces and internal security organisations like State Police Forces, BSF, CRPF and the Coast Guard, are prospective operators of Rustum-1.

Finally came the tableau showcasing snow and avalanche hazards and their mitigation schemes developed by the Snow and Avalanche Study Establishment (SASE). In the inhospitable snow-bound avalanche-prone mountainous areas of the Himalayas, Indian troops maintain constant vigil. The SASE, a DRDO laboratory at Manali "ensures the safety, mobility and life support of our troops by issuing timely avalanche and weather forecasts as also preventive measures from avalanches to safeguard facilities created in the region." Using remote sensing data such as satellite imageries and a network of manual and automatic weather stations established all across Northwest and Central Himalayas, SASE issues accurate avalanche and weather advisories based on various models developed by them. SASE is also known as 'Saviours of Cold Regions'.



Lt. Col V S Thapa led the DRDO contingent at the Republic Day Parade.



The Snow and Avalanche Study Establishment (SASE) tableau



The Rustum-1, indigenously-built UAV.



Agni-4, the two-stage surface-to-surface IRBM.

President's Fleet Review 2011



Flying the flag of the CNS, the INS Viraat at anchor with Delhi-class guided missile destroyers in the background.

The Vayu Aerospace and Defence Review was invited to witness the President's Fleet Review 2011 and, like on previous such occasions, offers its readers a first hand account of this event at Mumbai Harbour on 20 December 2011.

Traditionally held once during the term of each President of India, this President's Fleet Review (PFR) was held in Mumbai on 20 December 2011 where the Indian Navy and the Coast Guard showed-off their maritime might with a total of 81 ships, both anchored and in mobile column, plus 44 aircraft that flew in formation as the last of the missile corvettes sailed past the Presidential Yacht.

Embarking on the offshore patrol vessel INS *Subhadra*, after a resounding 21-Gun Salute, President Pratibha Patil reviewed most of the existing fleet of the Indian Navy including the indigenously built stealth frigates INS *Shivalik* and INS *Satpura* as well as the Italian-built fleet tankers *Deepak* and *Jyoti*, with the newly inducted MiG-29Ks providing the finale as they flew over the rows of warships. The Presidential Review Column consisted of INS *Subhadra* followed by INS *Sharda* and INS *Suvarna*, these being escorted by two fast attack craft, T81 and T82.

Wishing the Navy on the occasion, President Patil said "the Navy, today, is poised to achieve new milestones with the imminent induction of the aircraft carrier *Vikramaditya*, the *Kolkata*-class stealth destroyers, frigates of the *Talwar* class, indigenous ASW Corvettes and an impressive number of submarines and aircraft. Today, the Indian Navy is one of the most capable in the region and, with its well thought out modernisation plans, is destined to grow even further."

"Safeguarding of our maritime borders is a major requirement for the social and economic well being of our country. The oil exploration activities off our coasts and at sea are of significant economic importance. Therefore, the protection of our coast, our 'sea lines of communications' and the offshore development areas is a major prerequisite of our nation's development. These are major roles for the Indian Navy."

"A preponderant proportion of our overseas trade is through the sea routes.

Our nation is surrounded by water bodies on three sides. This gives us an inherent geographical advantage, but it also poses numerous security challenges. Since the menace of piracy surfaced in our maritime neighbourhood, the Indian Navy has been involved in anti-piracy missions and has earned the gratitude of the maritime community and of other navies operating in the region for their efforts."

"I am aware that with these increased challenges and tasks, our ships are being deployed to the far reaches of the oceans for prolonged duration. Our officers and sailors have consistently risen to the occasion and displayed the utmost dedication and commitment while working tirelessly in a difficult environment."

Amidst much applause from Navy personnel, she expressed "confidence" that the Indian Navy is fully prepared to meet any challenges that may threaten maritime security of India in the future.

Rubin submarines



First public debut of the Indian Navy's latest combat aircraft, the MiG-29K ship-borne multi role combat aircraft, which brought up the last formation at the PFR 2011.



INS Satpura (F48), the indigenously designed and built stealth frigate, commissioned on 20 August 2011.



One of the indigenously designed and built tank landing ships, INS Shardul (L16) is capable of landing troops, armour and other vehicles on beaches.



INS Delhi (D61) Missile Destroyer which was flying the flag of Vice Admiral AK Chopra, FOC-in-C Eastern Naval Command.



Pair of HAL Dhruv ALHs of 321 Flight.





Four submarines of the Indian Navy were part of the PFR 2011 including INS Sindhu Kesari (S60).



HAL-built Dornier 228s of the Indian Coast Guard (CGAS 750).



Lone Ilyushin Il-38 maritime reconnaissance/ASW aircraft of INAS 315.



INS Tir (A86) is an indigenously built ship for sea training of Officer Cadets of the Indian Navy. The missile corvette INS Kulish (P63) seen at the back.



Kamov Ka-31 AEW airborne early warning helicopters of INAS 339.



Admiral Nirmal Verma, CNS presenting the PFR 2011 plaque to the President Pratibha Patil.



The Fleet Tanker INS Deepak (A50) built by Italian company Fincantieri.



Part of the Presidential Review Column,
INS Sharda (P55) Offshore Patrol Vessel.

Aircraft at the PFR 2011

Sea Harrier FRS Mk.51 (INAS 300)
MiG-29K (INAS 303)
Kiran (INAS 551)
Ilyushin Il-38 (INAS 315)
Tupolev Tu-142M (INAS 312)
Dornier 228 (INAS 550, CGAS 750)
Kamov Ka-31 AEW (INAS 339)
Kamov Ka-28 (INAS 333)
Sea King Mk.42B (INAS 330)
Chetak (INAS 321, CGAS 842)
Advanced Light Helicopter (321 ALH Flight)

Ships at the PFR 2011

TYPE	EQUIPMENT
Aircraft Carrier	Viraat (R22)
Destroyers	Delhi (D61), Mysore (D60), Mumbai (D62), Ranvir (D54)
Tankers	Aditya (A59), Deepak (A50), Jyoti (A58), Shakti (A57)
Frigates	Shivalik (F47), Satpura (F48), Talwar (F40), Tabar (F44), Brahmaputra (F31), Beas (F37), Betwa (F39), Godavari (F20), Gomati (F21), Ganga (F22)
Offshore Patrol Vessels	Subhadra (P51), Sharda (P55), Suvarna (P52), Savitri (P53)
ASW Patrol Vessels	Agray (P36), Ajay (P34)
Mine Counter Measure Vessels	Alleppey (M65), Ratnagiri (M66)
Missile Corvettes	Kulish (P63), Karmuk (P64), Khanjar (P47), Kirpan (P44)
Landing Ships	Gharial (L23), Shardul (L16), Kesari (L15), Airavat (L24), Mahish (L19)
Fast Attack Craft	Tarasa (T63), Karuva (T78), Cankarso (T73)
Survey Ships	Investigator (J15), Jamuna (J16), Nirdeshak (J19), Darshak (J20), Sandhyak (J18)
Submarines	Sindhukesari (S60), Sindhuratna (S59), Shankush (S45), Shalki (S46)
Fleet Tug	Matanga (A53)
Training Ships	Tir (A86), Krishna (F46)
Sail Ships	Tarangini (A75), Mhadei
Coast Guard Ships	Sankalp (46), Samar (42), Vijit (31), Sagar Prahari (201)

with
**William L. Blair, President,
Raytheon India**

With the biennial Singapore Air Show ahead, Vayu reached out to William "Bill" Blair, President of Raytheon India, to discuss his company's role at the Show.



VAYU : There are many such expositions around the world. Why is Raytheon participating at the Singapore Air Show?

WLB: The Singapore Air Show gives Raytheon an opportunity to reach out to a large number of our partners in East Asia and bring them up to speed on the latest technologies and programmes. In the past, we've also used Singapore as an opportunity to visit with our friends from India and keep them apprised of the most recent developments in cutting edge technology.

VAYU : What is your aim for this Show?

WLB: As the president of Raytheon India, my hope is that we have a large number of guests from India come to our booth at Singapore and engage in productive dialogue with members of the Raytheon team about our broad suite of military modernisation solutions. These meetings and discussions could also serve as a great prelude to DefExpo 2012, which of course, Raytheon is eagerly anticipating.

VAYU : What displays will Raytheon have at Singapore that might be of interest to visitors from India?

WLB: I'm really excited about our Global Intelligence, Surveillance and Reconnaissance interactive demonstrator. This hands-on interactive experience allows customers to truly see how Raytheon provides end to end ISR solutions tailored to address each customer's unique requirements. From providing individual sensor capabilities such as the successful APY-10 maritime radar for India's P-8I aircraft, to fully integrated turn-key mission solutions that covers both air and ground segments such as our proven ASTOR (Airborne Stand-Off Reconnaissance) system operational with UK forces, Raytheon has the breadth of technology to fully address each customers mission need.

We will also have our Integrated Fighter demonstrator, which will give people a chance to 'test fire' our suite of platform

independent air-to-air and air-to-ground weapons. The air-launched weapons could go on either of the MMRCA finalists, so it is a great opportunity to get an up-close look at what the weapons are capable of.

VAYU : Are there one or two key technologies you want to highlight at Singapore?

WLB: Our suite of air-launched weaponry is a perfect example of this sort of capability we'll highlight at Singapore. The combat-proven Advanced Medium Range Air-to-Air Missile, AIM-9X Sidewinder, High Speed Anti-Radiation Missile, Paveway and Joint Standoff Weapon are platform independent, so they could go on either of the MMRCA contenders, with the proper U.S. Government approvals.

We also believe Raytheon's maritime surveillance capabilities are well positioned to address trade and military challenges that operators face in the region. Asia-Pacific nations continue to grapple with the challenges associated with porous ocean borders and the need to protect shipping lanes and local coastal economies from threats. Nearly 80% of today's global trade is transported in ships' hulls and securing maritime supply chains against disruption presents an enormous challenge for the globalised world. Over 60,000 vessels transit the Straits of Malacca every year with much of the cargo aimed at meeting critical energy needs of Asia-Pacific countries. Raytheon is a world leader in addressing a wide range of littoral and deep ocean threats. The company's Maritime Patrol Aircraft capabilities provide an integrated solution for enhanced situational awareness and mission effectiveness that addresses a wide range of challenges customers currently face. These include border security, maritime surveillance, disaster relief, environmental monitoring and multiple military applications. Empowered with exportable signals intelligence and unique tactical maritime

technology Raytheon's maritime patrol aircraft capabilities are designed to meet the needs of civil and military customers in the Asia-Pacific region.

Our maritime based reconnaissance, surveillance and target acquisition capabilities, versatile exportable sensor offerings and multi-INT integration expertise for multiple platforms enable us to create the right solutions for mission needs while providing a clear path for future upgrades as needed.

VAYU : Can you give our readers a sneak review at what they might see at DefExpo?

WLB: I don't want to spoil the surprise or fun, but for the first time ever, we'll exhibit the Serpent virtual demonstrator in India. Serpent is a short range fire-and-forget 83 mm organic assault weapon fielded that brings improved performance and a next generation reusable launcher. We'll have a great deal of technology on display there, and experts on hand-to-discuss it, so I encourage Vayu readers to visit our booth.

VAYU : How important is the Indian market to Raytheon?

WLB: Well, I'm not really fond of the term "market" in the first place. Market implies a business arrangement, and while that might be accurate for some, for Raytheon, which has been in India for more than 60 years, the relationship we have with India is more like that of a trusted partner. We have tie-ups and arrangements with a variety of Indian entities – from PSUs to private companies, and we are negotiating more as we speak. As a company, we have expanded our footprint in New Delhi by hiring new people and opening a new office. On a personal level, I live in New Delhi and my wife is originally from Rajasthan, so I feel a very strong commitment and connection to India. It is very rewarding to be able to help bring the best technology in the world to India.

Countering Insurgency, Jointly



Indian Air Force Mi-17 dropping troops for counter insurgency operations during Indo French Ex Shakti 2011

Indo-French joint military training: Ex Shakti 11

An Indo-French Joint Military Training Exercise *Shakti* 2011 was held at Chaubattia in the Kumaon hills from 9 to 21 October 2011 under the aegis of the 6th Mountain Division. The French Army was represented by four Officers and 50 troops of the 13th Mountain Infantry Battalion while an equal number of officers and troops

participated from the 2nd Bn., Bihar Regiment under the aegis of 99 Mountain Brigade of the Indian Army.

Exercise *Shakti II* is the first Indo-French exercise between the two nations, which aimed not only at training troops in Counter Terrorist Operations but also in enhancing defence cooperation and military relations between the two

nations. It provided an ideal platform for the personnel of the two countries to share their experiences on counter terrorist operations especially in mountainous terrain. The exercise was conducted in the areas adjoining the salubrious town of Ranikhet which provided an excellent opportunity for the contingents of the two countries to practice and rehearse drills and procedures related to operations in rugged terrain.

The activities conducted during training included familiarisation with weapons and equipment being used by both the countries, introduction to the organisation, concept and basic tactics at infantry company and platoon level and modalities of conducting complex operations including area domination patrols, cordon and search operations and search and destroy operations in counter insurgency environment. Personnel from the French contingent also got to fire infantry weapons being used by the Indian Army during day as well as night.

The training culminated in a 48 hours Consolidation Exercise in which troops of both armies carried out a Search and



Indian and French Army personnel (including a lady officer from France) during Ex Shakti 2011

Destroy Operation in the general area of Pilkholi village on the outskirts of Ranikhet. The troops had reached the area of operations after a gruelling march throughout the night of 20 October 2011 and thereafter carried out a precise, well coordinated and executed operation to neutralise 'the terrorists' hiding in the dense forests of Pilkholi. The search and destroy mission included clearing and destruction of a terrorist hideout, employment of Quick Reaction Teams to neutralise escaping terrorists and carrying out a thorough search of the dense forest. Highlight of the event was an audacious and surgical raid by heliborne commandos of both armies on a simulated target.

The commandos of the French Army also employed their paragliding skills and laid effective stops by employing three paragliding commandos during the raid. The final phase of the exercise was reviewed by Brigadier General Herve Wattecamps and Colonel Bertrand Lavaux as representatives of France and Major General Rajesh Arya, General Officer Commanding, 6 Mountain Division and Brigadier AK Yadav,



Indian and French Army officers interacting with media at the conclusion of Ex Shakti 2011.

Commander 99 Mountain Brigade representing India.

The GOC during his interaction with the press, said 'During his course of training, besides honing their counter terrorism skills and sharing their experiences on the Counter Insurgency/

Counter Terrorist operations, the troops developed a remarkable mutual understanding and inter-operability that will further strengthen relations between our two great armies.' Maj. Gen. Rajesh Arya declared the exercise an "unprecedented success."

Recognizing threats is our instinct



Photo credits: Asghar G. Lapp/Getty Images, Y. Debay, Stat - NKSAR 01 41 37 96 70



Systems



Munitions



Equipment

Being reactive is our strength

Tomorrow's threats are constantly evolving, skilfully hiding, and patiently waiting. To face them head on, you'll need more than powerful weapons. You'll need a highly reactive partner that can deliver intelligent, perfectly adapted solutions with extraordinary quickness and precision. Backed by 3 centuries of experience, a robust track record, and solid commitment to R&D, Nexter is able to offer a comprehensive range of state-of-the-art weapon systems, munitions and equipment. Beyond client satisfaction, we strive to create systems that are as safe for the environment as they are for you. A winning situation for everyone - your people, your business and the planet.

India and the Asia-Pacific Region:



Lt. Gen. Kamal Davar,
former head of the DIA,
writes on the

Challenges And Opportunities

*Projection of the IAF's long range air power:
Il-78MKI mid-air refuelling pair of Su-30 MKIs.*

The Western world, on both sides of the northern Atlantic, was largely regarded as the centre of gravity during the momentous 20th century, marked by two World Wars, the end of colonialism, a bitter Cold War rivalry between the two emerged superpowers, USA and the Soviet Union, and gigantic economic and technological growth primarily in the West. This left their Asian counterparts far behind in indices of human development, military power and thereby influence in the global arena. Nevertheless, as the 20th Century was coming to an end, there was an astonishing upsurge in the fortunes of Asia which today scripts a clear departure and has ushered relatively newer players, who will exercise a more than eminent role globally. Most strategic analysts have thus dubbed the 21st Century to predominantly become an 'Asian Century'.

Strategic Importance of the Asia-Pacific

Prior to any analysis of the strategic significance of a territorial or oceanic expanse, a theatre or a region, it is prudent to define its geographical boundaries, economic linkages and its myriad social and political inter-dependencies. Surprisingly, unlike the Middle East, Central Asia, West Asia, South Asia or SE Asia, the region being referred to as Asia-Pacific does not lend itself to a universally accepted geographical or a political definition nor entity! Most security analysts surmise that this region got its name to facilitate US strategic forays into Asia as America gradually increased its footprint in Asia. The vast and strategic expanse between the Gulf of Aden and the Straits of Malacca, that essentially is the Indian Ocean Region (IOR) and which carries over 70 percent of the world's oil



THE 'LOOK EAST' POLICY

and 50 percent of the container traffic, also gets tagged in a broader sense to the Asia-Pacific. Interestingly, as defined by the UNESCO, 48 countries, big and some infinitesimally small, constitute the Asia-Pacific region (including India, Australia, Japan, South Korea, Taiwan and China) but the USA has been excluded from this list. Nevertheless, in current strategic discourse, Asia-Pacific generally includes the countries of the Pacific Rim (including USA and Australia), South Asia, SE Asia, East Asia, NE Asia, collectively a large conglomeration of peninsular countries, archipelagos, island nations and island chains. India which is essentially an Asian, South Asian and an Indian Ocean entity, is firmly now categorised as a leading power in the Asia-Pacific region along with China, Japan, South Korea, Indonesia, Viet Nam, Singapore, Taiwan among the others in the Pacific Rim.

It is pertinent to note that Asia-Pacific is home to of nearly 4 billion people of the world's 6 billion and accounts for nearly 60 percent of the global GDP. By 2020, seven of the world's ten leading economies are likely to be in the Asia-Pacific region. The United Nations, recognising the growing importance of this region, set up the ESCAP which is the UN Economic and Social Commission for Asia and the



Arena of the 21st century Great Game?



Indian and US Naval ships in joint exercise.



South Korean troops along the DMZ.

Pacific. Even at the height of the economic crisis that the world endured a couple of years back, this region remained the fastest growing region globally, averaging an overall 7 percent growth with China growing at 9.5 and India at 8.3 percent in 2010 respectively. Almost 50 percent of the world's maritime trade passes through the confined straits and chokepoints in the archipelagic waters of Southeast Asia and the South China Sea. Thus this region which is of vital economic significance for the entire world lends itself not only to newer forms of regional and global rivalry but also varied forms of traditional and non-traditional security threats like maritime terrorism, sea piracy, poaching, access to territorial waters and so on.

This region is also witness to numerous outstanding and potentially dangerous territorial disputes. For example, those between China and Taiwan, between the two Koreas and nearer home, between India and Pakistan/China, which are flashpoints for likely conflicts. Asia-Pacific could also become the arena for the new cold war with an emerging and consequently assertive China taking head-on the sole superpower, the USA, now somewhat weary and over-stretched with its global commitments and not so successful interventions in Iraq and Afghanistan. Some analysts feel that "the world's maritime future is likely to be determined in large measure in the Asia-Pacific, particularly by the developing

relationship between the four major maritime powers of the area, China, India, Japan and the US."

Challenges for the US in Asia-Pacific

Since President Obama took office in 2009, the US administration has been consistently announcing the strategic significance of the Asia-Pacific region for global stability and especially to US interests. Obama's predecessor, George Bush, was largely preoccupied with the Middle East and West Asia, with ongoing US operations in Iraq and Afghanistan but President Obama's foreign policy priorities remain in the Asia-Pacific region consolidating economic linkages,



USAF F-16s on patrol off South Korea.

as also in efforts to manage the growing Chinese naval resurgence in this region. Secretary of State Hillary Clinton's first overseas visit after the Obama administration took charge, was not to Europe (their traditional starting point) but to Asia where she attended a meeting of the Association of Southeast Asian nations (ASEAN) - the first by a US Secretary of State - and also signed a treaty with the 10 member ASEAN. Interestingly, President Obama consulted many Asian intellectuals and leaders prior to his Asian odysseys and was advised by the respected Singapore veteran Lee Kuan Yew that "if you do not hold your ground in the Pacific, you cannot be a world leader."

The recently expounded US National Military Strategy (NMS) opines that the international order has attained "a strategic inflection point". It states that as US still endeavours for success in Iraq and Afghanistan, the fastest rising region in many ways is Asia with two rapidly rising powers, namely China and India, dangerous states like North Korea and Iran and various vibrant and emerging economies all set to play a greater role regionally and globally. Not surprisingly, China's rapid growth militarily in the region has been a source of much worry to the US since the last few years. The NMS declares that the US will closely follow the modernisation of the People's Liberation Army especially with regard

to the military balance across the Taiwan Straits. In addition China's "assertiveness in space, cyberspace, in the Yellow Sea, East China Sea and South China Sea" will be also monitored. In addition the NMS expresses concern about China's expanding "anti-access and area-denial capabilities.... to constrain US and international freedom of action." Without specifically mentioning it, the allusion is clearly to China's development of the Dong Feng 21D anti-ship ballistic missile, anti-satellite weapons, cyber-strike capabilities, emerging long-range precision strike systems and other military-related technologies. The Pentagon, however reiterates its preparations to "safeguard US and partner



Resurgence of Japan's aerospace industry : the Kawasaki P-1 long range maritime patrol aircraft, designed to replace the venerable Lockheed P-3C Orion with the JMSDF.

nations interests.” The US acknowledges a “responsible leadership role” for China and the NMS and at the regional level cites the utility of working with China to counter WMD proliferation, maritime

piracy and instability in the Korean peninsula. Finally, the US hopes that its defence diplomacy with China will help ease tensions in this region and “prevent miscalculation”.

The large scale *Exercise Key Resolve* conducted by the US and South Korean forces primarily to war-game their preparedness against any misadventure by the North Koreans, predictably invited a severe reaction from North Korea. The latter threatened “all out war” with “unprecedented all-out counteraction” that would turn South Korea’s capital Seoul into a “sea of flames”. The US and its allies especially South Korea and Japan will have to factor in North Korea’s continuing belligerent behaviour in this region towards them. (In late 2011, North Korea declared the late Kim Jong Il’s son, Kim Jong Un, as successor “supreme leader” of the ruling party, military and the people).

China’s Military and the Asia-Pacific

China’s military growth, in real terms, commenced in the early 1990s with military spending rates up by over 10 percent each

Chinese Dong Feng 21-D Ballistic Missile.



year. Its modernisation was primarily for the protection of its “core interests in Taiwan, Tibet and Xingjiang”. Its major efforts have been to discourage Taiwan from moving towards independence and also make it operationally problematic for the US to intervene militarily. As it lacked advanced technologies for state-of-the-art weapon systems, China imported a number of these from Russia. However, concerted efforts by the Chinese over the years have borne fruit and it has vastly improved its abilities to manufacture modern weaponry indigenously. Only recently China unveiled its first indigenously developed stealth jet fighter (J-20) and the Dong Feng 21 D anti-ship ballistic missile.

Though not yet a true blue water Navy, the Chinese naval force is feverishly working towards this by going in for the manufacture of two to three midsize aircraft carriers, developing a new class of nuclear submarines, better frigates and destroyers. It has now close to 50 modern diesel submarines and China has built new naval bases and has increased its patrolling in the waters not only close to its shores but across the Indian and Pacific Oceans much to the consternation of its maritime neighbours and the US. Chinese capabilities in ballistic missiles are rapidly improving, which are capable of striking not only across the Taiwan Straits but targets as far off in Japan, India and South Korea. Consequently, China has become more politically and diplomatically assertive along its periphery, notably in the East China Sea, South China Sea and the Yellow Sea and indulges, off and on, to intimidate other claimants in the region. The demonstrated destruction of its communication satellite (the first by any power in the world), naval ships patrolling in the Somalian waters, live firing exercises in the South China Sea and expression of strongly worded statements against the US and Japan are all examples of China's not so ‘peaceful rise.’

Meanwhile, although the overall number of US forces deployed in the Pacific has gone down, the US has also responded to Chinese naval build ups in the region. It is increasing its capability to operate in Asia by deploying more forces in Guam, coordination with Japan in interoperability, sale of advanced weapon systems to Taiwan, stationing of US Marines in Australia,



Republic of Singapore Air Force have 24 F-15s based in the continental United States for operational training and rapid deployment as required.

deployment of anti missile systems and increasing surveillance of Chinese naval deployments. Overall, most Asian countries prefer the US to maintain a strong presence in the Asia-Pacific region to ensure a degree of deterrence against Chinese ambitions in the region. Though the US remains the predominant maritime power in the Asia Pacific with its ability of deploying a large number of both naval and air expeditionary forces in the region from Hawaii to the Persian Gulf based on nuclear capable carrier battle groups, the growing Chinese capability will now make it impossible for the US to operate in this expanse with impunity especially in the areas around Taiwan.

India and the ‘Look East’ Policy

Although it was way back, even prior to our Independence, that an Asian Relations Conference was held in New Delhi in 1946 on Jawaharlal Nehru's initiative, India thereafter appeared to have fallen behind in taking any worthwhile Asian community initiatives as it did on the lines of NAM (Non-Aligned Nations) movement. Appreciating the dynamics of this vital region, it was only as late as in 1991, when India made amends and embarked on a well thought policy initiative dubbed as the ‘Look East’ Policy (LEP). This underscored a major shift in India's perspective of the world and Asia both strategically and in nurturing closer economic bonds with its Asian neighbours. The geographical proximity and economic potential of India's North East region with the countries of East and South East Asia was an important factor for embarking

on the LEP apart from China's growing assertiveness and all-encompassing engagement of this region. Initially the thrust of India's LEP was primarily to forge closer economic ties with ASEAN member states. Consequently, India became a Sectoral Dialogue Partner in March 1993, a Full Dialogue Partner in 1995, a member of the ASEAN Regional Forum in July 1996 and finally a Summit Level Partner in 2002.

Commencing 2003, cooperation in various fields was heralded by states extending from Australia to East Asia. India subsequently signed the ‘Long Term Cooperative Partnership for Peace and Prosperity with ASEAN which is the cornerstone of India's ‘Look East’ Policy and finally it formalised the ASEAN-India Free Trade Agreement (FTA) with ten members of ASEAN in August 2009. In 1997, a sub-regional economic grouping called BIST-EC (Bangladesh, India, Sri Lanka, Thailand Economic Cooperation) was established to reinforce India's LEP. Subsequently with the addition of Myanmar, Bhutan and Nepal, this grouping was enlarged as a political and economic forum to bridge Southeast Asia and South Asia at India's initiative in 1997 and is now known as BIMSTEC. India encourages BIMSTEC to forge economic linkages with peninsula member countries of the ASEAN to boost the development of its seven North East states. As another extension of India's LEP, India is also a member of the Mekong-Ganga Cooperation Project which includes Myanmar, Thailand, Laos, Cambodia and Viet Nam.



A significant aspect of India's LEP has been the enlarging of cooperation on security issues both bilaterally with ASEAN nations as well as through multilateral groupings like the ASEAN Regional Forum (ARF) which also brings in important non-ASEAN countries of Asia. India has taken the lead in the ARF to initiate dialogue and cooperation on various security aspects like border security, maritime security, energy security and counter terrorism aspects. In keeping with its intensive engagement with nations of the Asia-Pacific, India took over as the co-chair, from Australia, of the Asia-Pacific Regional Review Group of the Financial Action Task Force which sets international standards to combat money laundering and terrorist financing. In addition, during the visit of the Japanese

Prime Minister to Delhi in December 2009, both nations agreed on measures to enhance security cooperation. The ASEAN quest for suitable regional security architecture has led to the formation of the 'ASEAN Defence Ministers Meeting Plus Eight' forum. The first meeting of this forum was organised in October 2011 at Hanoi. This body has as its members, nations of the ASEAN and six members of the East Asia Summit namely India, China, Japan, South Korea, Australia, New Zealand and there were moves to include other major stakeholders (USA and Russia) also in this forum.

India's LEP, however, can only be successful if its regional cooperation initiatives are backed by adequate military preparedness especially with a formidable three dimensional capable blue water Navy

and an Air Force with a transcontinental capability to operate in both the Indian and Pacific oceans simultaneously. The Indian Navy must strive for better interoperability with the other navies in the region with additional 'Milan' type of exercises as it has been doing earlier. India's new initiative, the Indian Ocean Naval Symposium, provides it a new leverage for its soft power for convergent security in the region. India's naval preparedness will be of much consequence for ensuring the maritime balance of power in Asia-Pacific.

Australia's Initiatives in Asia-Pacific

Sensing the growing significance of the Asia-Pacific region, Australia has sought a leading role for itself, openly seeking India's support. Though there have been



RAAF F/A-18F Super Hornets fly towards Brisbane. Australia is acquiring 24 Block II F/A-18F Super Hornets as a bridging of air combat capability during the transition to the F 35 Joint Strike Fighter.

security architecture. A positive step in this relationship was signing of the Joint Declaration on Security Cooperation in November 2009 between the two countries. However, India has to move with caution vis-à-vis Australia as the latter's dealings on earlier occasions have bordered on some display of arrogance towards India even while it has no compunction in supplying uranium to a totalitarian regime like China. As recently as November 2011, Australia has indicated a reversal in its stand, clearing supply of uranium to India to "enhance strategic relationship between the two countries".

The Necessity of Regional Cooperation

Problems affecting most nations today are multi-faceted: terrorism, sea piracy, natural disasters, health pandemics, drug trafficking, money laundering, climate change, environmental degradation among others. These problems are generally beyond the capability of a single nation to resolve and call for genuine cooperation between nations. Certain problems are best resolved regionally either bilaterally or multilaterally pooling in expertise, resources, information and intelligence. With problems now taking on a formidable and in certain cases a sinister dimension like nuclear terrorism, the adverse fall-out will affect more than one nation and perhaps the region itself. Thus it is incumbent upon all those who are part of a regional entity to resolve all such issues in a spirit of

sincere cooperation beyond narrow partisan interests. India's diverse albeit cooperative initiatives are welcome pointers towards this end. Efforts thus must continue to bring China on board, to join the Asia-Pacific mainstream for regional cooperation. China's gigantic economic leaps will make it more energy hungry and as nearly 80 percent of its oil needs passes from the Middle East/West Asia through the Indian Ocean, it can ill afford to have a confrontation with the other nations of the Indian Ocean.

An enlightened policy

Asia-Pacific with the Indian and Pacific Oceans and many healthy and emerging economies along its rim, apart from the new powers, China and India, is slated to play a pivotal role geo-politically and economically globally. India with its genius and a rapidly growing economy has a vital role to contribute to the stability and prosperity of this region in keeping not only with its aspirations but the expectations of the world towards India. Since the last few years, India has made not only a promising start with its 'Look East' Policy but been proactive with its many initiatives pertaining to the regional economic and security architecture in Asia-Pacific. An enlightened policy based on our accelerating economic growth backed by adequate military muscle will enable India to contribute to peace and stability in the region in cooperation with the US, Japan and Australia.

marked differences between the two countries as regards the Australian initial stand of not supplying uranium for Indian reactors or earlier its aircraft 'buzzing' Indian naval ships on training cruises in the Pacific as also its racist treatment of Indian students, Australia now wishes that India take the lead in forging an Asia-Pacific community on the lines of the European Union. During his visit to India in 2010, Australian Prime Minister Kevin Rudd expressed that India was "central to Asia-Pacific community" and Australia and India should be natural partners in this region where big power rivalries will have to be "harmonised and reconciled." Australian Deputy Secretary (Strategy), Peter Jennings, recently stated that Australia has shared interests with India contributing to the regional



Satellite photo of China's first aircraft carrier, the 'Shi Lang' in sea trials.



Dragon Fly



Computer-generated image of the Sino-Pak JF-17 Thunder light multi-role fighter.

Pakistan is today facing a tsunami of turmoil, with the State struggling to cope up with multiple security, economic and strategic issues which are challenging to say the very least. Extremist elements within Pakistan have become more active than ever before and the insurgency on Pakistan's frontier is rampant. Still, what has been commendable is the State's continuous efforts to modernise the Pakistan Air Force and maritime strike capabilities, which have been going on at an accelerated pace. In fact, the defence build up of Pakistan does not seem to be affected by its rapidly declining security and economic situation, exacerbated by the turbulent relationship with the United States.

Pakistan has been on a steady acquisition spree to modernise its Air Force over the past decade, accelerating the process during the last few years. Significantly, Pakistan's weapon acquisitions have been exclusively centered on modernisation and build up of the Pakistan Air Force. This

has to be viewed in context of the reality that the Army in Pakistan, which has ruled the country for most of its existence, calls the shots in military modernisation and priorities. As part of the Armed Forces Development Programme (AFFDP-2019), Pakistan had earlier invested in the build up of its Army, managed to expand the land forces and initiated an infantry modernisation programme for its special, regular and paramilitary forces. However, the focus of Pakistan's major defence procurements thereafter has been build up of the PAF and maritime strike capabilities of the Navy.

Modernisation of the Pakistan Air Force has primarily been with the assistance of China, Islamabad's 'all-weather' friend, although post 9/11 the United States too supplied some significant equipment for the PAF. Chinese-origin supplies have taken precedence in Pakistan's import list over the last two decades. In balance, while the main suppliers to Pakistan have been China and the USA, France and Turkey



'Chinisation' of the Pakistan Air Force

have contributed majorly in supporting the PAF's large fleet of Mirages III/5s.

However, to go back in time, from the mid-1950s Pakistan acquired arms mainly from the USA (for high-technology systems) and later China (for low cost but efficient systems) with a small proportion contributed by France. In the 1960s Zulfikar Ali Bhutto's diplomatic policy brought Pakistan closer to Beijing and Pakistan entered into several economic and military cooperation agreements with the 'Dragon'. The strategic alliance between Pakistan and China commenced formally in 1963 with signing of the Shakasgham Valley agreement. After the 1965 Indo-Pak war, Pakistan received interest-free economic aid and also a significant amount of weapons, including F-6 fighters from China and became the only non-communist third world country to receive such generous assistance from it. The Shenyang F-6 (Chinese version of

the MiG-19) entered PAF's inventory in 1966 followed by other weapon systems. Chinese military assistance came not only in the form of arms but also development of indigenous facilities for defence production in Pakistan, particularly the F-6 Rebuild Factory (F-6RF) at Kamra which was set up with Chinese assistance.

The first United States arms embargo followed the 1965 Indo-Pakistan war and led to withdrawal of US military assistance as also the suspension of US equipment to Pakistan. Pakistan then turned to China, North Korea, Germany, Italy and France for military supplies. From the late 1960s, Pakistan received substantial number of MiG-19 fighters from China, apart from substantive army equipment. From France were received Mirage III fighters and even the Soviet Union provided Pakistan some Mi-8 helicopters.

In the 1970s, although US equipment was not available for Pakistan, modernisation

of the PAF was kept up with help of the Chinese and the French as well. China supplied 115 F-6 fighters between 1971 and 1981 (supplemented continuously to reach a total of 250) while France supplied a total of 72 Mirages from 1971 to 1983. Some F-104A Starfighters were received from Jordan during the December 1971 war. Indigenous defence production was focused on progress towards self reliance and more importantly to revitalise the PAF in the 1970s. Rebuilding factories for the Mirages and F-6s plus production facility for MFI-17 basic trainers were established.

China continued to be a major source of PAF weapons and this increased after the US arms embargo in 1990. About 90 A-5s had been obtained in 1983-84 for the price of \$1 million per aircraft and these served till 2009.

The primary air defence fighter became the Chengdu F-7 (Chinese-copy of the MiG-21F) of which two variants went into service: 120 F-7Ps were followed by 60 F-7PGs, an upgraded variant of the basic F-7M; the F-7P incorporated many PAF-specific modifications such as Martin-Baker ejection seat, two extra weapon stations for a total of 5, an extra 30 mm cannon and the Italian-designed FIAR Grifo 7 multi-mode radar. The F-7P was inducted in the late 1980s and early 1990s, intended to supplement the more advanced, but limited numbers of F-16 fighters. The Grifo 7 radar was later upgraded to the Grifo 7 Mk.II version. The F-7PG variant incorporated a 'cranked delta wing' to improve take-off, landing and turning performance considerably, as well as extra space in the nose to accommodate the much improved Grifo 7PG radar (source: *Wikipedia*).

During the late 1980s, the focus of Pakistan's weapon procurement was on strengthening the Pakistan Air Force, it being believed that effective air power would give them leverage in any future conflict with India. The Pakistan military leadership, in their second coming with Washington, sought another 71 F-16s aiming to raise the inventory to 111 such high performance multi-role combat

PLAAF J-10s: when in PAF service, these will be known as the FC-20.





Mirage V in the photo recce role alongside an F-16C.

aircraft. During the 1980s, Pakistan also made attempts to acquire Airborne Early Warning (AEW) capability from the USA which, in the event, did not happen and the PAF eventually turned back to China (and Sweden) this force-multiplier.

PAF modernisation: 1990 till now

American military and economic aid to Pakistan came to a halt following the sanctions in 1990. The sanctions were highly damaging in nature as they not only suspended the US military aid and assistance but the procurement of essential spares was also blocked. Later, the Brown amendment in 1995 permitted taking possession of military equipment frozen in the United States, *with the exception of F-16 combat aircraft*. The decade of 1990s was thus a setback for PAF modernisation owing to the American sanctions and also downturn in Pakistan's economy.

Economic growth had recorded a steep decline and Pakistan was under severe pressure from the international financial institutions to cut down on its spending on defence. Despite the US sanctions, low GDP and a collapsed democratic structure, Pakistan continuously tried to acquire new equipment for the PAF. In 1990, fifty Mirage IIIOs were acquired from Australia for a 'giveaway price' of \$28 million along with their engines and spares. These Mirages had been phased out from the RAAF and most of them had limited flying hours remaining on their airframes. Still, with resolve and effort including procurement of critical spares and cannibalisation, the PAF managed to 'retrieve' about two-thirds of them and so raise new squadrons.

Pakistan was to become even more imaginative in diversifying its sources of weapons supply. In July 2004 PAF finalised a deal with Libya to buy its

entire fleet of 50 Mirage IIIs and Vs, plus 150 sealed-pack engines and a huge quantity of Mirage spares. Libya had purchased the Mirages in the 1970s, but these had been grounded for the previous decade following sanctions imposed after the PanAm Boeing 747 was blown up over Lockerbie. It is believed that these jets would be cannibalised for spare parts to provide spares for the PAF fleet of Mirages for the next seven to ten years. The Mirage Rebuild Factory, which is a part of PAC, has in the event been rebuilding the four decade old version of the Mirage aircraft which were bought as scrap from various countries.

Pakistan's nuclear test in 1998 followed by General Musharraf's military coup a year later, then led to severe US sanctions, which imposed restrictions on acquiring high technology weapons from the West. The obvious result was China's pre-eminence in Pakistan's arms sources



PAF Ilyushin Il-78MKI received from the Ukraine



JF-17 Thunder of No.26 Squadron 'Black Spiders'

and Sino-Pakistan defence collaboration flourished. The Aircraft Manufacturing Factory (AMF) within the Pakistan Aeronautical Complex (PAC) at Kamra, also began production of K-8 Karakoram jet trainers, in collaboration with the China National Aero-Technology Import and Export Corporation (CATIC). The basic jet trainer was initially launched as the NAMC L-8 and subsequently co-developed in partnership with Pakistan (with a 25 per cent share). The upgraded version of the jet trainer K-8P has an avionics upgrade and has been available since 2005. PAF received an initial batch of eight K-8Ps, followed by further eight in January 2009. The original 12 K-8s have also been upgraded to the K-8P level. Of the 75 K-

8s ordered, some 40 were in service by 2010 and these have also been the mount of the PAF formation aerobatic team: *The Sherdils* (see following article).

The JF-17 Thunder

In an epoch-making deal, China and Pakistan entered into a formal arrangement for the co-development of a 'fourth generation fighter aircraft', the JF-17 Thunder (earlier developed as China's FC-1). The JF-17 is designated as a "low cost" combat aircraft to meet the tactical requirements of the Pakistan Air force, with the added advantage of offering a cost-effective light fighter to many of the world air forces having to replace their present and increasingly

obsolescent fleet. The JF-17 was co-developed by Pakistan and China and is being built by China's Chengdu Aircraft Industry Corporation (CAC) and Pakistan Aeronautical Complex (PAC). There have been earlier reports that the initial design was originally developed by the MiG Design Bureau in Russia (as to meet India's LCA requirements) but was eventually transferred to China. The JF-17 is powered by the Russian RD-93 engine, has good performance in the air defence and ground attack roles. The initial batch of JF-17s delivered to Pakistan was fitted with the Chinese radar (KLJ-7) but reportedly the PAC-built JF-17s would be equipped with the Italian Grifo-7. Pakistan has increased its initial objective



Pair of PLAAF J-10s

of inducting 150 JF-17s to somewhere near 250 aircraft. Interestingly, beginning in May 2011, immediately after Osama bin Laden's killing in Pakistan's cantonment town of Abbottabad, China announced their decision to deliver 50 JF-17s "free of cost" to Pakistan, by the end of 2011.

The JF-17 is indeed a remarkable achievement for Pakistan as it has now

China, as part of its fighter force expansion plans. An agreement for the acquisition of 36 J-10s (the PAF calls this FC-20) was finalised in November 2009 and deliveries are expected to be begin in 2012 and completed by 2013.

As for Naval aviation, China has confirmed the sale of six ship-based medium sized Z-9C helicopters to the



Lockheed Martin F-16B of No.11 Squadron, PAF.

entered into co-manufacturing fourth generation fighter aircraft. Reports suggest that initially only assembly of the aircraft was being done at Kamra but increasingly, components and sub-assemblies are being manufactured at Kamra. Further, Pakistan (and China) have been marketing the JF-17 quite aggressively and several countries including Algeria, Sri Lanka, Egypt, and Malaysia have shown initial interest in acquisition of the aircraft.

Earlier, in April 2006 the PAF got approval of the Pakistani leadership to go ahead with negotiations for the acquisition of the decidedly more powerful J-10s from

Pakistan Navy. Unconfirmed reports have suggested that Pakistan has also shown keen interest in procuring the J-11B from the Chinese. This single-seater, land based aircraft used by the PLA Navy is a version of the Su-27.

As a reflection of real politik, alongside the Chinese weaponry, defence supplies from the USA have continued post-9/11. Initial US supplies to Pakistan consisted of UH-1 utility helicopters and AH-1F/AH-1S Cobra attack helicopters, air traffic control radars, night vision equipment plus other equipment and support systems including intelligence gathering devices. Then,

most significantly, Pakistan acquired 18 F-16 C/D Block 52s, C-130E Hercules and air surveillance radar (AN/TPS-77 and L-88 LASS). The Pakistan Navy has received six P-3C Orion Maritime patrol Aircraft. It is important to note that Pakistan's 'Non-NATO Ally' status allows the sale of used US weapons well below their depreciated value. For example the F-16s supplied to Pakistan in 2005 with the original unit acquisition value of \$16.2 million have been transferred

at a current unit value of \$ 6.48 million. The eight P-3 aircraft were delivered "free of cost" to Pakistan in 2006. Pakistan also acquired around 100 Harpoon anti ship missiles for their P-3Cs.

Pakistan has focused on inducting force multipliers over the last decade, entering



The Modernisation Effect: PAF 2020

	1990	2020
Combat Aircraft*	380	420
AEW&C Aircraft	Nil	8
Mid-air refuellers	Nil	4
Maritime Patrol Aircraft	3	18

* The combat numbers do not give the true picture. Of the total combat aircraft in 1990 about 10% can be considered new generation but by 2020 more than 90% would be fourth generation aircraft types in the PAF inventory.



Dramatic picture of the Saab 2000 AEW&C aircraft dispensing anti-missile flares.

into procurement of airborne early warning systems from China and Sweden. In 2005, Pakistan contracted for the purchase of Saab 2000 turboprop aircraft equipped with Erieye Airborne Early Warning and Control systems (AEW&C). The deal for the purchase of Chinese built airborne

early warning aircraft (ZDK-03) was also finalised thereafter and Pakistan is the first country to buy the Chinese AEW aircraft. Currently, two Saab 2000 and one ZDK-03 are in service with the PAF, such Airborne Early Warning, a major asset for offensive air strikes at sea.

Four Il-78 aerial refuelers from Ukraine are in service giving PAF its first airborne refuelling capability and these enhance the range of Mirage IIIs and eventually JF-17s.

Shalini Chawla

Senior Fellow, Centre for Air Power Studies, New Delhi



The Shaanxi ZDK-03 is a variant of the Y-8 developed specifically for the Pakistan Air Force with a Chinese AESA radar mounted on the Y-8F600 platform. The first aircraft was reported as delivered to the PAF in late 2011.



The JF-17 in PAF service.

Thunder Over Pakistan

The JF-17 Thunder will arguably become the most familiar shape in Pakistan's skies over the next several decades, with the PAF embarked on inducting some 250 of this light weight fourth generation fighter, being built at the Pakistan Aeronautical Complex (PAC) at Kamra in collaboration with CATIC of China.

Following the first JF-17s received from Chengdu in February 2007, further batches arrived in February 2008, these being first displayed in a four-aircraft formation over Islamabad on 23 March

that year. With additional deliveries and start of the small batch production in 2009, the indigenous content of the first forty aircraft assembled in Pakistan has steadily increased and will be near 60% when the 40th aircraft is delivered. With the learning curve declining, the PAC is planning to step up production of JF-17s to two a month.

The first PAF Squadron to re-equip with the JF-17 was No.26 'Black Spiders', moving back to Peshawar in April 2011 and this was followed by No.16 Squadron 'Black Panthers' at Kamra itself, in Attock

district. Even as further induction of JF-17s takes place and Western avionics increasingly supplant the original Chinese standards, PAC and CATIC are embarking on a global exercise to market the JF-17 to Air Force's currently flying MiG-21/F-7s, Mirage III/5s, F-5s and even early model F-16s.

The only 'competitive' light fighter of the fourth generation that could compete with the JF-17 is India's Tejas Light Combat Aircraft which, in early 2012, has yet to achieve initial operational clearance (IOC).



JF-17 on taxi track before its flying display at Zhuhai.



At the roll-out ceremony of the first production JF-17 Thunder at Kamra on 23 November 2009: Prime Minister Syed Yusuf Raza Gilani seen with Air Chief Marshal Rao Qamar Suleiman, General Ashfaq Parvez Kiyani, Air Marshal Farhat Hussain Khan (PAC Chairman), China's Ambassador to Pakistan and other dignitaries.



Inching ahead !



JF-17 being displayed at the Zhuhai Air Show in 2010.



JF-17 at Izmir Cigli Air Base in Turkey.



JF-17 at the Zhuhai Air Show in 2010.



Production model of the JF-17 operated by No.16 Squadron 'Black Panthers', the second unit on the type.



9-aircraft formation of the Sherdils, now mounted on the K-8.

The Sherdils

PAF's Formation Aerobatic Team

The romantic aura surrounding the PAF Academy aerobatics team is something real and exalting. Made up of instructors of the Basic Flying Training (BFT) Wing, 'Sherdils' seem to be a shade above the squalor of 'patters and demos' when they take to the air. Anyone who has seen the ten-minute spectacle is bound to agree about one thing – it is technically superb and aesthetically pleasing.

The brainchild of an Academy instructor, Sqn Ldr Baharul-haq, the team was formed on the lines of 'Red Pelicans', the aerobatics team of RAF College, Cranwell where Bahar had been on an exchange tour. It was decided to put up a brief show on graduation parades as a demonstration of the professional skills of Academy instructors.

The T-37 four-aircraft team first flew on 17 August 1972 after several trials of candidate instructors. The team was finally formed under the tutelage of the 1965 fighter ace, Wg Cdr Imtiaz A Bhatti, SJ, the then Officer Commanding of BFT Wing; other formation members included Flt Lt Aamer Ali Sharieff, Flt Lt A Rahim Yusufzai and Flt Lt Niaz Nabi, the latter becoming a most durable master of the 'slot' position. The initial performance of the team brought instant applause and the 'tweety birds' became the star performers at air displays and firepower demonstrations for dignitaries, including Heads of State and military delegations.

The type of formation and sequence has virtually remained the same since the team's inception: line astern to diamond

formation during a loop, then clover-leaf, steep turn, barrel roll and finally, the breath-taking bomb-burst. Attempts were made to increase the number of aircraft in the team, but engine thrust demands were excessive for the outer formation members to cope with. A four aircraft diamond has thus remained the basic formation of the 'Sherdils'.

Initially the team had no name, which was rather unusual. The personal call sign of the leaders also denoted the team; it flew as 'Sherdils' for the first time on 19 September 1974.

[The original 'Sherdils' were Maharaja Ranjit Singh's proletarian guards in the nineteenth century. Ed.]

Appreciating the important quality affecting display aircraft, that is appearance, the T-37s were painted all-red. However, maintenance of the red-painted aircraft without the costly polyurethane coating became a problem. The team reverted to the all-metal finish, with only the nose, wing tips and tail painted day-glow orange. In 1980, with the induction of six ex-USAF T-37s, which were polyurethane-coated all white, 'Sherdils' became a logical choice for a new titillating appearance. The dramatic 'sunburst' paint scheme was adopted, red rays on an all white background. Later, the aircraft were again painted red, but with the rays in white, a scheme that is in vogue today. Coloured smoke has been used to enhance the aesthetic qualities of the formation; smoke trails give the impression of multi-coloured ribbons twirling in the sky.

No aerobatics team is without mishaps and the ‘Sherdils’ are no exception. On 8 October 1978 during a practice session, the dashing team leader Flt Lt Alamdar Hussain went down in a mid-air collision involving his slot man. He was posthumously awarded the Sitara-i-Basalat.

The story of ‘Sherdils’ would be incomplete without a tribute to its perennial member, the redoubtable Aamer Ali Sharieff. First as a Flight Lieutenant and then as a Wing Commander, he has the distinction of leading the team in the maximum number of performances spanning many years. Word has it that only his elderly spine, though not his spirit, kept Air Vice Marshal Aamer from becoming leader of the ‘Sherdils’ yet again, when he was the Air Officer Commanding at the Academy!

Team work is the hall-mark of ‘Sherdils’. Precise flying, sharp reflexes and sheer hard work go into each sortie. A ‘Sherdils’ display depicts mastery of machine, mastery indeed, over space, time and life itself.

Air Commodore (R) Kaiser Tufail (PAF)

Commissioned in 1975, the author flew several classic fighters including the F-6 (MiG-19), F-7P (MiG-21 variant), F-7PG (MiG-21 double-delta variant), Mirage 5, Mirage F.1E and the F-16 Fighting Falcon. He also was a member of the ‘Sherdils’ aerobatic team.



Female PAF pilot and T-37 jet trainer.

‘Shernis’ of the Pakistan Air Force

The first three female fighter pilots were commissioned into the Pakistan Air Force in 2006. After three and half years of regular training on the MFI-17 they transited to the K-8 Karakoram jet trainer before being posted to F-7P/PGs (MiG-21s).

Two of the first female pilots of the Pakistan Air Force later became part of the *Sherdil* Aerobatic Display Team which took part at the Zhuhai Air Show in China (seen in the picture below).



Line up of K-8 Karakoram basic jet trainers.



Cessna T-37 ‘Tweety Birds’— initial mount of the Sherdils.

David's armoury :

Since birth of the State of Israel on 14 May 1948, the nation has been subjected to continuing hostility at times emerging as existential threat. This in turn has created a security conscious environment in the democratic State with a resolute national will alongside vibrant defence industry for meeting Israel's own unique defence needs.

The following article takes a look at six contemporary missiles developed by Israel's defence industries either on their own or alongside their prominent foreign collaborator, the United States of America, for aerial supremacy and robust defence against missile and other aerial threats. Most of these will also defend India in the decades ahead.

The Rafael Python

Israel is surrounded by hostile nations and thus its air force have always put strong emphasis in air-to-air-combat, since the belligerent air bases are located nearby which makes close-combat scenarios a certainty. The IDF-AF's combat record registers more than 95-percent "kills" with close-combat missiles and they have emerged as masters of within visual range close-combat in numerous Arab-Israeli air wars during the second half of the past century with an impressive combat experience and expertise second to none. This impressive attribute is effectively backed by a highly sophisticated and rigorous training schedule of extensive flight-hours alongside a firm respect for the opposing Russian MiG designs without any room for complacency thus consistently maintaining a favourable high kill-to-loss ratio against their frequent adversaries. In addition surprise was the key Israeli element during these encounters with classic slashing attacks out from behind a cloud or "out of sun" into a firing pass leaving very little duration or room for the adversary to react.

The ancestry of Python 5 Near Beyond Visual Range Air-to-Air Missile (NBVRAAM) can be traced back to development of all-aspect Python 3 close-combat missiles. Introduction of Python 3 during the later half of the 1970s coincided with the extensive transformation of the IDF-AF with F-15s entering service in



The Python-5 positioned on the extreme right.

1976 to be followed by F-16s in 1980 and importantly the E-2C Hawkeye Airborne Early Warning & Control (AEW&C) platforms prompting rapid development of new tactics and operational procedures. Python 3 with a large delta canard controls had a slightly tapered body housing an Infra-Red (IR) seeker cell of exceptional sensitivity and wider look-angle in relation to contemporary technology sporting a plus or minus 30-degree gimbal angle operable in boresight, uncaged, or radar-slaved mode. The missile was regarded superior in most aspects to the contemporary models such as AIM-9L Sidewinder in terms of speed (Mach 3.5), turning radius, and range (up to 15-km).

The conventional rod-type high-explosive warhead weighs 11-kg. The effect of newer generation fighters and AEW&C

platforms and other enhancements were apparent during the war between Israel and Syria over the Beka'a Valley in 1982, when the Israelis mercilessly decimated the Syrian Air Force with their excellent battle management system exemplifying a "classic exploitation of AEW&C asymmetry". The IDF-AF as per their claim, destroyed 92 Syrian aircraft including 36 MiG-23s armed with potent R-23 (AA-7 *Apex*) Beyond Visual Range Air-to-Air Missiles (BVRAAM) without conceding a single loss while Israeli pilot Amir Nahumi registered himself as the first F-16 ace with six more victories after having opened his "account" in 1981. The Python 3 incidentally was credited with over 50 Syrian aircraft kills during the Beka'a Valley campaign albeit in pre-production rounds form.

also defending India

As the newer generation of Russian MiG-29 fighters with Helmet Mounted Sight (HMS) mated with R-73 (AA-11 *Archer*) missiles with considerable off-boresight capability were transferred to Syria during mid 1980s, the Israelis identified the threat seriously and embarked on a crash development of the Python 4 mated with third generation Display & Sight Helmet (DASH) intended to catch up with if not exceed the specified parameters. Python 4 was in operational service by 1994 and with numerous canard control surfaces and destabilisers was designed around an IDF-AF philosophy of a visual identification pass coupled with a close-in High Off-Boresight Angle (HOBAs) capability missile. Python 4 has an all aspect gimballed multiple detector array seekers with the ability to look 90-degrees off-boresight with a lateral squint capability and a high tracking rate thanks to digital signal processing techniques in the seeker, as well as a microprocessor based digital flight control system while a powerful 6-inch diameter rocket motor endows it more impulse to get through the energy sapping manoeuvres of a HOBAs launch, with enough speed remaining for good kill distance.

The Python 4 thrust is initially low to let the missile turn large angles at relatively slow speed before accelerating for the chase. The long burn motor has a tailored thrust profile to achieve optimal acceleration for close-in closing engagements and high energy for terminal phase homing or end game engagement. The intent of the designers was to produce a missile which can not only be launched from a wider range of angles than earlier missiles, but which can also maintain track on a highly manoeuvrable high-g target engaged during the merge or opening phase of an engagement. A passing target on a reciprocal heading can be engaged in most of the forward hemisphere still if the Python fails its

first opportunity to hit and track will be maintained on the target to continue a tail chase geometry pursuit, running down the target for a tail-aspect hit.

Effectively mated with Elbit-developed third generation DASH HMS for optimum performance and lethality Python 4 can be launched at a range of over 15-km, and the missile employs a blast fragmentation 11-kg warhead, which is triggered by an active laser proximity fuse with a backup impact fuse. It was no surprise that in the year 2000 when United States Marine Corps (USMC) F/A-18 Hornets from the Balkans theatre armed with then standard models of AIM-9 Sidewinder engaged in mock air combat with IDF-AF fighters armed with Python 3 and Python 4 missiles in conjunction with DASH helmet mounted sight, they were “handled roughly”, the IDF-AF reportedly prevailing in 220 out of 240 engagements. Interestingly, Python 4 is rumoured to be in service with the IAF for some time yet never officially confirmed and may be speculated as only in test batches to secure major follow-on orders in shape of Python 5.

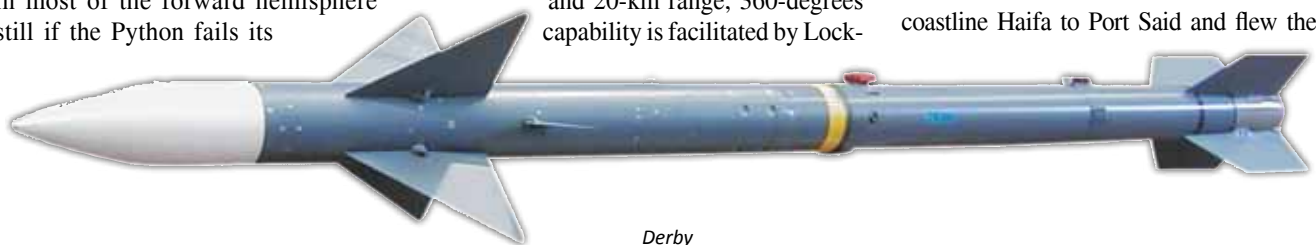
The determination of IDF-AF to retain ascendancy in close-combat missile is well reflected in their fifth-generation 3.1-metre long, 105-kg weight Python 5 promising performance in the extreme corners of its flight envelope, plus enabling the pilot to engage hostile airborne platforms with a full sphere launch capability from Within Visual Range (WVR) to NBVR. Like the Python 4 the fuselage of Python 5 consists of dual canards and rear fins with an improved motor. It also incorporates advanced computer architecture, Inertial Navigation System (INS), IRCCM and sophisticated flight-control algorithms and is designed to strike on the most critical and vulnerable areas of its target to ensure destruction. With a speed of Mach 4 and 20-km range, 360-degrees capability is facilitated by Lock-

On After Launch (LOAL) capability, to deal with rear hemisphere threats. More importantly the missile seeker uses staring Focal Plane Array (FPA) seeker technology that was first introduced in the United States AIM-9X Sidewinder that has inherently better Infra-Red Counter Counter Measures (IRCCM) and is readily programmable for ever expanding IRCCM techniques. This particular staring focal plane array technology provides greater ability to reject flares and other countermeasures while the extended range with LOAL mode gives it an added NBVR capability to its inherent close-combat attributes.

The fifth-generation dual-wavelength, focal plane array-imaging seeker is additionally able to acquire low-signature targets even in look-down mode, against adverse backgrounds and cloudy environments with extremely high off-boresight capability and possibly has discriminatory capability against multiple targets. As with Python 4 the missile employs a blast fragmentation 11-kg warhead, which is triggered by an active laser proximity fuse with a backup impact fuse. The Python 5 NBVRAM achieved operational status under wings of F-16I Soufa (Storm) in addition to AIM-120 AMRAAM as the first unit, the Negev Squadron, which was reformed at Ramon on July 27, 2003 to operate the two-seater developed on the basis of the F-16ES (Enhanced Strategic) long-range interdicator F-16 proposal.

Rafael Derby

The IDF-AF well realised the value and operational flexibility of BVRAAM long ago as it was repeatedly frustrated by high-altitude over flights by MiG-25 *Foxbat-B* reconnaissance models of the Soviet Expeditionary Force between October 1971 and March 1972. Soviet MiG-25Rs based at Cairo covered the Israeli-held coastline Haifa to Port Said and flew the



Derby

length of Sinai Peninsula involving 500-km penetration of Israeli airspace. With a speed of Mach 2.5 to 2.8 at a cruising altitude of 80,000ft they successfully evaded the formidable Israeli defences including F-4 Phantoms thus gathering valuable 'real time' intelligence and transmitting them to ground-stations through secure data-links for further analysis. Appropriate IDF-AF BVR tactics underwent development and during June 1982 two Syrian MiG-25s were destroyed by the IDF-AF with carefully planned and executed 'snap up' attacks by F-15 fighter/ AIM-7 Sparrow BVRAAM combination emphasising the growing maturity of the BVR tactics and procedures of the IDF-AF pilots. For the first time the formidable high-altitude MiG-25 interceptor, hitherto regarded as 'untouchable' was shot down.

Although subsequently IDF-AF acquired an active-radar homing BVRAAM in shape of the United States Raytheon AIM-120 AMRAAM, an Israeli desire to retain full control of the BVRAAM technology especially in relation to advanced programmable Electronic Counter Counter Measures (ECCM) modes led to development of indigenous Derby BVRAAM developed by Rafael Missile Division. The 3.62-metre long 118-kg weight active-radar homing BVRAAM shares design commonality with Python 4 (including warhead and proximity fuse and even the same launcher); with the addition of mid-body wings while its own 'no escape zone' overlaps that of the Python 4. The Derby is fitted with an ARH seeker with a compact gimbaled antenna, developed by Israeli Aircraft Industries' MBT Division. Derby has Look-Down/ Shoot-Down capability and advanced programmable and adaptable ECCM to operate under dense electronic warfare environments while reconfigurable upon the emergence of new threats. For BVR engagements a LOAL mode is adopted in which the missile initially fires using cues from the launch aircraft's fire control radar, or perhaps an Infra-Red Search & Track (IRST) system employing inertial guidance immediately after launch until the ARH seeker is activated at appropriate distance to home in on the target with substantial kinematics performance, allowing 'end game' manoeuvrability thanks to slightly enhanced rocket motor.

For greater accuracy over extended ranges, the 'Derby Uplink' capability

allows targeting data to be transmitted from the launch aircraft to provide accurate mid-course guidance while dealing with fast-moving or manoeuvring targets. The missile also has the ability to receive data-link updates from other platforms besides the launch aircraft thereby permitting 'stealthy' engagements. According to Rafael the "multi-shot capable" Derby has a launch-range in excess of 63-km if launched at Mach 0.9 at 25,000-ft against a head-on target, although its maximum range, or its effective seeker range, remain highly classified. During Aero India 2007, on being suggested so by this *Vayu* correspondent on aspects of Derby's maximum range, top Rafael officials along with their aides burst into laughter and intended to retain the veil of secrecy by reaffirming it as a "mystery". Derby also has a very low minimum range and an option for Lock-On Before Launch

(LOBL) mode thus also capable of being employed for short-range engagements in tight dogfights with Derby's seeker slaved to the aircraft's radar or the pilot's helmet mounted cueing system. During short range engagements Derby's capabilities are regarded similar to the Python 3 close-combat missile trapping enemy aircraft in "killing fields" within 60-km. Reportedly the Python 5 and Derby are set to arm the initial squadrons of India's Light Combat Aircraft (LCA) prior to availability of indigenous Astra BVRAAM. In fact, Derby BVRAAM already arms Indian Navy Sea Harriers to provide a combination of both BVR and close-combat capability.

IAI/Boeing Arrow

Israel faces the grim prospect of potential Tactical Ballistic Missile (TBM) strikes with Nuclear, Biological or Chemical



The Arrow missile

IAI

(NBC) warheads not only from its adversary nations but also from 'sub-states' (read terrorist groups) those could be supplied with Scud type TBMs by 'sponsor' nations. To tackle such threats the Israeli Defence Force (IDF) prefers deployment of a combination of Ballistic Missile Defences (BMD) systems with Arrow 2 Anti-Tactical Ballistic Missiles (ATBM) developed by MLM Division of Israel Aircraft Industries (IAI) which form the centre piece of Israel's layered system of strategic missile defence called *Homa*. The first battery near Tel Aviv became operational in 2000 followed by one to the south of Haifa in 2002. They are deployed in such manner that coverage of the systems overlaps over vital military, commercial installations and concentrated civilian population. Deployment of a third battery is presently under consideration and may be fielded in 2012. The system practically forming National Missile Defence (NMD) in the Israeli context is stand-alone yet integrated with national command & control and has the capability to provide early warning for itself and of dealing with multiple threats. In Israel, Arrow-2 functions as the upper-tier of a two-tier combined air defence/ATBM network. The lower tier comprises of United States and Israeli Patriot PAC-2/PAC-3 and United States Navy (USN) ship-borne AEGIS systems.

The refined and leaner (1,300-kg) Arrow 2, was first tested in 1995 being derived from the Chetz (Arrow)-1, a project initiated by the United States Strategic Defence Initiative (SDI) to be developed by IAI. Arrow 2 is meant to intercept tactical ballistic missiles just as they start re-entering atmosphere after reaching the highest point in their flight trajectory. In February 2003, IAI signed an agreement with Boeing to establish the production infrastructure to manufacture components of the Arrow missile in the United States with Boeing responsible for the production and co-ordination of approximately 50-per cent of the missile components in United States while IAI undertakes integration and final assembly of the missile in Israel. Under the Arrow System Improvement Programme (ASIP) being carried out jointly by Israel and United States Ballistic Missile Defence Organisation (BMDO), a real (as against simulated) Scud-B Short-

Range Ballistic Missile (SRBM) was successfully intercepted and destroyed at an altitude of 40-km at Point Mugu naval test range in California in July 2004. In December 2005, an Arrow 2 Block 3 missile successfully intercepted a target at an unspecified but reported record low altitude. In February 2007, the system successfully intercepted and destroyed a Rafael Black Sparrow target missile, simulating a ballistic missile, at high altitude. On 7 April 2009 the Arrow 2 Block 4 was successfully tested against the Blue Sparrow target missile.

The ASIP acquires importance in light of emergence and proliferation of more formidable and lethal ballistic missiles in Israel's neighbourhood. An Arrow battery is equipped with typically four or eight launch trailers, each with six launch tubes and ready-to-fire missiles, a truck mounted Hazelnut Tree Launch Control Centre (LCC), a truck mounted communications centre, a trailer mounted Citron Tree Fire Control Centre (FCC) and the units of a mobile Green Pine early warning radar system. There are microwave and radio data and voice communications (Link-16) between the LCC and the radar command & control centre with the launch system deployable up to 300-km from the site selected for the radar command & control centre.

The two-stage Arrow 2 ATBM is equipped with solid propellant booster and sustainer rocket motors. Arrow 2 is launched vertically, separately or in salvos, giving 360-degrees coverage to each battery. The Green Pine L-band, phased array, dual-mode (detection and fire control) radar determines the intercept point and thereby up-linking very accurate data to the Arrow 2 guiding the intercepting missile to within 4-m of the target. The missile uses an initial burn to carry out a vertical hot launch from the container and a secondary burn to sustain the missile's trajectory towards the target at a maximum speed of Mach 9, or 2.5-km per second. Thrust Vector Control (TVC) is used in the boost and sustained phases of flight. At the ignition of the second stage sustainer motor, the first stage assembly separates. The Kill Vehicle (KV) section of the missile, containing the warhead, fusing and the terminal Electro-Optical (EO) seeker is equipped with four aerodynamically controlled moving

fins to give low altitude interception capability. The dual mode missile seeker has a passive infrared seeker (Raytheon developed indium antimonite focal plane array) for the acquisition and tracking of TBM and an active radar seeker used to home on air breathing targets at low altitudes. After Arrow 2 is brought to the best engagement point on the TBM, its EO sensor acquires the target to allow very near pass and then activate the Rafael-developed high explosive directed blast fragmentation warhead which is capable of destroying a target within 50-m radius or sufficiently deflecting it beyond the confines of defended territory.

The ELTA Electronics subsidiary of IAI developed the EL/M-2080 Green Pine Early Warning & Fire Control (EW & FC) radar for the Arrow system. The radar includes the trailer mounted antenna array, the power generator, a cooling system and a control centre. Developed from the ELTA Music phased array radar, Green Pine is an dual mode, electronically scanned, solid state, phased array radar operating at L-band in the range 500-MHz to 1,000-MHz, weighs 60-t and comprises of 2,000 transmit-receive modules. Green Pine is said to be capable of tracking ballistic missiles from a range of up to 500-km and is able to track targets up to speeds over 3-km/s while intercept of the attacking missile may occur 90-km away at an altitude of 10 to 50-km. The long range of Green Pine radar system ensures that a second shot can be taken at the incoming ballistic missile if the first shot fails to secure the "kill". The ballistic missiles are again intercepted at a much higher altitude (exo-atmospheric or endo-atmospheric) to prevent them from disintegrating as they approach lower altitude, thus "faking" multiple targets on radar screens. Israel also receives data from the United States Defence Space Programme (DSP) early warning satellites and Boeing RC-135S Cobra Ball intelligence aircraft capable of picking up rapid movement or a rocket launch flash. Interestingly India placed an order and received its first Green Pine EW & FC radar in 2001. The Green Pine radar's strategic value along the Indian-Pakistani border is well appreciated covering all of Pakistan's military command centres and bases between Islamabad, the capital, and the

Indian frontier reportedly providing India with surveillance of Pakistan's nuclear centres and missile sites and relevant Telemetry Intelligence (TELINT) data. An enhanced version of Green Pine was the key to India's first Prithvi BDM test (see *Vayu I/2007*).

The Tadiran Electronics Limited Citron Tree Battle Management/Fire Control Centre (BM/FCC) is capable of conducting multiple, simultaneous (up to 14) interceptions and includes ten battle stations. Launches are controlled by Hazelnut Tree launcher control centre. Citron Tree, which is trailer mounted, downloads the radar data along with data from other sources and uses powerful signal processing tools to manage the threat interceptions along with man-in-the-loop intervention capability at every stage. The BM/FCC has computer workstations for the Sky Situation Coordinator, Intelligence Officer, Post Mission Analysis Officer, Resource Officer and Senior Engagement Officer as well as the Commander's station. Citron Tree BM/FCC has three banks of operator consoles laid out in a 'U' shape. The Centre Commander takes his position at the centre not only to oversee the engagement but also has links to the other parts of the battery, as well as to the Air Force Headquarters. Extensive communication systems ensure National Policy governs the ATBM engagements as information available includes incoming TBM tracks, predicted impact points and engagement profiles. The Engagement Officer sits at right of the Centre Commander assigning targets to four other engagement officers sitting on the right-hand leg of the 'U'. Each is assigned a geographical area to defend and two of the officers have an overview of the lower-tier Patriot Anti Tactical Ballistic Missile/Surface-to-Air Missile (ATBM/SAM) batteries. The Resource Officer sits at the left of the Centre Commander and monitors the status and readiness of the missiles. On left of the 'U' the Sky Picture Officer who is in contact with the home-front command and predicts the impact point to alert the civil authorities. An Intelligence Officer and a Post Mission Analysis/Debrief Officer manage the recordings.

The workstations display a large electronic map showing the area of battle. Predicted and confirmed launch sites

are colour coded to show priority sites. 'Link-16', 'Tadil-J', communications is being developed to allow inter-operability with Patriot PAC-2 FC units. Assigned targets can be handed over to the Patriot's AN/MPQ-53 phased array fire control radar. Tests carried out by the United States and Israel have successfully linked the Arrow and United States Patriot PAC-2/3 and also the Arrow and IDF Patriot version. There is one disadvantage of Arrow and this is its "narrow specialisation" because in contrast to its counterparts this system is practically unable to fight aircraft in terrain following mode and requires additional Patriot PAC-2/3 batteries to provide anti-aircraft cover. Patriot batteries are in turn supported by additional Beyond-The-Horizon (BTH) radar, array of satellites and Boeing E-8 Joint-Surveillance Target Attack Radar System (J-STARS) reconnoitring system.

Meanwhile the United States and Israel continue development of an upper-tier component (including an exo-atmospheric interceptor) to the Israeli Missile Defence architecture, commonly known as Arrow 3, based on an architecture definition study conducted in 2006-2007, determining the need for the upper-tier component to be integrated into Israel's Ballistic Missile Defence system. The KV of Arrow 3 is to be propelled by rocket motor and equipped with flexible nozzle to offer exceptionally large divert capability, while the gimballed seeker will obtain hemispheric coverage. By measuring the seeker's line of sight

relative to the vehicle's motion, the KV would employ 'proportional navigation' deflecting the KV to divert its course and align exactly at target's fight path, hence achieving an accurate kill even at very high closing speeds and over long distances.

DRDO/IAI Barak-8

A robust area air defence Surface-to-Air Missile (SAM) system remains an invaluable asset of any 'blue water' navy and to obtain such a system in February 2006 Israel and India signed a joint Indo-Israeli development agreement to create a new Barak-NG (now referred to as Barak-8) medium shipborne Surface-to-Air Missile (SAM), as an evolution of the eight-cell vertically launched 10-km ranged Barak-1 system in service with both navies. While the Indo-Israeli joint-venture will strive to replicate the success of Indo-Russian joint-venture exemplified by PJ-10 BrahMos supersonic Anti-Ship Cruise Missile (ASCM), its approval by the Cabinet Committee on Security (CCS) in July 2007, The Barak-8 (including its land based applications) surpasses the BrahMos project in size, and may be the largest joint defence development project ever undertaken between India and any other country. Conflicting reports however indicate that only in April 2009 India ultimately inked the \$1.1 billion deal with Israel for joint development of the Barak-8 with pre-production deliveries expected to start in 2012.



Prime contractor for the programme is the Indian Defence Research & Development Organisation (DRDO), with Israel Aerospace Industries (IAI) missile & space group acting as lead subcontractor with IAI Elta Systems providing the radar and Rafael to produce the critical components of interceptor missiles. According to the bilateral agreement, "the Indians will be able to locally produce and support the systems. Indian firms will contribute the solid fuel smokeless dual-pulse rocket motors, associated safe & arm for rocket motor, and the pneumatic actuation system." IAI will provide most of the applicable technology, just as Russia did for the BrahMos by offering its Onyx/Yakhont (SS-N-26) missile as the base platform with Elta and Rafael developing the multi-function phased array radar and the missile seeker. For the Indian Navy the layered defence capability to be provided by long range Barak-8 along with other SAM and Close-In Weapons System (CIWS) represents a key requirement especially in relation to rampant proliferation of ballistic and cruise missiles in the Asian continent. The layered SAM/CIWS network along with shipborne fighters from projected aircraft carriers will enable the IN to operate in high-threat areas outside land-based air cover by establishing local air superiority. Bearing in mind that hostile submarines are likely to make attacks with sea-skimming anti-ship missiles, even Anti-Submarine Warfare (ASW) screening becomes analogous to air defence.

The Barak-8 missile provides effective protection from all form of aerial threats, including manned, unmanned as well as Precision Guided Weapons (PGM) up to 60 to 70-km (probably a "very conservative" figure) and a ceiling of 16-km, thanks to a dual-pulse solid rocket motor. Fired from a Vertical Launch System the missile initially acquires positional energy in form of height, which can be traded for kinetic energy in form of speed to retain its manoeuvre capability even at the end of its run. In addition while the first motor pulse propels the weapon through most of its trajectory, the second fires as the missile approach its target. This ensures that the missile is not just coasting in the final stages, but along with energy necessary to secure multiple chances against fast, manoeuvring targets taking

evasive action or random weaving. More importantly the Active Radar Homing (ARH) seeker endows Barak-8 with extensive autonomy during the final stages of intercept. This is an excellent approach for dealing with saturation attacks even using passive ship radars, which can track many targets but its capacity to illuminate targets remain restricted, plus the radars can operate intermittently to ensure their survivability against enemy Anti-Radar Missiles (ARM) besides remaining free to track other targets. Besides emerging as India's primary naval area air defence SAM, initially entering service in *Kolkata*-class guided missile armed helicopter carrying Destroyers (DDGH), in Israel the Barak-8 is slated to equip its next-generation *Saar 5+* frigates/corvettes. The combat suites of both vessel classes will be built around the Elta EL/M-2248 Multi Function-Surveillance & Threat Alert Radar (MF-STAR) conformal S-band digital solid-state Active Electronic Scanned Array (AESA) Radar System which Elta claims to be superior to the United States SPY-1 AEGIS radar.

MF-STAR can deliver an accurate high quality arena situation picture and weapons support and extract fast low Radar Cross Section (RCS) targets like stealthy cruise missiles, even in the toughest environmental (clutter & jamming) conditions by employing multi-beam and pulse Doppler techniques as-well-as robust Electronic Counter Counter Measures (ECCM) techniques. Besides acting as ship's primary sensor in providing 3-D long-range air surveillance, at medium range MF-STAR automatically track and classify threat and simultaneously besides searching the horizon for potential missile threats. In parallel, it supports multiple engagements by offensive and defensive weapons. The agile radar operates in multiple simultaneous modes, offering short search frames and Track-While-Scan (TWS) revisit time. The system also offers rapid tracking update rate and high accuracy for priority targets. The radar will automatically establish tracks of high flying targets at ranges beyond 250-km and at low flying targets, at ranges above of 25-km.

For weapons guidance, MF-STAR supports different operating modes of missile systems including mid-course guidance of ARH/SARH SAM and

illumination enslavement for Semi-Active Radar Homing (SARH) SAMs, thus making dedicated guidance radar systems redundant. Also incorporated is an automatic splash detection and measurement, to support naval gunnery in maritime security and CIWS role. As apparent the performance of Barak-8 surpasses operational profiles of RIM-162 Evolved Sea Sparrow Missile (ESSM) or land based VL-MICA and will be able to compete with Raytheon Standard SM-2 Block IIIA, MBDA Aster-15, or land-based Patriot. In fact Barak-8 ARH seeker would give it a performance advantage over the SM-2, and corresponds more closely to the currently in development SM-6. Moreover Barak-8's potential uses in a point defence role against ballistic missiles remain implied in the land-based system's name. The missile launcher will comprise an eight-round module, three or more of which will make up a typical system.

For land based applications of the Barak 8 the Defence Acquisition Council (DAC) of the Ministry of Defence (MoD) took the decision to develop the Medium Range-Surface-to-Air Missile (MR-SAM) with Israeli collaboration on 19 June 2006. On 4 January 2007 the Defence Minister cleared formation of the Price Negotiation Committee headed by Defence Research & Development's VK Saraswat and Israeli Aircraft Industries Itzhak Nissan. On 16 December 2008, Cabinet Committee on Security (CCS) cleared the deal. DRDO informed CCS that MR-SAM was the land derivative of an ongoing Barak-8 SAM project for the Navy. On 27 February 2009 India signed a \$1.4 billion defence contract with IAI to co-develop an Air Defence System for the IAF. This DRDO-IAI joint venture will develop for and equip the Indian Air Force with nine air defence squadrons, each including two batteries comprising a multi-mission radar system performing target acquisition and guidance, Command & Control (C&C) element and three container-launchers each mounting eight missiles to replace the obsolete Pechora (SA-3 *Goa*) SAM. There would therefore be nine C&C centres, eighteen acquisition radars, eighteen guidance radars, and fifty four launchers armed with four hundred and thirty two (432) ready-to-fire missiles. The missile is reputed to be able to decimate multiple

Rafael

targets both in high and low altitudes indicating a low minimum range and thus able to function as both an area and point defence missile.

Capable of engaging targets 70-km away, the MR-SAM is four times more manoeuvrable (being aided by tungsten jet vane system for thrust vector control and a highly evolved electro-pneumatic control actuation system) than the indigenous Advanced Air Defence (AAD) Anti-Tactical Ballistic Missile (ATBM) system which performs sub-optimally while engaging aircraft in the tail-chase mode thereby reducing the air defence engagement envelope. The land-based Barak-8 Air & Missile Defence (AMD) system concept includes highly sophisticated Battle Management, Communication Command & Control, Computers & Intelligence centre (BMC4I) to be produced by the MBT Division of IAI's Missiles, Systems & Space Group. It will offer both stand alone operations for a single fire unit, as also Joint Task force Coordination (JTC). Rafael will supply the vertically-launched Barak-8 interceptor missile, while IAI Elta Systems Ltd. will supply the Land-Based-Multi Function-Surveillance & Threat Alert Radar (LB-MF-STAR) a rotating S-band digital Active Electronic Steering Array (AESA) Radar System that can deliver an accurate, high quality arena situation picture and extract low radar cross section targets like stealthy cruise missiles, even in the toughest environmental conditions. The vertical launched missile is designed to offer 360-degrees protection, utilising the advanced active-radar seeker. The missile is equipped with a two-way datalink, supporting mid-course updating and terminal updating and validation. To extend its datalink and C3 coverage over a wide area, the system will integrate surface based radars and communication elements with airborne manned and unmanned elements, maximising its operability and range over all types of terrain. The progress of the projects hitherto is shrouded with mystery yet rumoured to be in final stages of development having undertaken successful initial firings.

And IAI still retain an ace up its sleeves, as the company has hinted that its Barak-8 air defence missile may well be adapted for launch from airborne platforms.

The Rafael Spyder

The SPYDER (Surface launched PYthon & DERby), developed in cooperation with IAI is a quick reaction, low level SAM system designed to effectively counter attacks made by low-flying aircraft, bombers, helicopters, Unmanned Aerial Vehicles (UAV), Unmanned Aerial Combat Vehicles (UACV), cruise missiles and Precision Guided Munitions (PGM). The SPYDER system provides excellent protection of valuable assets, as well as of forces located in the combat area. The SPYDER system incorporates Rafael's most advanced, proven performance air-to-air missiles (described in detail earlier in the article) the Derby Active Radar Homing (ARH) missile and the Python 5 dual waveband Imaging Infra Red (IIR) missile, retaining full commonality with the AAM version.

SPYDER's highly mobile (Czech-origin Tatra) truck-mounted Missile Firing Units (MFU) are equipped with both Python 5 IIR and Derby ARH missiles. The MFU carries any combination (IIR/

RF) of four missiles on a rotatable launcher assembly ensuring 360-degrees engagement capability under all-weather conditions. Capable of engaging multiple threats and cluster targets simultaneously, the missiles enjoy the flexibility of Lock-On-Before Launch (LOBL) and Lock-On-After Launch (LOAL) modes of operation. The slant launching method, unlike vertical launch, allows LOBL so the missile's on-board seeker is locked on to the target even before launch thereby allowing the Squadron Commander to confirm the missile is locked on to the designated target which gives high kill probability against short-range high-maneuvring targets and enables the engagement of designated targets by add-on optical sensors. If the target is beyond seeker acquisition range, the missile is launched in LOAL mode. The seeker searches for the target and switches to homing phase upon acquisition of the target. The interception envelope of the SPYDER system spans from less than 1km to 15km against targets flying at altitudes



The SPYDER system

between 20m and 9km and capable of single, multiple and ripple firing.

The system is highly modular with a standard missile battery comprising up to six missile firing units and a truck-mounted Command & Control Unit (CCU) additionally comprising the Elta EL/M-2106 ATAR 3D surveillance radar with advanced ECCM capabilities that can simultaneously track multi-targets (around 60). Toplite Electro-Optical (EO) observation payload provides further assistance. Based on a Net-Centric Warfare (NCW) approach, the wireless data link communication enables deployment of the MFUs at a distance from the CCU. The CCU is also capable of operating with neighbouring SPYDER air defence batteries and share information with higher echelon Command & Control (C&C) centres, up to 100-km away, with additional provision for receiving air situation pictures from other datalinks, thereby ensuring high flexibility in combat situations.

The highly mobile SPYDER-MR Medium Range Air Defence Missile System (MRADMS) comprising of booster-enhanced Python 5 IIR and Derby ARH missiles ensures protection of high value assets as well as manoeuvring combat forces. The missiles operate on LOAL mode. The system is an all-weather, network-centric, self-propelled, multi-launch, quick-reaction ADS. Vertical launch SPYDER-MR enables 360-degrees missile launching, within two seconds of the target being declared hostile by the system. The maximum intercept range has been enhanced over 50km and an altitude of 20m to 16km to increase the defensive footprint. The IAI/Elta MF-STAR (Multi Function-Surveillance & Threat Alert Radar) Radar Sensor Unit (RSU) is mounted separately.

The Government of India has reportedly signed an agreement with Israel to acquire eighteen SPYDER SAM units to protect high-value assets of the Indian Air Force (IAF).

Rafael's Iron Dome

The Iron Dome is an effective and innovative mobile defence solution for countering short range rockets and 155mm artillery threats with ranges of up to 70-km in all weather conditions, including



Artist's depiction of the Iron Dome system.

low clouds, rain, dust storms or fog. The system uses a unique vertically launched interceptor with a special warhead that destroys low radar cross section (RCS) targets in the air within seconds reducing collateral damage of the protected area.

The Iron Dome radar detects and identifies the rocket or artillery shell launch and monitors its trajectory. Target data is transmitted to the Battle Management & Weapon Control (BMC) for processing. Once the threat's trajectory quickly analysed and the expected impact point is estimated, if the estimated rocket trajectory poses a critical threat, command is given within seconds and an interceptor launched against the threat. The interceptor receives trajectory updates

from the BMC via uplink communication, approaches the target, and uses its radar seeker to acquire the target to obtain a lethal passing distance. The target warhead is detonated over a neutral area, therefore reducing collateral damage to the protected area. The Iron Dome is a cost effective system that can handle multiple threats simultaneously and efficiently. The system can be integrated with multiple radar and sensor systems.

The combat proven Iron Dome system has been selected by the Israeli Defence Ministry as "the best system offering the most comprehensive defence solution against a wide range of threats in a relatively short development cycle and at low cost."

Sayan Majumdar

Raging Bulls Turn Sixty

*Spearhead formation of
Jaguars of the Indian Air Force.*

No. 14 Squadron Diamond Jubilee

Sixty years after its formation on 15 August 1951, No.14 Squadron of the Indian Air Force prides itself as ‘Spearhead of the IAF’. It currently operates the Jaguar strike fighter which type was selected in the late 1970s to fulfil the ‘Deep Penetration Strike Aircraft’ (DPSA) requirement.

The fact that No.14 Squadron (‘The Fighting Fourteen’ or informally ‘The Raging Bulls’) were the first to get Jaguars was a departure from an earlier pattern when they were the last in service to operate the legendary Spitfire fighter and about the last to receive the transonic Hunter fighter-bomber, having briefly transited to the jet age via the Vampire twin-boomed fighter.

‘The Fighting Fourteen’ have spent considerable part of their existence in Eastern India, first at Barrackpore in the Calcutta suburbs and later at Kalaikunda, south-west of Calcutta. It was from this airbase that they were ‘blooded in action’, briefly during September 1965 and with maximum effort in December 1971.



The most novel way of releasing a book: Team Leader of the Akash Ganga team descends with the IAF ensign and first copy of ‘The Fighting Fourteen’ history book, put together by The Society for Aerospace Studies (publishers of Vayu Aerospace and Defence Review)

No.14 Squadron IAF also had the unique opportunity of being briefly deployed at the captured PAF airbase of Jessore during the final stages of the Bangladesh war.

As pioneers of the Jaguar in IAF service, No.14 Squadron can claim the distinction of having produced two Chiefs of Air Staff and several Air Marshals from amongst that batch of ‘Famous Twelve’ who were first to convert to Jaguars with the Royal Air Force in Britain (see following article). The Squadron has continued its excellence in service and displayed professionalism of the highest order over the past three decades. They were the nodal Squadron to take part in an international exercise at Alaska, halfway around the world from their home base at Ambala.

In December 2011, the 'Fighting Fourteen' celebrated their Diamond Jubilee at Ambala with the present commanding officer Wg Cdr Anand Sondhi first hosting a welcome dinner at his residence. The highly attended seminar on the Jaguar Strike Fighter took place at the Station Briefing Hall the next morning followed by what has now become a traditional golf tournament, the *Bulls*, past and present playing for the 'Pinto Cup' at the Kharga Golf Course, undeterred by sudden thunder and lightning which brought occasional bouts of heavy rain.

The uncertain weather could not wash out the splendid Diamond Jubilee Dinner at the Air Force Officers Mess on the Mall where hundreds of 'Bulls' and their families celebrated the evening with great aplomb, the present Squadron officers in bright red neckties and their wives in gorgeous saris swirling to the beat of music on the dance floor.



Releasing the parachute before marching to the dias



Air Chief Marshal NAK Browne releasing the illustrated history of No.14 Squadron ('The Fighting Fourteen') at the Squadron complex at Ambala on 7 December, 2011. With him on the dias are (L-R) Air Commodore PN Kaushik, AOC No.7 Wing Ambala, Pushpindar Singh (the author), Air Marshal LK Malhotra (Commodore Commandant) and Air Marshal DC Kumaria (behind the Air Chief)

The formal events on 7 December took place within the massive air base, at No.14 Squadron's complex, a lavish breakfast followed by group photographs and then the highlight: the *Aakash Ganga* team parajumping from a Mi-8 helicopter at 8000ft, whose leader then smartly presented the first copy of No.14 Squadron's illustrated history book 'The Fighting Fourteen' to the Air Chief who in turn 'released' the book at the specially set up stage.

Overhead, three Jaguars (of the 'Tuskers') and three Bisons then flew past in vic formation before the Air Force Drill Team displayed their incredible precision. This was followed by a cultural programme on stage and a vigorous bhangra by the *Rattray's* Sikhs from Jullundur even as guests, officers, airmen and their families partook in the lavish Barakhana.

For No.14 Squadron, professional air warriors as they are, it was then back to routine, as 'spearhead of the IAF strike force'.



Wg Cdr Anand Sondhi and his 'Bulls' continue on their professional journey carrying forward legacy of the 'Fighting Fourteen' into the future. No.14 Squadron were the champions at Eklavya 2011.

(Right): Air Commodore (R) VK Murthy posing with poster of the Spitfire Mk.XVIII which type he flew with No.14 Squadron on its raising.



Air Marshal (R) DR Nadkarni and Air Vice Marshal (R) Viney Kapila who had joined No.14 while still flying Vampires in 1957.



Pioneers with the Jaguar: Air Marshal DC 'Tiny' Kumaria and Air Chief Marshal (R) SP 'Bundle' Tyagi



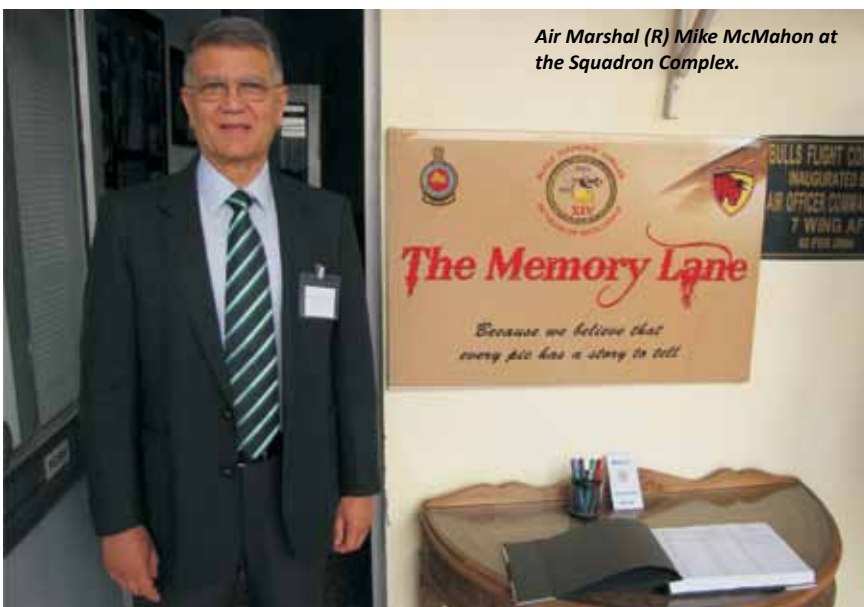
'Veterans' of the 1971 operations : (L to R, their ranks as in 1971) P/O KD Singh, F/O RS Sukumar, F/O Jagdish Singh Grewal, F/O SK Chopra, F/O R Mohan, F/O NS Lohan and F/O SK Sofat.



(Left): Jaguar Trainer of No.14 Squadron on display at the Diamond Jubilee celebrations.



Wg Cdr (R) Rajesh Khosla (scribe during the 1971 operations) with Air Commodore PN Kaushik, AOC No.7 Wing Ambala.



Air Marshal (R) Mike McMahon at the Squadron Complex.



CO of No.14 Squadron, Wing Commander Anand Sondhi with the CAS, Air Chief Marshal NAK Browne.



The Famous Twelve

The 'famous twelve' who were selected for conversion training on Jaguars in Britain in 1979 were Wg Cdr DR 'Natty' Nadkarni, Sqn Ldr M 'Mike' McMahon, Sqn Ldr JS 'Sis' Sisodia, Flt Lt SC 'Satish' Adhikari, Sqn Ldr SP 'Bundle' Tyagi, Sqn Ldr DDS 'DD' Kumar, Flt Lt NAK 'Charlie' Browne, Flt Lt DC 'Tiny' Kumaria, Sqn Ldr S 'Mike-2' Mittal, Sqn Ldr JJ 'Willy' Williams, Flt Lt N 'Goofy' Gupta and Flt Lt S 'Sunil' Laud. Batches of some 80 technical tradesmen for maintenance training on the type were also selected and the teams arrived in the U.K. in mid-February 1979.

After a brief aeromedical course at North Luffenham, the first four officers from the Indian Air Force joined Course No.29 at No. 226 OCU at RAF Lossiemouth, Scotland on 26 February 1979, in freezing weather conditions. The CO designate Wing Commander DR Nadkarni, with over 4000 hours on single-seat jet fighters, had flown Hunters and MiG-21s, having commanded a MiG-21FL squadron before being earmarked to form the IAF's first Jaguar unit. The other three officers - Squadron Leaders Mike McMahon, JS Sisodia and Flt Lt SCS Adhikari had between them, a wealth of flying experience, fresh from HF-24 Marut, MiG-21bis

and Su-7 squadrons. A cosmopolitan flavour existed at the Course, which included German, Danish and four

British pilots. "A glance at the ribbons on the uniforms of the IAF contingent revealed that they were combat hardened, Nadkarni and McMahon with decorations earned during the 1971 operations" recorded an impressed RAF Officer.

Wing Commander KB Latton, OC No. 226 OCU at RAF Lossiemouth was, not unexpectedly, full of praise for the professionalism and the rapid manner in which the IAF pilots adapted to Jaguar systems and procedures which were

necessarily new to them, adding that "they were first-rate operators and extremely popular".

The first technical officers, NCOs and airmen assembled for the ground support technician's course at BAe Warton also on 26 February 1979, under the command of Group Captain Sashi Ramdas, Chief Engineering Officer, who worked in close collaboration with Robert Duncan of Warton's Product Support Wing. The course was split into six specialist groups for instruction on Jaguar airframe, engines, electrics, avionics and armament, with an officer's course combining all engineering aspects. With a spirit of



'The Famous Twelve', with Jaguar at Ambala.

professional camaraderie, high standards were achieved in short time before the course ended on 2 May, some course members being dispersed to various vendor plants to study construction, final assembly and inspection procedures. Lead-in courses for avionics specialists in India were followed by training on various Jaguar systems in Britain.

After 45 flying hours on the Jaguar plus 5 hours for back-seat captain's qualification in a two-seat Jaguar, the IAF officers were attached with No.54 Squadron, RAF Coltishall for 20 hours of tactical flying at an operational station. The IAF pilots were fully integrated as members of the Squadron, practicing drills, operational procedures, tactics, flying tactical training sorties, low level weapons delivery at the ranges, strafing and air combat. In a friendly move, the CO-designate No. 14 Squadron IAF was accorded permission to fly to RAF Bruggen in North Germany as part of his cross-country flying to briefly visit with No.14 Squadron RAF, then also on Jaguars.

On being asked to compare their new aircraft with the Soviet types they had all been flying earlier, the IAF pilots had professional praise for the low level handling qualities of the Jaguar, its rock-steady flight, excellent cockpit view and sophistication of the controls. Cockpit management required far more work than in a MiG-21 but at least one IAF pilot stated that the MiG-21bis was "far more spirited in flight"!

Two more batches of four pilots each received conversion training on the Jaguar with the Royal Air Force at Lossiemouth, the second batch being later attached with an RAF Jaguar operational-recce squadron. The IAF pilots certainly astonished their instructors by the rapid manner with which they achieved proficiency on the new aircraft-type, completing their conversion and operational weapons training in two-thirds of the normal syllabus time. What was more, the IAF pilots nominated for Instructors Courses passed out top including Flt Lt Sunil Laud, who topped the Qualified Weapons Instructors (QWI) course at No. 226 OCU Lossiemouth.



Sqn Ldr M McMahon (later Air Marshal and Vice Chief)



Sqn Ldr SP Tyagi (later Air Chief Marshal and Chief of Air Staff)



Flt Lt NAK Browne (later Air Chief Marshal and present Chief of Air Staff)



Sqn Ldr JS Sisodia (later Air Vice Marshal)



With the first Jaguar 2-seater (JT-051) at Warton are (L-R) Flt LT Barbora, Sqn Ldr Mike Mittal, Flt LT A Khanna, Sqn Ldr Jonas, Flt Lt Tiny Kumaria and Sqn Ldr NM Gupte

As Air Marshal DR Nadkarni, then Wing Commander and designate CO of No.14 Squadron on Jaguars recalls, "Flying training in the UK was to be done at No.226 Operational Conversion Unit (OCU) based at RAF Lossiemouth in Scotland. The twelve IAF pilots were divided into three batches of four pilots each following at an interval of about three months. The first batch consisted of myself, Sqn Ldr M (Mike) McMahon, Sqn Ldr JS (Sis) Sisodia and Flt Lt SCS (Satish) Adhikari. In the second batch were Sqn Ldr SP (Bundle) Tyagi (who was later to become the CAS from 2005-2007), Sqn Ldr JJ(Willy) Williams, Sqn Ldr DDS Kumar and Flt Lt DC (Tiny) Kumaria (the current AOC-in-C WAC, IAF). The last batch comprised Sqn Ldr SC (Mike) Mittal, Flt Lts SR (Sunil) Laud, NM (Nitin) Gupte and NAK (Charlie) Browne, who is the present Chief of Air Staff.

The first batch arrived at London in mid-February 1979. After the initial briefing and orientation at the High Commission, we were sent to RAF North Luffttenham for issue of flying clothing. On reaching where we were pleasantly surprised to see an RAF Sikh Senior NCO who met us enthusiastically and arranged the issue of our kit. Thereafter we were sent to RAF Mount Batten, Plymouth for the sea survival course. The practical part of this course took place in the English Channel on a cold February day. We were taken out in a small ship and made to jump overboard clutching our survival packs. After absorbing the initial shock of hitting the icy water we had to deploy our respective dinghies and clamber aboard - not the easiest of manoeuvres in choppy seas. We then had to bale out the water, hook on the SARBE and make ourselves as less miserable as possible. After about an hour in the sea a rescue helicopter winched us up one by one and took us ashore to a welcome mug of hot coffee

laced with rum. Following this exercise our fingers were numb for a couple of days.

After this we reported to 226 OCU (RAF Lossiemouth) which was commanded by Wg Cdr Bruce Latten. The OCU comprised three Squadrons. One was exclusively for ground school and simulator, second for operational conversion and the third for running advanced courses like Qualified Weapons Instructor (QWI). After two weeks of ground school and simulator we were ready for flying. The flying syllabus for

the operating procedures of the RAF were very similar to those of ours and hence we adjusted smoothly barring a few initial hiccups with the Scottish accent of some air traffic controllers.

Flying the Jaguar was a pleasant experience and we all thought that the aircraft would be a welcome introduction of modern avionics in the IAF. However, handling the NAVWASS involved a higher cockpit workload and called for some hard work by way of preflight planning and preparation of maps for missions involving multiple way points and IP to target runs some of which also involved weapon drop at one of their ranges. All the pilots successfully completed the syllabus which also included weapons training and acquitted themselves well. This was our first exposure to Western Air Forces and we benefited considerably from the RAF's proficiency and expertise in planning and executing low level missions.

Another benefit of the Jaguar induction was the exposure to aircraft ferries. The first ferry consisted of a trainer and a fighter in which two BAE test pilots were associated. Tim Fergusson and I flew the trainer whereas Chris Yea accompanied in the fighter. The route was Warton — Toulouse (France) — Brindisi (Italy) — Larnaca (Cyprus) — Baghdad (Iraq) — Muscat (Oman) — Jamnagar

and then to Ambala. All the subsequent ferries were by IAF pilots but after the Iraq-Iran war broke out the route was changed to go via Luxor (Egypt) and Kuwait. Larnaca proved to be the favourite halt because of its beautiful beaches and delicious seafood!

As more Jaguars started coming in, the training programme of further pilots continued. Subsequently Flt Lts SR Laud and DC Kumaria were sent back to Lossiemouth for the QWI course and both of them did the IAF proud by topping their respective courses. Now over thirty years on, the avionics of the Jaguar have been upgraded twice with DARIN series system and consequently the cockpit display has changed beyond recognition by old timers like me."



Then Air Marshal Dilbagh Singh AOC-in-C Western Air Command with then Wing Commander Nadkarni on landing at Ambala.

us was the same as for the RAF pilots but abridged to about 45 hours and an additional 25 hours for the first batch with No.54 and 6 Squadrons at RAF Coltishall near Norwich. Two pilots of the second batch also flew with No.41 Squadron, Coltishall for photo reconnaissance training.

It was a bitterly cold winter when we commenced our flying and one had to be suitably clad in thermal innerwear, a warm middle layer called the bunny suit and finally a water proof immersion suit (mandatory when sea temperature was below 10 degrees C) with sealing at the neck, wrists and feet (all this made taking a toilet break somewhat cumbersome). As far as flying was concerned we found that

Air Marshal DC 'Tiny' Kumaria, presently AOC-in-C Western Air Command and who was one of the original twelve IAF pilots selected for Jaguar conversion training and advanced courses in the UK, was requested to write his experience of the QWI course which he attended with the RAF in September-December 1981.

When seconded to No.226 Operational Conversion Unit (OCU) of the Royal Air Force, we found that the unit comprised three flights. 'A' Flight Commander was a QFI responsible for basic conversion, 'B' Flight Commander, a QWI, was responsible for armament training and air combat while the 'C' Flight Commander, a senior instructor, was responsible for ground and simulator training. From the beginning it was clear that the QWI was lynchpin of the Squadron, since the role of the aircraft was ground attack.

On return to India in August 1979, a case was taken up to train at least two pilots as QWIs with the RAF. Air HQs, in their wisdom, selected an 'A2' QFI who was also a FCL, in the belief that a senior pilot should be chosen for the course. By the time Government approval came in 1981, there was only one Flight Lieutenant eligible with these qualifications. Hence, Flt Lt SR Laud went for the No.10 QWI Course and "topped it". On his return, the QRs for the second course were changed, it was decided to send someone who had not done a professional course. Hence Flt Lt DC 'Tiny' Kumaria was detailed for the 12 QWI Course that began in September 1981 at RAF base Lossiemouth.

On arrival in Scotland, it was found that all the other officers detailed for the course had anything between 1500-2000 hrs of flying experience on type as against the mere 200 hours of Flt Lt Kumaria's! The US and Canadian Air Force officers had undergone similar courses in their respective countries and had been instructors at their respective 'Top-Gun' Schools at Nellis (Nevada) and Cold Lake (Alberta). Notwithstanding the disparity in flying experience, at the end of the Ground School it became clear this was not going to be a hindrance since Flt Lt Kumaria had secured 'full marks'. As a result, he was made to function as the "Buddy" for the Omani officer, a relationship that has lasted over the decades (currently he is Chief of the Royal Air Force of Oman).

Flying exercises during the Course were highly intensive. To give an idea of the level of preparations required, a typical sortie would begin with ground planning, using ballistic tables to work out manual release parameters for a new NATO weapon (i.e the ballistics were not fed in the NAWASS computer). Having worked against time, the next step was to plan the route and get Air Traffic clearances and

Range reservations. A typical profile would be a First Run Attack (FRA) at the Tain Range, located at the edge of the Morangie forest (made world famous by the Glen Morangie distillery located nearby). After the FRA, the route was such that it would position the formation for an interception by the student officers from the Intercept Weapons Instructors (IWI) course on Phantom fighters from RAF Leuchers. Since the Jaguar was heavy at this stage, with a couple of 1000 lb. bombs, defensive maneuvering was resorted to. This was followed by a live drop of the 1000 lb bombs in a Toss/Loft Medium Glide attack profile, followed by a simulated attack over sea on a ship target. This would be followed by splash firing against ship towed target. The formation would then route back through the local flying area where it would be bounced by higher weight air defence aircraft like the Lightning and had to resort to offensive manoeuvring. The exercise would culminate with FRA over Tain Range making good pre-planned Time Over Target (TOT).

On one such mission, Flt Lt Kumaria was handed over the lead by Flt Lt Osborne (now a British Airways Boeing 747 Commander), who had a 'kit dump'. In order to make good the TOT, they ran in straight for the IP and in the process overflew the Glen Morangie Distillery (otherwise prohibited below 3000) in a four ship formation. Apparently, the eight Adour engines set off the sprinkler system, ruining huge quantity of the prized single malt whisky! Over the next weekend the formation members had to drive to the distillery to apologise for causing damage to the precious produce of Scotland. On the arrival it was found interesting that the Manager's house was named 'Nainital'. Later it was learnt that the grand old lady had spent her early childhood in India before inheriting the business. Needless to say all was soon forgiven and they were treated to prized 36 year old matured whisky, and the guilt of causing damage was put to rest (since the damaged whisky was fully insured).

The air combat exercises during the Course were also unique. One such sortie was 1 vs 1 vs 1. All three aircraft fought each other, the underlying requirement being to maintain high speed during combat with one, while looking out for the third 'free' member. There was only one sit and pilots were required to cross the finish line with

between 500-800 kg of fuel remaining. In order to ensure that no one cheated on excessive use of reheat and hence fuel, they were invariably asked to carry out an overshoot on arrival. If anyone's Service Group lights came on, he had to buy the day's 'Black Beer'.

One of the instructors, Flt Lt Mason who left the RAF at the end of the Course, volunteered to write the QWI manual and sought 'Indian' assistance. The book was readied for release on the last day of the course and still continues to serve as the basic document with the RAF and was the forerunner for the Fighter Weapon Manual of the Indian Air Force. Then Sqn Ldr NAK Browne (now the CAS) worked extensively at the TACDE to bring out the TACDE manual.

The Course culminated for Flt Lt Kumaria on a very high note, with 100 percent marks in both flying and ground subjects. However, even after the Course breakup party had begun, the CO decided to hold yet another gen test. The marks of this paper were never revealed, probably it was not even corrected. However, one mark was reduced in Tiny's case so that the final mark tally could read 99.9 percent and not 100 percent!

In the next few years the learning value of the QWI course was to be put to full use.

[Extracts from the book]

The Fighting Fourteen: Illustrated History of No.14 Squadron IAF 1951-2011



Flt Lt DC Kumaria (later Air Marshal and present AOC-in-Chief, Western Air Command)

‘The Daring Eagles’



The IAF's 105 HU

The Air Station at Gorakhpur in Uttar Pradesh is home to the Indian Air Force's second oldest and currently largest helicopter unit. 105 HU, 'The Daring Eagles' have a long and distinguished career over the skies of India having been raised in Jorhat on 23 November 1959. Early days saw them operating with the Bell 47G and S-55, later receiving two Chetaks in 1962 before converting to the Mi-4 on 30 September 1963. The first 18 years of their existence saw them operating around the demanding environs of Eastern Air Command. They saw action in the Indo-China conflict of 1962 where a three aircraft detachment at Lumpo performed reconnaissance, casevac and re-supply missions in

support of the Indian Army's 4th Division. Their impressive performance included the evacuation of 135 casualties from the front and the air supply of 14.6 tonnes of stores.

105 HU saw further combat during the Indo-Pak war of 1971. Noteworthy during the 1971 in the Eastern Sector was their

performance at Sylhet, where together with 110 HU and 111 HU they airlifted a force of Indian Army troops across the Meghna River at night, under enemy fire. This was followed by an advance on Daudkandi and then onto the outskirts of Dacca. The combined helicopter force completed 409 sorties in 36 nonstop hours,

lifting a total of 6023 men and 5,500 kgs of supplies during the Sylhet airlift. Throughout the conflict, 105 HU flew an impressive 94,972 kgs of supplies.

The Daring Eagles converted to the Mi-8 on 1 September 1981 and moved to their current home of Gorakhpur in August 1987. They have since taken part in various rescue missions over the decades as part of its remit to assist the civilian



powers with disaster relief, predominantly with regard to floods and earthquakes. Their first major mission was to West Bengal in 1976 to assist in flood relief and since then have been called into action nearly 20 times, with virtually non-stop deployments since the year 2000.

In October 1987 they were deployed to the Jaffna Peninsula in Sri Lanka to assist the Indian Army with peace keeping duties during *Operation Pawan*. In March 2008, they were awarded the 'Presidential Standard' for distinguished services and in September 2010 they converted to the Mi-17.

Currently the unit continues in its civil relief missions, as well as standard re-supply, Army support and VIP missions. More importantly in June 2011 it took over the mission of supporting the Indian security forces in their operation against Naxal guerrillas in India's 'Red Corridor'. The 'Red Corridor' goes through several Indian States that extend from the borders of Nepal and China, south the border of Tamil Nadu state in southern India. The states concerned are amongst the most under developed in India and include, Andhra Pradesh, Bihar, Chattisgarh, Jharkhand, Madhya Pradesh, Orissa, Uttar Pradesh and West Bengal. 'Naxalite' is a generic term used to describe the various militant communist groups operating in the corridor. The insurrection by the Naxalites is the result of under-development in the most rural of areas and exploitation of the locals by various official and private sector players. The activities of the various 'Naxal' groups increased between 2000 and 2010 leading to the Government of India declaring them as 'terrorist organisations' that are predominantly being funded by foreign powers. The Government of India has attempted to resolve the situation with the introduction of an integrated action plan that broadly seeks to develop economic regeneration projects in the effected areas as well as increasing police funding for the better containment of the communist influence. The increased funding has led to four IAF helicopters being deployed into the area, together with three Border Security Force HAL Dhruvs based at Ranchi in Jharkhand. This helicopter force has supported various police and paramilitary groups such as the Central Reserve Police Force, Border Security



Daring crew of 'The Daring Eagles'

Force, Indo-Tibetan Border Police and various local state forces. The helicopter force has been vital to the various ground units with their ability to deploy reinforcements, re-supply and casualty evacuation.

The Indian Air Force commitment, known as *Operation Triveni*, was previously performed by No.152 Helicopter Unit, home based at Sarsawa in Western Air Command. However the baton was passed over to 105 HU in 2011 and the size of the unit rose as a consequence, from the normal 8 to 14 helicopters. Currently they have four aircraft detached at Raipur to support operations in Chattisgarh and surrounding areas. 'The Daring Eagles' bear the brunt of the work owing to ongoing serviceability problems with the HAL Dhruv and on average each crew will spend approximately 21 days on rotation.

Indian rules of engagement do not allow for use of the UB32 rocket pods against their own civilian population. However the Mi-17s do take incoming fire whilst flying and are allowed to return fire in self defence. The Mi-17s are particularly vulnerable in the hover, especially whilst taking off and landing. Rocket propelled grenades and mortars have been used against them and to counter this air crew are equipped with AK47s and 7.62 mm machine guns located in the port side cabin door and first window of the starboard side. Furthermore, the

attachment of bolt-on armour around the cockpit gives added protection to the crew against small arms fire, which normally consists of the pilot, co-pilot, engineer and air gunner. The first 6 months of operations in the 'Red Corridor' has seen the unit come under fire several times and several of the crew men have been put forward for commendations. The Indian Government action plan appears to be having positive results as the number of effected states has started to decline. By the end of 2011 they were reporting that the number of Naxalite-related casualties nationwide had decreased by nearly 50% in the preceding year.

The IAF has long been a big operator of Mil helicopters from the Kazan plant having ordered 130 Mi-8s, 93 Mi-17s, 50 Mi-17-IVs, 80 Mi-17V5s with the prospect of more. The older Mi-8s are gradually being replaced as newer Mi-17s enter the IAF's inventory.

Phil Camp and Simon Watson
(on a recent visit to various IAF stations under Central Air Command).





Air Marshal Philip Rajkumar writes on

The Tortuous MiG-21 Upgrade Saga

The earliest mark of the MiG-21 (NATO Code *Fishbed*) to enter the IAF's inventory in 1963 was the MiG-21F-13, also referred to as the Type 74. It could carry 2 x K-13 Infra Red (IR) homing air-to-air missiles (NATO code *Atoll*) and had a single 37 mm NR-37 cannon and a gyro gun sight with radar ranging. The role of the aircraft was primarily for air defence.

This was followed in 1965 by the MiG-21PF (Type 76) which was the first version to be equipped with an Airborne Interception (AI) radar, the R1L. The MiG-21FL (Type 77), made its appearance in 1966 and was equipped with the R2L AI radar. These two versions did not have a gun and could only carry 2 x K-13 missiles. The small number of Type 74s and Type 76s in IAF service were phased out by 1968.

As war clouds gathered over the sub-continent in March 1971, a podded gun carried at the ventral station was supplied

by the Soviet Union, but only a PKI fixed gun sight was available for aiming. Trials were then carried out with the Gyro Gun Sight GGS Mk 4 by the Tactics and Combat Development and Training Squadron (now the Tactics and Combat Development Establishment) at Jamnagar in mid-1971 but the modification was not pursued because the sight had to be installed inverted to fit in the available space. The December 1971 Indo-Pak war convinced the operations directorate at Air Headquarters that the MiG-21 fleet had to have a gun with a predictor gyro sight and a request was made to the Soviets for a gun-armed version of the MiG-21.

The MiG-21M arrives

In 1973 the Soviet Union offered an improved version of the MiG-21, the MiG-21M, which in the IAF was known as the Type 96. This version had an AI radar (the RP-21M) and a twin barreled GSh-23 internally mounted cannon which

MiG-21FLs (Type 77) of the IAF's No.30 Squadron.





could fire 3000 x 23 mm rounds per minute and had a gyro gun sight as well. In addition, this was equipped with an improved ejection seat (the KM-1) which had ground level ejection capability. The

Soviets offered this version with a new engine, the R-13-300, which had somewhat more thrust than the earlier R-11F2S-300 engine which powered the Type 77 fleet. The airframe could accommodate the

R-11 engine as well, but the R-13 engine had a second stage afterburner which cut in at Mach 1.6 to improve supersonic acceleration. However, a large saddle tank spoilt the beautiful area ruling of the Type 77 airframe and the Type 96 could not match the supersonic performance of the Type 77. The Type 96 however, had a gun, a radar warning receiver, could carry 2 x 490 litre drop tanks under the wing, an 800 litre drop tank at the ventral station and was therefore a more versatile platform.

As licence manufacture of the MiG-21M was contemplated, the IAF had to quickly decide on choice of the engine. In February 1973 two MiG-21M aircraft, one fitted with a R-13 engine and designated the MiG-21MF (C-1533) and the other fitted with the earlier R-11 engine, remained as the MiG-21M (C-1531), both positioned at ASTE at Kanpur. Sqn Ldr S Krishnaswamy (later CAS) and I carried out a comparative evaluation of performance of the two aircraft with the two different engines between 22 February and 4 March 1973.

The evaluation consisted of 24 operational profiles flown at low, medium and high altitude. Acceleration times to various Mach numbers, up to Mach 2.05 and time to climb to 19 km were compared. On 4 March 1973, I wore pressure clothing and flew two static climb





MiG-21M (Type 96) at HAL Ozar.

sorties to 19 km on the two aircraft one immediately after the other. The visibility was barely 1.5 km at Kanpur because of dust haze and the radar surveillance by the radar unit at Memora, near Lucknow was not very good. I had to go out about 180 km in a south easterly direction, accelerate to Mach 1.85 in the turn on to reciprocal heading and then climb to 19 km. On each occasion I reached 19 km with the 450 litres low fuel level warning light glowing in the cockpit while I was still at a distance of 100 km from base. The prevailing poor visibility, pressure clothing which restricted outside view from the cockpit, the absence of navigation aids other than the radio compass and the low fuel state called for careful handling of the situation. I had to throttle back to idle below 15 km altitude, descend at 500 km/hr IAS, arrive overhead base with just 300 litres which gave me three to four minutes to execute the circuit and landing. It was satisfying to complete the static climbs. The R-13 engine did give the MF version a small but noticeable edge in performance over the M version at low and medium altitude. Since the R-11 was already

being manufactured at HAL, Koraput Air Headquarters decided to drop the R-13 on techno-economic considerations.

The Soviets did not give up efforts to convince Air Headquarters to produce the R-13 instead of the R-11 at Koraput and offered an improved version of the R-13, the R-13F for evaluation by IAF test pilots. In April 1975, Air Headquarters sent a team of three officers, Wg Cdr PM 'Ramu' Ramachandran (later VCAS), Sqn Ldr BR Madhav Rao, an AE(M) officer who had vast experience of working on the MiG-21 and myself to Krasnodar, near the Black Sea to carry out the evaluation. The R-13F engine was identical to the R-13 except that it had the provision for an emergency reheat mode which could be engaged when required by turning on a switch which was just ahead of the throttle. At Krasnodar we were not allowed to exceed 1000 km/hr IAS in the local flying area. Ramu and I could not find any difference in performance in the sub sonic regime. When we discussed our findings with the Soviets, they turned around and said that the main advantage could only be seen while accelerating to limiting

IAS at low level or while accelerating through the transonic regime at medium altitude. When asked to be allowed to go supersonic at Krasnodar, they refused, saying that the area where they carried out supersonic flights, foreigners were not allowed to fly! We returned to Air Headquarters and categorically stated in our report that it was not worth going in for the R-13 F.

Our rejection of the R-13F engine had a very beneficial effect because when the CAS, Air Chief Marshal OP Mehra, visited the Soviet Union a little later, his team was shown the definitive MiG-21bis, fitted with the R-25 engine. The R-25 was a much superior engine to various engines fitted in MiG-21s so far in IAF service and the MiG-21bis entered service in 1976, being more capable than the M version because it had a superior AI radar, the *Almaz*, and a better engine. Both the airframe and engine were to be manufactured under license later by HAL.

In 1983 Air Marshal LM Katre was appointed Chairman of HAL. He set about trying to revive the moribund design bureau of the company. He ordered the HPT-32 to be re-engined with a turbo-prop, the Hindustan Turbo Trainer-34 (HTT-34). I had an opportunity to fly some sorties on this very lively aircraft, which had impressive performance, spun exactly like the HPT-32 and would have made an ideal trainer for the basic flying stage in the IAF. Had this aircraft development been pursued we would not now have had to go to the world market to look for a HPT-32 replacement. The Ajeet trainer project was given the go ahead and a MiG-21bis modernisation project was launched at HAL, Nasik. Air Marshal LM



The first upgraded MiG-21 bis ('Bison') in Russia.

Katre was a visionary Chairman and HAL had an opportunity to dramatically transform itself under his leadership but regrettably, his tenure at HAL (and later as CAS) was all too short.

Dr Kota Harinarayana who was the Chief Resident Engineer (CRE) at Nasik joined HAL and was made chief designer of the Nasik Design Bureau. One MiG-21bis airframe (C-2270) was modified with the following modifications:

- ◆ The leading edge of the wing was fitted with a vortex plate. This was no more than a steel plate with a rounded contour to fit the leading edge with a metal plate about six centimeters in length which protruded from the bottom of the leading edge into the airstream. This device was a modification developed by the National Aerospace Laboratories (NAL) after extensive wind tunnel work at Bangalore and meant to energise the airflow over the wings at high angles of attack thereby improving turn performance.
- ◆ The normal two position wing flap was replaced by a blow back flap which extended in stages as the speed reduced. It retracted fully at about 700km/hr IAS. This device was also meant to improve manoeuvre performance at low speeds.
- ◆ An enlarged saddle tank which increased fuel capacity by 200 litres was fitted. This modification certainly made the dorsal spine behind the cockpit look fat and ugly!



MiG-21bis in camouflage paint over the Punjab (photo by Air Marshal MM Singh).

- ◆ Some Soviet era avionics like the radio, radio compass, radio altimeter were replaced by Western avionics. To make use of the savings in weight a small rubberised fuel tank containing 120 litres of fuel was fitted in the area behind cockpit pressure bulkhead.

After initial flights at Nasik, the aircraft was positioned at ASTE in early 1985 for a thorough evaluation. I was the Chief Test Pilot at ASTE at that time and the evaluation was done by pilots in the Flight Test Squadron. I flew only one sortie on 14 June 1985, to look at the problem areas pointed out by the evaluation pilots. The vortex plate did improve subsonic turn rates by about 8-10 % which was good for a passive, low cost device. Supersonic acceleration, however, deteriorated due to the fat saddle tank and the combat flap did not significantly improve manoeuvre performance. Air Headquarters rejected this attempt at modernisation but this was, however, a good learning experience for the Nasik design bureau.

One of the principal drawback of various marks of the MiG-21s in IAF service was the absence of a navigation and attack system. Navigating at low level with only a stop watch, compass and map required a lot of training and practice to attain and retain proficiency. Weapons could be delivered accurately in a dive only by adhering to rigid entry and release conditions which did not allow for any tactical flexibility in the attack. Lay down attacks with retarded weapons were equally difficult because the target would disappear below the nose well before the release point. The final release had to be done by counting down a time delay after the target had disappeared! This method was not very accurate and so by 1986 the IAF had started serious search for a suitable navigation and attack system for its MiG-21 fleet.

Evaluation in Egypt

In 1987, Marconi Elliot of the UK informed Air Headquarters that they had fitted a nav/attack system in MiG-21Ms of the Egyptian Air Force (EAF). The system consisted of a Head Up Display



MiG-21 bison in frontline service.

(HUD), a display processor which also did weapon aiming computations and an air data computer which accepted inputs from the aircraft's pitot static system and twin gyro platform to perform navigation calculations. A colour video camera which recorded HUD symbology to act as a useful mission debrief tool and a keyboard fitted just below the HUD which was the input device, completed the system. Apart from the HUD, keyboard and camera which were fitted in the cockpit the rest of the system was neatly packaged in nose compartment of the aircraft.

Thanks to good relations existing between the UK, India and Egypt, the company offered to arrange for a no cost - no commitment evaluation of their system fitted in an EAF aircraft. The EAF



Egyptian Air Force R&D Department Sticker

HeadQuarters to attach me to an operational squadron for a short while to get my hand back and practice weapon delivery. I flew seven armament sorties with No. 29 Squadron at Jamnagar between 4 and 7 August 1987. I really enjoyed myself firing rockets and guns and dropping practice bombs over Sarmat range after a long break!

The evaluation was conducted at the Al Mansoura air base in the Nile delta, north of Cairo between 24 and 29 August 1987. I was first briefed on the system characteristics by Marconi Elliot representatives and the EAF Research and Development department personnel. I familiarised myself with the system in a system simulator on the ground and was first given a sector recce



IAF team in front of 'Monument to Aviation' at Krasnodar Air Base, USSR, April 1975. Sqn. Ldr. B.R. Madhav Rao is 3rd from left, Wg.Cdr. P.M. Ramachandran is 5th from left and Sqn. Ldr. P. Rajkumar is 7th from left.

wanted their aircraft to be insured and the insurance company in turn wanted to know the qualifications and experience on type of the pilot who would perform the evaluation. Air HeadQuarters detailed me to do the evaluation and the insurance

company accepted my competence to do the job as I had flown over 2000 hours on various marks of the MiG-21 by that time!

As I was not in regular flying touch with the MiG-21M, I requested Air

sortie in a MiG trainer by Colonel Ibrahim of the EAF. The early morning haze over the delta was dense and visibility was barely a couple of kilometers. When we reached Port Said and started flying westwards towards Alexandria over the

Mediterranean Sea, the visibility improved considerably. Colonel Ibrahim said he would send a chase aircraft when I flew solo and I agreed because the triangular cross country way points were small towns in the delta and it would have been easy to miss them in the haze. In all I flew four sorties (tail nos 8354 and 8324) to assess navigation performance and did dummy dives over the airfield to prepare for the weapon delivery sorties. Unfortunately the EAF got cold feet at this stage and did not authorise me for weapon delivery saying that the Wadi Natrun range in the desert west of Cairo was “not available”. One or two sorties of weapon delivery would not have enabled me to collect any statistically significant data and EAF statistics would have had to be used in any assessment. In my view the lack of live firing did not affect the evaluation.

After having flown the inertial nav/attack system in the Darin Jaguars, I thought this system on offer was primitive. It may have been state of the art some years earlier but it was clearly out of date. I did, however, find flying the MiG-21 with a HUD a pleasure and the video recorder debriefing tool of immense value. Air Headquarters now gave up its search for a nav/attack system for the time being.

The Need for Comprehensive Upgrade

When AOC, AF Station Gorakhpur in 1989, I was sent on a short course on Systems Analyses at Metcalfe House in old Delhi. I found this course very informative and useful because it taught one how to develop quantitative criteria to aid decision making. In 1991 when I was Commandant ASTE I was asked by Air Headquarters to carry out a study on operational effectiveness between Soviet-origin and Western aircraft. Amongst other things this study clearly brought out the need to upgrade as many systems in an aircraft as possible if its effectiveness was to be improved. To meaningfully upgrade the MiG-21 fleet, a number of

improvements had to be made in one go particularly pertaining to its primary sensor, the AI radar, and then navigation, weapons, weapon aiming systems plus airframe life extension which was required for reasonable exploitation of the upgraded fleet.

The Soviet Union had passed into history at the end of 1991 and now the Russian Federation offered an upgrade package for the MiG-21bis fleet in 1992. At about the same time, India established diplomatic relations with Israel and defence ties with that country started to develop at a

Mikoyan design bureau had offered a very attractive upgrade package at reasonable cost. The package consisted of a new radar called the *Kopyo*, Beyond Visual Range (BVR) missile carrying capability, latest Close Combat Missiles, an Inertial Nav/Attack System (INAS), Counter Measures Dispensing System (CMDS) and some EW capability. In December 1993, I led a team of IAF, HAL and DRDO officers for a first round of talks on the upgrade proposal with the Mikoyan design bureau and had the pleasure of interacting with Mr RA Beliakov who was Chief Designer of the

bureau. I had a group photograph taken of the team and him standing near the bust of Artem Mikoyan, the famous designer who had founded the design bureau. The Indian team visited several other plants where other systems on offer were being manufactured. Of particular interest was the team's visit to the Vympel missile design bureau at Tushino and the Sokol plant at Nizhny Novogorod (old name Gorkhy)

dedicated to the manufacture of MiG designs. This was the plant where upgradation of the first two airframes would be carried out. We spent two weeks in the freezing cold of Moscow but returned to Delhi convinced that the Russian package was the manner to go. In July 1994, I led another team for the second round of talks and we were able to finalise the technical specifications of the upgrade. Commercial negotiations followed and the contract was signed sometime in 1996.

The IAF positioned a team of test pilots and technical officers at the Sokol plant at Nizhny to oversee the upgrade programme. Wing Commander N Harish was the first IAF test pilot to fly the upgraded Mig-21bis now called the Bison (son of Bis!) in 2000. MiG-21 Bison squadrons are now in operational service and so the long and tortuous upgrade saga of the MiG-21 recorded its final chapter.



During MiG-21 Upgrade talks in Moscow, December 1993 : at the Mikoyan Design Bureau. In front of bust of Artem Mikoyan, famed founder of the MiG Design Bureau are (left to right) Flt. Lt. Chatterjee,, unknown, Wg.Cdr. Sethi, Gp. Capt.H. Masand, RA Beliakov, Head of Design Bureau, Air Cmde P.Rajkumar, Manucharov Rawal, Dy GM, HAL, Nasik.

rapid pace. Israel Aircraft Industries (IAI) offered an upgrade of the MiG-21, which they had developed for the Romanian Air Force. In May 1993 I was sent to Tel Aviv to evaluate this proposal. The first topic I raised with the IAI engineers was about airframe life extension. When asked whether they had the structural data of the MiG-21bis airframe to carry out the life extension they replied in the negative and said they expected the IAF to provide such data. I then flew a sortie in a Lavi test bed aircraft to evaluate the Elta 2032 radar which was being offered for the upgrade. Unfortunately the radar failed after only 10 minutes of flight and I was not able to evaluate it. When I submitted my report to Air Headquarters stating these two important factors, the Israeli proposal was rejected.

In July 1993 I was posted to Air Headquarters as Director Air Staff Requirements and the MiG-21 fleet upgrade problem dropped into my lap. The

Third T-50 Flown

On 22 November 2011, Sukhoi test pilot Sergey Bogdan carried out the maiden flight of the Sukhoi T-50-3 from Komsomolsk-on-Amur in Khabarovsk Krai in Russia. This is the third flying prototype of the fifth-generation multi-role fighter and was airborne for over an hour. It is the first example equipped with the Tikhomirov Scientific Research Institute of Instrument Design active phased-antenna array radar but lacks the nose-mounted pitot tube of the first two. A batch of 16 Ufa Motor Building Production Association 117S engines for the T-50 has been completed, out of which six will be used for static tests and others integrated with T-50s.



and also equipped with an Electro-optical Targeting System (EOTS), considered the world's most advanced targeting system for long-range detection and precision. While the decision on the aircraft, known in Japan as its F-X fighter, was made public on 27 December 2011 at a Security Council meeting chaired by Prime Minister Yoshihiko Noda, there are some dissenting views from other Japanese military experts.

The Japanese MoD plan to deploy four new fighters in fiscal year 2016, with plans to acquire a total of 40-50 aircraft at a cost of around \$4 billion. Japanese media have however reported the total cost, including purchasing, maintenance and repairs, will be about 1 trillion yen (US\$12.8 billion).

The 'Final' F-22 Raptor

The last Lockheed Martin F-22 Raptor on order for the US Air Force left the Lockheed Martin assembly line on 13 December 2011 which was commemorated with a ceremony. This F-22 Raptor (tail number 4195) now moves into production flight check for delivery to the US Air Force in 2012, completing the operational fleet at 187 aircraft.

Operational F-22s are based at Langley Air Force Base, Virginia; Elmendorf AFB, Alaska; Holloman AFB, New Mexico and Hickam AFB, Hawaii. USAF F-22 units have deployed to Kadena Air Base, Japan and Andersen AFB, Guam, as part of rotational deployments designed to enhance security in the Pacific theatre. The Raptor has conducted joint and coalition training both stateside and overseas in locations including the United Arab Emirates.



Japan selects Lockheed Martin F-35

Japan has formally opted for Lockheed Martin's F-35 Joint Strike Fighter (JSF) to meet its F-X future fighter requirement. Concluding a process that started in 2007, this selection was made from three candidates: Lockheed Martin's F-35 Lightning II, also known the Joint Strike Fighter (JSF), Boeing's F/A-18E/F Super Hornet Block II and Eurofighter's Typhoon.

The Japanese Ministry of Defence (MoD) had four key criteria to meet its fifth generation stealth fighter requirement: performance of the aircraft and its weapons; price; the participation of domestic firms in production and after-sales maintenance support through its life cycle. The Japanese air defences are preparing for future challenges in the shape of Chengdu J-20 and Sukhoi T-50, fifth-generation jet fighters from China and Russia.

Of the three models, the F-35 is the only fifth-generation fighter among the three, incorporating high-stealth capabilities

India Aviation HYD

Bangladesh Air Force modernisation plans

The Bangladesh Air Force is to receive 16 Chengdu F-7BGIs in 2012, according to its Chief of Air Staff. The aircraft will be used to replace the oldest F-7s still serving with the force since the late 1980s. Within the next 13 to 15 years, Bangladesh will acquire an additional 20 to 32 fighters. The selection process for the new fighter was initiated in 2009: under consideration are the Saab JAS39 Gripen and the Sukhoi Su-30, while unsolicited offers for Lockheed Martin F-16s and MiG-29SMTs have also been received.



During the next decade, the Bangladesh Air Force plans to expand by adding a third fighter squadron and a maritime strike unit to the existing two multi-role and two fighter squadrons. The current fleet of Nanchang A-5C-III *Fantan* strike aircraft will be replaced, while new advanced trainers will be acquired to replace the Aero L-39C Albatross.

US Marines 'to buy all UK Harriers'

The US Marines are to purchase all 74 of the UK's decommissioned Harrier VTOL fighters and their spare parts. Peter Luff, Minister for Defence Equipment, Support and Technology announced that all aircraft plus spares and associated equipment would be sold to the US for \$ 180 million, which represents around one-tenth of the recent investment in the fleet to upgrade these for service until 2018.



The US Marine Corps currently operate around 120 Harrier AV-8B aircraft, including training variants, but are expected to phase out the Harrier as the F-35B comes into service in the middle of the next decade. British Harriers and aircraft carriers were scrapped in the 2010 Strategic Defence and Security Review, which left the Royal Navy without carrier-borne strike capability until launch of the first of the *Queen Elizabeth*-class aircraft carriers in 2019. The new RN-carriers will operate the F-35C carrier variant of the JSF.

First French Air Force A400M

Following the launch of A400M series production, Airbus has begun final assembly of the first A400M for the French Air Force. The fuselage for this aircraft, construction number 007, arrived at the final assembly line in Seville (Spain) on board an Airbus Beluga on 22 November 2011. The wings and nose had arrived earlier, also in a Beluga, on 26 October. Integration of the central box and outer wings has already begun. France will receive its first A400M military airlifter during the year 2012-2013. Eight series production A400M aircraft are currently at different stages of production.

Kfirs offered to Bulgarian Air Force

Against a Bulgarian requirement for around eight new or used fighters, Israel has offered upgraded IAI Kfirs. On 6 November 2011, Bulgarian Defence Minister Anyu Angelov announced that the decision on a new fighter will be made within one or two years and following the first batch of eight aircraft, there is a possibility of a further eight being acquired in 2015.



In October 2011, the Bulgarian Government authorised its defence ministry to sign a military co-operation agreement with Israel, which included training and exercises and to formalise an MoU on defence industry co-operation.

Ex-RAAF Hercules for Indonesia

Four RAAF C-130H Hercules, worth an estimated \$30 million will be 'donated' to the Indonesian Government for disaster relief and humanitarian work, as will three high speed naval intercept vessels deployed to Indonesian waters to interdict smuggling. The agreements, signed in Bali on 20 November 2011, between Prime Minister Julia Gillard and Indonesian President Susilo Bambang Yudhoyono mark new strategic partnership between the countries.

Meanwhile, in December 2011, Australian and Indonesian Air Force Hercules participated in *Exercise Rajawali Ausindo* at RAAF Base Darwin, which involved RAAF C-130H/J-30s from No. 37 Squadron and Indonesian Hercules of *Skadrons Udara* 31 and 32.

Indonesian acquisition of F-16s

The United States is to supply twenty-four refurbished F-16C/D aircraft, plus 28 F100-PW-200 or -220E engines, to Indonesia. This was announced by President Barack Obama during his nine-day Asia-Pacific trip in November 2011, where he issued a joint statement with Indonesian President Susilo Bambang Yudhoyono.

The upgraded Lockheed Martin F-16s will give Indonesia a "much-needed" boost and will be supplied at the comparatively low price of \$750 million. The upgradation of the aircraft will include AN/ALR-69 radar warning receivers, ARC-164/186 radios, new mission computers, AN/ALQ-213 electronic warfare management systems, AN/ALE-47 countermeasures dispensers, situational awareness data links (SADL), enhance position location reporting systems (EPLRS) and LN-260 inertial/GPS navigation units. Overhaul and upgrade work will be undertaken by the 309th Maintenance Wing at Hill AFB, Utah.

Either the AN/AAQ-33 Sniper or AN/AAQ-28 LITENING targeting pods will also be supplied. In addition, two Block 15 and four Block 25 F-16 airframes will be used as a source of spares. Some 30 Indonesian pilots will convert to the F-16 in the USA, while maintenance personnel will be trained in Indonesia. Contract signature is expected in 2012 and delivery by July 2014.



Su-27SM(3) fighters for Russian Air Force

Sukhoi have completed delivery of 12 new multi-role Su-27SM(3) fighters to the Russian Air Force, released under a state contract, signed between the Sukhoi Company and the Ministry of Defence at MAKS-2009. The production took place at the Sukhoi's KnAAPO aircraft plant in Komsomolsk-on-Amur.



The Su-27SM(3) fighter aircraft has a strengthened airframe to enable increased takeoff weight (by more than 3 tons) and additional suspension points to accommodate weapons. The fighters are equipped with new avionics and weapons systems as well as with the new AL-31F-M1 turbofan engines produced by the MMPP "Salut", characterised by higher thrust and extended time between overhauls.

The new cockpit consists of 4 MFDs which have replaced the earlier analogue layout there is a new ECM suite while the integrated information system (CIS) has improved the operational and technical characteristics of the aircraft. A new system provides robust and secure communication and data links between ground stations and other aircraft.

Upgradation of Saudi Black Hawks

Twelve Sikorsky UH-60A Black Hawks of the Royal Saudi Land Forces Aviation Command will be upgraded as UH-60Ls, as announced by Sikorsky Aerospace Services in November 2011 and based on the US Army's H-60 Helicopter Recapitalisation and Upgrade Programme. The helicopter's T700 engine will be upgraded to T701D standard, while new flight controls, avionics, instruments panel, aircraft flight control computer, wiring harnesses, a high-speed shaft and a sealed lead acid battery will be installed.

Beriev Be-200s for Russian Ministry of Defence

The Russian Ministry of Defence will acquire eight Beriev Be-200 amphibians, according to Russian Defence Minister Anatoliy Serdukov, with orders being placed in 2013 and 2014. These will most probably be used for firefighting and search and rescue (SAR), though there is not clear idea of which regions they will be based in. Also, the MoD is ready to discuss completion of testing of the Beriev A-42 amphibian for naval use (mainly SAR and maritime patrol), as well as its upgrade with modern avionics and mission equipment. The proposal depends on Beriev submitting acceptable price and timing schedules for completion of work.



S-92 for Irish Coast Guard

Sikorsky Aircraft Corporation have delivered an S-92 helicopter for operation by CHC Helicopter on behalf of the Irish Coast Guard. Equipped for dedicated search and rescue (SAR) operations, the helicopter will provide coverage for deep Atlantic Ocean missions, service Ireland's offshore islands and provide rescue cover from Cork to Galway on the country's west coast. Based at Shannon, the S-92 will replace the current Sikorsky S-61 helicopter, which has long served with the Coast Guard.



Raytheon's Patriot Systems for Taiwan

Raytheon has received a \$685.7 million Foreign Military Sales (FMS) contract for additional new fire units of the Patriot Air and Missile Defence System for Taiwan.

"Our partnership with Taiwan dates back more than 45 years, and we are committed to providing Taiwan with the best air and missile defence system capability available," said Sanjay Kapoor, vice president for Integrated Air and Missile Defence at Raytheon's Integrated Defence Systems business (IDS).

"Patriot is the world's most capable air and missile defence system, protecting against a full range of advanced threats, including aircraft, tactical ballistic missiles, cruise missiles and



unmanned aerial vehicles". This system has been ordered by 12 nations. Raytheon is the prime contractor for both domestic and international Patriot Air and Missile Defence Systems and system integrator for Patriot Advanced Capability-3 missiles.

C295 for Mexican Air Force

The Mexican Air Force has taken delivery of a new C295 aircraft, which is addition to the five C295s delivered in 2011. The aircraft will transport troops and paratroops and can be readily configured for medical evacuation (MEDEVAC) or can carry up to nine tonnes of palletised or bulk cargo.

The Mexican Air Force, Navy, and Federal Police have acquired the entire family of Airbus Military Light and Medium aircraft including ten C295, seven CN235 (six of them in Maritime Patrol version), and ten C212 (eight of them Maritime Patrol versions).



IBAE

Eight more CN235s for French AF

Flight Test Centre of the *Direction Générale de l'Armement* (DGA) of the French Ministry of Defence has taken delivery of first of eight Airbus Military CN235 medium airlifters ordered by the French DGA in 2010. These eight aircraft will be operated by the French Air Force, to add to the 19 examples already in service. The last of the remaining seven aircraft ordered will be delivered by the end of 2012.

The CN235 can carry up to six tonnes of payload and its cabin can be rapidly reconfigured for different transport missions: troops, paratroops, medical evacuation, cargo, or a mixed configuration of cargo and troops. It incorporates a specialised loading system for palletised loads. The French Air Force already operates 19 CN235 aircraft. The *Centre d'Essais en Vol* of the French Government also operates three Airbus Military C212s.



Elbit to upgrade USAF HUDs

Elbit has been awarded a five-year, Indefinite Delivery/Indefinite Quantity (IDIQ) contract for an amount of \$38.5 million, by the Defence Logistics Agency-Ogden for the manufacture of Reliability and Maintainability (R&M) Electronic Module Assemblies (EMA) for all US Air Force Block 30 and Block 50 F-16 Wide Angle Conventional (WAC) Head-Up Displays (HUDs). To date, Elbit Systems of America has received initial orders in the amount of \$3 million under the IDIQ contract.



The Wide Angle Conventional Head-Up Display (WAC HUD) takes critical flight and mission data which is normally displayed inside the cockpit on an instrument panel and projects that information on a transparent surface directly in front of the pilot allowing for eyes out of the cockpit and improved situational awareness. The new design reduces total part count, lowering power consumption and significantly improving meantime between failures (MTBF).

Bell 412s for Sri Lanka ...

Bell Helicopter has delivered two Bell 412s to the Sri Lanka Air Force. "We've had a strong partnership with the Sri Lanka Air Force for more than 40 years," recalled Larry D. Roberts, senior vice president for Bell Helicopter's Commercial Business. Accepting the keys to the new Bell 412s was Air Marshal Abeywickrema representing the Sri Lanka Air Force. The Sri Lanka military operates a large fleet of helicopters in Sri Lanka with the majority of them being Bell Helicopter products.

...and receives order for 412s in Indonesia

The company has also received five firm orders with two potential follow-on orders for Bell 412s from PT Dirgantara Indonesia (PTDI) for delivery to government agencies in Indonesia. PTDI will then transport them to Bandung, where local content and customer specific mission equipment will be added prior to PTDI making final delivery to end-users. In 2010, Bell Helicopter announced plans to extend the capability and performance of the Bell 412EP through a series of upgrades which are expected to be available to customers in 2012.

Sikorsky's UH-60M Black Hawk for Sweden

Sikorsky Aircraft has delivered the fourth of 15 UH-60M Black Hawk aircraft for further transfer to the Swedish Defence Material Administration (FMV). Sikorsky is building and delivering all 15 UH-60M aircraft to an accelerated 18-month production schedule that began in May 2011. Seven aircraft were on schedule for delivery to the US Army September through December, with eight additional deliveries through the fall of 2012.



The FMV is procuring the 15 aircraft via the US Government's Foreign Military Sales programme. The accelerated build schedule will enable the Swedish Armed Forces to deploy three UH-60M aircraft to Afghanistan in April 2013 to be used for medical evacuation, utility, and search and rescue missions.

Sweden is the first European country to acquire the US Army's UH-60M Black Hawk, which aircraft come equipped from Sikorsky with an advanced flight control system to reduce pilot workload, full night vision device capability for night operations, and a state-of-the-art communications suite.

Airbus Military C295s for Ghana

The Ghana Air Force has received the first of two C295 aircraft ordered from Airbus Military. The second aircraft will be delivered in the first quarter of 2012. The aircraft is qualified for the transport of troops, paratroops, medical evacuation and both palletised and bulk loads, for which it is equipped with a palletised loading system. It will be primarily used for domestic transport and will also play an important role in humanitarian relief missions. Its short take-off and landing (STOL) and rough-field capabilities will provide the Ghana Air Force with access to remote locations that were not accessible previously.



CN235 MPA for Mexico

The Mexican Navy has taken delivery of the first of four CN235 Maritime Patrol Aircraft (MPA) ordered from Airbus Military through a contract with EADS North America. The remaining three aircraft will be delivered in the first half of 2012.



This CN235 in MPA configuration incorporates the latest technology developed for surveillance over the sea. The combination of the Forward Looking Infra Red (FLIR) system and a Search Radar allows this aircraft to locate and track ships in patrolling the coastline. The Automatic Identification System (AIS) and the Fully Integrated Tactical System (FITS) help make this aircraft the ideal tool to carry out military surveillance missions for the Mexican Navy. The FITS was entirely developed by Airbus Military and ensures that the extensive data gathered by the aircraft's on-board sensors can be used by the crew to execute their mission.

7 more P-8A Poseidon for US Navy

Boeing has received a \$1.7 billion low-rate initial production (LRIP) award from the US Navy for seven additional P-8A Poseidon maritime surveillance aircraft. LRIP-II is the follow-on to an initial LRIP-I contract awarded in January to provide



six Poseidon aircraft. Overall, the Navy plans to purchase 117 Boeing 737-based P-8A anti-submarine warfare, anti-surface warfare, intelligence, surveillance and reconnaissance aircraft to replace its P-3 fleet.

As part of the contract, Boeing will provide aircrew and maintenance training for the US Navy beginning in 2012, in addition to logistics support, spares, support equipment and tools. The training system will include a full-motion, full-visual Operational Flight Trainer that simulates the flight crew stations and a Weapons Tactics Trainer for the mission crew stations.

Boeing completed assembly of the first LRIP-I aircraft at its Renton, Wash., facility in mid 2011, which subsequently completed a successful first flight on 7 July 2011, from Renton Field to Boeing Field, which marked its transition from fabrication and assembly to mission system installation and checkout in Seattle.

Algeria receives Yak-130s

The Algerian Air Force will procure a batch of Yak-130 trainer-combat aircraft, with the first delivered in end 2011. "Algeria has ordered these state-of-the-art trainer-combat aircraft to have high-quality training of Su-30MKI(A)'s pilots", with both types manufactured at production facilities of IRKUT Corp. According to a company spokesman, "Russia has taken the lead over its main competitors on a wide market of subsonic jet trainer-combat aircraft for advanced training. An expected growth of the market is reasoned by the fact that the trainers of previous generation (such as the British Hawk) lag behind in characteristics for "4+" and "5" generation combat aircraft".



Russian Air Force requires "more than 250 Yak-130s"

The Russian AF envisages procurement of considerable numbers of Yak-130s, assessed as 250- 300 aircraft. Alexei Fedorov, CEO of Irkut, opines that enhancement of the Yak-130's combat capacity "will seriously expand its market". Many countries involved in local conflicts or anticipating such problems, are keen to have this attack aircraft, which is armed with three tons of armament and capable of guided weaponry. The Yak-130 can carry laser-guided bombs and rockets. Yak-130 is also armed with the R-73 short-range guided missiles with up to 20 km range of engaging targets. For enhancing the Yak-130's armoury an optional optic-electronic aiming system is being considered, which will enable the use thermal-imaging and laser weaponry. According to Mr. Fedorov, an airborne radar may be installed in the next stage of the trainer's development. Combat capabilities of Yak-130 could be enhanced by installing an in-flight refueling system. Experts believe that such 'light combat aircraft' will be in demand because of increasing low-intensity conflicts and anti-terrorist operations worldwide. Being equipped with modern aiming systems, Yak-130s will be "efficient for fighting helicopters, transport planes and unmanned aerial vehicles."

Pakistan first to acquire Brazilian MAA-1B

Pakistan will acquire the Brazilian Mactron MAA-1B Piranha short-range infrared-guided air-to-air missiles for arming its PAC/Chengdu JF-17 fighters. In 2010, Pakistan had taken delivery of several MAA-1A versions of this missile and had signed a letter of intent to order the more advanced MAA-1B. The current procurement is believed to be for 100 missiles, costing \$108 million, reportedly the first export sale for the MAA-1B, which is currently scheduled for service with the Brazilian Air Force from 2012.

Russia Far East Air Force reinforced

During 2011, the Russian Air Force in the Far Eastern Military District has received almost 100 new or upgraded aircraft, including two new-production Sukhoi Su-30M2 advanced fighters, 46 upgraded Sukhoi Su-27SM fighters and 12 upgraded Sukhoi Su-25SM attack aircraft. In addition are 12 Ka-52 attack helicopters (based at Chernigovka, Maritime Territory), with ongoing crew conversion training and eight new production Mil Mi-8AMTSh helicopters. Two Mi-26T heavy lift helicopters are also scheduled to be delivered along with a further 12 Su-25SMs in 2012.



Final Tiger helicopter to ADF

The Australian Defence Force (ADF) has taken delivery of the last production Tiger Helicopter. Tiger (ARH022) was accepted by ADF at local defence manufacturer Australian Aerospace's Final Assembly plant on Brisbane Airport, the formal hand-over ceremony attended by representatives of the Commonwealth, aviation and aerospace industry executives, senior officers of the Australian Defence Force, and senior management of Australian Aerospace Limited and its parent, Eurocopter.

Acquired under *Project Air 87*, the Tiger replaces ADF's existing rotary-wing force comprising Bell 206B-1 (Kiowa) reconnaissance and UH1-H (Iroquois) gunship helicopters. The Tigers have been deployed with the Army's 1st Aviation Regiment in Darwin, the Army Aviation Training Centre at Oakey in Queensland and at RAAF Edinburgh, in South Australia.

AS350 B2s for Ecuadorian Army

Eurocopter has delivered the first two Ecureuil AS350 B2 of nine helicopters contracted by the Ecuadorian Armed Forces in July 2010 under its extensive modernisation programme. The two Ecureuil AS350 B2s were delivered to the Army Aviation Brigade at La Balvina, Sangolquí in the presence of the Ecuadorian Defence Minister Javier Ponce, the Head of Armed Forces Joint Command Ernesto González, Army Commander Patricio Cárdenas and various other Ecuadorian military officials and Eurocopter representatives.

The Ecuadorian Armed Forces were one of the first armies in Latin America to integrate Eurocopter aircraft into their fleet and now have nearly 30 Eurocopter helicopters, including 2 Ecureuil AS350Bs, 2 A315B Lamas, 2 SA316 Alouettes, 19 SA342 Gazelles and 4 AS332 Super Pumas. The new Ecureuils will replace the Lamas and will be used for army pilot training activities in Guayaquil as well as reconnaissance, SAR and firefighting, among other operations. The AS350 B2 is a light single-engine helicopter with an endurance of 3 hours at 140 knots and a capacity of 4 passengers and 2 crew members. Powered by a Turbomeca Arriel 1D1 engine, the Ecuadorian Army's new Ecureuils are also equipped for night flight and include rescue hoists.

A-29 Super Tucano selected for LAS

The US Air Force has selected the A-29 Super Tucano for its Light Air Support (LAS) programme. The aircraft will be supplied in partnership with Sierra Nevada Corporation (SNC) as the prime contractor and will be used to conduct advanced flight training, aerial reconnaissance and light air support operations.



As specified by the US Air Force, this is a firm-fixed price delivery order contract in the amount of \$355 million for the Light Air Support (LAS) aircraft and associated support. Twenty LAS aircraft will be provided, as well as ground training devices to support pilot training and support for all maintenance and supply requirements for the aircraft and associated support equipment.

Fourth A330 MRTT for the Royal Australian Air Force

The fourth Airbus Military A330 MRTT multi-role tanker transport for the Royal Australian Air Force has been formally handed over. Known as the KC-30A in RAAF operation, this particular aircraft is the only one for the RAAF to have been converted from the basic A330 in Madrid, the others having been converted by Qantas Defence Services in Brisbane, Australia. In RAAF service, the aircraft are equipped with two underwing refuelling pods, the fly-by-wire Airbus Military Aerial Refuelling Boom System (ARBS), and a Universal Aerial Refuelling Receptacle Slipway Installation (UARRSI) enabling it to be refuelled from another tanker. Powered by two General Electric CF6-80E engines, the aircraft are equipped with a comprehensive defensive aids suite (DAS) and fitted with 270 passenger seats.

Saab contracts with FMV on Gripen support

Defence and security company Saab has received an order from the Swedish Defence Materiel Administration (FMV), for continuous operational support of the Gripen. The order amounts to MSEK 127 and includes technical support, product maintenance, flight testing and running simulators for operational support of the Gripen system.

BPD orders the EC120

The Baltimore Police Department (BPD) has ordered four EC120s to replace its current fleet, which are part of a fleet renewal programme and are scheduled to start delivering in summer 2012. "The Baltimore Police Department's commitment to the EC120 showcases the appeal of the platform in the airborne law enforcement community," said Treg Manning, American Eurocopter Vice President of Sales. "The department's current fleet of 120s have provided crucial support for its airborne law enforcement missions and have shown the durability of this airframe."



DRF Luftrettung orders 25 EC145 T2 helicopters

Eurocopter and the German air rescue organisation DRF Luftrettung have ordered 25 helicopters of the newest generation, the EC145 T2, making the air rescue organisation Europe's largest customer for this type of helicopter. With the purchase of these aircraft, the DRF Luftrettung will successively replace the BK 117s in its helicopter fleet. The DRF Luftrettung is to put the first five aircraft into operation in 24-hour air rescue service in the window from December 2013 to the end of 2015.

The remaining 20 helicopters in this order are to be delivered in phases through 2022. All EC145 T2 helicopters ordered by the DRF Luftrettung will be produced in Donauwörth, Germany and delivered to the customer from there following final assembly. The DRF Luftrettung, based in Filderstadt, operates a total of 31 helicopter stations in Germany, Austria and Denmark, eight of them on 24-hour alert.

15th MRH90 delivered to ADF

Australian Aerospace have delivered the 15th MRH90 to the Australian Defence Force (ADF) following signing of an agreement to overcome programme issues and ensure timely delivery of the world's most advanced helicopters. Australian Aerospace's production facility at Brisbane Airport is assembling and delivering 46 MRH90s to replace Army and Navy Black Hawk and Sea King helicopters.

With a range of 900 km, with 2 pilots, 2 loadmasters and 18 combat troops at speeds in excess of 300 km/h, the MRH90 is a fly-by-wire, all-composite construction, medium-lift helicopter with the highest crash-worthiness standards, considered "the world's most advanced helicopter in the ten-tonne class".



Six additional CAE P-8A operational flight simulators

Boeing has ordered six additional P-8A Poseidon operational flight trainers (OFTs) from CAE for the United States Navy. CAE will manufacture the simulators as well as develop a suite of P-8A Aircraft Equipment enhanced Desktop Environment (AeDTE) trainers, which will be used as role playing stations during training of P-8A aircrew. The P-8A OFTs and AeDTEs are part of a recent contract awarded to Boeing to support low rate initial production lot two (LRIP-II) of the P-8A multi-mission maritime aircraft.

The US Navy plans to acquire 117 P-8A aircraft to replace its current fleet of P-3C Orion aircraft while the Indian Navy, first international customer for the P-8, has ordered eight P-8I aircraft.

Six EC145s for Kazakh

Eurocopter delivered the first of six EC145s ordered by the Kazakh Ministries of Defence and Emergencies. A total of 45 of the helicopters are to be purchased, which will be assembled by the new joint venture Eurocopter Kazakhstan Engineering, in which Eurocopter and Kazakhstan Engineering have a 50/50 share.



300th Raytheon AESA delivered

Raytheon Company have delivered its 300th active Electronically scanned array APG-79 radar to Boeing for integration on the US Navy's F/A-18E/F Super Hornet and EA-18G Growler, including 24 AESA systems delivered to the Royal Australian Air Force for the F/A-18 Super Hornet.

"The APG-79 radar continues to deliver enhanced situational awareness for aircrew and unparalleled fighter combat proficiency for our domestic and international customers," said Mark Kula, vice president, Tactical Airborne Systems for Raytheon's Space and Airborne Systems business.

US Navy order C4ISR services

BAE Systems has received a \$132 million US Navy task order to provide C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) technical services for military operations around the world. The company will conduct maintenance, upgrades, logistics, training and sustainment support for various equipment, sensors and systems. These services will be performed on military structures, vehicles, ships and small boats.

The award, from the Navy's Special Communications Requirements Division, is a continuation of work BAE Systems has been performing for more than 25 years. In many cases, employees deploy overseas and are embedded with Special Operations Forces or other military units to ensure their readiness.

VIRGILIUS system for AW101 CSAR

The VIRGILIUS system, produced by Elettronica S.p.A., has been selected by the Italian Ministry of Defence to protect the Combat Search And Rescue (CSAR) version of the AW101 helicopters, following their procurement by the Italian Air Force. The contract will allow equipping of 11 CSAR AW101 helicopters with ELT's latest generation of defence systems based on the Virgilius ESM (Electronic Support Measures) configuration that also includes the Radar Warning Receiver function.

The VIRGILIUS system is a fully integrated EW system designed to increase the operational performance of single and combined active/passive equipment (RWR / ESM, ECM) through the intelligent coordination (EW Management) of shared resources, featuring a multithread capability and minimising installation impact on platform.

7,000th Airbus is an A321 to US Airways

Airbus delivered its 7,000th aircraft (an A321) to US Airways from the Airbus facility in Hamburg, Germany. This milestone comes just two years after the delivery of Airbus' 6,000th aircraft which underlines the continued vibrancy of the commercial aviation sector and the market's clear need for eco-



efficient aircraft. By the end of the 2011, US Airways operated a fleet of 93 A319s, 72 A320s, 63 A321s and 16 A330s. The airline also has firm orders for an additional 58 A320 Family aircraft, eight A330 aircraft and 22 A350 XWBs on backlog.

American Airlines selects CFM

As part of an extensive single-aisle fleet renewal programme, American Airlines have ordered CFM56-5B engines to power their new Airbus A319 aircraft scheduled for delivery between 2013 and 2017. The aircraft order was previously announced in July 2011. Bob Reding, executive vice president of operations for American Airlines said, "The CFM56-5B-powered A319s will provide us with substantial fuel, emission and noise benefits, as well as operating synergies with our existing fleet of CFM6 powered aircraft. We are looking forward to introducing the -5B into our fleet powering our new Airbus A319 aircraft."

Hawaiian Airlines order 5 more A330s

Honolulu-based Hawaiian Airlines has increased its order for Airbus A330-200s, signing for an additional five aircraft. Hawaiian became a new Airbus operator in 2010 and now has a commitment of 22 A330 aircraft, including four that are leased. The airline currently operates five A330-200s.



Rolls-Royce Trent for Thai Airways

Rolls-Royce Trent XWB and Trent 1000 engines will power 12 Airbus A350 XWB and eight Boeing 787 Dreamliner aircraft which are part of Thai's fleet modernisation programme "and will further improve the airline's operational and environmental performance". When these engines are delivered, Thai will be an operator of every member of the Rolls-Royce Trent engine family: the Trent 500, Trent 700, Trent 800, Trent 900 - as well as the Trent 1000 and Trent XWB.

Volaris MoU for 44 A320 Family aircraft

Mexican low-cost carrier Volaris has signed a Memorandum of Understanding for 44 eco-efficient Airbus A320 aircraft, comprising of 30 A320neo and 14 A320 Family aircraft. The order makes Volaris the first airline to order the A320neo in Mexico. Engine selection will be announced by the airline at a later date.

Since starting operations in 2006, Volaris has become one of the top three airlines in Mexico having quickly expanded their network throughout the country and into the United States. The new 44 A320 Family aircraft will support Volaris in their expansion and renewal of fleet. The airline currently operates 33 Airbus aircraft and has a backlog of 15 more.



Turkey's Atlasjet order 15 Bombardier CS300

Atlasjet Havacilik A.S. of Istanbul, Turkey has signed a letter of intent (LOI) to acquire 10 CS300 jetliners and take options on a further five CS300 aircraft.

"There are several reasons why we selected Bombardier's all-new CS300 aircraft," said Murat Ersoy, Chairman, Atlasjet. "The CS300 aircraft has the best economics in its class; it is well suited for our unique operations in hot temperature environments; and, based on its performance and economics, it will return the highest profitability in strategic markets. With its offering of widebody comfort in a single-aisle aircraft, it is the right-sized platform for us."



Qatar order 50 Airbus A320neo and 5 more A380s

Qatar Airways has selected the A320neo as the reference aircraft for expanding its short to medium haul fleet and has increased its order for the A380. The agreement signed at the 2011 Dubai Airshow, is a firm contract for 50 A320neo aircraft and five additional A380s. The A320neo is an option for the A320 Family and incorporates new engines and large 'Sharklet' wing tip devices, which together will deliver 15 percent in fuel savings, representing some 3,600 tonnes less carbon dioxide per aircraft per year.



1,000th RR Trent 700 Engine

Rolls-Royce, along with Cathay Pacific and Airbus celebrated delivery of the 1,000th Trent 700 engine in November 2011. Cathay Pacific was the first airline to operate the Trent 700 in 1995. Since then, the engine, which powers the Airbus A330, has become the largest selling member of the Trent engine family, with more than 1,400 in service or on order.

The Trent 700 has secured more than half the market share overall and more than 75 per cent in the last three years. Its success is the result of a combination of fuel efficiency and environmental performance, with the lowest emissions and noise on the A330.

Air Arabia selects Rockwell Collins' 2nd-gen dPAVES IFE system

Air Arabia has selected Rockwell Collins' second-generation dPAVES(tm) in-flight entertainment (IFE) system for 44 new Airbus A320 aircraft, the first airline in the Middle East to select this system. Rockwell Collins' PAVES family of IFE systems lead the industry with installations on more than 1,600 single-aisle air transport aircraft. This latest version of dPAVES enhances the passenger experience with new levels of information and entertainment content while significantly reducing size, weight, and power consumption.

Russia's NordStar acquires 7 ATR 42-600s

Russia's NordStar Airlines have ordered upto 7 ATR 42-600s (5 firm aircraft and 2 options), the total value estimated at some \$ 132 million. ATR and NordStar had previously announced an order for 2 firm ATR 42-600s plus 2 options, which has now been increased with the 3 additional firm aircraft. This follows an order in 2010 for 4 firm 42-500s plus 3 options.



Five additional ATR 72-600s for Skywest Airlines

Australia's Skywest Airlines will introduce five more ATR 72-600 aircraft into its fleet, to be operated on a range of routes on behalf of major carrier Virgin Australia, these five aircraft taking to 13 the number of firm orders of ATR 72 aircraft placed by the Singapore-based leasing company Avation plc in 2011 for Skywest Airlines: four ATR 72-500s, which are already operating on Virgin Australia's regional network and nine new generation ATR 72-600s, the first of which Skywest will receive in 2012. This new contract for five ATR 72-600s also includes options for eight additional aircraft. Like the ATR 72-500s now operated for Virgin Australia by Skywest Airlines, all of the ATR 72-600 aircraft will fly in Virgin's new white and red colour scheme.



First ATR 72-600 for Caribbean

Caribbean Airlines have taken delivery of its first ATR 72-600 aircraft in Toulouse. The Port-of-Spain-based carrier, which becomes one of the very first operators of the new 'ATR -600 series', booked a \$ 200 million-valued contract for the purchase of a total of 9 of these aircraft, configured with 68 seats and equipped with the new standards of comfort, including in-flight entertainment.



Third Sukhoi Superjet 100 in operation

Aeroflot Russian Airlines have placed its third Sukhoi Superjet 100 aircraft (SSJ100) into service. The airliner, named after the famous Aeroflot pilot Ivan Orlovets, performed its first scheduled flight SU713/714 on the route Moscow – Nizhny Novgorod – Moscow.

The Sukhoi Superjet 100 (MSN 95011) was delivered to Aeroflot under contract with the VEB-Leasing JSC on financial lease (leasing). The aircraft is configured to carry 87 passengers in a comfortable two-class layout (12 - business class and 75 - in economy class). Aeroflot have ordered a total of 30 SSJ100 airliners.



Republic order 80 A320 neo airliners

Republic Airways, the parent company of Denver-based Frontier Airlines, has confirmed orders for 60 A320 New Engine Option (A320neo) aircraft plus 20 A319neo aircraft. Frontier currently operates a fleet of 59 A320 Family aircraft. Republic has selected CFM International's LEAP-X engines for all 80 of their A320neo and A319neo aircraft. The aircraft will also feature large wingtip devices ('Sharklets'). Together, the Sharklets and LEAP-X engines will result in a 15 percent fuel burn reduction, corresponding to an annual carbon dioxide reduction of 3,600 metric tons per aircraft.



Lao Airlines Airbus A320

Lao Airlines, the national carrier of the Lao People's Democratic Republic has taken delivery of the first of two new CFM56-5B-powered Airbus A320 aircraft. The high reliability, long on-wing life and low maintenance costs of the CFM56-5B engine makes it extremely popular with major airlines, low-cost carriers and leasing companies worldwide. "By selecting the CFM56-5B, Lao Airlines is taking significant steps in reducing its operating costs".

Wuhan Helicopter order 3 Eurocopters

Wuhan Helicopter and Eurocopter China have signed an agreement for two AS350 B3e and one EC120 B light single-engine helicopters, for use in utility missions. The three helicopters are the first Eurocopter models to be included in Wuhan Helicopter's fleet and comprise two AS350 B3e and one EC120 B. Intended for utility missions and are scheduled for delivery in the first quarter of 2013.

First ATR 72-600 to Air Lease Corporation

ATR has delivered to the US-based lessor, Air Lease Corporation (ALC) their first ATR 72-600 turboprop aircraft. ALC has ordered 12 ATR 72-600s, with options for 8 additional ATR 72-600s. The delivery of the first aircraft to ALC



comes during a year when ATR has booked a record number of orders for its turboprop aircraft.

Brazil's TRIP Linhas Aéreas, one of the leading carriers in South American regional aviation, will operate this and the next five ATR 72-600s delivered to ALC, expansion of its domestic network to new destinations, as well as adding capacity and more frequent routes in growing markets.

Belorussian and Cuban collaboration

Facilitating co-operation on civil aviation, the Belorussian Ministry of Transport and Communication signed a Memorandum of Understanding with Cuba, which essentially covers work by the Minsk Aircraft Repair Plant on the maintenance, repair and overhaul (MRO) of parts and components for the *Cubana de Aviacion* fleet as well as a range of training activities. The possibility of establishing a joint MRO venture in Cuba will also be considered, along with another opportunity of delivery by the Minsk Aircraft Repair Plant to Cubana of Yakovlev Yak-40 and Yak-42 aircraft with sufficient flight hours remaining prior to requiring overhaul.

First Thai A380 in final assembly

The first Airbus A380-841 for Thai Airways International entered final assembly at Toulouse in France in late November 2011. As seen is the first stage of final assembly, where the front, central and aft fuselage sections, wings, horizontal and vertical tail planes are joined. Thai will take delivery of the aircraft in the third quarter of 2012, becoming the eighth airline to receive the type following Singapore Airlines, Emirates, Qantas, Air France, Lufthansa, Korean Air, China Southern Airlines and Malaysian Airlines. Six have been ordered by Thai.



Defexpo

Ukrainian and Kazakhstani JV to manufacture An-140s

The Antonov State Enterprise of Ukraine and AeroKZ of Kazakhstan have agreed on a joint venture to manufacture An-140-100 turboprops at a newly-built plant in Kamchagay city near Alma Ata. Majority of the investment will be used to set up the factory and construct a runway at the adjacent airfield. Three aircraft are expected to be assembled in 2012, reaching upto eight in 2013 and 12 in 2014. At its full manufacturing capacity, around 20 aircraft will be produced annually. It remains to be seen if these expectations can be met, since the An-140 programme is moving at a slow pace in Ukraine (where the turboprop is built at the Kharkov State Aviation Production Enterprise), Russia (Aviacor in Samara) and Iran (HESA in Isfahan), where final assembly lines have been established but only 17 aircraft produced since 1997.



AW139 for Trento

The Autonomous Province of Trento in Italy has taken delivery of the first of two AW139 medium twin helicopters. The aircraft will be operated by the Fire Fighting Department Aviation Unit based in Trento to perform emergency medical service, search and rescue and disaster relief missions across the Province. The second AW139 is expected to be delivered by end of the year.



JetBlue orders A320neos

JetBlue Airways has finalised its order for 40 A320neo aircraft previously announced at the Paris Air Show in June 2011. (The airline has not yet announced its engine selection for the A320neo order). With this contract, JetBlue also converts 30 of its pre-existing orders for A320s to the larger A321 model with enhanced wingtip devices. In total JetBlue currently has on order 40 A320neo aircraft, 30 A321s and 22 A320s.



Bombardier 415s achieve milestone

The Bombardier 415 amphibian aircraft has reached an important milestone, with over 200,000 hours flown since its entry-into-service. "Given the limited amount of actual specialised flying time per year, it is quite impressive that the Bombardier 415 programme has attained a remarkable rate of 200,000 flight hours during which it has dropped over five billion litres of water," said Michel Bourgeois, President, Specialised and Amphibious Aircraft & Military Aviation Training, Bombardier Aerospace.

Including the recent order from "an undisclosed customer", Bombardier has booked firm orders for a total of 84 aircraft, and to date, 76 Bombardier 415 aircraft are in service with more than 18 operators worldwide. The aircraft is also offered in a multi-purpose version, the Bombardier 415 MP aircraft, for search and rescue, maritime patrol and environmental protection, while maintaining its firefighting capability.



1100th Pilatus PC-12 delivered

Pilatus has delivered the 1,100th unit of its flagship single engine turboprop PC-12. Thomas Bosshard, CEO of Pilatus Business Aircraft Ltd stated, "We are extremely pleased to have the honour of delivering this milestone aircraft to Frontline Aviation. Since its introduction to the market in 1994, the PC-12 programme has greatly exceeded all expectations originally set for it by Pilatus, and we anticipate continued popularity of the PC-12 NG for many years to come."

The versatile PC-12 NG performs many roles worldwide, including executive transport, commuter, medevac, police and border surveillance, cargo transport, military liaison, and regional airliner. The PC-12 fleet has amassed 3.3 million flight hours of operating experience, including thousands of hours in some of the world's harshest environments.

Recaro BL3520 seats for SAS

SAS Scandinavian Airlines have ordered Recaro's BL3520 Economy class seats from the Schwaebisch Hall-based manufacturer. SAS ordered Recaro BL3520 economy class seats in the airline's design for installation in its Boeing B737-800 short-haul fleet, with delivery of the first seats planned for early 2012. After orders from the Lufthansa Group, SAS is the latest Star Alliance member to choose this market-acclaimed Recaro seat.

Recaro Aircraft Seating have managed to significantly reduce the weight of the BL3520 seat unit by three kilograms, making it about 30 percent lighter than comparable models, which helps airlines to lower costs by reducing fuel consumption and carbon-dioxide emissions. Furthermore the BL3520 offers passengers more living space; possible because of a leaner, space-saving backrest combined with patented Recaro solutions including a higher literature pocket. Instead of being placed in the passenger's knee area, it is located above the tray table which ensures "an outstanding level of passenger comfort."



Increased Hawker 400XPR Production

Hawker Beechcraft Corporation Global Customer Support (GCS) have announced plans to increase scheduled production of its Hawker 400XPR aircraft following a sellout of previously planned production. The Hawker 400XPR is a factory-direct aircraft upgrade programme for the Hawker/Beechjet 400 that synergises the aerodynamics of genuine Hawker winglets, propulsion of the Williams International FJ44-4A-32 engine, optional Rockwell Collins Pro Line 21™ avionics and a number of additional system enhancements. Certification of the engines and winglets is expected for the end of June 2012.



GE Engines to power Etihad Boeing 787s and 777s

Etihad Airways has selected the GENx-1B engine to power 10 additional Boeing 787 Dreamliner aircraft and signed a 15-year OnPoint™ solution agreement for the maintenance, repair and overhaul on these GENx engines. Etihad also ordered two GE90-powered Boeing 777 Freighter aircraft.

LEAP-1B-powered 737 MAX

Southwest Airlines has launched CFM International's advanced LEAP-1B engine on the Boeing 737 MAX with a firm order for 150 aircraft. In addition, the airline expanded its current order book with an order for 58 additional CFM56-7BE-powered Next Generation 737-800s. The total engine order is valued at approximately \$4.7 billion, both LEAP-1B and CFM56-7BE engines being produced by CFM International.

LEAP engines incorporate revolutionary technologies combining advanced aerodynamic design techniques, lighter, more durable materials, and leading-edge environmental technologies, making it a major breakthrough in engine technology. As a result, operators of the 737 MAX will achieve 10-12 percent lower fuel burn compared to today's CFM56-powered 737; an equivalent reduction in carbon emissions; a 50 percent reduction in NOx emissions versus current ICAO CAEP/6 requirements; a 75 percent reduction in the aircraft noise footprint; all while maintaining the benefits of CFM's legendary reliability and low maintenance costs.

Tanzania's Precision Air Services order 5 ATR -600s

Tanzanian carrier Precision Air Services have ordered four ATR 42-600s and one ATR 72-600 aircraft. Delivery of the 50-seat ATR 42-600s will start in late 2012. The ATR 72-600 will be delivered in 2014. With this acquisition, Precision Air Services will bring its fleet of ATRs to 14 aircraft, thus becoming the largest operator of ATR aircraft in Africa. The current fleet of ATRs of Precision Air Services includes 5 ATR 72-500s, 2 ATR 42-500s and 2 ATR 42-300s.



AW189 maiden flight

Set to enter service in early 2014, the twin-engine AW189 helicopter is optimised for long range offshore transport and SAR missions. The spacious cabin seats 16 passengers in the standard configuration with an option of higher density layout or an ultra long range 12 seat configuration. In the SAR role the 11.2 m3 cabin accommodates the mission console, stretchers and seating for the crew and survivors. A single or dual rescue hoist is positioned above the large sliding cabin door on the starboard side and a range of equipment including FLIR, searchlight and radar can be fitted.

The cockpit design incorporates the latest in advanced situational awareness technologies which reduce crew workload and enhance safety. The new generation AW189 will meet the very latest international regulatory safety requirements (EASA / FAA Part 29, JAR OPS 3 / EU-OPS).



Thales TopDeck avionics in S-76D

The Thales TopDeck avionics suite to be installed in Sikorsky's new S-76D helicopter will offer new 'click to fly' ability based on a concept never been installed on a helicopter before the Icub-S concept of "Intuitivity, Interactivity, Integration and Safety". The S-76D helicopter is the newest model in the S-76 helicopter series, while TopDeck is an integrated modular avionics suite in a glass cockpit derived from the latest technology.



Several variations of the TopDeck avionics are currently flying onboard the AgustaWestland A109, Boeing's Chinook, and the ATR72 from the ATR consortium.

First Bell 429 with Multi-Mission Configuration

Bell Helicopter has delivered the first Bell 429 with a multi-mission configuration to Fairfax County, Virginia, the first of two Bell 429s being delivered. The multi-role Bell 429 is capable of completing missions for airborne law enforcement, helicopter emergency medical services and search and rescue.



Self Ad 38 years

CAE delivers Falcon 900EX simulator

CAE's Falcon 900EX full-flight simulator (FFS) at the North East Training Centre in Morristown at New Jersey (near New York City) is the world's first FFS equipped with the next-generation EASy II cockpit with Honeywell Primus Epic avionics suite. The CAE training course has received regulatory approval by the FAA and JAA / EASA.



EASy II cockpit display with synthetic vision in CAE Dassault Falcon 900EX full-flight simulator at Morristown, New Jersey.

AgustaWestland GrandNew for Sampoerna

AgustaWestland's GrandNew light twin engine helicopter has been bought by Sampoerna (PT Hanjaya Mandala Sampoerna Tbk.) for transportation of VIPs and many levels of management throughout Indonesia from Sumatra, through Java, to Sumbawa, Flores and Sulawesi. This will be the second GrandNew to be delivered to an Indonesian customer.



10 AgustaWestland Helicopters for Weststar Aviation Services

Weststar Aviation Services of Malaysia has signed a contract for 10 AgustaWestland helicopters comprising five AW139s configured for offshore transport, one AW139 for VIP transport, two AW169s and two AW189s. The contract was signed by Tan Sri Syed Azman Syed Ibrahim, Group Managing Director of Weststar and Bruno Spagnolini, CEO, AgustaWestland, at the Langkawi International Maritime and Aerospace (LIMA) exhibition.

Bristow for six AW189s

The Bristow Group has signed a contract for six AW189 helicopters plus options for additional aircraft, to be used for offshore transport missions. The AW189 was launched in 2011 in response to the growing market demand for a versatile, affordable, multirole helicopter in the 8-tonne class and has rapidly found success in the market place. Set to enter 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 an ultra long range 12 seat configuration.



10,000th Turbomeca Arriel delivered

Turbomeca (Safran group) have delivered its 10,000th Arriel production engine, which will power a United States Army UH-72A Lakota helicopter. EADS North America was awarded the United States Army's Light Utility Helicopter contract in 2006 for 345 UH-72A Lakota twin-engine helicopters powered by Turbomeca's Arriel 1E2. 454 Arriel 1E2 engines have been delivered on schedule for the US Army's UH-72A Lakota. The US Navy has purchased five additional Lakotas for their Test Pilots School.

NH90 development completed

The NH90 programme has reached a major milestone with “declaration of compliance for the NH90 TTH (Tactical Transport Helicopter) variant’s Final Operational Configuration. This marks the NH-90 TTH’s development completion, and enables deliveries to begin in the helicopter’s full operational definition.”

The declaration of compliance was issued by the NATO Helicopter Management Agency (NAHEMA), which is the North Atlantic Treaty Organisation’s function that manages the NH90 acquisition for the participating countries. With this go-ahead, the initial NH90 TTH variant in the final operational configuration is to be received by the French Army, and will be followed by the startup of deliveries in 2012 to Italy, Belgium and Germany.



Bell Helicopter deliveries to Mexico

Bell Helicopter has delivered three Bell 412s and the first Bell 429 to Mexico. The three Bell 412s were delivered to Heliservicio Campeche to support its oil & gas operations in the Gulf of Mexico. Heliservicio currently operates a fleet of 22 Bell 412s, with a total of 31 Bell aircraft, all of which are maintained by Servicio Tecnico Aereo de Mexico, the Bell Helicopter platinum-level Certified Service Facility for Mexico.

AgustaWestland acquires 609 tiltrotor programme

AgustaWestland has acquired the 609 tiltrotor programme from Bell Helicopter Textron, with all legal and regulatory approvals successfully completed. The development of the AW609 tiltrotor programme is now moving forward under full AgustaWestland control with civil certification expected in late 2015, early 2016 and deliveries following immediately afterwards. The first two prototypes have achieved more than 600 flight hours so far and have validated the AW609’s 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.

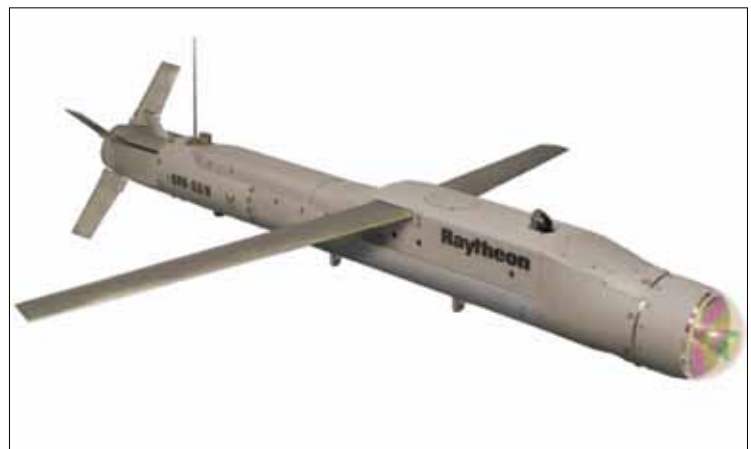


Preliminary orders for approximately 70 AW609s have been placed by around 40 customers in over 20 countries to perform a range of commercial and government roles. The AW609 provides customers with a new way to fly and AgustaWestland expects significant worldwide market opportunities for the aircraft with no aircraft in the market offering similar capability.

Raytheon SDB II warhead tests

The warhead for Raytheon Company’s Small Diameter Bomb II “performed at twice what was required” during a series of recent tests. The test marked the first demonstration of an SDB II warhead built on a fully-automated production line. SDB II is the world’s first weapon capable of engaging fixed or moving targets around-the-clock in adverse weather conditions from a range of greater than 40 nautical miles.

“SDB II is affordable because we designed it to be low cost, producible, and meet government specifications. Harry Schulte, vice president of Raytheon Missile Systems’ Air Warfare Systems, said “We are determined to keep SDB II on cost and ahead of schedule because the warfighter needs, but doesn’t have, an air-launched weapon that can engage moving targets in adverse weather.”



Landmark orders for PurePower Geared turbofan engine

Pratt & Whitney have received orders in excess of 2,000 PurePower Geared turbofan engines while completing more than 1,250 hours and 2,800 cycles of full engine testing for its first two applications. Pratt & Whitney has commitments from 25 airline and lessor customers.

In March 2011, the PurePower engine won the first announced engine selections for the Airbus A320neo aircraft. Shortly after, Airbus named it the lead engine on the company's A320neo, scheduled to enter service in 2015. Since the beginning of the year, Pratt & Whitney has won commitments to power more than 370 firm A320neo aircraft, equating to more than 700 engines.

Cassidian develops "powerful" ground surveillance radar

Cassidian have developed "the world's most powerful radar for battlefield surveillance" for use by the German Armed Forces. With a combination of the latest technologies, this ground surveillance radar under the German Army designation *Bodenüberwachungsradar* (BÜR) can track movements on the ground, in the air close to the ground and over water, with previously unattainable precision, speed and reliability.



The BÜR system is based on the latest electronic scan control technology AESA (Active Electronically Scanned Array), which creates new possibilities for detection and surveillance. Because of the electronic beam scanning, the radar can perform multiple reconnaissance tasks simultaneously, thus achieving a much greater level of efficiency and reliability in comparison to mechanically scanned radars. Each BÜR system assumes the tasks of several conventional radars.

"Significant progress" in GE38 qualification programme

GE have reported significant progress in the GE38 engine qualification programme to meet United States Navy requirements for the Ship-to-Shore (SSC) project at an affordable cost. Nearly 1,000 hours have been completed during GE38 factory engine testing under the US Navy's Heavy Lift Replacement System Development and Demonstration programme. The first of 20 flight test engines will be installed on the first CH-53K ground test prototype helicopter, the latest variant in Sikorsky Aircraft Corporation's CH-53 series, being developed for the US Marine Corps heavy-lift mission. In addition to the operation of these 20 flight engines, the GE38 testing programme includes five factory-test engines that will accumulate more than 5,000 engine test hours by 2013.

Saab Carl-Gustaf for the US Army

Defence and security company Saab has signed a contract with the US Army for the company's Carl-Gustaf man-portable weapon system, which marks the first time the Army has bought the 84mm recoilless rifle system. The Army and US Special Operations Command placed a combined order with a total value of \$31.5 million. The Carl-Gustaf system has along and successful history and has successively been modernised and adapted to meet new requirements. A true multi-role, man-portable shoulder-fired weapon, the system is in use in more than 40 countries worldwide. With the Carl-Gustaf M3 version, "Saab offers state-of-the-art capability for demanding customers investing in the future."



Northrop Grumman LITENING AT system with RAAF

Northrop Grumman Corporation has been awarded a four-year extension by the Royal Australian Air Force to the existing support contract for the LITENING AT system, used as the RAAF's Target



Designation System for F/A-18 Hornet aircraft (HTDS). The contract extension valued at approximately \$8 million provides for in-service support for the targeting pods and data links through to September 2015. Over 550 LITENING pods have been delivered to date and integrated on a wide variety of aircraft including AV-8B, A-10A/C, B-52H, EA-6Bs, F-15E, F-16 and F/A-18, LITENING is in operation with the U.S. Air Force, Air National Guard, Air Force Reserve Command, the US Marine Corps, the Italian and Spanish navies, the Israeli Air Force, the Royal Netherlands Air Force, the Finnish Air Force and the Portuguese Air Force, in addition to the RAAF.

Safran and Thales in optronics partnership

Thales and Safran have signed a Memorandum of Understanding to create an equally-owned joint venture for optronics (electro-optical) systems and equipment. Through this joint venture Thales and Safran will combine their respective areas of expertise in optronics and expand their offering of products and services to cover emerging needs for new defence systems, including both modernisation programmes and original equipment. The new systems under consideration include the optronics pod for the modernised Atlantique 2 maritime patrol aircraft, the imaging system for the upcoming French-British MALE (medium altitude, long endurance) drone, modular optronics systems for army land vehicles and optronics for tomorrow's helicopters. The partnership will be in the form of a joint venture covering technical, commercial and programme aspects, with the industrial assets remaining under the control of the two parent companies.

DCNS to build two BPCs for Russia

Design for the BPC-type force projection and command vessels ordered by the Russian Federation is now underway with DCNS, prime contractor for the programme, beginning with studies to tailor the vessel design to specific requirements of the Russian Navy. Signed in June 2011, the BPC contract with Russia is DCNS's first international success with the BPC platform, involves delivery of two *Mistral*-class force projection

and command vessels, also known as landing helicopter docks or LHDs. It also includes related services (initial logistics, training, etc.) and a transfer of technologies. The programme is now underway with design studies to tailor the vessel for Russia's specific requirements. The two BPCs will be largely identical to the *Mistral*/BPC-type vessels operated by the French Navy.

The Russian version will be adapted to accommodate Kamov Ka-28 twin-rotor helicopters and equipped with specific systems including anti-ice protection for the flight deck to cope with extremely cold conditions. The electrical systems will also be adapted to meet Russian standards. Following the design phase, construction will begin in the first half of 2012 at STX shipyard in Saint-Nazaire (France).

New Saab airborne ECM dispensing system

Defence and security company Saab, supplier of Electronic Warfare self-protection systems has introduced BOH, a new highly effective countermeasures self protection pod for use on any fixed wing aircraft.

BOH is an implementation of the Saab BOL Countermeasures Dispenser System (CMDS) and Compact Integrated Defensive Aids Suite (CIDAS) into the shape of a missile. The BOH is modular and can be arranged in a multitude of configurations to provide covert sustainable pre-emptive dispensing, missile warning, forward firing of flares and cocktail dispensing. All these capabilities have been incorporated into the form-factor of a missile utilising the well established AIM-9 Sidewinder and AIM-120 AMRAAM interfaces and characteristics for lean aircraft integration.

Y-9 Maritime Patrol version revealed

Latest images of a maritime patrol aircraft (MPA) variant of the Shaanxi Aircraft Industries Company Y-9 were revealed on the internet in November 2011. The aircraft may be referred to as the Y-8Q or Y-8GX-6 (Gaoxin-6, 'New High 6'), the Y-9 being a variant of the earlier Y-8. Differences from the Y-8 airframe include a redesigned wing, pressurised cabin and 5,100shp WJ-6C turboprops with six-bladed JL-4 composite propellers. The MPA variant features a large radome under the nose (presumably housing a sea search radar) and an electro-optical turret under the forward fuselage, in front of a large weapons bay ahead of the main undercarriage sponsons. A long magnetic anomaly detector (MAD) is mounted under the vertical tailplane. At least two MAD-equipped Y-9s are depicted in the picture released, which seems to have been taken at Shaanxi's factory airfield.



Peru to participate in KT-1 Production

On 23 November 2011, the Peruvian Defence Minister Daniel Mora announced that the country was negotiating to produce parts of the Korean Aerospace Industries KT-1C Woong Bee turboprop trainer, as part of a forthcoming deal to acquire the aircraft. The *Fuerza Aèrea del Perú* (FAP) or the Peruvian Air Force is keen to replace the Embraer EMB-312 Tucano with either the EMB-314 Super Tucano or KT-1C, although recent interest has largely favoured the Korean aircraft.

Meanwhile, it is learnt that KAI have offered \$1 billion in industrial co-operation programmes as an incentive for Israel to select its T-50 Golden Eagle advanced jet trainer, which is in competition with the Alenia Aermacchi M346 Master.

UAE in THAAD contract

Lockheed Martin have received contracts worth \$1.96 billion to produce the Terminal High Altitude Area Defence (THAAD) Weapon System for the Missile Defence Agency and the United Arab Emirates. The contract is the first Foreign Military Sale (FMS) of the THAAD Weapon System and includes the production of two THAAD Weapon Systems and additional maintenance and support equipment.

Lockheed Martin is currently under contract for four THAAD batteries for the US Army. The THAAD missile defence system has operational flexibility to intercept in both the endo- and exo-atmospheres to provide versatile capability.



Raytheon's UAE THAAD contract

Raytheon will provide AN/TPY-2 radars, associated spares, training and other services through 2018 to the United Arab Emirates (UAE) as the radar component to the Terminal High Altitude Area Defence (THAAD) missile defence system. This \$582.5 million contract for the radars is part of the THAAD missile systems sale to an international customer. The radar searches, detects, tracks and discriminates threats from non-threats and then delivers data to the THAAD's fire control and communications element for engagement.



Cassidian's SPEXER 2000 coastal radar

As part of Cassidian's SPEXER security radar family, the new SPEXER 2000 Coastal was launched during the 2011 Langkawi International Maritime and Aerospace (LIMA) exhibition. "SPEXER 2000 Coastal is the worldwide first security radar using the latest radar technology of Active Electronically Scanning Array (AESA) which provides a multi-tasking and multi-mode capability and increases the detection and target assessment capability substantially", explained Elmar Compans, Head of Cassidian Sensors & Electronic Warfare.

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. Due to a unique signal processing architecture, the SPEXER 2000 Coastal is able to reliably detect sea, land and air targets. Hence, in case the scenario makes it necessary, the deployment of different sensors for simultaneous land and sea surveillance is not necessary any longer. In addition, a camera can be cued to the radar in order to identify suspicious objects. This ensures a superior surveillance performance and a high level of situational awareness providing security forces in a littoral environment with additional reaction time towards illicit intrusions.





The first RAF Voyager arrives at RAF Fairford in July

Voyager Underway At Cobham

Richard Gardner reports on Cobham's role in converting A330-200s into Voyager tanker/ transports for the RAF.

In the competitive world market for aerial tankers, the Airbus Military A330-200 MRTT is currently the largest and most capable in production. An increasing number of global customers prefers the combination it offers of advanced airframe, fuel efficient engines, massive fuel capacity, and additional fuel-tank free cabin space that can accommodate nearly 300 troops or a large amount of cargo. But the key to the success of the A330 MRTT (Multi-Role Tanker Transport) is the use of state-of-the-art air refuelling systems that offer safe and fast delivery to up to three receiver aircraft at once, at extended distances, or topping up multiple numbers of combat aircraft with fuel during many hours on station. No other tanker in production or at the planning stage, offers such operational flexibility. The A330 MRTT is now cleared for military and civilian operation and is being delivered to air forces as replacement for ageing tankers. But not only is this new aircraft now available as a low-risk tanker, after extensive development and trial evaluations and tests, it is also emerging as a most effective force multiplier, offering the option of acting as a strategic air transport with additional potential for use as an ISR platform. It is just at the start of what is expected to be a 40 year service life.

The military launch customer for the Airbus A330 MRTT was the UK's Royal

Air Force, though the first deliveries were made to the second customer, the Royal Australian Air Force. This resulted from the fact that the RAAF order was a straightforward direct procurement purchase while the UK order was a much more elaborate Private Finance Initiative in which the RAF pays for tanking and air transport missions as required with the aircraft owned and managed by the Air Tanker consortium. The RAF retains responsibility for all military missions and crews and support personnel are a mix of uniformed military and civilian personnel, including reservists. The RAF only uses the hose and drogue method of

flight refuelling, though the Australian tanker is fitted with a remotely controlled fly-by-wire refuelling boom, which is compatible with US Air Force aircraft. All A330 tankers have two hose-and-drogue refuelling pods beneath the wings.

The UK company Cobham, which is the world's oldest specialist aerial refuelling specialist supplier, and has delivered all the RAF's previous air-to-air refuelling systems, has now taken over responsibility for rebuilding the Airbus A330-200 airframes into Voyager tanker transports and in September opened a new FSTA conversion centre at Hurn, near Bournemouth, UK. Des Taylor, Managing



The third aircraft in the new Cobham conversion facility (all Richard Gardner photos).



Director Cobham Aviation Services, set the scene for the official opening event at Hurn. “We see this new facility as the programme’s maternity ward,” he said, “In this case we will take a standard Airbus A330-200 from the Toulouse production line and give it the special modifications it needs, ready to be delivered fully fitted out and tested and ready for introduction into service.” The first two aircraft in the Air Tanker fleet of 14 were converted in Spain at Getafe, Madrid, by Airbus Military, with a large contingent from Cobham working alongside their European partners over the last two years. With the flight testing and receiver clearance trials now nearing completion at Boscombe Down, and the second aircraft being prepared for delivery to Air Tanker, the UK conversion programme has now transferred to the new Hangar H12 complex at Hurn, where two A330s can be converted side-by-side. This new facility has created over 100 new skilled direct jobs, with many more indirect jobs to be created and sustained into 2016.

The Conversion Programme at Cobham consists of nine stages: removals; structural and support changes; system installation and equipping; hangar ground testing; ground tests (outside hangar); flight line; finalise refurbishment; customer acceptance and delivery. The aircraft seats (and in-flight entertainment systems) are

removed at the first stage, along with the cockpit fittings and all the cabin interior fittings and panels. This, and the very large underfloor cargo holds, provide good access for the fitting of the new fuel pipes and electrical wiring, as well as the centre-line refuelling units, which are fitted in the lower rear fuselage. There is much wing work required to take the two Type 905E AAR pods, even though there is already some built-in structural strengthening at the mounting positions thanks to the similarity between the shared wing design of the A330 and A340. Finally, when all the modifications and additions are in place, the aircraft seats are re-fitted. The tanking capacity of the aircraft is such that, unlike the VC-10s and TriStars it is to replace, there is no need for additional fuel tanks to be carried. Every one of the 14 aircraft on order will carry two 905E underwing refuelling pods, but only seven will carry the 805E fuselage AAR units, making these three-point tankers. These Cobham-designed and manufactured refuelling pods are the world’s most advanced, with added safety features and high performance, catering for transfer speeds of between 180-325 kts, enabling a very wide range of aircraft types to be refuelled. Cobham has a new flight refuelling ground-based test facility and this has been used to de-risk the latest refuelling systems to

be used on the Voyager. The 905E wing pod refuelling units deliver a flow of 1,600 litres per minute, while the central fuselage mounted 805E unit delivers 2,300 litres per minute and is intended for use with refuelling larger aircraft, such as the A400M. In both units the hose length is 90ft.

At the opening ceremony, Sr Javier Matallanos Martin, Senior VP CEO Office at Airbus Military, outlined in more detail some of the many facts and figures associated with this programme. He said the Voyager has more than 10 tons of military equipment onboard. There is over 60km of additional wiring, with 450 new cable looms and 30 additional antennas. A completely new military console is added in the cockpit for the tanking role, along with the enhanced vision system, which includes a set of CCTV cameras and special lighting and the AAR wing and fuselage refuelling units, plus military defensive aids and communications.

Mr Phillip Blundell, Chief Executive of Air Tanker, which is responsible for this 25-year PFI deal, reminded the audience that this innovative programme was not just about the aircraft, but represented an enormous commitment which also included a new training school and two-bay hangar at RAF Brize Norton, and the ongoing sustainment of the capability in partnership with the MOD and the



Close-up of the underwing refuelling pod and the fuselage mounted 805E refuelling delivery unit.

Royal Air Force. He said that not only would the aircraft be an outstanding tanker, but it would perform an essential transport role as well, including that of aero-medical ‘flying ambulance’. He said that the first Voyager would enter service at Brize Norton in late 2011, initially in the strategic air transport role, where it was urgently required for demanding air bridge trooping and freight flights from

the UK to operational theatres. The type would also take over regular long-range military transport flights between the UK and Cyprus and the Falkland Islands.

Officially opening the new centre, Air Marshal Kevin Leeson, Chief of Materiel (Air), expressed his enthusiasm for the new arrival, which he said was bringing a “crucial new capability” to the RAF. The VC10s had been in RAF

service for over 40 years and the TriStars for nearly 30 years, thus the new order of reliability and payload that was about to arrive would transform what the RAF could do. He said no other tanker could carry so much fuel to give away and also carry 291 fully equipped troops and freight. A Voyager could accompany four Typhoons topping them up with fuel for over 3,600 miles, or it could maintain a refuelling position for four and a half hours at a distance of 1,000 miles with 50 tons of fuel to be off-loaded to receivers. With a payload of 20 tons, equivalent to 200 passengers, the Voyager has a range of 6,400 nautical miles. Total fuel capacity is 245,000lbs.

The first Voyager will start to operate in the tanking role in late 2014 with the full fleet in place in mid 2016. The 9 dedicated RAF Voyagers will carry the full defensive aids suite to carry out their dual tanker/transport role and will be available in full military configuration. Any aircraft with a standard NATO refuelling probe should be able to take fuel from a Voyager, but the types to be officially qualified include the Typhoon, Tornado, C-130, A400M, E3D Sentry and F/A-18. In a phased receiver clearance programme RAF Typhoons will follow the Tornado GR4 trials and other probe-equipped RAF and NATO aircraft will be cleared as the programme rolls out.



RAF Voyager landing. The conversion includes extensive military communications and self-defence equipment fitted in addition to refuelling units.



Aeroplanes in the sun



The Bell-Boeing V-22 Osprey over Dubai city.

1 2th edition of the Dubai Air Show was inaugurated on 13 November 2011 by Sheikh Mohammed bin Rashid Al Maktoum, Vice President, Prime Minister of the UAE and Ruler of Dubai. The show got off to a great start with orders for airliners valued at US\$26 billion being announced on the very first day.

Boeing and Emirates Airline formalised an order for 50 Boeing 777-300ER (Extended Range) aircraft, plus options for an additional 20, which, with a value of US\$26 billion, making it the



The third Boeing 787 Dreamliner, ZA003, made its Middle East debut at Dubai 2011.

and sand



single largest commercial aircraft order in Boeing's 95 year history, in dollar value. The Emirates Boeing 777-300ERs will be powered by the GE90-115B and the airline has also signed a 12-year OnPoint solution agreement for the maintenance, repair and overhaul of these newly ordered engines. The engine order list price and service agreement is valued at approximately \$6 billion (USD) over the life of the contract.

The UAE Royal delegation also inspected aircraft on static display, including the Boeing C-17 of the UAE

Armed Forces, the Black Hawk helicopter of the UAE Presidential Guard, the Boeing 737-800 of *flydubai* and the Boeing 787 Dreamliner. Jeff Johnson, President Middle East, Boeing, said: "The UAE has received four C-17s this year, providing it with new strategic capabilities in both defence and humanitarian operations."

the Show (50 A320neo and five A380s) worth US\$6.4 billion. Firm orders for the A320neo from ALAFCO (50) and ACG (30) worth a combined US\$7.3 billion demonstrates the A320neo's strong investment appeal by lessors. Spirit Airlines made the largest commitment at the show for 75 A320 Family aircraft (30



Airbus too had a great show, with a total of 211 aircraft ordered plus commitments worth US\$20.5 billion, underlining the outstanding demand for its A320neo. The order intake includes 135 firm orders worth US\$13.7 billion (130 A320neo and five A380s) and 76 memorandum of understanding (MoU) worth US\$6.8 billion.

However, it was Qatar Airways that placed the single largest firm order at

A320 with sharklets and 45 A320neo) worth US\$6.7 billion.

Republic Airways Holdings meanwhile finalised a \$2 billion order for CFM International's advanced LEAP-1A engines to power 20 Airbus A319neo and 60 Airbus A320neo aircraft. At the same time, the airline has also signed a Rate per Flight Hour (RPFH) agreement with CFM to support at total of 172 LEAP-1A engines.



Royal Air Force Typhoon multi-role fighters flew across the skies of Dubai showing-off their capabilities including agility and speed. The aircraft had just taken part in joint exercises involving the Emirati and other international allies and whilst in the region marked its presence at the air show.

The Typhoon flew along the coast of Dubai, over the Atlantic Palm, the World islands and then on to Abu Dhabi where both the fighter and the camera-ship C-27J Spartan circled over the bold red of Ferrari world, the Emirates Palace and the spectacular Sheikh Zayed Grand Mosque. The Typhoon was piloted by Squadron Leader Bolton of the Royal Air Force.

Under the terms of the comprehensive services and support agreement, which is valued at approximately \$3.9 billion over its 18-year term, CFM will guarantee engine maintenance costs on a dollar per engine flight hour basis.

Rolls Royce won several orders which were announced at Dubai and included those by Saudi Arabian Airlines

cabin, high-speed G150, the large-cabin, long-range G450 and the large-cabin, ultra-long-range G550. Gulfstream also conducted a regional Operators' Forum on 14 November 2011 to provide updates and technical presentations on maintenance and operational subjects relevant to Gulfstream operators in the Middle East.



Flight deck of Bombardier's CSeries.

From Canada was brought a full - scale flight deck demonstrator for the all-new CSeries aircraft to make its world debut at the Dubai Air Show and visitors to the Bombardier CSeries aircraft dome experienced "the most advanced flight deck demonstrator in the industry".

"Step-by-step, the CSeries aircraft advances towards its first flight. The state-of-the-art flight deck demonstrator shows the progress we're making. Resulting from a clean-sheet design, the CSeries aircraft flight deck leverages the full spectrum of Rockwell Collins and Bombardier's avionics design heritage," added Mr. Robert Dewar, Vice President and General Manager, CSeries, Bombardier Commercial Aircraft.

CAE announced receipt of a contract from Emirates airline for two full-flight simulators (FFSs), one for the Airbus A380 aircraft and one for the Boeing 777. Emirates is the world's largest operator of both aircraft types. The contract is worth a total of more than \$34 million at list prices, and brings the total number of FFS sales that CAE has announced to date during fiscal year 2012 to 21.

The Boeing 777 FFS will be delivered to Emirates' training facility in Dubai in the first half of 2013. The A380 FFS will be delivered in the second half of 2013.

which ordered Trent 700s for up to eight A330s while Garuda Indonesian Airlines ordered Trent 700s to power four A330s, in addition to the six they ordered last year. All these orders are covered by TotalCarea long term service support agreements. Rolls-Royce has now received orders for over 1,400 Trent 700 engines.

Oman Air selected the Trent 1000 to power six Boeing 787 Dreamliner aircraft. The Trent 1000, which is "the quietest and most efficient" engine for the 787 Dreamliner, has been selected for eight of the last nine engine competitions and last month powered the first 787 Dreamliner commercial flight with All Nippon Airways (ANA). Rolls-Royce also won a share of an order from Thai Airways International for V2500 engines to power five purchased and six leased Airbus A320 series aircraft.

Gulfstream Aerospace Corp. displayed three of its business jets at the Dubai Airshow including the wide-



Sheikh Mohammed bin Rashid Al Maktoum overseeing the \$26 billion order on Boeing. From left: Jim Albaugh, President and CEO of Boeing Commercial Airplane; Sheikh Ahmed bin Saeed Al Maktoum, Chairman of Emirates Airline & Group and David Joyce, President and CEO of GE Aviation.

Helicopters at the Dubai Air Show

Eurocopter exhibited five of their helicopters at the Dubai Air Show: the NH90, EC725, EC175, EC145 T2, and AS350 B3.

The NH90 and EC725 are targeting the Middle East's evolving requirements for helicopters in maritime surveillance,

aircraft provide a mission-ready family for the full range of operational scenarios in the market", according to the company.

Eurocopter's EC175 is "the world's newest medium twin-engine helicopter, designed from the start for demanding airlift missions in support of the offshore oil and gas industry with deliveries to

incorporating new Arriel 2E engines, along with the company's Fenestron shrouded tail rotor, upgraded main and tail rotor gear boxes, new digital avionics suite and a 4-axis autopilot.

Also included in Eurocopter's static display at the Dubai Airshow was an AS350 B3 operated by *helidubai*, which is equipped for such multi-role operations as filming, emergency medical airlift, scenic flights and VIP transport. As part of the AS350 B3's participation in the Dubai Airshow, an aerial tour movie of Dubai filmed by *helidubai* at day and night was screened on the Eurocopter exhibit stand.

Bell Helicopter, a Textron Inc. company displayed the Bell 429, Bell 407AH as well as the Bell/Boeing V-22 Osprey tiltrotor, the first time on a public display in the Middle East. The Bell 429 is "the world's newest light twin helicopter. It features a state-of-the-art glass flight deck and the largest cabin in its class". Introduced earlier this year, the Bell 407AH is a Bell-qualified armed commercial aircraft designed to support a wide range of law enforcement and paramilitary missions worldwide. The Bell 407AH comes equipped with a baseline law enforcement package that can be customised with multiple weapon configurations.

AgustaWestland, a Finmeccanica company announced that the AW139 medium twin helicopter fleet operated by Gulf Helicopters of Qatar have achieved the 20,000 flying hours milestone. Gulf Helicopter is one of the largest AW139



The NH 90 in demonstration flight

anti-piracy, security, search and rescue, border patrol and transport duties. "Along with the AS565 Panther, these rotary-wing

international customers beginning in end 2012" while the EC145 T2 is an evolved version of the twin-engine EC145,



Dassault Rafale taxis past Emirates Boeing 777 at the Dubai Air Show

operators worldwide and a prime player in the Middle East with 12 helicopters of this type already in service and five more to be delivered. Gulf Helicopters first ordered the AW139 in 2007 as part of its fleet renewal and expansion plans and the aircraft has been performing offshore transport missions.

The flying display

As part of the celebrations, the UAE's own aerobatic team, *Al Fursan* opened the daily flying display with the Alenia Aermacchi MB399 aircraft (see picture). It was joined by a number of military and commercial aircraft, plus the Patrouille de France aerobatic team, flying Alpha jets.



The PAF brought the JF-17 Thunder to the Show, this example being from No.16 Squadron 'Black Panthers'.



PAF K-8 Karakoram basic jet trainer comes into land at Dubai.

Interview with

Alexei Fedorov, President Irkut Corporation at the Dubai Air Show 2011



Alexei Fedorov, President of Irkut Corporation in a MC-21 aircraft development cockpit

What are perspectives of Irkut Corporation in markets of the Middle East and North Africa?

These markets are of priority for us. Irkut Corporation have the experience of long-term and fruitful cooperation; with Algeria where Su-30 MK multi-functional fighters are successfully operational with the Algerian Air Force. The initial contract was signed in 2006 and completed by Irkut two years ago. Being satisfied with outstanding characteristics of the fighter, Algeria ordered another batch in 2010.

The Algerian Air Force will get Yak-130 advanced jet trainers manufactured at Irkut's plant in Irkutsk-City in Russian Siberia. Algerian pilots have much experience of flying the trainer and really like it. Our expectations on further development of cooperation with the region are strongly focused on the Yak-130.

What opportunities do you see for the Yak-130 in this region?

The Yak-130 is a subsonic combat trainer of the new generation and in this aspect is the first in the world. It differs from trainers of previous generation by its capacity to provide a full-scale training of pilots for fighters of "4+" and "5" generations. The trainer matches them in its manoeuvrability, thrust-to-weight ratio, capability of flight at high angle of attack, IT software in the pilot's cockpit

The Russian Air Force has received the first batch of Yak-130, now being used for comprehensive training of future pilots. The Russian Air Force's development programme visualises acquisition of really large numbers of this trainer.

Our main efforts currently are on expanding markets for Yak-130s. A major focus is on increasing its combat capabilities. The trainer is capable of carrying up to three tons of weaponry, both conventional and guided.

For enhancing the Yak-130's armoury, we are considering the optic-electronic aiming system as an option. The next step is the installation of radar. After these developments, the Yak-130 trainer will be fully capable to fulfill its role both training and combat.



Algerian Su-30MK.

We realise that many countries worldwide, including in this region, are inclined to have this type of aircraft in their inventory. It is capable of undertaking important combat tasks including fighting against terrorism, destruction of low-speed aerial targets and pinpoint targets on ground.

Irkut has gained recognition worldwide mainly because of the Su-30MKI fighter. Can you please elucidate developments in this aircraft?

contract with the Russian MoD. This project is being undertaken by us jointly with the Sukhoi Design Bureau. To meet requirements of the Russian Air Force, elements of on-board systems will be replaced by customised items.

Besides, we also expect major deals for modernisation of Su-30MKs delivered earlier. So, a programme on modernisation of the Indian Air Force Su-30s is being formulated and with upgradation of the on-board systems, the fighter's combat performance will be considerably

enhanced. The Indian Air Force is also planning to integrate BrahMos supersonic missiles in the Su-30MKI. The result will be a unique weapon system, with formidable capability against combat vessels of all classes.

The Su-30MK programme will continue to develop for a long time ahead. However, without decreasing the volume of its military hardware production, Irkut Corporation will increase the manufacturing of civil aircraft.



The Yak-130

Focus on Malaysia



MiG-29s of the RMAF's No.17 Squadron line up for formation take off at Langkawi

That 'other' M-MRCA competition dominates!

The ongoing Malaysian multi-role combat aircraft (also M-MRCA, an acronym very familiar to Indian readers) competition added zest to the Langkawi International Maritime and Aerospace (LIMA) Exhibition 2011 as competitors scrambled to showcase their aircraft in the 5-day event.

The Malaysian Government is considering replacing RMAF's 10 MiG-29 aircraft and in July 2011, Malaysian Defence Minister Dr. Ahmad Zahid had said that his government was evaluating the Eurofighter Typhoon and FA-18 Super Hornet, as well as the Sukhoi Su-35 and JAS Gripen for the proposed acquisition.

The Eurofighter Typhoon was the first aircraft to be showcased at LIMA's opening aerial display, even as Eurofighter's Malaysia Director Ian Malin responded to the criticism of its high cost saying that, "there's no point buying a cheaper aircraft that will end up costing you more in the long run".

Meanwhile, Boeing made a dramatic entry by flying the US Ambassador to Malaysia, Paul W Jones in an F/A-18 Super Hornet from Kuala Lumpur to Langkawi who on landing said that this fighter would be an "extraordinary choice" for Malaysia as it would complement the F-18 Hornets currently in service with the RMAF.

Success of the Dassault Rafale was stressed during the NATO's aerial bombing campaign in Libya. French Air Force Capt Cedric Ruet, who flew 18 sorties and clocked between 80 and 90

flying hours in Libya, said "It is an easy plane, meaning pilots can easily adapt to its controls. We had junior French pilots flying it in Libya." He added that the Rafale could well be included in any country's inventory, including that of Malaysia, which had different aircraft types in service.

Saab was represented by two Royal Thai Air Force Gripens, with six of the 12 on order already in service. Saab also chose the event to reveal a new defensive-aids pod for fighter aircraft designated BOH. The missile-shaped pod fits on any AIM-9 rail or AIM-120 pylon.

Even as the Western companies are in competition, local reports suggest that the RMAF might well buy a second batch of Sukhoi Su-30MKMs instead of an entirely new type. Victor Komardin, Deputy General Director and Head of the Rosoboronexport delegation at LIMA, stated "In 2007 the first Malaysian cosmonaut was sent to the International Space Station on board the Russian Soyuz Spacecraft. This was an offset provision of the contract for the delivery of the Su-30MKM fighters to the Royal Malaysian Air Force. Just imagine what kind a breakthrough it made for the nation! With Malaysia we have perhaps accomplished the most successful of offset programmes. Activities in this direction were started in early 1990s with the deliveries of the MiG-29 fighters. And we intend to continue this work. The Royal Malaysian Air Force are interested in additional supplies of multi-

role fighters. In addition to our Sukhois which are giving good service, Russian is ready to offer advance technologies, including nano technologies, and licensed production in the field of civil aviation within the framework of the same offset agreement. I am sure that LIMA 2011 will permit us to fully permit us to fully present our capacities."

On the helicopter front, anticipating a future Malaysian RFP for attack

In sharp contrast to the 'greys', as were painted the variety of combat aircraft types including the Dassault Rafale on static display, was the white-overall Dornier 228 of RUAG, seen here at the LIMA 2011



helicopters, Eurocopter displayed their Tiger helicopter while Boeing displayed the AH-6i. Eurocopter unveiled the first of 12 EC725s that the RMAF has ordered for delivery in 2013 and 2014 and also received confirmation for two brand new EC225 helicopters acquired by MHS Aviation and Awan Inspirasi for offshore operations. These are slated to replace the RMAF's long-serving Sikorsky S-61 fleet. However, at LIMA, Sikorsky signed an MoU with local company MRO Airoad "to explore maintenance and support for the S-61, including the S-61T" upgraded version. Sikorsky displayed the S-92, and Schiebel flew the unmanned Camcopter 100. AgustaWestland displayed one of five AW139s bought by Malaysia's Maritime Enforcement Agency, and announced new Malaysian orders for civilian versions of the AW139/169/189 series.

To support the deliveries of Malaysia's new EC725s and enhance Eurocopter's in-country support and services activities, the company's Eurocopter Malaysia subsidiary will be moving in July 2012 from its main facility in Subang to a new, expanded site within the Malaysian International Aerospace Center. Expressing his appreciation, Defense Minister Dr. Ahmad Zahid Hamidi said, "This is a highly appreciated gesture on the part



Eurocopter's EC 725 will be operated by the RMAF in increasing numbers

of Eurocopter. We have full confidence that all 12 helicopters will be delivered on time. The EC725 fleet represents a significant step towards strengthening the Royal Malaysian Air Force's capability. In addition, cooperation projects related to the supply of the EC725s also are moving along smoothly, ensuring that Malaysia's aviation industry is developing with the right skills and knowledge."

As part of the EC725 contract, an agreement for 13 strategic cooperation projects was signed – including the integration of Malaysian industry into

Eurocopter's global supply chain, and the development of joint ventures with local companies to establish an in-country MRO (maintenance, repair and overhaul) facility, a regional EC725/EC225 full-flight simulator center, and other capabilities. The MRO and flight simulator installations are being created together with the Boustead Group, and all 13 cooperative projects will be aligned with Malaysia's goals of enhancing its industrial capabilities and economic strength through technology transfer and strategic partnerships.



From the Cockpit



Converting to the Harrier with the RAF

Second production Harrier GR Mark 1, XV739; note the full array of vortex generators on the wing (Hawker Siddley Aviation).

Once we finished our high speed experience on Maruts (30 December 1983), we were ready to leave for Harrier conversion training. The first batch of three pilots from the Navy was already in the UK, meanwhile I flew a quick trip on a HJT-16 on 4 May 1983 to award an instrument rating to a close aviator friend who was an exceptional pilot and QFI. Within a week of this last sortie, we were in the UK, reporting for flying training on Harriers.

The pace of activity quickened, we collected our flying clothing and reported to RAF Brawdy for orientation, meant for foreign officers new to the country. Also, to make foreign officers learn radio and various patterns followed in the very tight and busy air space. The course included ten hours on Jet Provosts.

I was affected by local pollen which caused severe allergies, made more acute after two trips with my instructor who was hell bent to show us what a Jet Provost could do. The lady doctor gave me pills and told me that I could fly as these medicines would not have any ill effect during flying.

During our short stay at Brawdy, I also had the opportunity to fly the Hawk - a great treat as the aircraft had superb handling capabilities. My instructor made me carry out a section take off and section landing at the end of our trip.

The course was extremely useful; we had not flown in such busy airspace with perpetual rain throughout the year.

We reported to No.233 OCU based at Peterborough for basic conversion onto the VTOL Harrier with RAF. We had Americans, Italians, us Indians and RAF pilots during the course, most of our instructors having recently returned from the Falklands. My instructor was also ex *Red Arrows* and I looked forward to fly with such experienced aviators, whom we had till now only admired from a distance.

We went through ground school conducted by our instructors whereas simulator flying was conducted by dedicated simulator instructors. I recall we had Scottish and Irish instructors too whose English was rather hard to understand. Tongue in cheek, my (English) instructor told me that they too were trying to understand them for very long and we Indians were not alone! My first experience on the Harrier was a fast taxi, followed by an initial take off run, before my instructor handed me the controls. I had to continuously apply brakes or use partial nozzles to slow down as the idling rpm was too great to taxi 'the beast' at slow pace. We got clearance to carry out simulated take off on the runway.

I was very shortly to experience the incredible acceleration of this aircraft. The Harrier, in a matter of 2 seconds or less built up to 100kts till I chopped throttle to idle rpm. I felt as if I was being catapulted all over again...this aircraft would be fun but also tough to master at the same time was my first thought. We returned to the

dispersal to review our planned dual check, but adrenalin had already started to flow at very fast pace.

One of the most important point that my instructor impressed upon was "never to exceed the undercarriage retraction speed after takeoff." Not sure why he said that as 350kts would be way off during climb. Sure enough as I was busy doing my other checks my instructor took over the controls and throttled back to lower speed; I had crossed 350kts. Flying on AOA and with the head up display was a novelty and as most information was available on the HUD, we knew our position at all times. The Harrier work load was phenomenal compared with the throttle stick and standard cockpit instruments we were used to. This took longer as we had been flying 'head down' for most of our flying careers and were definitely slower than the youngsters who were coping better than us. We however, had experience on our side which proved helpful in the long run.

The next critical phase was commencement of VSTOL work, which was eagerly awaited. Looking at the Harrier in hover was awesome and we all wanted to be in that cockpit.

Before we began VSTOL workup, we were shown films of previous Harrier pilots trying their hands at hover, as there was no two-seat trainer at that time. This particular film was nicknamed as a "horror movie," which was obvious from its contents. Our entire course was in a somber mood and

looked at each other even as we appreciated the pioneers who had dared to tame this absolute beast of an aircraft. Our instructor was reassuring and told us that all the observations would be ironed out as we had the Harrier trainer now.

My first hover was followed by various new exercises such as RVL, RVTO, conventional landing and takeoff and many more new exercises which the Harrier was capable of performing. The most challenging of manoeuvres for me were vertical landing in the centre of tall woods and full performance takeoff from a very short strip and that too with a building at the end of few hundred yards of the takeoff run. But of course, these two exercises were carried out towards the end of our forty hour conversion course.

The vertical landing pad was situated slightly off the runway and led towards some tall trees. We were to carry out vertical landing on that pad followed by vertical takeoff and carry out another

VTO from the woods was also a treat as I climbed out parallel to those tall trees before carrying out a second VL on the same pad. Taxi back to dispersal was another experience as I had not seen this grassy taxi track. This particular sortie has remained firmly etched into my memory, more than anything else which did with the Harrier during my subsequent operational flying.

Short takeoff with full load from a small air strip was another incredible exercise which was carried out with my instructor. After lining up I felt it would be impossible to clear that building in front. However, I had my instructor in the rear seat. He asked me about my feelings and I said that, frankly, we would not clear it "but as you are sitting behind I am confident that we will do so."

I opened full power and for the first time was ahead of the Harrier to see my nozzling out speed. As I nozzled out, we were already at over 150 feet above that house. Immense relief and

The few introductory air combat sorties were greatly enjoyable, however we were not taught any advanced manoeuvres as there was no contract for that kind of training. The British would not give away any information, unless they were paid for it—fair enough! I experienced another aspect of the Harrier during this phase. Although the aircraft would tend to depart, it would never spin, which was a very good confidence builder. This was not so in VSTOL flight when the aircraft behaved like a ball being rolled around by a circus stuntman.

We had been quite confident in handling the Marut after forty hours of flying, however the Harrier was another story. We barely became proficient to carry out basic handling and perform all the basic drills including various types of takeoffs and landings with average skill.

Still, our night conversion was not a big deal as we had plenty of experience in this mode. During my first night dual



VL. To start with, we were not even sure whether we would find the damn thing!

I took off with minimum fuel to make sure that I was within the hover weight to call downwind for a VL. When I came on short finals, I carried out all procedures to make a vertical landing even as I peered like a hawk to spot that VL pad. Having seen the pad at the last moment I steadied up in the hover almost half way into the sky and gingerly drifted back the pad. Descent in the midst of tall trees for a touchdown was 'to be born again'. Partridges flew away but appeared to be habitual of Harrier presence in their parts of the woods. They knew friend from foe, the Harrier obviously appeared to be a friend but a very noisy one at that.

confidence was restored. My instructor assured me that the Harrier was a fun aircraft to fly.

The Harrier is a unique aircraft. The UK remains the only nation which developed an operational V/STOL fighter. Conventional and short landings with the Harrier have their own idiosyncrasies owing to the under carriage design. Imagine coming onto the finals in cross winds with the nose offset way off from the centre line. You are required to touch down by still facing into the wind regardless of runway direction. It was hard but we got used to it. Going into the runway without flare was not a problem as all naval aviators are aware and as the conventional deck landing also demands no flare to catch a wire.

check, my flight commander who was to clear me for the night solo saw an opportunity to show off some aerobatics as there was a full moon. But, he asked me *never* to do this even though I finally retired after many thousand hours of flying the Sea Harrier off the INS *Viraat*.

At the end of our course we had joined an elite group of Harrier pilots who respected each other for obvious reasons; not everybody was destined to harness this aircraft.

To pass out from No. 233 OCU was a great feeling as we parted company from our international friends to proceed to Royal Naval Air Station Yeovilton for our Sea Harrier training. More on that next!

Commander (Retd.) B.S. 'Bill' Hothi

December 2011 marked the 50th Anniversary of

OPERATION VIJAY



Lesser coat of arms of Portuguese India

during struggles against Rajas and the rival Dutch over the next century while the islands of Bombay were ceded by the Portuguese to King Charles II of England in 1661 as part of the dowry of Queen Katharine Biaganje. Religious intolerance, introduction of hateful Inquisition and barbaric dealings resulted in poor administration and by 1662 the only Portuguese Colonies left in India were those of Goa, Daman and Diu.

Nearly three centuries later, even after the British quit India in 1947, the Portuguese refused to recognise signs of the times. In 1949, the Government of India approached the Portuguese for a peaceful transfer of their enclaves, but without any response. On the contrary, the Portuguese in Goa worked on clandestine links with anti-Indian forces such as the Nizam's Hyderabad in 1948 and later with the Pakistan Government during the fifties. Peaceful agitation by the Goa National Congress was brutally suppressed although in mid-1954, volunteers of the United Front of Goa overthrew Portuguese



The Island of Goa, from the "Livro das Plantas das Fortalezas, Cidades e Povoacoes do Estado da India Oriental" published in the 1600s.

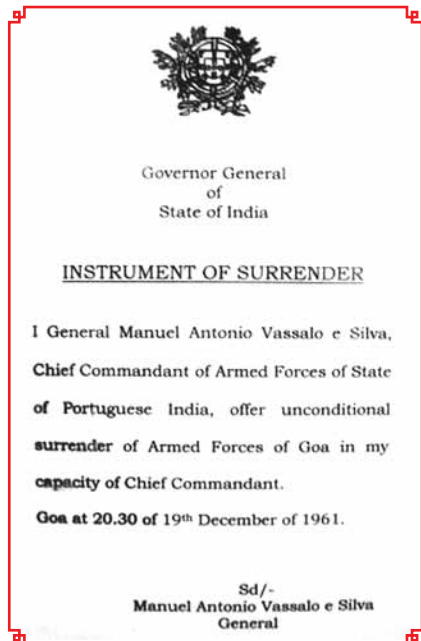
Situated on the western coast of India some 400 kilometres (250 miles) south of Bombay, is the former Portuguese colony of Goa, extending some 100 kilometres (62 miles) along the Arabian Sea, having a maximum width of 64 kilometres (40 miles). The Western Ghats or Sahyadri range distinguishes the eastern flank of Goa and the territory is intersected by numerous rivers, mostly navigable as they flow east-west into the sea. The Portuguese 'acquired' the Goa settlement in 1510, calling the earliest provinces *Velhas Conquistas* (old conquests) and later adding the *Novas Conquistas*, or the new Conquests, which stretched southwards to Canacone, just north of Karwar.

There were two other smaller territories colonised by the Portuguese: Daman on the Gulf of Cambay about 180 kilometres (100 miles) north of Bombay and Diu, a fairly small island separated from the southern extremity of Kathiawar peninsula by a narrow tidal creek, but through a considerable swamp.

The Portuguese first came to India as traders in 1498 when Vasco da Gama 'discovered' the Malabar Coast of India after rounding the Cape in South Africa. After initial forays at trading, the Portuguese sent an armada with heavy artillery to establish control, seizing the Anjidiv Island, making this a base for their eastern naval squadron. By 1508, the Portuguese had established a near monopoly of trade all along the Malabar Coast and upto Gujarat, notwithstanding skirmishes with Moorish traders and defeating an allied Muslim fleet off Diu. In 1509, the Government in Lisbon sent Afonso de Albuquerque as Governor and the first of Portuguese rulers of their Indian colonies who consolidated by massacring the resident Moors. In spite of their cruel, selfish and arrogant rule, the Portuguese were able to set up a number of trading forts not only on the western coast but also in Madras and Bengal, but lost much of these



rule in the pockets of Dadra and Nagar Haveli; satyagrahis were shot down in cold blood in August 1955 and now the country reacted in anger and resentment. Still, the Government of India tried to reason with the Government of Portugal that this small foreign enclave on Indian soil was a constant irritant both to India's self respect and national interests. The United Nations was unable to prevail upon Portugal to respect the majority wishes and by late 1961, Prime Minister Nehru confessed that the Government of India's policy of solving the Goa question by peaceful means had failed and that "we may be forced to adopt other methods to solve the problem". In December 1961, it took India's armed forces just 36 hours to obliterate five centuries of Portuguese colonisation on Indian soil.



The liberation of Goa and other Portuguese colonies in India was coded as *Operation Vijay* and the Indian Armed Forces functioned under HQ Southern Command at Poona. Considering the marginal strength of the Portuguese forces in Goa, Daman and Diu, which totalled some 7000, including about four infantry battalions of European troops, four squadrons of armoured cars, a regiment of artillery and some anti-aircraft guns protecting Dabolim airfield (with perhaps a flight of fighter-bombers at Dabolim airfield, as was vaguely reported) the plan was to launch operations with an Infantry Division and a Parachute Brigade

Group with naval and air support as required. Such an overwhelming force was required to accomplish the objectives speedily and with assurance so also to avoid any foreign interference.

Troop movements began on 2 December 1961, with military train specials moving the 17th Infantry Division from Ambala and other cantonments in the north, plus the 50th (Independent) Parachute Brigade from Agra. Troops for the operation were concentrated by 11 December at Belgaum (for Goa), Vapi (for Daman) and Poona (for Diu) under Major General KP Candeth. The 17th Infantry Division (*Black Cats*) concentrated its 48 and 63 Brigades for thrusts into Goa from the east with the 50th Para Brigade, plus 2 Sikh Light Infantry Group from the north. There was a decoy entry from the south. The plan for Daman was to be executed by 1 Mahratta Light Infantry Group, and that for Diu by 20th Rajputs.

The initial objective of the forces entering Goa was to be the line Mapuca - Bicholim - Sanguelim - Ponda - Margoa and the final objective was Panjim, the capital.

Panjim and Marmagao

The Indian Air Force was to give tactical support to the ground operations in Goa from the airfields at Poona and Belgaum but at the start of operations, the IAF were to neutralise any threat from the Portuguese Air Force by destroying the runway at Dabolim and the wireless station at Bambolim (the only links with Lisbon). The Navy was to neutralise coastal batteries and blockade the ports. Air support for operations in Daman and



On the Goa frontier, Portuguese officer with local policeman.



Portuguese troops of West African origin in Goa.



Indian Army vehicles enter Panjim to cheering crowds.



Air Cdre Shivdev Singh and Air Vice Marshal Erlic Pinto after landing in Mi-4 at Panjim.



50 Para Brigade taking the surrender in Panjim.



Portuguese Army POWs being repatriated from Dabolim in a chartered (French registered) DC-6.

Diu were to be launched from Santa Cruz airport (Bombay) and Jamnagar air base respectively. For Diu, only very limited air support was envisaged, restricted to one aircraft at a time from Jamnagar, and available on call. Air Vice Marshal Erlic Pinto was Air Commander with headquarters in Poona while tactical air operations in the Goa sector were controlled by No.2 TAC under Air Commodore Shivdev Singh from Sambre (Belgaum). In Daman, air operations were controlled by Gp. Capt. SJ Dastur with fighters on an on-call basis though by an air control team (ACT).

This was the first combined operation in Independent India, involving all three armed

forces and for the Indian Air Force this was first employment of its new combat aircraft which had been inducted just a few years earlier. Poona was the main bomber base, housing Nos.16 and 35 Squadrons equipped with Canberra B(I)58 bomber-interdictors. These launched the first offensive air missions of *Operation Vijay* at first light on 18 December. Led by Wg. Cdr. NB Menon, CO No.35 Squadron, the Canberra bombers were escorted by four Hunter F.56s of No.17 Squadron which raided Dabolim airfield, dropping sixty-three 1000-lb bombs with several direct hits being scored on the main runway. One Super Constellation and a Douglas DC-6 of the Portuguese airline TAIP were still at Dabolim dispersal area but no military aircraft and a second raid by eight Canberras of No.16 Squadron led by Wg.Cdr. Surinder Singh at 1120 hours dropped 48 bombs, some of which again registered direct hits on the main runway. Dabolim was declared non-operative for any military aircraft

Role and deployment of the IAF in 'Operation Vijay'

Santa Cruz (Bombay)

- 4 Mystere IVAs of No.1 Squadron for anti-shipping role and fighter sweeps
- 2 C-119Gs of No.12 Squadron for transport support duties
- 4 Hunters of No.20 Squadron for air defence of Greater Bombay.
- 1 Mi-4 helicopter of No.109 Helicopter Flight for air sea rescue operations

Lohegaon (Poona)

- Canberra B(I)58s of Nos.16 and 35 Squadrons for tactical bombing
- Hunters of No.17 Squadron (less one section) for air defence of Poona-Bombay and fighter escort/fighter sweep duties
- B-24 Liberators of No.6 Squadron (less detachment at Jamnagar) on M.R. duties
- Hunters of No.37 Squadron for night fighter duties at Bombay
- 4 Vampires of No.45 Squadron to constitute reserve
- 2 Ilyushin IL-14s of No. 1 Communication Flight

Sambre (Belgaum)

- 8 Vampire FB.52s of No.45 Squadron for close air support and interdiction.
- 4 Hunters of No.17 Squadron for air defence of Sambre area
- 2 Harvards of No.122 Flight for supporting/ target direction duties
- Austers of No.3 A.O.P. Flight
- 2 Otters of No.2 Communication Flight
- 3 Mi-4 helicopters of No.109 Helicopter Flight.
- 3 Vampire PR.55s of 108 F.R.Flight for photo reconnaissance/Tac. R. duties



Entrance to Dabolim airport, Portuguese era.

reinforcement although both Portuguese airliners parked on the apron made a desperate getaway using the taxi-track at night. "A foolhardy but nevertheless courageous and successful take off".

A force of six Hunter F.56s of No.17 Squadron led by Sqn. Ldr. Jayant Singh, operating from Sambre, attacked the Bambolim wireless station at 0710 hours on 18 December with rockets and cannon fire, completely destroying the facility.

From Poona, B-24 Liberators of No.6 Squadron carried out around-the-clock maritime reconnaissance throughout 18 and 19 December. In addition to special anti-submarine patrols flown, B-24s were used to drop flares by night to assist in identification of coastal traffic on the approaches to Diu and Daman and also to assist the Army during mopping up operations near Marmagao just before the Portuguese surrender on the 19th. Finally, the venerable B-24s air-dropped thousands of leaflets over population centres in Goa clarifying the tasks of India's armed forces "to defend the honour and security of the motherland" and urging the people to prevent the Portuguese from destroying "our bridges, our railways, our temples and churches, our schools and public buildings and the fine, God-given harbour".



The photo shows a bridge destroyed by the Portuguese to delay advance of the Indian Army

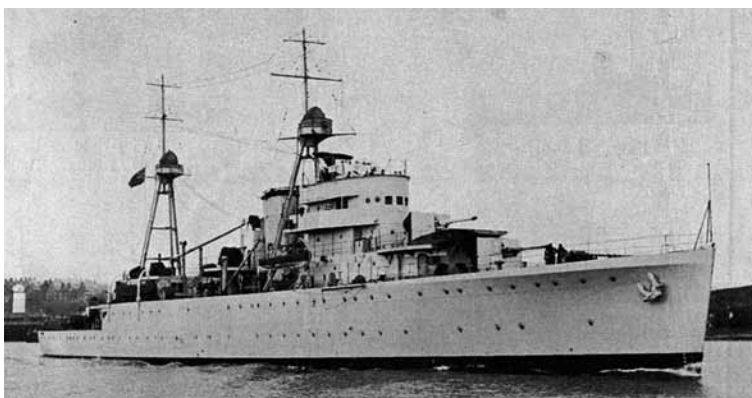
Also at Poona were Vampire NF Mk.54s of No.37 Squadron to carry out night fighter duties over Bombay and two Il-14s of No.1 Communication Flight.

For tactical air support of the Army in its rapid advance, the IAF positioned, in addition to the Hunter F.56s of No.17 Squadron, four Vampire FB 52s of No.45 Squadron at Poona.

The bulk of No.45 Squadron, with eight Vampires was based forward at Sambre for close support and interdiction. A flight of Hunters were at Sambre



After 'Operation Vijay': Squadron Commanders of No.2 Wing with the AOC at Poona. From L to R : Sqn Ldr Jayant Singh (CO, 17 Sqn Hunters), Sqn Ldr Ian S Loughran (CO, 37 Sqn Vampires), Wg Cdr Hank Datta (CO, 6 Sqn Liberators), Gg Capt SJ Dastur (OC, 2 Wing Poona), AVM EW Pinto (AOC-in-C, Ops Command), Sqn Ldr Behl (16 Sqn Canberras) and Wg Cdr NB Menon (CO, 35 Sqn Canberras)



The Portuguese warship 'Afonso de Albuquerque', which was sunk in action by the Indian Navy off Goa



Photo Recce pictures taken by Vampires of No.108 Squadron which were made available to the Ops Room during the Goa Operations. The photographs show Portuguese troops and Army convoys stranded on various roads.

for air defence as also three Vampire FR.55s of No.108 FR Flight for photo and tactical reconnaissance. Other aircraft at Sambre were two Harvards of No.122 Flight for support and target direction duties, Austers of No.3 AOP Flight, two Otters of No.2 Communication Flight

and three Mi-4 helicopters of No.109 Helicopter Flight.

Early in the morning on 18 December 1961 when columns of the Indian Army crossed the Goa frontier at multiple points, the main advance from the north was by three columns of the 50th



Parachute Brigade Group comprising 1 Para (Punjab), 2 Para (Marathas), 2 Sikh Light Infantry and a Squadron of 7th Light Cavalry. Short skirmishes apart, the troops advanced rapidly, improvising crossing of rivers with requisitioned boats and an enthusiastic and helpful local populace. The race to first enter Panjim, capital of Goa, was won by 2 Sikh LI closely followed by the 1st Para (Punjab) who crossed the river Mandavi and took the surrender of the Portuguese garrison. The Portuguese Governor General, General Vassalo-e-Silva later formally surrendered to Brigadier KS Dhillon, 63 Brigade Commander whose advance battalions (3 Sikh, 3 Bihar and 4 Sikh LI) had advanced from the east, after a gruelling forced march beyond Ponda, brushing aside any opposition and manhandling their recoilless guns and mortars as they encountered blown bridges and culverts. There were some sharp firefights around Margao, the main Portuguese force for protecting Vasco da Gama having been concentrated here with some armour, artillery and engineer elements. 4 Sikh LI spearheaded the advance and captured Marmagao port on 19 December; the 48th Brigade Group under Brig. Gurbux Singh followed into Panjim.

In all, just 23 tactical air sorties were flown during the Army's advance in Goa as very minor opposition was encountered. There were two cases of mistaken identity, one when four Vampires were called up to neutralise Portuguese armoured car concentration but attacked the wrong target because of the lack of smoke indicators. Fortunately, there was no serious damage or casualties to friendly forces. The other case involved an unmarked Harvard being hit by small arms fire as it overflew 2 Sikh LI positions. IAF roundels were immediately painted on the Harvard's return to Sambre!

The Army's operations in Daman on the other hand were more actively supported, essentially by 4 Mystere IVAs of No.1 Squadron operating from Santa Cruz airport (Bombay). The Mysteres were assigned the anti-artillery role and fighter sweeps while four Hunter F.56s of No.20 Squadron were positioned for air defence of Greater Bombay.

On 18 December, as the 1 Maratha Light Infantry Group moved into Daman, the first objective was the *aeroporto*



The ATC building at Diu Airport after direct hits by rockets from No. 4 Squadron Ouragans.

(aerodrome), stiff resistance being met from vicinity of the Flying Control Tower. The Big Fort at Nani Daman was also well defended and had to be pounded by 9 Field Regiment at 0410 hours. Immediately after first light, two Mysteres from Santa Cruz were directed by an air control team, the aircraft firing rockets at the Portuguese gun and mortar positions in the Big Fort. Mystere pairs thereafter came in at regular intervals to carry out intensive strafing by their 30mm cannon and firing 55mm rockets at tactical targets in the north (Big) and South forts, barracks, gun positions, MMG bunkers and strong points adjacent to the airfield.

Heavy fighting continued throughout the day and by nightfall, the lead troops firmed in for the night. On the morning of 19 December, no fighting took place as the Portuguese garrison was demoralised. Two Mystere IVAs came in at 0745 rocketing the Big Fort and some gun emplacements. The accurate gun strike proved to be the last straw and the Governor Antonio Jose Da Costa Pinto, himself wounded, unconditionally surrendered at 0830 hours. Undoubtedly the Portuguese garrison in Daman had been made of sterner stuff than their brethren in Goa.

The Portuguese colony of Diu was the smallest of their possessions in India, yet perhaps the hardest fought for by the garrison consisting of four companies of infantry, some 3.7" AA guns in the fort area and layers of mine fields. The 20th Rajputs were to cross the tidal creek during darkness and capture Diu airfield on the island but the approach on marshy

ground was slow and contested by strong defences at Porte Do Passo De Coro. The assaulting 4 Madras, approaching the Citadel Diu from the mainland also met heavy opposition and had to withdraw. The Navy's cruiser *INS Delhi* which had been positioned off Diu then provided naval gun fire against the Citadel and airfield control tower around midday.

The directive for operations in Diu had clearly laid down that no offensive air action was to be taken without guidance from the air control team (ACT) accompanying the troops. But contact between the Armament Training Wing (ATW) at Jamnagar could not be established because of the confused land battle. At 1100 hours, 4 Ouragans of No.4 Squadron had flown over Diu but initially mistook dhobi washings for white

flags of surrender! Then at 1400 hours, two Ouragans raided Diu airfield, bombing the intersection of two runway with direct hits. Close air support was ordered and attacks were made by Ouragans against airfield installations and the wireless station. By 1500 hrs, the ATC tower, meteorological office and wireless stations were completely destroyed. A full scale bombing raid by 16 Canberras (in two waves of eight aircraft) was flown in the evening but recalled as it was feared that the Indian Army positions were too close to the enemy positions on ground. Ouragans of No.4 Squadron continued to carry out strikes against Portuguese defensive positions, flying 35 sorties on 18 December, including those against the two main forts on Diu Island. A Portuguese patrol vessel which fired on the Ouragans was "appropriately dealt with and sunk" with cannon fire.

On 19 December, 32 armed reconnaissance sorties were flown by the Ouragans but as the battle was virtually over, no weapons were fired. The formal surrender took place at 1830 hours in the evening.

As recorded in the Official History of the Ministry of Defence, "it will be no exaggeration to say that it was the Air Force which efficiently tipped the scale of battle in Diu in India's favour, and the Diu garrison surrendered without the army even having stepped ashore on the island". The Army's debt to the Air Force was handsomely acknowledged by the GOC-in-C Southern Command in a special congratulatory message.



Bit of history in the Vayu office: Portuguese flag taken by the Indian Air Force from the Governor General's house in Panjim after the surrender, now in safe hands.

December 2011 marked
the 40th Anniversary of



File picture of Mi-4s of the IAF in an exercise.

Heliborne operations at Sylhet

When he was commanding the 50th (Para) Brigade ten years earlier, Sagat Singh had led the Indian column that took the surrender at Goa in December 1961. Now, in December 1971, as GOC IV

Corps, his responsibility was to lead the Indian Army's advance to Dacca, the shortest approach being from Agartala, which was only 80 kms away by air. Sylhet, at the northern end of the sector and Chittagong near its southern end,

were connected with each other and with the capital Dacca by rail and road, the bridge at Ashuganj providing the only link over the river Meghna.

The Indian Army's IV Corps had been allocated the long and tenuous geographical



The iconic photograph taken on 16 December, 1971 when Lt Gen AAK Niazi surrendered to Lt Gen Jagjit Singh Aurora at Dacca. Standing behind, first row left-to-right are V/Adm. R Krishnan, Air Marshal HC Dewan, Lt. Gen. Sagat Singh and Lt. Gen. Jacob.



The dozen Mi-4s which helilifted an entire brigade across rivers and other natural obstacles, were truly force multipliers during this 'lightning campaign'.

area along the border between East Pakistan and India's North-Eastern States, from Dawki and Sylhet in the north down to Cox's Bazaar and the Chittagong Hill Tracts in the south adjoining Burma. IV Corps were tasked with advancing towards the vast Meghna river, neutralising Pakistani forces along Akhaura, Brahmanbaria and Ashugang, also moving south towards Comilla, Lakshan and Chandpur, the latter controlling the waterways leading to the capital Dacca.

Air support was to be provided by IAF Gnats from Kumbhigram and Agartala with longer range strikes to be made by Hunters and limited air cover provided by MiG-21s from Gauhati. Importantly IV Corps were assigned ten Mi-4s, mostly of No.110 HU, augmented by some from Nos. 105 and later No. 111 HUs. The Mi-4s had been re-positioned in Kailashahar from their permanent base at Hashimara.



Sqn Ldrs. Nanda Cariappa, CS Sandhu and Harmeet Singh with Mi-4 during the Sylhet heliborne operations.

In an audacious move, the Mi-4s began the helilift of 4/5 Gorkha Rifles (FF) from Kailashahar to a location north of the river Surma, in full view of Pak troops in Sylhet south of the river. From 7 to 9 December, the Mi-4s continued to lift Indian troops to a concentration area north of the Surma River near Sylhet.

This successful 'feint' locked in two Pakistani Brigades from Sylhet and Maulvi Bazar so as to hold this front against what they believed was a sizeable force. The noise of Mi-4s at night was greatly magnified giving the impression that an entire brigade was being helilifted. Meanwhile another Indian battalion (5/5 GR (FF) 'Chindits') moved from Dawki towards Sylhet from the north. Gnats of No.24 Squadron from Agartala roved over the battlefield, while Hunters dropped napalm and fired rockets against enemy defence points, targeting Chafee tanks that had posed a threat near Comilla.



Sqn Ldr 'Nanda' Cariappa (centre) commanded No. 111 Helicopter Unit with Mi-4s, which helilifted Indian troops over the Meghna river, alongside other Mi-4s, to hasten surrender of far larger enemy forces.

In this manner, IV Corps immobilised a sizeable enemy force outside Sylhet and the Comilla-Lalmai areas and were now preparing for major moves to the Meghna, an important objective being to capture the bridge intact at Ashuganj. Pak artillery fire was being controlled by an OP on top of a concrete grain silo which was accurately taken out by 30mm cannon fire of Gnats as was similarly done against a post at Narayanganj.

However, with the bridge at Ashuganj blown by the Pakistanis, the Corps Commander worked out a bold plan with Sqn Ldr CS Sandhu, commanding 110 HU for Mi-4s to helilift troops over the Meghna at night. Gp Capt Chandan Singh had earlier carried out a reconnaissance to determine a suitable place at which the Meghna could be crossed towards Narsinghdi. On the night of 10 December, the first troops of

the 4/5 Gorkha Rifles (FF) were ferried to landing pads and this continued with entire companies helilifted through the night. Normally the Mi-4 could carry 14 troops but as fuel was expended, the number of troops were increased to 23 per trip. Heavy equipment and stores were transported by barges and boats from Rajpura to Narsingdi and by dawn of 11 December, over 650 troops were across the Meghna and in defensive positions.

The Mi-4s then moved down to Daudkandi where another battalion was moved across the Meghna river to Baidya Bazaar, just 7 miles from Narayanganj, virtually on the outskirts of Dacca, so besieging the capital from the east and south-east.

The Mi-4s had been flown by their aircrew almost continuously for 36 hours, a total of 409 sorties for helilifting 311

Brigade Group (4 Guards, 10 Bihar, 18 Rajput) with nearly 5000 men and 51 tonnes of equipment at Sylhet, Narsinghdi and Baidya Bazaar without any mishap or a single casualty, with 100% serviceability maintained.

As Air Chief Marshal PC Lal, the CAS later observed, "the bold and imaginative use of helicopters and fighter aircraft for pinpoint attacks by IV Corps presented a most convincing demonstration of how well the Services could work together..... the GOC was a paratrooper himself and had worked in close proximity with the Air Force, with excellent relationships developed at Tezpur. To the Mi-4s of Nos.105, 110 and 111 HU goes the credit for making the Indian Army's truly a lightning campaign."

Extracted from the book 'Himalayan Eagles: History of the Indian Air Force, Volume II'

Proliferation compounded



Avro (HS-BAE) 748 of No.11 Squadron.

How many transport aircraft types?

Until the early 1970s, the IAF had eight different transport aircraft types in its inventory. For 'heavy lift' were Antonov An-12s, while the medium transport aircraft fleet consisted of the Fairchild C-119 Packet, C-47 Dakota, DHC-4 Caribou, Ilyushin Il-14 and the Avro 748. For the light transportation role there were DHC-3 Otters and some Devons.

With such a proliferation of types, with attendant maintenance and other logistic and training problems, it became necessary to select a medium tactical transport aircraft (METAC) and standardise on a modern medium lift transport aircraft.

After several years of evaluation, when various options were examined, including the Avro 748 RLTT, F-27M, Antonov An-26, Aeritalia G-222 and Lockheed L-400, the Antonov An-32 was selected as the METAC and inducted in large numbers from 1984 onwards. Meanwhile, the Antonov An-12s were supplanted by the Ilyushin Il-76 to meet the heavy airlift tasks (HETAC). The Dornier 228 was to be licence built by HAL as replacement of the Otters and Devons.

25 years on, to supplement the tactical airlift fleet and support special operations, the Lockheed Martin C-130J-30 Super Hercules was ordered and the first of six delivered in 2011. Another batch of six is to follow. In another programme which will see major augmentation of its heavy lift capability, the Boeing C-17 Globemaster III will enter IAF service from 2012 with relatively 'substantial' numbers likely to be ordered.



Antonov An-32 of No.48 Squadron.

In a parallel programme, HAL have begun the design and development of a multi-role transport aircraft in collaboration with Ilyushin of Russia, based on the Il-214T which will be equivalent to the An-12/C-130 in terms of payload capacity (16-18 tonnes). The IAF have indicated their requirement for 45 of these, but the programme continues to drift.

Recently, the IAF have floated an RFI for 56 transport aircraft (6-8 tonne capacity with rear loading configuration) to replace the Avro 748s which are presently

employed for multi-engined aircrew training, navigation and signals training, VIP transportation and Logistics Air Support. (Meanwhile, the VIP squadron has replaced the Avros with Embraer ERJ-145s but the Avro continues with various Command communication flights)

The Antonov An-32s are presently being upgraded and with midlife extension and will continue in service till 2030.

Deja vu? For the next two decades or so, the IAF will operate nine transport aircraft types, totalling nearly 300 in number.



Artist's depiction of the Avro 748 RLTT in the 1970s.

Gubernatorial Grace

My generation of post-Independence entrants to the Indian Air Force (IAF) lightheartedly associated Air Force Day with All Fools Day as both fell on the first of April. In the late '70s however, Air Force Day was changed to 8 October to mark the commissioning date of the father of the IAF, Subroto Mukherjee. As Deputy Chief of the Air Staff (DCAS), then AVM Subroto Mukherjee commissioned me at No 1 Air Force Academy, Begumpet, Hyderabad on 30 August, 1952. 23 years later I was posted to command our flying training air base at nearby Hakimpet and was advised by the AOC-in-C Training Command Bangalore to make a formal call on the Governor of AP, Sharda Mukherjee, widow of the IAF's first Indian air chief.

Having confirmed a 15-minute evening appointment at Raj Bhavan, I decided to take along, as a memento, a framed photograph of Subroto Mukherjee commissioning me and sent for our Station Photo Officer to brief him. I walked a portly, senior Master Warrant Officer (MWO) who listened attentively to my request as I handed over the original picture to him. His eyes lit up when he looked at it and exclaimed '*Sir, itne saal aap ne hamari tasvir rakhi ?*'. I then paid attention to the three young airmen (two standing and one kneeling) between the DCAS and me. Coincidentally the taller of the two was the same MWO, then a new young photo tradesman, who now had additional motivation to reproduce a fine product, which he did.

My wife and I had a most pleasant call on Her Excellency. The charming lady governor was delighted with the photograph



Seen on 1 April 1975.

and placed it immediately on her office table. On conclusion of our call, she requested us to wait a few minutes, while she completed her last appointment for the day, and then invited us to join her at her personal chamber. At the end of a most enjoyable, friendly and informal evening, I was emboldened enough to request her to be the Chief Guest at the next Air Force Day function at our Officers Mess, then located in Kothi Asafia. She sent for her Secretary and immediately confirmed her acceptance. When he heard the news, my AOC-in-C in Bangalore was happy but cautioned me on the protocol involved which included a band to play the national anthem on her arrival/ departure and no alcohol to be served while she was present. Since the local Divisional commander and I had been colleagues at Staff College 16 years earlier, organising an army band was no problem but an air force party sans spiritual succour was unheard of in those days !

The Governor arrived promptly and all of us in mess ceremonial uniform stood stiffly to attention while the national anthem was played. My wife and I accompanied this dignified and elegant lady, introducing her to our officers, ladies and guests. She then reminisced on the lively air force parties she recollected and said perceptively, 'Group Captain, in case your mess bar is closed, may I request you to have it opened?' I happily signalled the President of the Mess Committee and shortly thereafter there was a sudden relaxed conviviality and reversion to the familiar cheerful ambience of an air force party. On departure she thanked me warmly and handed me an envelope. The cheque within was used to procure the very first TV set for the Airmen's Mess at the Air Force Station, Hakimpet.

In response to my 'thank you', letter, she replied personally and concluded her note with: 'Group Captain, your picture will always be on my table'.

Air Vice Marshal Cecil Parker (Retd)



Seen on 30 August 1952.

25 Years back

From Vayu Aerospace Review Issue I/1987

MiG-29 licence-production

A senior Soviet delegation led by the Aviation Industry Minister AS Systov visited New Delhi, Nasik, Hyderabad and Koraput to review present production of the MiG-27M and MiG-21bis but also feasibility of licence-manufacture of the MiG-29 by HAL. While the first MiG-29s in “fly away” condition are now in India, the option of manufacturing the type at Nasik, parallel with the MiG-27M, has yet to be taken. India has firmly decided against the manufacture of the Mirage 2000 by HAL at Bangalore where production of the Jaguar for the Indian Air Force continues.

First IAF Dornier 228

The first wide door-modified Dornier 228 for the Indian Air Force had its maiden flight at Kanpur on 5 January 1987, representing the first of some 50 Dornier 228s for the IAF. Hindustan Aeronautics Limited have designed and developed the special wide door for the IAF which service will use the Dornier 228 for a multiple of light transport and logistic support duties. The HAL-built Dornier 228 is to replace the Otter and Devon in IAF service and supplement the HS 748 and An-32 medium transports in tasks which the lighter and far more efficient and economical Do228 is better suited.

India may seek Soviet AWACS

Indian Foreign Secretary AP Venkateswaran has stated that in the event of the US providing an AWACS to Pakistan, India would be forced to seek similar capability from the Soviet Union.

Continuous Expansion of Vayudoot

Vayudoot, still the world’s largest operator of the Dornier 228, has achieved a record utilization rate of over 20,000 hours flown till December 1986, with high dispatch reliability. A number of new air stations were connected during January 1987 including a service linking Calcutta to Daparijo and Along via Guwahati, Lilabari, Passighat and Ziro in the Eastern Region. In the Western Region, Vayudoot started regular Dornier 228 services from Bombay to Daman and further to Surat and Bhavnagar. A Bombay-Poona-Goa service was inaugurated from 16 January while, in the Southern Region, the recently introduced Madras-Coimbatore service was extended to Cochin and Mangalore plus a shuttle between Coimbatore and Madurai.

Opposition to Air India – Indian Airlines merger

There appears to be some modification to the Government’s earlier move to merge Air India and Indian Airlines after Mr JRD Tata’s reportedly highly critical views of the proposal. Mr Tata’s views are well known, and respected, where he has stated that the “cons of a full merger would substantially outweigh the pros” and would be “fraught with very serious consequences and difficulties.” Mr Tata has suggested, instead, that the Government “consider a

more modest and gradual scheme which would retain the separate identity of the two airlines and, without cost or loss of intentional competitiveness, would achieve the same savings expected from the merger proposal”.

Remaining Mirage 2000 deliveries

France will soon supply to India the remaining nine Mirage 2000 fighter aircraft, the French Ambassador, Mr Jean-Benard Merimee stated. Talking to newsmen, Mr Merimee, on a three-day visit to Gujarat, said France was bound to supply to India the spare parts for the aircraft under the contract. He said, “The fighters are giving excellent service and there is no problem.” Forty Mirage 2000s have already been delivered. Mr Merimee said that India had turned down a French proposal to set up a plant for the manufacture of the Mirage 2000 at Hindustan Aeronautics Limited in Bangalore.

SAAB offer LCA Consultancy

It is learnt that the Swedish aerospace company Saab-Scania have offered transfer-of-technology to India on the Light Combat Aircraft project. The Swedish offer is particularly relevant for the Indian project as the overall concept of the Saab JAS-39 Gripen, under development in Sweden since the early 80s, is very close to that of the LCA. British Aerospace, who are acknowledged as leaders in composite-structures, technology, are working with Saab to provide the composite wing for the JAS-39 as also flight control technologies. Further, the JAS-39 will be powered by the General Electric F.404 engine (as the RM-12 adapted by Volvo Flugmotor) which too has been selected by ADA for the LCA. The ADA are reportedly also in favour of the Ericson air-interception radar for the LCA, again similar to the type selected for the JAS-39.

Ex-Air India 707s for ARC

It is reported that the Aviation Research Centre (ARC) of the Research and Analysis Wing (RAW) has acquired two of the remaining Air India Boeing 707s for Rs 9 crores, including spares and handling equipment. The Boeing 707s will supplement the ARC fleet of other transport aircraft and helicopter.

Aircraft Carrier for the Eastern Fleet?

Vice Admiral Subash Chopra, FOC-in-C Eastern Naval Command is reported to have stated that it was the endeavour of the Command to operate one of the Navy’s future aircraft carriers, based at Visakhapatnam naval base. Meanwhile, the Visakhapatnam airport, now under Naval control, will have a parallel runway constructed for which the necessary land has been acquired.

New OPVs, more Dornier 228s for Coast Guard

Talking to newsmen on the 10th anniversary of the Coast Guard on 1 February, the Director General Vice Admiral IJS Khurana said that the Indian Coast Guard would shortly place orders for three modified offshore patrol vessels (OPVs) in shipyards abroad to ensure their induction by 1990. The OPVs will embark twin-engined helicopters for maritime surveillance, SAR and other utility tasks. The Coast Guard’s responsibilities are becoming onerous, with 2.8 million sq km of the exclusive economic zone to watch over, from the coastal waters off Kutch, to the Palk Straits region and off Sandheads in the northern Bay of Bengal. To monitor activities of shipborne adventurers, the Coast Guard is acquiring fast reaction vessels and, probably, 18 Dornier 228 maritime patrol aircraft by 1990.

Happy New Year to Vayu readers

Seasons Greetings !

The season of cheer has many stringing up their Christmas and New Year greeting cards in their homes, adding to the festivities of the time. Still, ever mindful of costs and the environment, millions have taken to sending their greetings electronically which is quick and cool but sans the spirit.

It has taken the Imperial College of Science & Technology in London to reveal how the equivalent of 1.5 billion cards and 83 sq km of wrapping paper are thrown away by the British public alone, which could provide upto 10 million litres of biofuel, enough to run a bus for 18 million kms or fuel 20 round trips to the moon.

Fuel for Chandrayan II ?

Arguing the M-MRCA merits

The German lady makes a forceful point while the French gentleman listens in somewhat detached manner. Undoubtedly the German Chancellor Angela Merkel and French President Nicolas Sarkozy had other things in mind when they met at Paris in December 2011. However, for the Indian observer, following the medium-multi role combat aircraft stakes now in its 'final lap', this evocative image can be interpreted in any which way [see FLASH news!]



Year of the Water Dragon – and bedecked Elephant

According to the Mayan Calendar, the year 2012 marks the end of lifecycle on earth. But the Chinese and Indians competing to 'dominate' life on earth, have no such worries.

The Indian vedic calendar vigorously promotes life well beyond this year while the I-Ching analysis, a popular method of Feng Shui fortune telling, is sanguine that there is much future beyond the Mayan doomsday.

Only weeks apart were two significant landmark events : a 108 metre-long Dragon sculpture was installed at the centre divider of Eu Tong Sen Street in Singapore, entrance to Chinatown. Along the



splendid avenues of New Delhi roam pachyderms, gaily painted and bedecked with flowers, perhaps inspiring a leading jewellery company to design an elephant head to be worn with glitter and twinkle on India's Republic Day.



(From PC Jewellers catalogue)

Monkey business

As reported by Agencies, 'India and Pakistan could be in for monkey diplomacy after an unsuspecting primate strayed across the border into Pakistan to be snapped up by soldiers and packed off to a British-era zoo'.

The monkey from India was apparently found ambling around in the desert region near Rahim Yar



Photo by Nadir Siddiqui

Khan and the Rangers at a border post saw it and sent him to Bahawalpur zoo in Southern Punjab. A spokesman for the zoo added cautiously "We don't suspect the monkey has been deliberately sent to Pakistan. I don't think it is a trained spy. It is just a common monkey."

However, an animal rights group in India has reportedly written to the authorities asking that the monkey be released back into the wild where it belongs.

Mera Finnair Mahan !

26 January 2012 : it took the Finnish carrier to celebrate India's 63rd Republic Day in grand manner - a Bollywood jig by the cabin crew, all dressed in dazzling salwar kameez and traditional Indian attire !



That's the surprise Finnair had in store for its passengers bound for New Delhi from its hub at Helsinki when crew members danced to the tune of Bollywood songs.

"Finnair congratulates India on Republic Day January 26 - clap your hands", read the message on the in-flight video screens, followed by a stream of crew frolicking in, as the song *Deewangi Deewangi* was played on the PA system.

Afterburner

IRKUT

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