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Aerospace & Defence Review

II/2011

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Cover : The first prototype of HAL's light combat helicopter (LCH) in flight demonstration at Aero India 2011 (photo by Phil Camp).

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No Surprises !

52 Preceding the 2011 Aero India Show, there was great hype in the air, with senior executives from almost every major aerospace firm heading for the Yelahanka event. Although the much anticipated arrival of a pair of F-22 Raptors turned out to be a squib, there was an unmistakable M-MRCA overhang. Contenders for this largest 'contract of the 21st century' flew in their aircraft and demonstrated them to perfection. The contending fighters certainly eclipsed the few civilian aircraft elbowing their way in, while new HAL types were the LCH and IJT with a mockup of the LUH. But there were no other surprises.

This was the largest *Vayu* editorial team extant to cover an Aero India, all through the various exhibition halls, aircraft on static display and in the air, press conferences, et al. Readers are given a flavour of what was what during the Show, with exclusive pictures and individual interviews. The Air Chief's announcement of an imminent decision certainly created 'shock waves'. Read on.

The M-MRCA : getting it right !

88 Admiral Arun Prakash writes about the lucid comparative assessment by US-based strategic analyst Ashley Tellis on the M-MRCA selection process. This monograph 'Dogfight', was commissioned by the Carnegie Foundation.

India's Aerospace and Defence Industry

40 Based on the CII-KPMG Report, released on sidelines of Aero India 2011, it is observed that India is already 'the most lucrative defence market globally. with a mega acquisitions programme coupled with the government's proactive stance, a healthy foreign supplier base mix and an increasing number of deal closures seen over the past few years'.

That other Air Show in Asia – Zhuhai 2010

82 An interesting comparison between the China Air Show a few months before Aero India 2011, where domestic participation reached an all time high. Apart from well-known International exhibitors from the west, the Chinese civil aircraft industry showcased its new range of airliners even as 'fellow travellers' Pakistan had an impressive presence.

There is also a new competition in the air with the Chinese ZW-10 and Indian LCH being developed near simultaneously (see cover).

The Haft of the Spear

98 The inimitable Professor Prodyut Das examines various options for selection of an airborne carrier to launch the Indian BrahMos supersonic cruise missile, 'Buff, Bone or the Spirit'. The case for a 'Super Canberra' is logically argued.

'Pashtun Jaguar' : Training for Helmand

106 Richard Gardner reports from Netheravon in the UK during 'Exercise Pashtun Jaguar' as crews and helicopters are prepared for an operational return to Afghanistan.

The Civil aviation boom : 3.3 billion air travelers by 2014

110 According to IATA's the industry consensus forecast, by 2014 there will be 3.3 billion air travelers in the world and China will be the biggest contributor, with nearly half of the new travelers being on Asia-Pacific routes. Inevitably, Asia-Pacific will also lead the demand for new aircraft over next 20 years.

ALHTK : The Raptor Factor

118 Sayan Majumdar writes on the new concept dubbed Air Launched Hit-to-Kill (ALHTK) which has gained momentum, based on a war game in the European Theatre in 2020. The ALHTK strategy would have roving packs of fighters, supported by ISR platforms to intercept missiles in rapidly established protection zones.

Also :
India's Defence Budget 2011-12, Countering Chinese Seapower in the IOR, the 'Shi Lang', the Hercules in India, The Dream Machine, and beginning the new series 'Vayu 25 years back'.

Regular Features

Commentary, Opinion, Aviation & Defence in India, World, Aviation & Defence news, Tale Spin

Choosing a fighter aircraft

Before year end, the government is expected to sign one of the country's most expensive defence deals estimated at $11 billion for purchasing 126 medium multi-role combat aircraft (equivalent to seven squadrons) for the Indian Air Force (IAF). The induction of these aircraft, proposed several years ago, is aimed at replacing some of the IAF's antiquated fighter fleet. It should also assist in making up for a steady depletion in the number of the IAF's fighter squadrons.

Considering the huge monies involved and the significant post-Cold War improvement in India's relations with the West, notably with the US, New Delhi is being offered top of the line fighter aircraft from five companies — Boeing and Lockheed Martin from the United States, Saab from Sweden, Dassault from France, the European consortium EADS and the Russian RAC- MiG. As India gets underway with negotiations, the months ahead are likely to witness considerable lobbying by these companies. Offers of bribes and kickbacks are not uncommon, especially when big sums of money are involved. The government, therefore, needs to tread cautiously in the next few months during negotiations. India is already lagging behind in modernisation of its considerably antiquated armed forces, and it can ill afford a controversy that could lead to cancellation of such a deal and hence delay.

For almost a decade India was haunted by the Bofors episode in the late 1980s. Unnerved by the spate of inquiries and adverse media reports following allegations of kickbacks, successive governments at the Centre suffered from a near paralysis in making defence purchases for almost a decade. This, in addition to other reasons, resulted in a major setback to India's defence modernisation process. In recent years, India has either cancelled or aborted three major deals - artillery guns from South Africa, light howitzers from Singapore and helicopters from Europe - following allegations of unethical practices. In addition, the Scorpene submarine deal is already under investigation following similar allegations. The government must tread cautiously and as transparently as possible while equally being mindful of the need to be strategic while finalising a deal of such magnitude and importance.

From The Tribune

The edge within

One must change facts on the ground to suit one's theories on paper. Notwithstanding its vision for the sub-continental neighbourhood and beyond, or its infusion of geopolitical calculations into the emphasis on trade and growth, India has done little — on the ground — to match the ambition of its "Look East" policy and plans to integrate the region. It is, therefore, not really the lack of the big idea but of political will that's confined those self-same ideas to the incubator. As a result, India's neighbours are beginning to set the pace of development, infrastructural development to be precise — that which must precede trade and growth — around its borders.

It was always a question of political will in ensuring India's border infrastructure was even marginally comparable to China's Herculean efforts. While everybody talks about how India is being encircled by China, what's the status of the Bhutan-India rail link vis-a-vis the Beijing-Lhasa railway that China is now set to expand to the strategic Chumbi valley area near Sikkim? Given its record, there is little reason to doubt China will meet its deadline. And once the Tibet railway comes within 500 km of the Siliguri corridor by 2017, Bangladesh too may demand connectivity to the Chinese market through India. There will be a sister line to the Nepal border, and eventually Kathmandu perhaps. Meanwhile, the Kumming-Singapore railway project is making rapid progress, with the blessings of the Thai government. Add to that China's Stilwell Road project, and the picture is near-complete.

Although the benchmark has been set, and too high for India's comfort, ultimately this isn't about China. It's about India's capacity to develop its border areas — economic integration of the Northeast and development of Arunachal Pradesh, where the environment ministry has unwisely chosen to obstruct projects. Better connectivity, roads, airports and railways are as much about trade and growth as the need to mobilise and dispatch troops if the necessity arises. At the moment, India has little in terms of such border infrastructure to sleep peacefully over, although sleeping is what it seems to be doing best.

From The Indian Express

Defence in times of resource crunch

In India's 2011-12 Budget, Finance Minister Pranab Mukherjee has allocated Rs.1,64,415 crore ($ 36 bn) for Defence. An increase of 11.59 per cent over the budget estimate of Rs 1,47,344 crore for fiscal 2010-11, this amounts to just 1.8 per cent of the country's gross domestic product (GDP).

According to the Stockholm International Peace Research Institute (SIPRI) database, India is among the world's 10 highest military spenders. However, its per capita defence expenditure is the lowest among the world's top defence spenders. Even as the percentage share of the GDP, India's defence expenditure has been lower than the global average.

Many defence experts consider 2011-12 outlay highly inadequate, given India's dangerous neighbourhood. Pakistan is drifting into a chaotic state, while West Asia's turmoil seems to be getting more complex. The experts' biggest concern is China's growing assertiveness and huge military budget. According to SIPRI Year Book 2010, India's military expenditure has grown from $ 22 bn in 2000 to $ 37 bn in 2009, whereas China's has more than tripled during the same period, from $ 31 bn to $ 99 bn.

In this context, critics of India's defence budget argue that it should have been a minimum of 3 per cent of the GDP. Such an expectation was, of course, unrealistic. Finance Ministers have to deal with a difficult challenge of balancing competing demands. In Mr Mukhejee's case, he had to address the worrying fiscal deficit and also meet a number of vital requirements of sectors like education, health and agriculture. He has, however, assured that "any further requirement for the country's defence will be met".

This outlay needs to be viewed in the context of the chronic problem of underutilisation that ails the Defence Ministry. While examining the expenditure pattern in the years 2006-07 to 2009-

IAI-Elta

10, the Sixth Report of the Standing Committee on Defence observes: "…notwithstanding the growth in the allocation, there is underutilisation of the allocations made to them (services) in all the years." Therefore, while advocating a higher outlay, the critics need to keep in view the current spending capacity of the defence establishment. A 3 per cent share of the GDP will amount to over Rs.2,69,000 crore, a jump of over Rs 1 lakh crore, which will be a wholly unrealistic outlay, as much of it will have to be surrendered. There is certainly a strong case for enhancing the defence outlay, by stages, to around 2.5 per cent of the GDP, but first the spending capacity of the defence apparatus will have to be augmented on the basis of a sound long-term national security strategy and capability development plans.

The good news from the Defence Ministry is that last year it was able to fully utilise and, in fact, exceed its capital budget, meant chiefly for modernisation. Another positive feature is the growing share of the defence budget's capital outlay. The revenue-to-capital ratio was just 74:26 in the ninth defence plan; it increased to 63:37 in the tenth defence plan and this year nearly 42 per cent of the defence budget has been allocated to the capital head. This trend indicates an increasing emphasis on defence modernisation.

Even within the constraints of a relatively modest defence budget, there is ample scope to improve the country's defence capabilities. The same resources can be innovatively applied to much greater effect. Substantial scope exists for securing greater value for money by harnessing the great potential of India's domestic industry. This would need sharing adequate information about capabilities (not equipment) required in the future, formulating broad specifications or qualitative requirements in consultation with the industry and encouraging the domestic private industry to participate in the procurement process. The manner in which specifications are currently formulated, most prospective Indian vendors get excluded from the competition. As in the developed countries, our defence forces will also have to learn the art of effecting performance - cost trade-offs and not always aspire for the most perfect equipment or weapon systems. Experience shows that reasonable compromises at the margins of performance parameters can result in huge time and cost savings and enable the local industry to enter the market presently monopolised by a handful of dominant global players.

The second innovation can be to outsource logistics, product support and maintenance to the industry to the extent possible. This measure can lead to greater efficiencies and cost savings. It is a growing practice in the West. There is no need to own and manage non-core services, if these can be handled by industry or service providers. This practice will also lead to substantial savings in terms of smaller inventories and minimising their obsolescence.

A third measure should be reform in project and process management combined with the intelligent use of information technology (IT). IT can greatly improve inventory management, logistics and in general decision -making. A major problem affecting many sectors in the country, including defence, is inordinate delays in project management. Given the huge outlays in defence, the cost of delays is particularly prohibitive. Speedier processing of major programmes and efficient project management can generate substantial resources for defence which can then be deployed for other vital capabilities.

While a robust defence for the country requires more money, it is perhaps equally important to secure maximum value from the available resources.

N S Sisodia
DG, IDSA

Flying Blind

If with the Commonwealth Games, 2G spectrum or Adarsh you thought that you had seen the last or worst of corruption scandals, think again. The news that pilots who have failed to qualify for their commercial licences have been paying for fake marksheets to obtain them anyway trumps them all. If the allegations are true, then Parminder Gulati, the first pilot caught may well be a true pioneer of corruption. Inflating the price of a roll of toilet paper or grabbing a flat meant for the kin of dead soldiers is one thing; taking to the skies without proper knowledge of how to pilot your aircraft and with the lives of hundreds of people depending on your competence - or rather, incompetence - blazes a new trail. Rules and regulations appear to serve little purpose, other than as an intellectual exercise for scamsters to figure out a way around them.

It would be farcical if it were not so horrifying - touts offering to have below-par exam papers 're-evaluated' much like blackmarketers try to scalp movie tickets outside a theatre. Or the fact that when the marksheets and other documentation for acquiring an airline transport pilot licence are submitted at the Directorate General of Civil Aviation (DGCA) head office in Delhi, staff there cannot cross-check the authenticity because the databases containing exam results are not networked. Surely a process needs to be in place whereby the DGCA offices distributing pilot licences have access to their own exam results.

It is luck of the highest order that this scam has come to light without any lives being lost, despite the many hard landings by Gulati that prompted officials to check her documents. The DGCA has launched a drive now to scrutinise the licences of about 4,000 pilots who might have obtained them through a similarly compromised process. Well and good, but civil aviation minister Vayalar Ravi must take personal charge of this. It's extremely unlikely that such a scam could have been perpetrated without the involvement of at least a few DGCA officials, especially since reports allege that a number of them have been resisting a probe. There must be no scope for a cover-up.

With the scam believed to have started in 2009, it has at least come to light quickly enough that there is a fair opportunity for cleaning it up before it becomes institutionalised. The investigative and judicial process must be swift. Just like those involved in the manufacture of spurious medicines, the guilty here have endangered thousands of lives for monetary gain. They must be found before luck runs out and we have an accident on our hands.

From The Times of India

Sagem

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Sinking the pirates

Most experts will tell you that once a merchant ship is hijacked by pirates, it is almost impossible to mount a rescue operation because the lives of hostages are at stake. In most cases (similar to aircraft hijacking), quick on-scene decisions are not taken. Local authorities usually await instructions from the concerned government.

But recently, the Indian Navy and Indian Coast Guard (ICG) jointly succeeded in neutralising two Somali pirate threats in the Indian exclusive economic zone (EEZ) without any back seat driving from South Block.

Piracy off the Somalian coast has been ongoing since 2005. Increasing pressure from about a dozen warships (including Indian) in the Gulf of Aden, where piracy attacks reduced by 50 per cent in 2010, has forced the Somali pirates to look elsewhere for booty.

The pirates seize slow-speed, long-range fishing trawlers and use them as 'mother ships' to sail on international sea routes and, on sighting a merchant ship, launch small high-speed boats (skiffs) carrying armed pirates who intercept and board the victim ship, sail it to Somalia, and later release the captured ship and hostages in return for millions of dollars.

On 10 April 2010, Somali pirates seized three Thai trawlers — *Prantalay*-11, *Prantalaya*-12 and *Prantalaya*-14 — with their crewmen. On 4 December INS *Krishna* and ICGS *Samrat* intercepted a hijacked Bangladeshi merchant ship off the Lakshadweep and Minicoy (L&M) islands, but had to allow the ship to sail to Somalia (where it joined 31 hijacked ships with 700 hostage sailors), when the pirates threatened to execute the Bangladeshi crew. Emboldened by this success, the Somali pirates continued their illegal activities in the waters near the L&M islands. Sixty thousand ships with goods worth over a trillion US dollars pass through the Indian Ocean annually.

To check increased pirate activity, on 13 December 2010, the Indian Navy and ICG launched a combined operation, *Island Watch*, involving ships and aircraft on surveillance missions, in the seas off the L&M islands.

At 10.30 am on 28 January 2011, an ICG Dornier 228 aircraft operating from Kochi noticed two white high-speed pirate skiffs closing in on the slow-moving 73,000-ton Bahamas registered container ship MV CMA CGM *Verdi*, about 220 nm west of Kochi. The unarmed ICG Dornier 228 aircraft made four low-level passes which caused the two skiffs to panic and abort their attack and return to mother ship *Prantalay*-14, which was also spotted by the Dornier. Two Indian Navy ships (*Cankarso* and *Kalpeni*) and two ICG ships (*Sankalp* and *Samar*) operating in the area were ordered to intercept the *Prantalaya*-14. INS *Cankarso* was the first to arrive the same evening, at 5 pm. Ignoring INS *Cankarso's* repeated calls to stop, the *Prantalaya*-14 attempted to escape, forcing the *Cankarso* to fire a single 30 mm warning shot a few hundred metres ahead (traditionally known as "firing across the bows") of the pirate ship. The pirate ship responded with gunfire, which forced the Cankarso to fire a single shot in self defence from its 30 mm gun. This shot hit the petrol tank of one of the embarked skiffs and a fire quickly devoured the wooden hulled *Prantalaya*-14. Twenty hostage fishermen and 15 pirates managed to jump in the water from the burning trawler.

The INS *Cankarso* rescued 20 Thai and Burmese fishermen and transported them to Kochi. Before departing, it left 15 pirates at sea, in naval life rafts, due to shortage of space. These 15 pirates were subsequently embarked on ICGS *Sankalp* and handed over to the Mumbai police on 31 January 2011. (Admiralty courts dealing with cases of piracy or maritime incidents and crimes are located in Mumbai, Chennai and Kolkata.) Interrogation revealed that the pirate mother ship *Prantalaya*-14 had sunk with 10 pirates, two hostage fishermen, 23 AK-47 rifles, two rocket launchers and seven grenades.

On 5 February 2011, the ICG Maritime Rescue Co-ordination Centre (MRCC) at Mumbai received information that a Greece-registered oil tanker MT *Chios* had managed to escape a pirate skiff attack off the L&M islands. An IN Dornier 228 aircraft from Kochi searched the area, while INS *Tir* and ICGS *Samar* were directed to intercept the pirates. ICGS *Samar* detected a suspicious contact on radar (later identified as *Prantalay*-11), about 100 nm from Kavaratti island and 300 nm west of Kochi. On reaching the area, at about 4.30 am, the *Samar* had to open fire to chase away a pirate skiff which, in the darkness, had mistaken *Samar* for a merchant ship. At about 5.45 am, an ICG Dornier aircraft from Kochi (armed with medium machine guns) also arrived and identified *Prantalay*-11. The Indian Navy and ICG units then closed to within a mile of the trawler.

The *Prantalay*-11 and its sleepy pirates were taken by surprise and had no reaction time to threaten their hostages and, after a brief exchange of fire, surrendered with no loss of life (three pirates were injured). A total of 28 Somali pirates and 24 hostage Thai fishermen were then embarked on ICGS *Samar* for passage to Mumbai, arriving on February 9, along with *Prantalay*-11, which was also towed by ICGS *Samar*.

While the Indian Navy and ICG deserve a pat on the back for these operations, it must be remembered that *Prantalay*-12 has not yet been neutralised and there may be other pirate mother ships around. On 8 February the Italian oil tanker *Savina Caylyn* (crew included 17 Indians and five Italians) was hijacked by Somali pirates (using a skiff and 'mother ship') some 450 nm from India's west coast and 700 nm from Somalia.

Piracy has spread to the Arabian Sea and needs to be eliminated ruthlessly before the pirates join hands with sea-borne terrorists. Hopefully, the proposed Indian Navy and ICG coastal stations in the Andaman & Nicobar islands, as also the L&M islands, along with coastal radar stations will become operational soon. More importantly, given the problems of co-ordination between multiple maritime agencies (Indian Navy, ICG, Customs, Marine police, port authorities, offshore rigs, lighthouses, fishermen associations, police etc), Indian Parliament needs to replace the 2009 government directive post 26/11 (with respect to coastal security) with a more comprehensive legislation which unambiguously indicates single-point command, control and accountability and also empowers that single-point authority (and the Indian Navy and ICG personnel at sea) to deal with the complex task of neutralising emerging threats in our waters and ports.

Vice Admiral (Retd). Arun Kumar Singh

AgustaWestland

Mirage 2000 upgradation contract

The long pending programme for upgradation of 51 Mirage 2000Hs of the Indian Air Force is to go ahead with the two sides having finally overcome their differences over cost of the contract which is estimated now to be just under $2 billion for the 51 Mirage 2000H/THs presently operated by Nos. 1, 7 and 9 Squadrons.

IAF Deputy Chief Air Marshal RK Sharma stated at Aero India 2011 that, "the negotiations are now successfully concluded. The final report is with the defence ministry and we expect to conclude the contract by the end of this financial year."

Under the upgrade programme, the IAF looks to extend the Mirage 2000 service life by 20 or more years after integrating a modern glass cockpit for improved situational awareness, better avionics, a new electronic warfare suite, sensors and next generation weapons. Seen above is the IAF's first Mirage 2000 (KF101) during Aero India 2011.

HJT-36 initial clearance 'by July'

The HAL HJT-36 intermediate jet trainer (IJT) is likely to obtain its initial operational clearance (IOC) by July 2011. Hindustan Aeronautics Limited are "very sure" about this milestone, as confirmed by Air Chief Marshal PV Naik, at Yelahanka during Aero India 2011.

The IJT has been developed by HAL as a successor to the HJT-16 Kiran, whose Mark I has been in service for well over 40 years. The HJT-36 is a stage-II trainer for selected pilots before they graduate onto the Hawk advanced jet trainer. A tandem-seat, all-metallic aircraft, the HJT-36 will also be used for formation flying, instrument and poor-weather flying, tactical cross-country navigation, night flying and basic air-to-ground and air-to-air armament training. With a maximum speed of 750 kmph, it has an altitude ceiling of 9 km. The maximum take-off weight is 5,100 kg and the aircraft can carry 1,000 kg of armament on five hard points, as also carry drop tanks. A conventional-configuration aircraft incorporating manual flight controls, its cockpit is ergonomically designed, air conditioned and pressurised. The IJT has Martin Baker lightweight ejection seats.

"Rafale suits IAF's requirements"

French Air Force Chief General Jean-Paul Palomeros, while at Aero India 2011, appeared very confident of the Rafale and its selection "as the M-MRCA of choice". He stated that the "Rafale was designed to be the next generation aircraft using the best technologies and integrating them to achieve an operational goal which was to get a true multi-role aircraft. I am very pleased with the aircraft's capabilities and we are very confident in sending the Rafale to India not only for fine display but also to showcase that the jet is suited to the needs of our friends from the IAF."

He believes that 'multi-role' is the future for fighter aircraft and is also confident of keeping the cost of running the Rafale at the lowest possible and improving its maintenance every day. Regarding the interface between the French and Indian Air Forces, he said, "We have been working with the IAF for a very long time and I'm very pleased to see the skills of Indian pilots on the Mirage 2000. The same pilots can very easily train on the Rafale." In further praise of IAF pilots, General Palomeros added that considering the expertise and high skills of Indian crew, he was sure that they would "get the grip on the Rafale very quickly".

Boeing

Eurofighter consortium "seeks India partnership"

The Eurofighter Partner Companies are keen to win India "as a new industrial partner for production and further development of the world's most advanced swing-role combat aircraft." Addressing the media at Aero India 2011, Bernhard Gerwert, CEO of Cassidian Air Systems and Chairman of the Supervisory Board of Eurofighter GmbH, outlined details of the industrial partnership offer to integrate India as a partner in the Eurofighter programme.

In order to phase India into the global Eurofighter Typhoon programme as a significant manufacturing and engineering partner, the Eurofighter partners will pursue an ambitious industrialisation plan. Gerwert explained, "We are starting to develop the base for a comprehensive future supplier network which will plug India into the global Eurofighter supply chain. Even before the M-MRCA selection, we invest in making India the new home for the Eurofighter Typhoon."

Seen in the picture from left to right: Guido Crosetto, Secretary of Defence (Italy), Karl-Theodor zu Guttenberg, Defence Minister, (Federal Republic of Germany), Costantino Mendez, Secretary of State for Defence (Spain), Peter Luff, Minister for Defence Equipment Support & Technology (United Kingdom)

Acquisition of the Eurofighter Typhoon by the IAF will create more than 20,000 high-skilled jobs in India and support the development of a self-reliant indigenous defence industry. "India would gain access to a wide array of technologies from Europe's leading aerospace and defence companies, avoiding over-dependance on a single source."

Rostvertol offers Mi-28NE and Mi-26T2 for the IAF

Rostvertol has received two RFPs for their Mi-28NE and Mi-26T2 helicopters from the Indian Air Force. The Mi-28NE helicopter is intended for support of the land forces, by both day and night in all weather conditions. It has high speed, combat survivability, a wide nomenclature of up-to-date protection and range of armament options.

The Mi-26T2 is the heaviest helicopter in the world and can lift up to 20 tonnes either inside its cargo bay or as an external load. With development based on the Mi-26, whose design has proven itself in a 30-year long operation, the Mi26T2 is fitted with glass cockpit comprising two multi-functional LCDs, two PS-7 control panels and set of backup electro mechanical units.

Defence procurements "will be on merit"

Making it clear that India will not give in to foreign pressures while acquiring the medium multi-role combat aircraft (M-MRCA), Defence Minister AK Antony said that the purchase decision will be based "solely on merit," and that there will be "no political decision in defence acquisition process, including the M-MRCA."

Further, Antony said, "The contract will be won based on meeting the IAF's request for proposal (RFP) and depending on whether or not the contenders meet all requirements of the IAF. We will only be concerned about the requirement and not which country the aircraft belong to." He added that "the RPF process involved a technical evaluation committee and a cost negotiation committee. Only then will the recommendation come to the government for a final decision."

The competing aircraft have gone through flight and weapons trials and the IAF's evaluation report submitted to the defence ministry. Emphasising that India needed to build its domestic capabilities over critical technologies in the long run, Antony, however, said that military threats from Pakistan and China had left India with "no choice but to look outside to meet the requirements of the armed forces". Antony added that "although the thrust was on self-reliance and indigenisation, achieving 'zero import' would not be possible."

Meanwhile, according to reports, US President Barack Obama has also written to Prime Minister Manmohan Singh, "hoping that the two American fighters would be considered for the M-MRCA contract."

Defence Minister AK Antony and Minister of State for Defence Dr MM Pallam Raju seen with US Ambassador to India Timothy Roemer after the inaugural of Aero India 2011.

IAF to acquire 230 helicopters

The Indian Air Force will acquire more than 230 helicopters "in the near future". Air Chief Marshal P V Naik has said that the force is in the process of acquiring helicopters of different types and sizes in the next couple of years, including "12 AW 101 VVIP helicopters, while trials for 22 attack and 15 heavy lift helicopters have been completed, 80 Mi-17 IV helicopters are being inducted and 50 more of these would be added."

The CAS said the field evaluation trials (FETs) for procuring 197 helicopters for the Army and Air Force were also over and the report was expected to be submitted shortly. Of the 197, the IAF would receive 55 helicopters. Under the LUH programme, the Army has conducted trials of the Russian Ka-226 and Eurocopter Fennec, the reports would be sent to the MoD soon. For the attack helicopters, the Russian Mi-28 and US Apache 64D Longbow are competing.

On upgrades to be carried out on the Su-30MKI, Naik said that HAL, DRDO and Russian manufacturers were also involved in the development of an AESA radar for the air dominance fighter.

Changes in offset policy?

With the imminent $10+ billion contract for medium multi role combat aircraft (M-MRCA) in mind, the Defence Ministry has constituted a committee to suggest changes in the stringent offset policy that would, among other things, ease the procurement procedure for the contract. The committee, which has been given three months to complete a report, comes as the race for the contract enters its final stages and contenders are straining every reserve to stay ahead.

The committee, headed by DG (Acquisition) Vivek Rae, is studying the existing offset policy to suggest changes and arrangements in view of demands from the industry, in particular apprehensions that domestic defence manufacturing sector is not able to absorb the financial flow calculated as per the offset rules. As estimated, the value of offset contracts is expected to exceed Rs. 10,000 crores in the 11th Plan. With the M-MRCA tender set to enter the next stage of negotiations, it is believed the committee will suggest ways to bridge gaps between the older DPP 2006 under which the tender was issued and the new policy of 2011 that has modified the offsets.

Among other things, the committee will examine suggestions that transfer of technology, a key requirement in most contracts, also be considered for meeting offset obligations. This would substantially bring down the acquisition cost as well. The committee is expected to suggest ways for valuation of foreign technology to make it eligible for meeting offset obligations.

Roll out of EMB-145 AEW&C

The first of three EMB 145 Airborne Early Warning and Control (AEW&C) platforms was presented on 21 February 2011 to representatives of the Indian government at a ceremony held at Sao Jose dos Campos, Brazil. Based on the Embraer ERJ 145 regional jet, the aircraft features an in-flight refuelling system, Satcom capability, a significant increase in electrical and cooling capacities, apart from considerable aerodynamic and structural changes. These improvements will enable installation of the advanced electronic systems currently being developed by the Defence Research & Development Organisation (DRDO) under CABS (Centre for Airborne Systems) coordination. The aircraft will now start intensive ground and flight tests, with the ferry flight to India scheduled for the second quarter of 2011.

Seen at the roll out ceremony are Dr VK Saraswat, Dr Prahlada, Dr S Christopher, Air Marshal Daljit Singh, and senior officials from the Indian Embassy.

All MiG-21/27s to be phased out by 2017

Even as the last MiG-21FL (Type 77), in service with the IAF since 1966, is to be retired by 2012, the remaining five MiG-21MF squadrons will follow into retirement two years later, with last of the six MiG-21 bison squadrons phased out by 2017. This was initially stated by the Air Chief during his Press Conference at Aero India 2011 and repeated by Defence Minister AK Antony at the Rajya Sabha on 23 February 2011. "We have got a clear cut plan to replace them. By 2017, the entire MiG series will be replaced in a phased manner, that is from 2014 onwards."

The MiG-21 has remained backbone of the IAF's combat force for several decades and at a point during the 1980s, constituted over 60% of the inventory with over 20 squadrons in frontline service, supplemented by another eleven squadrons of MiG-23BN and MFs, plus MiG-27MLs. The lone MiG-25R strategic reconnaissance squadron was stood down in May 2006 and the last MiG-23BN squadron number plated in March 2009 (see *Vayu* Issue II/2009).

After 2017, there will remain 3 squadrons of MiG-29UPGs, this type currently undergoing considerable upgradation in Russia. The first of 69 MiG-29UPG to be upgraded under a $960 million dollar deal was flight-tested in Russia on 4 February (photo above) according to the United Aircraft Corporation (UAC). Speaking at Aero India 2011 on 9 February, UAC President Mikhail Pogosyan added that the first upgraded aircraft would be delivered to the IAF by the end of 2011. Under the terms of the deal, signed in 2008, UAC will upgrade the first six aircraft in Russia; the remainder will be retrofitted at Hindustan Aeronautics Limited's Nasik facility.

No response from Rolls Royce on Jaguar re-engining

Even as Deputy Chief Air Marshal Ravi Sharma answered media questions on the Jaguar re-engining programme during the Chief's Press Conference at Yelahanka, stating that the response to RFP was expected by end February, reports were rife that Rolls Royce had planned not to participate. This was thereafter confirmed by Rolls Royce India executives who are "concerned that the competition was less than an upgradation and more of a complete re-engining programme".

Rolls Royce's approach was to be "an optimised cost effective/low risk Adour engine upgrade programme which would minimise aircraft integration and would utilise the existing Adour infrastructure in HAL". This basically means that the company had offered to replace/upgrade certain key components and subsystems in the Jaguar fleet's existing Mk.811 engines to

bring them up to the required performance parameters with the Mk.821 which would be a selective engine upgrade, and not a full replacement. The IAF had short-listed the Rolls Royce's Adour Mk.821 or the Honeywell F125IN engine for its Jaguars, both of which provide over 40 kilo newton thrust.

With Rolls Royce not responding to the RFP, Honeywell would become the sole competitor thereby leading to a single vendor situation which is contrary to the current Indian defence procurement procedures.

New batch of Mi-17V-5s for IAF

India is to take delivery of the first of 80 Mi-17V-5 helicopters in March 2011, the helicopters having been ordered from Rosoboronexport in December 2008 under a $1.3 billion contract. Deliveries should be complete by 2015, increasing the IAF's medium-lift helicopter inventory. It is also suggested that the IAF will have a follow-on order for a further 50 Mi-17V-5 helicopters.

HCL Infosystems for IAF

HCL Infosystems, the well-known hardware services and ICT System Integration Company, have been awarded an order of Rs. 300 crore by the Indian Air Force to deploy the Wideband CDMA based Portable Wireless Network covering many Air Force Stations across India. The IAF has also finalised contract for establishing a captive 3G mobile network for its personnel which give latest value added services using state of art mobile communication technology.

This WCDMA network will be integrated with the Air Force Network (AFNET), deployed earlier by HCL Infosystems, as the backbone connectivity and ensure video interactivity for video calls, cross connectivity with other communication platform like IP-based communication within Air Force Network.

The 3G network will also have transportable mobile base stations for establishing communication with higher echelons even from remote locations in the country. HCL Infosystems will implement the whole project on turnkey basis.

Suryakirans to supplant Kirans with new mounts

The Suryakiran Aerobatic Team (SKAT) carried out scintillating displays over Yelahanka during Aero India 2011. Presently commanded by Wg Cdr Prajual Singh, the nine HAL Kiran Mk.IIs were flown at their professional best, with an amazing new repertoire including an unusual formation sky writing of the letters 'I-A-F' in white smoke.

However, this occasion could be considered as a swan song for the Kiran aircraft operated by the Suryakiran team as this type will surely be replaced by more modern aircraft coming into service with the IAF. The HJT-16 Kiran is to be replaced by the HJT-36 intermediate jet trainer in IAF service, but owing to delays in development and consequently introduction into service, the Suryakirans could well instead be equipped with the Hawk Mk.132 Advanced Jet Trainer of which the IAF is to receive 106 aircraft, both direct supply from BAE Systems and licence-built by HAL.

The Suryakiran team 2011: standing (L-R) S/L Digvijay Singh, W/C Deepak Setia, S/L K Ramji Yadov, S/L Gurpreet Singh Sudan, S/L Ashwin Thakare, W/C Ajeet Kulkarni, W/C Prajual Singh (CO and team leader), S/L Vikram Mehra, S/L Akhilesh Singh, S/L Brijesh Paul, W/C D Roy-Choudhury and S/L Venu Nambisan.

As Wg Cdr Prajual Singh put it, "the team will start performing on Hawks as the Kiran Mk.II is phased out." His teammate Sqn Ldr K Ramji Yadov added, "The team's performance and manoeuvres will definitely get better as Hawks are more modern aircraft." However, "nothing will beat the thrill of flying an indigenously built aircraft… the team can't wait to fly the IJT." He ended by saying, "Yes, we are, of course, emotional about the Kirans that we fly now. But as professionals we understand the need to change them as they have become old."

Chief of Air Staff, Air Chief Marshal Pradeep Naik summed it up succinctly: "the Suryakiran team is too good to be done away with... there is no question of it being dismantled." The team will get the Hawk in the near future but the long term target is to use the IJT, he concluded.

No.44 Squadron and No.110 Helicopter Unit awarded President's Standard

President of India Pratibha Devi Singh Patil awarded Presidential Standards to the IAF's No.44 Squadron and No.110 Helicopter Unit at IAF Station Bagdogra on 9 March. The Presidential Standards are awarded to the flying formation after completion of 18 years existence and performing "outstandingly in operations".

No. 44 Squadron *'Mighty Jets'*, presently based at Nagpur, was initially raised at Chandigarh in 1961 with An-12s and thereafter equipped with Il-76s. During the Sino-Indo conflict of 1962 the An-12s airlifted AMX-13 tanks to Chushul, situated at an altitude of 14,000 feet. During the 1971 war the Squadron was involved in the carpet bombing of enemy armoured concentrations. In 1988 the Squadron executed the strategic intervention mission airlifting paratroopers to the Maldives to thwart the coup attempt by mercenaries.

No. 110 HU *'Vanguards'* were raised in 1962 with Mi-4 helicopters and presently operate Mi-17 helicopters from Kumbhigram. The unit participated in *Op Orchid* in 1964 and in the 1965 war provided logistical support to the Indian Army and thereafter participated in operations such as Op *Pawan*, Op *Hammer* and Op *Suraj*. No.110 HU introduced the now well established acronym SHBO (Special Heliborne Operations) to armed forces lexicon.

Grob

All Air India flights to fly under AI code

From 27 February 2011 all flights of national carrier Air India are operating domestic and international flights under the AI code, thereby making the IC code of the erstwhile Indian Airlines and its subsidiary Alliance Air redundant. Indian Airlines and its subsidiary Alliance Air were merged with Air India to form the corporate entity National Aviation Company of India (NACIL) in 2007. The two airlines, however, were still using separate codes till end-February.

Kingfisher shifts focus to domestic sector

With IndiGo set to replace Kingfisher Airlines as the second-largest airline in the country in terms of the number of passengers, Kingfisher is planning to focus more on the domestic sector. "Our domestic passenger numbers are set to increase after we join the One World Alliance by the end of this calendar year," said Kingfisher Airlines Chief Executive Officer, Sanjay Aggarwal, but added that the carrier has no major plans for international expansion.

The Oneworld Alliance, with 11 airlines in its fold, covers 870 destinations across 146 countries through a network of over 9,300 daily flights. The alliance also carries 335 million passengers on a combined fleet of over 2,400 aircraft. In December, IndiGo recorded a market share of 18.6 per cent, which was also Kingfisher's market share.

Kingfisher Airlines plans to more-than-double its fleet size, from 66 to 137 aircraft by 2015-16. In the next financial year, Kingfisher will add nine more aircraft including six A320s, two A330s and one ATR. Of these, eight will come directly from the market. The carrier plans to add 14 aircraft in 2012-13, 20 in 2013-14, 16 in 2014-15 and 13 in 2015-16.

Indigo to add 14 A320s in 2011

The country's largest low-cost airline Indigo, which entered record books with the single largest order for big jets in commercial aviation industry in December, will add 14 A320s to its fleet this year. This will take its total fleet strength to 48. The Gurgaon-based carrier had sealed

a $15.6-billion (around Rs 70,000 crore) deal to buy 180 aircraft with a capacity to carry about 150 passengers each. Aditya Ghosh, President, Indigo, said a final decision on engine selection was yet to be taken by the airline.

Ghosh added that currently the airline had no plans for an initial public offering of shares to fund its expansion plans. The airline had no immediate plans to raise fares in the backdrop of an increase in jet fuel prices. The carrier has already secured the approval to start operating flights on the Singapore, Bangkok, Dubai and Muscat routes from several Indian cities.

Amritsar-Toronto flights re-started

Almost four months after the withdrawal of Air India's Amritsar-London-Toronto flight, the new flight from the holy city to Toronto re-started from 20 February 2011. The flights are fully booked out for the entire month ahead.

NRIs hailed the resumption of flight from Amritsar to Toronto, stating that though UK-bound Punjabis would be disappointed, but it would bring about much-needed India-connection for the huge Sikh population in Canada.

Gripen

Air India's reduced budget

Air India is likely to be allocated Rs. 1,200 crore in the Budget for 2011-12, or half of what the civil aviation ministry had sought for the ailing carrier. Funds will be released in tranches and will be subject to the airline meeting performance milestones set by the MoF. Air India has already accumulated losses of Rs. 13,000 crore and debt of Rs. 50,000 crore. At a meeting with the Prime Minister's Office in November 2010, the airline's independent directors had said that the carrier needed one large injection of funds instead of small doses of equity infusion which may not be effective in helping the airline improve its financial condition.

Earlier, the MoF had asked for the airline's turnaround plan when Civil Aviation Minister Vayalar Ravi had requested for infusion of more funds into the national carrier. The turnaround plan, which is essentially a five-year business plan, has two parts: financial turnaround of the airline using equity infusion from the government, and an operational business plan focusing on fleet size, routes and ways to regain market share.

These include completion of route rationalisation exercises, implementation of IT-related projects like passenger scheduling system, rationalisation of contract and casual employees, reduction in staff costs, induction of independent directors and a chief commercial officer. The other milestones were leasing of three Boeing 777-200 LRs and operationalisation of Special Business Units.

Of the five independent directors on the airline's board, Anand Mahindra has offered to resign, while Air India Chief Operating Officer Gustav Baldauf has left after his outspoken comments on "government interference".

Eurocopter sells five AS350 B3s in India

Acquisition of five AS350 B3 helicopters by three Indian customers has been announced by Eurocopter. Three of the rotary-wing aircraft were ordered by Global Vectra, whose fleet will grow to seven AS350 B3s, while Summit Aviation and SS Aviation have each purchased one. All five are scheduled to be delivered during 2011.

AS350B3 of Global Vectra at Panchtarni Helipad 12,729ft a.s.l., in Kashmir, performing passenger transportation for pilgrimage

"Slow Indian decisions frustrating": GE chief

General Electric (GE) CEO Jeffrey Immelt has said the company was frustrated at "the slow pace of decision-making in India" and considered this the biggest challenge even ahead of corruption. However, the company lists India as an extremely important market. Apart from the aero-engine business, where GE have recently been selected for the LCA Mk.II's engine, GE has been competing for a massive contract with the Indian Railways to supply locomotives. But the process has been held up in numerous bureaucratic hurdles and delays, a solution to which is still not in sight. The company expects its business in India to grow by over 30% this year, on a par with developing economies such as Latin America and China.

Honeywell support for Jet Airways

Jet Airways and its subsidiary, JetLite, have selected Honeywell to provide comprehensive global maintenance support for APUs fitted on their fleet of Boeing B737s and Airbus A330 aircraft. Honeywell's new APU maintenance contract will provide Jet Airways and JetLite with predictable and lower maintenance costs through 2018. The agreement covers maintenance support for the 131-9B APU on Boeing 737NGs, and the 331-350 APU on Airbus A330s. Jet Airways and JetLite currently operate a combined fleet of 73 B737NGs and 12 A330s. During the programme term, fleet size is expected to grow to one hundred B737NGs and twenty-five A330s.

CAE and AAI training programme

Airports Authority of India (AAI) and CAE are to start a helicopter ab-initio pilot training programme to be launched later this year at the CAE Global Academy at Gondia. The programme will lead to a commercial helicopter pilot licence (CHPL) and within three years is expected to graduate approximately 100 new helicopter pilots annually. CAE Global Academy Gondia is the newest flight school in India, established two years back, to train aspiring airline pilots. Also known as the National Flying Training Institute Private limited (NFTI), the school is a joint venture of AAI and CAE. Pawan Hans Helicopters, a minority shareholder of NFTI is to provide expertise and operator experience for the new training programme.

L-3 products to include MADRAS in India

L-3's Aviation Products Group has stated that their Modular Airborne Data Recording/Acquisition System (MADRAS) voice and data recorder will be the first L-3 product produced by the Centum Group in India for export back to the US and will also provide L-3 with the capability to supply contemporary aviation recorder technology for the Indian market. This is part of

Samtel

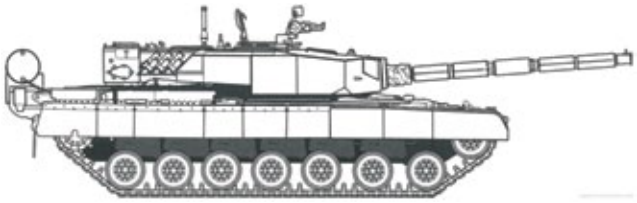
a product cooperation agreement announced previously between the Bangalore-based company and L-3 Aviation Products Group (L-3 APG). The MADRAS integrates voice and data recording with built-in data acquisition into a single-box solution for military and commercial aircraft.

Maharashtra Govt acquires Sikorsky S-76

Sikorsky Aircraft Corp. signed a contract to sell a S-76C++ helicopter to the Maharashtra Government for VIP transport, which joins a growing fleet of Sikorsky helicopters operating in India or on order by Indian customers, including other S-76(r) family aircraft and lightweight S-300(tm) and S-330SP(tm) helicopters. A Sikorsky spokesperson said, "this aircraft is recognised the world over for its safety, performance, efficiency and comfort. We thank the government and look forward to delivering this highly capable, fully configured aircraft before the end of the year."

Further indigenisation of Arjun MBT

The Defence Research and Development Organisation (DRDO) is working on "a more potent variant of the Arjun tank which will be rolled out in three years." Dr VK Saraswat said the German engine with the current version of the tank would be replaced by an Indian powerplant and the new variant (Arjun Mk.II) would be 90% indigenous. "The new variant will have high indigenous quotient, except for some hydraulic and electronic systems. The tank should be ready in early 2014. It will feature several modifications including superior missile firing capabilities. "



The Indian Army raised the first armoured regiment (43rd) equipped with Arjun tanks in May 2009, and is raising a second regiment. The army has so far placed orders for 248 tanks, each costing Rs 16.8 crore. The Arjun was earlier plagued with problems concerning its fire control system, suspension and poor mobility owing to its heavy weight and accepted the Arjun tank only after an independent audit by an international tank maker to endorse the battle-worthiness of the tank after extensive evaluations. The tank has been designed and developed by the DRDO's Combat Vehicles Research and Development Establishment, Avadi.

Promotion policy for Generals reviewed

The Indian Army is reviewing an earlier promotion policy for Flag ranks that segregated them into command and staff streams. Introduced around two years ago during the tenure of the then Army Chief, Gen Deepak Kapoor, the segregation was not well received in the Army's top echelon. "From the next selection board that considers prospective general officers, we expect that there will be no segregation into command and staff streams," said a senior officer at the Western Command Headquarters.

Under the earlier policy, senior officers were earmarked either for the command stream, whereby they were eligible to take over as corps commanders and subsequently as Army commanders, or the staff stream, where they could be posted only on administrative duties at formation headquarters not involving command of troops.

Sources said the results of the board for promotions to lieutenant general, held in December 2010, have started trickling in and these are still in the command and staff format. Among officers approved for the rank of lieutenant general, two are from artillery, one from signals and one from air defence.

The 'top-heavy' Army has vacancies for 90 lieutenant generals and 290 major generals, even as a shortage of over 12,000 officers exists at the junior and the middle level. The increase in vacancies consequent to the implementation of the AV Singh Committee Report had led to many appointments being upgraded, with posts tenable by brigadiers and major generals being now filled by major generals and lieutenant generals.

Sources point out that the outcome of the selection board for promotion to the rank of major general, has been "stalled for the time being". The Defence Ministry has reportedly asked the Army to settle some pending issues pertaining to vacancies at this level before approving the board's recommendations.

Army to probe howitzer trials "leak"

The Western Army Command has ordered a Court of Inquiry (CoI) under a Lieutenant General to probe the 'leak' of the trial report of M777 artillery guns, which the Indian Army wants to procure under a FMS deal with the USA. Sources have said the Army inquiry will investigate the entire issue with specific focus on possible violation of Official Secrets Act (OSA). It is after a considerable time that the Army is conducting a CoI against several officers, suspecting them to have violated the OSA.

F-INSAS for Indian Army

The MoD has issued a global RFI (request for information) for procuring integrated computer and communication systems (ICCS) for the infantry, which arm constitutes well over one-third of the 1.13-million strong Indian Army. This is prelude to gradually transforming infantry soldiers into high-tech, networked, self-contained warfighters under the Army's overall F-INSAS (future infantry soldier as a system) plan.

Chief of Army Staff General V K Singh has identified transformation of the infantry into an agile, lethal and networked force, which is capability-based to meet the future challenges, as one of his top-priority areas. Under the ICCS, infantry battalions will be equipped with soldier-wearable computers, radios and GPS, backed by central power pack modules and battle-load carrier vests.

Although the plan was to implement F-INSAS across all the 359 infantry battalions by 2020, it has faced some delays. Now, systems development and integration will first be carried out, followed by user-trials by two infantry brigades. Finally, the F-INSAS project will be fielded for the entire infantry. The computer module, for instance, will include data terminals for senior commanders, portable planning boards for commanders and wrist displays for soldiers. This will ensure jawans are able to receive, store and transmit complex voice, data and video signals for advanced situational awareness. ICCS will have the ability to accept and present realtime information provided by C4I (command, control, communication, computer and intelligence) tools, says the RFI. Soldiers should have the ability to exchange pertinent information up and laterally across the chain of command under all environmental and climatic conditions, it adds.

These will bolster the soldier's "lethality, survivability, sustainability, mobility and situational awareness in the digitised battlefield." There are also plans to equip each infantry section of 10-12 soldiers with a robotic mule, which apart from helping them carry additional load, will also be mounted with remotely-activated weapon systems for concentrated firepower.

"More women in armed forces": Antony

The percentage of women in the armed forces will be increased in phases, Defence Minister A.K. Antony has said but the Armed forces would employ women "only in non-combat jobs. They would have equal opportunity as men for employment in such disciplines." The Indian Air Force has the highest percentage of women on its rolls, followed by the Navy and the Army.

Nishant UAV flight trials

The Nishant Unmanned Aerial Vehicle has successfully completed a series of confirmatory trials recently conducted by the Indian Army at Chandan Range Pokharan. Nishant has been designed and developed by the Aeronautical Development Establishment (ADE), specialising in UAVs, Flight Control Systems and Simulators, in partnership with other DRDO laboratories such as Defence Electronics Applications Laboratory (DEAL), Dehradun, Research & Development Establishment (Engineers), Pune and Aerial Delivery Research & Development Establishment (ADRDE), Agra. The flight trials were conducted by the Army before taking delivery of a set of four Nishant UAVs together with ground systems.

Indo-Singapore Armed Forces in joint training

After completion of the first leg of its joint training exercise *'Agni Warrior'* with the Singapore Army, soldiers from the two countries are now embarked on *'Bold Kurukshetra'* in Central India. "These exercises underscore the warm and cordial defence relations between India and Singapore and are aimed at enhancing cooperation and mutual understanding between the two armed forces. It encompasses multi-tiered planning, use of new generation equipment and joint execution of mission by artillery batteries and combat groups."

Northrop Grumman MoU with Pipavav Shipyard

Northrop Grumman and Pipavav Shipyard have signed a Memorandum of Understanding to explore synergies in technology, experience and capabilities for mutual security interests of the US and India. Raj Kumar Sharma, India Country Manager Northrop Grumman stated that, "This memorandum covers the exchange of programmatic and planning information in accordance with the export laws of governments of India and the United States. It also allows both companies to identify synergies and develop operational concepts that may benefit future potential customers."

Indian Navy positions Dornier in Seychelles

Indian Navy has deployed a Dornier 228 to Seychelles under a government to government MoU. The Dornier stationed at Victoria, capital of Seychelles will be operated for Exclusive Economic Zone surveillance and anti-piracy patrols, operated by Indian Naval aircrew in response to requirements projected by the Seychelles government. Earlier during Defence Minister AK Antony's visit to the Seychelles, the two countries had agreed to take forward their cooperation to tackle the spread of piracy in the Indian Ocean Region (IOR). India has agreed to facilitate Seychelles' acquisition of one new Dornier 228 and two Chetak helicopters from HAL for maritime surveillance. Antony said "The Indian Ocean links us all and is critical for our economic interests. We must cooperate to ensure peace and stability in this region."

New fleet tanker for IN

INS *Deepak*, first of the two new fleet tankers being built by Fincanteri Shipyard, Italy, was commissioned into the Indian Navy at Mumbai on 21 January 2011. The ship's Commanding Officer, Captain VK Madhusoodanan, read out the commissioning warrant which was followed by hoisting of the National flag and Naval Ensign and breaking of the Commissioning pennant on the ship's mast, marking the formal induction of INS *Deepak* into the Indian Navy.

Designed by Fincanteri Shipyard specifically for the Indian Navy, this ship is one of the largest in the Navy, 175 metres long, 25 metres wide and has a full load displacement of 27,500 tonnes. The second generation ship has been designed, constructed and delivered in a record time of 27 months, and has state-of-the-art facilities to operate various types of helicopters from its deck including the Seaking. The ship presently has a crew of 15 officers and 182 sailors.

IN Boeing P-8I to be equipped with Harpoon Block II missiles

Indian Navy Boeing P-8I maritime patrol aircraft are to be equipped with AGM-84L Harpoon Block II missiles, a weapon already purchased for integration with the Indian Air Force Jaguar Maritime aircraft. Plans for the proposed acquisition under a Foreign Military Sale at an estimated cost of $200 million were notified to US Congress by the Defence Security Cooperation Agency on 21 December 2010. The contract will cover 21 AGM-84L Block IIs, five ATM-84L training missiles, captive air training missiles, spares, support and training.

Maini Group contract with Marshall Aerospace

The Maini Group has signed a long-term contract with Marshall Aerospace for the provision of structural machined parts in support of the Boeing P-8I. Marshall Aerospace was represented by Andrew Monk, Supplier Manager and Jeremy Rogerson, Supplier Quality Assurance Manager, while representatives from the Maini Group were Gautam Maini and Naresh Palta.

In August 2010, Maini Global Aerospace Pvt. Ltd. (MGA) made an entry into the sub-tier of Marshall Aerospace with a long-term contract for structural components for the extended range fuel cells of the Boeing P-8I long range maritime reconnaissance and anti-submarine warfare aircraft ordered by the Indian Navy.

HAL planning for M-MRCA production

HAL is expected to create new production facilities employing nearly 3,500 people for manufacture of the chosen M-MRCA. This will be located on the eastern side of the main runway, adjacent to the ASTE complex. HAL presently has 19 production divisions and 10 research units.

HAL to go public?

Hindustan Aeronautics Limited awaits the government's "green signal" to go public soon to raise funds and improve its corporate governance. Former HAL finance director D Shivamurti stated that "being a fully owned state-run enterprise,

Pawan Hans

it is for the government to decide when to begin the disinvestment process and the quantum of dilution. The process of making an initial public offer (IPO) will be for various reasons, including meeting corporate governance objectives, making public stakeholders and having financial muscle to meet our future requirements for scaling strategic operations."

Once the government approves divesting in the open market, the company board will decide the quantum, value and timing of the issue. "We will be investing about Rs 20,000 crore (Rs 200 billion) over the next ten years to modernise and expand our capacity to execute orders valued at Rs 100,000 crore (Rs 1 trillion). We plan to raise funds internally (about Rs 1,500 crore) and from the market through a combination of equity and debt instruments than depend on the government for capital investments," Shivamurti added.

"Total modernisation of HAL facilities"

HAL has embarked on an extensive "total modernisation of its facilities" programme at an estimated cost of Rs 20,000 crores which will be self-generated. This was the highlight of HAL's press conference on 10 February 2011 at the Aero India Show. In perspective, HAL have massive orders totalling nearly Rs 100,000 crores, which covers the production and supply of fighters, trainers, transport aircraft and helicopters over the next plan period.

P. Soundara Rajan, Managing Director of HAL's Helicopter Complex and Director Corporate Planning & Marketing, said that, "In the next ten years, some 1500 helicopters of various types will be produced by HAL, including the ALH, LCH, LUH and the medium helicopter." He revealed that HAL's planning, the 6-tonne helicopters (ALH and LCH) would continue to be produced at Bangalore while new facilities would be built at perhaps another location for the LUH and medium helicopter.

Photograph shows P. Soundara Rajan and other HAL executives with Maj Gen PK Bharali, ADG Army Aviation.

Concerning various fixed wing programmes, the HJT-36 intermediate jet trainer has resumed flight testing and it is expected that IOC would be achieved by July 2011 when IAF pilots will begin conversion to the type. N C Agarwal, HAL Director for Design and Development, also referred to the ongoing multi-role transport aircraft (MRTA) programme under a joint venture agreement with the Russians and said that the aircraft will be delivered to the customer in 2016-17. On the fifth generation fighter aircraft (FGFA), cost sharing would be in the ratio of 35:65, with HAL assuming the former.

Following the press conference, HAL formally handed over a batch of five Dhruv ALH Mk.IIIs, with the Shakti engine to the Indian Army. (see picture)

Finmeccanica to expand in India

Finmeccanica are looking at establishing fresh partnerships with government and private players to expand their base in India. As part of its growth strategy, Finmeccanica wants to adapt the approach of anticipating new programmes and seeking early involvement through transfer of technology and capabilities by creating strong synergies with its partners.

Commenting on the Indian defence market, Giorgio Zappa, COO Finmeccanica felt that, "Indian Ministry of Defence's current agenda to expand the defence industrial base, encourage indigenous defence production and reduce defence imports is commendable as that will ensure faster indigenisation. India is a key country for us; we seek preferred partnership and want to expand our presence by showing our technologies with the capabilities of local partners."

Probe on Antrix Board

The Prime Minister's Office-appointed panel of Dr. BK Chaturvedi and Prof. Roddam Narasimha is expected to have extensive discussions with at least four members of the 2004-05 Antrix board which is said to have approved the draft contract with Devas Multimedia in December 2004 with the final contract in January 2005. The deal will also be reviewed with others in the government, ISRO, department of space, space commission and the cabinet members.

According to reports, the draft was approved by at least two members of the Antrix board in December 2004, former ISRO chairman Dr. G Madhavan Nair and head of a Hyderabad-based private firm, G Ravindra Reddy, the lone private sector board member at the time.

The panel will probe whether additional secretary in the department of space in 2004 Veena Rao, and then member, finance of space commission S K Das in 2004-05, were part of the board when the draft was formulated. It will also investigate the final contract signed in January 2005 and whether the two had approved of it. The panel will examine as to other members being present at the board meeting in December 2004. Veena Rao, S K Das, J N Godrej and Ratan Tata, did not attend the meeting for different reasons.

Avdel

PM commends BrahMos team

Prime Minister Manmohan Singh was given detailed briefings on capabilities of the BrahMos supersonic cruise missile, jointly developed by India and Russia, during his visit to BrahMos Aerospace Thiruvananthapuram Limited (BATL) at Chakka, on 12 February 2011. The PM was accompanied by Defence Minister AK Antony, Chief Minister of Kerala VS Achuthanandan, and a number of senior government, defence and defence research functionaries.

"During his visit, the Prime Minister commended the BrahMos Aerospace team for developing such a superior weapon system without parallels," said Dr A. Sivathanu Pillai, BrahMos Chief Executive Officer.

The BrahMos, which has already been inducted into the Navy and the Army, will have its air version tested on Su-30MKI aircraft next year. Prototype of the universal BrahMos launcher, designed and built indigenously by BATL, was shown to the PM. The six-metre-long launcher, fabricated from large aerospace grade extrusions, is the first and the largest launcher built within India.

Prime Minister Manmohan Singh visiting a BrahMos Aerospace Unit in Thiruvananthapuram.

The PM then reviewed the domestic, public and private industrial infrastructure available to produce a number of BrahMos missiles and ground systems for meeting all requirements of the three Services. He commended the steps taken for product support in extreme regions to ensure readiness of the systems.

The PM also visited an operational BrahMos mobile command post and an autonomous BrahMos launcher of the Army, where he was briefed by Lieutenant-General Vinod Nayanar, Director General of Artillery.

Tata's new aerospace facilities in Hyderabad

The Tata Group have signalled their continued commitment to Andhra Pradesh with groundbreaking ceremony for three new Aerospace manufacturing facilities in the presence of the Chief Minister of Andhra Pradesh N Kiran Kumar Reddy and S Ramadorai, Chairman of Tata Advanced Systems. The three projects are Tata Lockheed Martin Aerostructures, Tara Aerospace Systems (a JV with Sikorsky Aircraft) and Nova Integrated Systems (working on advanced surface to air missiles).

BEL MoU with Sagem

Bharat Electronics Ltd (BEL) and Safran Sagem have signed a MoU on Land Navigation and Artillery pointing applications based on Sagem Sigma 30 Inertial Navigation System. Sigma 30 equips the world's leading artillery systems, including the indigenous Pinaka missile system. The MoU shall facilitate the ToT of Sigma 30 to BEL which will reinforce BEL's position as a leader in Artillery Fire Control Systems. Besides, this partnership will offer the Indian Army a local source of manufacturing and maintenance, in addition to the maintenance facility already commissioned by the Indian Army, thus, further enhancing the customer support.

Rolta and SELEX Communications in strategic partnership

Rolta and SELEX Communications have signed a Strategic Partnership Teaming Agreement for the Indian Tactical Communication System (TCS) programme, wherein the companies will collaborate to provide comprehensive tactical military communications solutions to Indian Army. Under this agreement, SELEX Communications will undertake transfer of its state-of-the-art technology for radio relay systems, switching systems and field wireless systems among others to address the TCS programme needs. With a high level of Indian content, these sophisticated military communication systems will fulfil the long-standing national need of indigenous technology in this critical area.

Axis Aerospace MoU with Thales

Axis Aerospace & Technologies Pvt. Ltd (AAT) and Thales have signed a Memorandum of Understanding (MoU) for the creation of a Joint Venture (JV), to establish a flight training centre at Devanhalli Aerospace Park, adjacent to the new Bangalore International Airport. The JV, a first of its kind in India, will initially have three Full Flight Simulators, housed in a modern, purpose built facility large enough to accommodate additional simulators to meet future market requirements. AAT will be the majority shareholder and the JV plans an initial investment of about US$ 50 million for the project. Thales will supply the simulator equipment and provide management expertise in establishing and maintaining the centre. AAT will operate the centre locally to train around 2,000 pilots a year.

CAE's new Indian aerospace and defence complex

CAE has inaugurated its new aerospace and defence complex in Bangalore, located close to Devanahali International Airport. The complex is headquarters for CAE's operations in India where it designs and develops defence training systems and operates an engineering 'centre of excellence' where visual databases and other software components for CAE's simulators are developed.

The facility also houses India's first independent aviation training centre. The six-bay capacity centre currently offers Airbus A320 and Boeing 737 pilot training on three CAE-built full-flight simulators. More than 1,500 pilots trained at the centre last year, including pilots from Indian-based airlines such as Air India, Go Air, IndiGo, Kingfisher Airlines, Spicejet plus pilots of the Indian Air Force. Other customers include Fly Wings Aviation and SriLankan Airlines. The training centre is part of the CAE-Airbus Training Services Cooperation agreement.

Dhruv simulator cockpit delivered to HATSOFF

The Helicopter Academy to Train by Simulation of Flying (HATSOFF), the joint venture owned equally by HAL and CAE, have announced arrival of its simulator cockpit for the civil/conventional variant of the Dhruv at the HATSOFF training centre in Bangalore following design and manufacture at CAE's facility in Montreal, Canada. The Dhruv simulator cockpit will now be installed and integrated with the CAE-built full-mission simulator currently in operation at HATSOFF.

The simulator features CAE's roll-on/roll-off cockpit design, which enables usage of cockpits representing various helicopter types. The cockpit for the civil/conventional variant of the Dhruv is the second for the HATSOFF training centre and will be ready-for-training in May 2011. The first cockpit for the simulator represents the Bell 412 helicopter, training for which commenced in July 2010.

Saab to establish R&D centre in India

Saab has announced the establishment of a Research and Development Centre in India, to "create a sustainable and long term relationship to be able to co-develop critical technologies with India." The aim of the R&D centre is to continuously transfer already identified concrete programmes and technologies to India. The centre with an initial staff of 200-300 Indian engineers "will form a bridge between India and Sweden. The centre will stimulate innovation all around India" stated Saab President & CEO Håkan Bushke, (seen above), the areas of focus to cover aerospace, defence and urban innovation including civil security.

CASSIDIAN opens new engineering centre in Bangalore

Cassidian, the defence and security division of EADS has opened a new Engineering Centre in Bangalore, the first defence oriented engineering centre operated by a foreign company in India and therefore "a landmark achievement towards Cassidian's strategic goal to establish a long-term partnership with India." The new centre is staffed almost entirely with highly qualified Indian engineers after extensive training in Europe with plans to increase the current number of 60 employees to more than 200 by the end of 2012.

Minister of State for Defence MM Pallam Raju and Dr. Stefan Zoller, CEO of Cassidian at the opening of the centre.

The major objective of the Engineering Centre is to leverage the vast pool of skilled engineers available in India to develop products fulfilling the specific requirements of

the Indian customers and to provide consultancy and other services to the aerospace and defence companies in India. The Engineering Centre will be at the forefront of Engineering and System Development, developing its core competencies in the areas of Radar Systems, Protection Systems, Avionic Systems, Engineering IT & 3D Visual Simulation, Aerostructure and Aerospace Modelling and Simulation.

Ballistic Missile Defence System tested

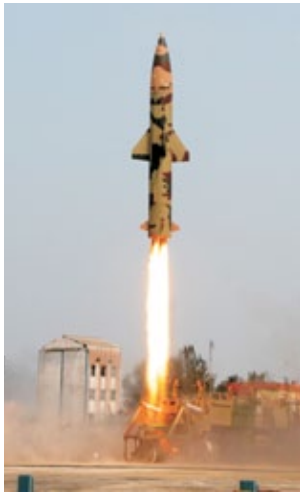
The Indian Ballistic Missile Defence System was successfully flight tested off the coast of Orissa on 6 March 2011. A Target Missile mimicking an enemy Ballistic Missile was launched from Launch Complex –III, ITR, Chandipur a little earlier.

The missile tracking network consisting of long range and multi function radars and other range sensors positioned at different locations detected and identified the incoming missile threat. The radars tracking the Ballistic Missile constructed the trajectory of the missile and continuous complex computations were done in real time by ground guidance computer to launch the interceptor at an exact time. The fully automatic launch computer launched the interceptor at 0937 hrs and the onboard INS (Inertial Navigation System) and ground based Radars guided the interceptor to the target (incoming Ballistic Missile). The Interceptor intercepted the Ballistic Missile at an altitude of 16 km.

Dr VK Saraswat, Scientific Advisor to the Defence Minister, along with Avinash Chander, Director ASL, SK Ray, Director RCI, P Venugopalan, Director DRDL, Dr Sekhar, Chief Controller R&D (Missile Systems & LIC), Satish Kumar, Director TBRL, Programme Director VLN Rao and SP Dash, Director ITR monitored all the operations and guided the teams during the launch.

Successful launch of Dhanush and Prithvi missiles

The Dhanush Missile was successfully test fired from the INS *Suvarna* off the coast of Orissa on 11 March 2011. Dhanush is the DRDO-developed ship-launched missile against surface and sea targets. All parameters of the event were monitored by radars and electro optical systems located along the coast.



Prithvi-II

Dhanush

Within one hour of the Dhanush missile launch, the Prithvi (P-II) surface-to-surface missile was successfully flight tested from LC-III, ITR, Chandipur. The trajectory of the Missile was also monitored by all the Telemetry, Radars and Electro Optical Systems all through the flight. Prithvi(P-II) reached the designated target with an accuracy of few meters, witnessed by the down range ship at the impact location.

Both the Dhanush and Prithvi missiles were launched by the Strategic Force Command as part of regular user training exercises. The two missiles were test fired within five days of the successful demonstration of Ballistic Air Defence Missile System on 6 March 2011, by the DRDO. The Missiles have been integrated with a very high level of quality under supervision of the Missile Systems Quality Assurance Agency MSQAA.

The launch operations of both the Missiles were monitored by Director, DRDL, P. Venugopalan, Director, ITR, SP Dash, Programme Director, VLN Rao and number of Scientists of DRDO. Scientific Advisior to Defence Minister and DRDO chief Dr. VK Saraswat witnessed both the launches from ITR, Balasore.

US Ambassador to India Timothy J Roemer flew a sortie in the F-16IN Super Viper at Aero Inida on 9 February 2011.

Wikileaks and the M-MRCA

On 18 February 2011, just days after end of the Aero India 2011 show, media reported an awkward leak which quoted US ambassador to India Timothy Roemer, in a confidential cable last year, having held India's aviation industry as "two to three decades behind the US and other western nations" despite some advances. After his trip to HAL facilities in Bangalore in February 2010, Roemer had also expressed surprise at the lack of automation and safety precautions at the HAL plant. US companies need to "approach partnerships carefully to understand the management and technological experience of Indian firms", he said.

This is particularly embarrassingly timed in context of the imminent decision on the $10.4 billion M-MRCA programme for acquisition of 126 medium multi-role combat aircraft for IAF. The US Ambassador had expressed serious doubts on the ability of HAL to handle such projects like the M-MRCA, dubbing it "untested and suspect". This has immediately drawn a sharp riposte from the MoD, which referred to the present engagement of HAL in producing a frontline 'air dominance' fighter like Sukhoi-30MKI, with Russia's help.

100 years of Airmail

The Ministry of Civil Aviation has launched a programme to commemorate the event and has declared the year 2011-2012 as the 'Centenary of Civil Aviation in Year'. India Post also issued a set of four Rs 5 stamps along with a miniature sheet on the Centenary of Airmail on 12 February 2011.

HAL Cheetah for Namibia

Mr P Soundara Rajan, Managing Director (Helicopter Complex) and Director (Corporate Planning & Marketing) formally handed over the first HAL Cheetah to the Defence Minister of Namibia Major General (Retd) Charles Namolah.

The Namibian delegation included the Namibian Air Force Chief, Air Vice Marshal NK Pinehas and their High Commissioner in India. As per the contract signed in April 2009, HAL will also supply two Chetak helicopters to Namibia.

General Dynamics UK in Hawk support agreement with HAL

General Dynamics UK has signed a £4.9 million contract with Hindustan Aeronautics Limited, to support the Indian Air Force's fleet of Hawk trainers. General Dynamics UK will establish an overhaul capability to provide 3rd and 4th line servicing for all the Indian Air Force's and Navy's Hawk Mk.132 aircraft's Stores Management Systems (SMS). The Hawk SMS includes two Weapons Control Panels (WCP) and one Weapons Programming Unit (WPU) manufactured and supplied by General Dynamics UK.

Andrew Boyle of General Dynamics UK.

A key component of the contract agreed is the licensing of General Dynamics UK's Intellectual Property (IP) such as documents, training & technology to HAL for the service life of Indian Hawks. This type of licensing, which is a key requirement of the Indian Ministry of Defence, is a clear demonstration of General Dynamics UK's intention to be "a good business partner for India."

Air Works are authorised Rockwell Collins Dealers

Air Works India Engineering Pvt. Ltd have been appointed as authorised dealers by Rockwell Collins, a leading provider of communication and aviation electronic solutions. Under this agreement, Air Works will be the first Indian authorised reseller and provider of services for Rockwell Collins products, providing Flight Line Maintenance (FLM) and warranty repairs or modifications to Rockwell Collins products. This agreement reiterates Air Works' commitment to enhance its capabilities and provide its valued customers advanced levels of service.

Speaking on the occasion, Mr. T.C. Chan, Vice President and Manager Director, Asia Pacific, for Rockwell Collins said, "We are extremely excited on the announcement and shall look forward to building a fruitful relationship with Air Works. We are hopeful that this agreement will bring a new dimension to customer service for Rockwell Collins' customers in India".

First Bell 429 delivered to India

Bell Helicopter has announced first delivery of a Bell 429 helicopter to Span Air, headquartered in New Delhi.

There are currently two Bell Helicopter customer service facilities in India, Air Works India and Deccan Charters, to support the numerous Bell helicopters operating in the country.

Sameer Rehman, Director Bell Helicopter Asia Pacific Region presenting a commemorative plaque to Capt. S.K. Mallik, pilot of the first Bell 429 helicopter in India.

Magellan Aerospace Systems on ALH

Magellan Aerospace have signed an agreement with HAL for a new Wire Strike Protection System (WSPS) which includes the design and development of a WSPS for the Advanced Light Helicopter (ALH), which will be carried out at Magellan's Bristol Aerospace division in Winnipeg during 2011. Bristol is the global expert for this unique system, offering a proven design and acknowledged technological expertise.

The system comprises an upper and lower cutter and windshield deflector, designed by Bristol to be integrated into the unique structure of the system. Don Boitson, Vice President and General Manager Bristol Aerospace, commented, "We have been making and delivering WSPS kits since 1980, and are delighted to have HAL join our family of global customers."

Ashok Nayak, Chairman HAL stated, "This contract for design and development of a Wire Strike Protection System is strategically an imperative for our future business growth and we acknowledge the potential of Magellan Aerospace and HAL with this programme".

Latest shape of the IAF: C-130J-30 Super Hercules.

The Defence Budget 2011-2012

The Government of India has raised the Defence Budget by 11.6 per cent to Rs 164,415 crore for 2011-12 from Rs 1,47,344 crore last year. "To procure modern weapon systems and defence equipment, Rs 69,199 crore has been allocated for capital expenditure," finance minister Pranab Mukherjee informed the Lok Sabha while presenting the Budget on 28 February 2011.

And, has become a customary corollary, "Needless to say, any further requirement for the country's defence would be met," he said. The Rs 8366 crore hike in capital expenditure, which is 12 per cent more than last year's Rs 60,833 crore, comes at a time when the Government is looking to finalise major pending deals including 126 medium multi-role combat aircraft, 197 light helicopters and 145 Ultra-light Howitzers for the Army.

Of the total budgetary allocation for 2010-11, the Army has been granted Rs 64,251 crore, Navy Rs 10,589 crore, Air Force Rs 15,928 crore and DRDO Rs 5,624 crore. Of the Rs. 69,199 crore capital outlay, the Army gets Rs 18,986 crore, Navy Rs 5,688 crore, Naval Fleet Rs 7,320 crore and Air Force Rs 30,699 crore.

Analysis and comments

Keeping a balance between fiscal prudence and India's strategic imperatives, Union Finance Minister Pranab Mukherjee has hiked the country's defence budget by almost 12 percent to Rs 1.64 lakh crores for fiscal 2011-12. Most importantly, defence capital acquisition for the financial year 2011-12 has been hiked, while capital expenditure for the same has been raised by about 12 percent to Rs 69,199 crores a move that should provide a sizable boost to the ongoing military modernisation programme.

Defence Minister AK Antony.

The Government has clearly taken into account the number of major weapon purchases expected to take place in the upcoming fiscal, including the high-profile, but much-delayed Medium Multiple-Role Combat Aircraft (M-MRCA) tender for 126 fighters. Acquisition of 145 ultra light howitzers and 197 reconnaissance and surveillance helicopters for the Indian Army and Air Force are also on the cards. The hike of 12% in defence budgetary allocations, compared to 4% last year, emphasises the Government's two-pronged strategic approach, more secure borders.

However, Bharat Verma, with characteristic candour, states that, "the presentation of annual defence budgets is an exercise in futility. The increase in defence budget from Rs.147, 344 crore (Rs 1,473.44 billion) in fiscal 2010-11 to 164,415 crore (Rs 1,644.15 billion) in fiscal 2011-12, reflects a gain of 11.59%. In real terms, if one looks at the inflation, there is no increase in the Budget."

In fiscal 2010-11, the defence budget allocations were approximately 2.34 per cent of the gross domestic product and in fiscal 2011-12 with the rising GDP they almost remain the same. There is not only a standard 'status-quo' in the defence budget, but also a vague promise as usual by the finance minister that 'any further requirement for modernisation of the armed forces will be met'.

He urged that:

- Three per cent of the GDP for the next five years should be set aside for modernisation of the Indian Armed Forces. This will help in long-term planning as sophisticated and technology driven military hardware can neither be bought off the shelf nor inducted overnight.

- The rapid march of technology has left India behind by almost twenty years in comparison to the West and China. The Indian imports of weaponry have increased from 70 per cent to 80 per cent despite the fraudulent mantra of indigenisation.

  The defence budget should have raised FDI from 26 per cent to 49 per cent and up to 75 per cent depending upon the cutting edge technologies being brought in to the country.

This will reduce the 'technology deficit' and ensure that defence factories are setup within the country to marginalise sanction regimes. This change in policy will provide enormous lateral spin-offs for the civil industry as well.

"The inconsistencies and lack of decision-making capabilities by the defence minister in the last six years has left the Indian Armed Forces in lurch. The abortion of purchase of air-to-air refueller and 197 helicopters for the Indian Army at the last minute have not only denied urgently required capabilities to the military but have also made India a laughing stock.

Further, by touting 'indigenisation' and yet signing a 25 billion dollar deal for the fifth generation fighter aircraft to be developed in a foreign land that takes away direct benefits and spin-offs to our industry depicts a careless and superficial approach to policy making. The lack of logic in policy-making will increase India's dependency on imports. The defence budget, which is neither here nor there, reflects Prime Minister Singh's consistent promotion of 'incompetence' at the ministerial and bureaucratic level," he concluded.

The Navy will play an increasingly important role in the Indian Ocean and littoral countries.

In the Union Budget 2011-12, expenditure of about USD 35.74 billion has been earmarked for national defence services and about USD 10.17 billion for homeland security (which has been increased from USD 32.95 billion and USD 8.75 billion revised estimates for the last year). The total defence budget has increased by 8.47% and out of it, capital acquisition of USD 15.04 billion has increased by 13.75% from last year. The total defence budget accounts for about 13.07% of the total Central Government expenditure. If the scope of national defence is enlarged to national security, it would include expenses for civil defence, security aspects of the Department of Space, expenditure of the Ministry of Home Affairs, research and development, which roughly account for about 21.03% of total Government budget.

It is provided in the Economic Survey 2010-11 that SMEs develops skills and become highly competitive and the driver of technology which is also essential for growth in the manufacturing sector. There is a strong case for enhancing public investment and building PPP in skill development and technology development. Besides increase of budget allocation, the Government should provide support to SMEs in terms of investment and level playing field with public sector undertakings. Further, there is no announcement of introducing research and development fund in the budget as was envisaged in the Defence Production Policy 2011."

The Hercules in India

The first Lockheed Martin C-130J-30 Super Hercules (KC-3802) at Air Force Station Hindan.

Aircrew of No.77 Squadron at the induction ceremony.

Air Force Station Hindan, 5 February 2011. Sombre in grey is the IAF's first C-130J-30 Super Hercules, with tail number KC-3802 of No.77 Squadron IAF. The official ceremony begins at 1500 hrs when the Defence Minister arrives at the venue, to be welcomed by the CO and to make his inaugural address following that by the CAS. It is all over by 1621 hrs when the Minister leaves for the 129 HU dispersal and departs back for Delhi.

Named after the legendary Greco-Roman hero who had to perform the famous cycles of 12 labours before he undertook war like campaigns, the

Hercules aircraft too has had to endure many labours. After decades of musing and marketing, it came to pass that the Hercules arrived in India, this time to stay and well cloaked in Indian Air Force colours. However, the first Hercules tactical transport aircraft to operate in India belonged to the USAF's 42nd Squadron of the 322nd Air Division which were committed to northern India to help in the airlift of troops in wake of the frontier war with China.

Then, in response to Prime Minister Nehru's request for assistance, President John F Kennedy had ordered the immediate deployment of the Hercules transport aircraft, the first US air transports to operate in India since the 'over the hump' flying by C-46s and C-47s during 1942-45 on the Assam-Burma-China front. The twelve C-130As of the 42nd Squadron remained deployed in India for nine months, their crews rotated from Evreux on 30-day tours.

Starting a new Squadron series

When the Indian Air Force started off, it was logically with No.1 Squadron, an initial flight of Wapiti IIs at Drigh Road on 1 April 1933. By the end of World War II, the IAF had sequentially added another nine squadrons but left out Nos. 5 and 11 (both of which were existing Royal Air Force Squadrons in India at the time). Nos. 1, 6 and 9 were later allocated to the new Royal Pakistan Air Force and were only resurrected in Indian Air Force service in the decade that followed independence.

As the IAF expanded, Nos. 14, 15 and 16 Squadrons were raised in the early 50s, (No. 13 was never formed) and then as the force grew, so did the numbering progress logically. After the 1962 frontier war with China, the IAF was to expand its combat and transport strength and this was re-doubled after the 1965 war with Pakistan. Thus came about additional Squadrons numbering from No.20 onwards (No.28 was the 'first supersonics') but when the Auxiliary squadrons were embodied into the regular Air Force, Nos.220, 221, 222, 223 and 224 Squadrons were formed. Earlier, Nos.101, 102 and 106 Squadrons came about with reconnaissance as their forte. Transport squadrons were numbered as 11, 12, 19, 25, 33, 41, 42, 43, 44, 49, 59, equipped with types as disparate as C-47s, C-119s, Caribous, Otters, Il-14s and An-12s. As obsolescent types were phased out and An-32s, Do 228s and Il-76s were inducted, these became new equipment for the existing squadrons.

The still unofficial emblem of No. 77 Squadron depicts its covert role

In the last few years, the Indian Air Force has adopted a new numbering system, whose logic has not been entirely explained. Thus, when the Ilyushin Il-78MKIs were received, these mid-air refuelling aircraft formed No.78 Squadron, while the A-50 Phalcon AEW&C aircraft equipped No.50 Squadron (the aircraft nomenclature and squadron in sync?). Now, the new C-130J-30 Super Hercules goes to the newly created No. 77 Squadron.

Actually, there were IAF Squadrons of the '70 series' in the 1960s but these were allSA-2 surface to air missile squadrons formed in wake of the China frontier war but long since retired. What lies ahead with the numbering of the future Boeing's C-17 Globemaster III squadron, is speculative!


Contingent of USAF personnel in their distinctive camouflaged uniforms.

Just short of a half century later, the much evolved successor, the C-130J-30 Super Hercules was ordered by the Government of India but not before some contentious issues had been resolved, with some others still pending resolution.

Back to 5 February 2011: the induction of C-130 J-30s simultaneously marked the raising of No.77 Squadron, named 'Veiled Vipers', the initial unit establishment being for 6 aircraft, all of which would be at Hindan by end 2011. Defence Minister A K Antony handed over the keys of the aircraft to Group Captain Tejbir Singh, Commanding Officer of No.77 Squadron, in presence of the Chief of Air Staff, Air Chief Marshal PV Naik and General Norton Schwartz, Chief of Staff USAF, marking the aircraft's formal induction into the IAF.

Air Chief Marshal PV Naik, Chief of the Air Staff, described the C-130J-

Air Chief Marshal Pradeep Naik hands over commemorative plaque to General Norton A Schwartz, USAF.

30 as "most potent and magnificent" and welcomed its induction two decades after the An-12 was phased out of service.

(No.44 Squadron which was the first to be equipped with Antonov An-12s, was raised on 1 March 1961 and were fully committed transporting troops and equipment to forward air landing grounds during the 1962 frontier war. The last An-12s were phased out on 30 June 1993. The Squadron, presently flying Il-76s are to get their colours on 9 March 2011.)

Speaking on the occasion, Defence Minister A K Antory referred to the induction as one of the steps being taken to modernise the IAF "which has to fulfill regional and global obligations," and hoped that this would contribute to enhancement of operational strength of the IAF.

The event was attended by Defence Secretary, Pradeep Kumar, Vice Chief of the Air Staff, Air Marshal NAK Browne, Air Officer Commanding-in-Chief, Western Air Command (WAC), Air Marshal DC Kumaria and other senior IAF officials. US Ambassador to India, Timothy J Roemer, other US Embassy officials and executives from Lockheed Martin Corporation were among others present at the ceremony. A sizeable contingent from the US Air Force was at Hindan that afternoon, in their camouflaged airman battle uniforms, common enough in India's western neighbourhood including Afghanistan but new to India.

Set in stone: commemorating induction of the C-130J-30 Super Hercules by No.77 Squadron IAF at Hindan on 5 February 2011.

Model layout of the C-130J-30 infrastructure created for the Super Hercules at Air Force Station Hindan.

The Indian Air Force Deputy Chief Air Marshal Ravi Sharma with a USAF officer at the ceremony.

The future is here: the Super Hercules has a modern cockpit with multi-function, liquid crystal displays (LCD) for aircraft flight control, operating and navigation systems. In addition to four displays on the instrument panel, pilots use holographic head-up displays, approved as primary flight instruments, a precedent among military transports.

Adopting 'Kill with Stealth' as its motto, No. 77 Squadron have the quick deployment of 'Special Forces' in all weather conditions, including airdrops and landings on unprepared or semi-prepared surface even in complete darkness as their prime role. The Super Hercules would be capable of low-level air-to-air refuelling to enhance range and rapid forward basing of personnel and equipment in emergent situations.

The war time employability will include special air operations, airborne operations, air transported operations, air supply operations, air maintenance operations and casualty evacuation among other roles. The peacetime roles include operations and air maintenance in mountainous terrain in adverse circumstances, UN or multinational missions, humanitarian assistance including disaster relief and evacuation of Indian Diaspora during emergencies and crisis situations.

The Super Hercules inducted was flown to India by the pilots of the newly formed No. 77 Squadron from USA. IAF pilots and personnel underwent training at various USAF bases including at the Lockheed Martin complex in Atlanta. The second aircraft is expected in first week of March, this year.

Defence Minister AK Antony flanked by the Air Chief and Defence Secretary at the induction ceremony.

Member of the IAF Special Forces (Garud) at Air Force Station Hindan.

Air Force Police guarding the Hercules.

"Aerospace and

Indian Army tanks at a ceremonial parade. Induction of large batches of T-90S tanks is underway.

Interesting Times ...

... for the Indian

That India is today one of the biggest markets for Aerospace and Defence is no longer 'breaking news'. As is ushered in first year of the new decade, contracts worth $ 24.66 billion have been signed by the Ministry of Defence with global defence equipment manufacturers in the preceding 48 months and another $ 41.99 billion deals are in the pipeline. While the most talked, written about and analysed 126 medium multi-role combat aircraft (M-MRCA) programme will cost in the order of $ 10+billion, analysts already foresee the Indian Air Force expanding to a strength of some 1000 fighters equipping 60 Combat squadrons by 2030.

As per the CII-KPMG report being reviewed and which was released by the Minister of State of Defence on the sidelines of Aero India 2011, "India has already mustered the critical factors deemed indispensable for success in developing an aerospace and defence sector, namely sustained government support, technical capability to enable manufacturing, a sound industrial framework and a skilled human resource base. These assets can help the country become a leading aerospace and defence hub". Moreover, "the government is clear in its vision for this sector : indigenisation of the industry and acquiring advanced technologies which will in time facilitate the lowering of dependence on imports" The Defence Procurement Policy (DPP) 2011 reflects the government's commitment to forging international partnerships through expansion of the offset policy.

India has the advantage of a large and highly developed Small and Medium Enterprises (SME) base with one of the fastest growing air transport MRO markets in the world, all which augur well for the country to become "the most prominent aerospace and defence industry in the world, producing cost-effective and sophisticated equipment and systems to meet its own defence requirements and indeed, of the rest of the world".

In the context of emerging opportunities for defence and aerospace in India, the report observes that the country is already "the most lucrative defence market globally with a mega acquisitions programme coupled with the government's proactive stance, a healthy foreign supplier base mix and an increasing number of deal closures seen over the past few years". This is further manifested by the large number of tie-ups being forged by large Indian

Defence industry"

Aerospace and Defence Industry

manufacturing/technology companies with global aerospace and defence companies in the recent past, which give them a foothold in the aerospace and defence manufacturing sector.

The factors that underpin this projected opportunity in Indian aerospace and defence include the Government taking steps in modernisation of the industry backed by a substantial budget ; positive industry reforms and the potential economic opportunities offered by offsets that will flow back as a part of any major defence acquisition plan and transfers of technology.

At the same time, it is manifest that there are interplays of modernisation, reforms and technology, with each aspect becoming instrumental in driving the growth and stability that every stakeholder aspires to achieve.

India's aerospace and defence being of national importance, the respective defence ministries and their policies are key stakeholders in the sector regardless of the level of privatisation. Given the level and quality of investment involved in the sector, the public sector is logically the most equipped to kick-start such programmes through the key factors of defence budgets, allocations and other stimulii.

On the other hand, for the long term sustenance of the sector, it is the policies, regulatory ecosystem and the support that the government provides the private sector, that needs to leverage the indigenous industrial capabilities of a country. For instance, in the USA, defence policies have historically been dominated by the Pentagon with a strong focus on advanced technology development with an assured market. Its industrial policy, which had the advantage of being formed much earlier than its European counterparts, allowed the US firms to transfer military technologies to the nascent civilian aircraft industry and so enabled consolidation of the sector, which eventually led them to dominate the world market.

Since the aerospace and defence industry is highly capital intensive, funding remains a key element. The United States is the single largest spender, bigger than the top 15 defence-spending nations put together ! The USA is also one of the most advanced in terms of technology, Research and Development (R&D) activity as well but India and China are slowly on the upward curve in aerospace and defence spending.

Defence manufacturing is a high technology industry that involves complex

DRDO's Akash SAM's are to be delivered to the Indian Armed Forces.

interwoven processes and integration which demands an optimum level of integration between Original Equipment Manufacturers (OEMs) and their suppliers to work together and create integrated solutions that make manufacturing more cohesive, efficient and cost effective.

Sustainable Funding

Manufacturing capability is very critical indeed so as to minimise unit production costs while maintaining the required quality standards. Flexible production lines, procurement of material in bulk, production modelling during the design process, all help to achieve maximum yield. The application of technology in the form of systems engineering and integration, enterprise resource planning, computer-based modelling techniques for the design and development of weaponry, electronic warfare, avionics systems, radars and so on, are pertinent examples.

Japan, in this context, has made a great mark in the world by becoming a pioneer in advanced technology manufacturing processes. Japanese companies such as Mitsubishi, Kawasaki and Honda are major subcontractors of US firms for civil and military aircraft where technological ability forms the backbone. Agencies such as the Japan Aerospace Exploration Agency (JAXA) are developing innovative technologies and evaluation methods for improving the quality and reducing the cost of aircraft materials, components and structures. Israel, too, has devoted a large share of its national resources for development of highly sophisticated military technologies and equipment. The defence manufacturing industry in Israel accounts for a notable share of its industrial capacity and includes comprehensive involvement of large private sector corporations.

HAL Hawks

R&D remains critical

R&D remains critical for the sustenance of this industry, with no other sector more strongly linked to such spending by a country. A close examination of the US R&D spend in aerospace, defence and national security over the past few years points to almost $ 11 billion being spent in 2011, which is about 46 percent of the global R&D spend projected in the same year.

The private sector also plays a key role in funding R&D spend in various countries. In France, Research and Development activities absorb more than 15 percent of the annual turnover of French aerospace companies, much more than the amount spent by counterparts. However, in recent times and owing to the global turn of events, governments across the world are looking at budgetary cuts. R&D in defence is now looking to focus on innovations in supply chain and also trying to mobilise the private sector for support in financing these innovations.

SMEs are imperative

The global aerospace and defence value chain is incomplete without the presence and development of SMEs supporting the larger integrators and the public sector enterprises. Typically these companies come with advantages of being leaner, more agile, low set up cost, high level of skills and displaying cost effectiveness in production of smaller systems and sub-systems. Over the years, it is observed that such players are achieving optimum size and scale and expanding into new areas such as design and development.

On the macro level, Lockheed Martin have emerged as a great example of an integrator using its market accessibility capabilities to source from countries

Elbit Systems

including Denmark, Australia, Turkey, Norway, Canada to provide various systems, sub-systems and services.

Closer to home, India itself has 50 percent of its industrial production, 40 percent of total exports and 90 percent of all enterprises coming from this sector. Global integrators in India are providing value added training and certification to their local SME supplier base.

MROs : an effective support system

There is need to develop new MRO facilities across the globe, this is even more compelling than ever. In fact, more is spent by organisations on Maintenance, Repair and Overhaul than the cost spent on manufacturing and procurement itself! Global experiences suggest that MROs are not just critical for expanding capacity for new fleet inductions; but are more critical in facilitating life cycle extensions for existing fleet and keeping operational costs in check.

North America and Europe currently control more that a 60 percent of the global MRO market. According to an in-depth study by OAG Aviation Solutions in partnership with Aero Strategy, by 2018, $ 67.3 billion a year will be spent on the maintenance, repair and overhaul of military aircraft throughout the world. Emerging MRO hubs such as Singapore are, however, now balancing the global MRO equilibrium. It is not incidental that the US remains to be the biggest aerospace and defence manufacturer as well as the largest MRO hub in the world.

The successful BrahMos venture with Russia: these missiles are to be fitted in submarines and frontline warships of the Indian Navy.

Human resource skills

Backbone of the defence sector remains its human resource and in turn, the skills and technical abilities of the workforce. Estimates suggest that almost 50 percent of the workforce in this sector is constituted by engineers and management graduates. Countries like France have developed highly regarded specialist schools like *Institut Superier de l'Aeronautique et del'Espace* (ISAE) and *Ecole Nationale de l'Aviation Civile* (ENAC) in Toulouse and *Ecole Nationale Superieure de Mecnique et d'Aerotechnique* (ENSMA) in Poitiers to train engineers for this field. As the French industry grew, substantial investments were made in the form of professional federations such as Groupement des Industries Francaises Aeronautiques et Spatiales (GIFAS) to promote the interests of this sector.

MRO activities.

India's increasing importance

As one of the world's top 10 military markets, India's increasing importance to defence contractors has been well established. With Indian aerospace and defence well on the path to growth and development through technology transfers and business from both the domestic private sector and the global integrators, there are key lessons that can be learnt from the experience of contemporaries across the globe, a pertinent example being the French aerospace and defence Industry which has a pool of 134,000 specialist employees. It is important that India develops appropriate training grounds for its manpower.

Synchronised working of the government's will and policy coupled with technology and R&D, proven manpower and manufacturing abilities for this sector is imperative to create sustainable growth and economic contribution. Support from the Government is vital for development of the aerospace and defence sector and the Ministry of Defence (MoD) has been taking feedback from industry participants and other stakeholders in making current policy environment more industry friendly. Frequent revisions of Defence Procurement Policy (7 revisions

in a span of nine years since the first one in 2002) "is a clear reflection of the MoD's willingness to streamline the process of procurement".

Defence acquisitions, in the Indian context, are a complex decision-making process. However, the government has introduced a series of reforms in the Indian defence acquisition policies and procedures with the key objective of developing a sustainable defence capability base within India. The Defence Procurement Policy 2011 (DPP 2011) has been accepted as a well planned and comprehensive document "in spirit", one which reflects the government's commitment to enable the domestic defence industry to forge partnerships with international defence majors "to bring in latest technologies and manufacturing efficiency". Still, implementation of this policy and the true effects that it will have in steering aerospace and defence industry forward remains to be seen.

The most notable change in DPP 2011 is expansion of the scope in offset policy guidelines which not include civil aerospace, internal security and training within the ambit of eligible products and services for the discharge of offset obligations. The expansion in the list of companies eligible for transfer of technology for the maintenance infrastructure is also a useful step.

While the DPP 2011 addresses issues related to the concerned stakeholders, the private sector still has demands which should be addressed including upwards revision on timelines of offset banking, introduction of offset multipliers to facilitate flow of critical technology, sustained focus on development of specialist personnel skills for acquisitions and concerns about the 'Limitation of Liability' clause in the contract.

Government defence production facilities are beginning to produce high technology items like the Rohini medium range surveillance radar (above).

Defence Production Policy

Parallely, the new Defence Production Policy (DPrP) has been issued to "harness the emerging dynamism of Indian industry and capabilities available in the academia and the R&D institutes". Besides the promotion of SMEs, providing necessary impetus to R&D and addressing "grievances" of the Indian industry, the government has been forthcoming to include domestic manufacturing in line with the futuristic demands from the defence forces. This production policy also aims at identifying step by step and addressing any issue which impacts, and has the potential of impacting competitiveness of the Indian defence industry in comparison to foreign companies. It would be worthwhile to designate a mechanism that works towards enhancement of private sector participation as has been modeled for the DPSUs.

Foreign Direct Investment (FDI)

FDI in the defence sector remains one of the most vexed topics for the private industry. There are mixed views amongst segments on FDI liberalisation, with one school of thought believing that enhanced FDI in this sector would provide the much needed boost for defence equipment manufacturing while others believe that such liberalisation would "impair the growth of the domestic industry" and would shift the control and management to foreign hands. To this effect, the Department of Industrial Policy and Promotion (DIPP) had put forth a discussion paper Foreign Direct Investment (FDI) in Defence Sector (May 2010) suggesting further liberalisation of the FDI regime from existing 26 percent to 74 percent under the "approval route". However, the MoD has been reluctant to allow a higher FDI considering "the sensitivity and strategic nature of the sector" (but that is a moot point considering over 70% of capital equipment is still imported : Ed).

It is understood that there is a window to seek FDI beyond the benchmark limit of 26 percent on a special case to case basis but such approvals are difficult to obtain

Private players like Alpha Design Technologies are getting into the defence realm.

and only provided in exceptional cases such as transfer of critical/sophisticated technology. Moreover, most of such approved ventures are with DPSUs. Unfortunately, "there are no express guidelines/parameters which would be treated as qualification criteria to obtain such an appeal".

Besides FDI, for a successful joint venture, it is important to ensure clarity on profit and cash distribution, management responsibility, recognition of the value of the intellectual property being provided, remuneration of key executives and perhaps most importantly, a defined separation process at the end of joint ventures.

Partnerships in action

The Government's supportive policies and opportunity in the Indian aerospace and defence sector have fostered multiple Memorandums of Understanding (MoUs) between Indian (both public and private) and foreign companies, and the latter have responded well. Majority of the global top 10 players have signed MoUs with an Indian partner and are on course in translating to partnership for identifiable results.

Introduction of the "buy and make (Indian)" category of Requests for Proposal (RFPs), with minimum 50 percent indigenous content on cost basis can help ensure a balanced mix of global equipment and localised components in new procurements. Such a two-fold effect, could make global players rethink their India strategy to carve out their market share and enable the Indian government to achieve their ultimate ambition of 'Self- Reliance' without having to source every single sub component from Indian vendors.

Private players or Indian arms of foreign OEMs face certain disadvantages in that they have no exemption from customs duty on import of inputs/goods required for manufacture/ development of equipment; no exemption from excise duty on inputs/ goods required for manufacture/ development of equipment; supply to DPSUs or Defence organisation are exempt from levy of excise duty, hence, credit of inputs duties (such as specified components of customs duty and excise duty) cannot be claimed; supplies to defence sector are not considered 'deemed export' and extended benefits of tax/duty on procurement of inputs used in manufacture and supplied. On the other hand, supply of manufactured goods to Defence organisations is exempt from levy of excise duty.

Public Private Partnership (PPP)

Another important facet is Public Private Partnership (PPP). Global industry experience suggests that PPPs could prove to be the first step towards liberalisation of this industry and the trend of having an agreement in place between the government entity and private companies to utilise the resources, needs to be encouraged for real growth in the aerospace and defence sector. This would also help improve financial viabilities of indigenous projects. These agreements could range from complex teaming and work share programmes to simple lease plans.

Globally, as PPP models and their financing benefits become better understood, service delivery is more effective and security concerns are answered, with a result, their use becomes more widely accepted. With this comes an expansion of the envelope for which PPPs are considered.

The motor industry is a model to follow.

In India with the aerospace and defence infrastructure comprising 39 ordnance factories, eight DPSUs and about 50 DRDO labs with experience spanning many decades, it is pertinent to utilise and further boost this capability by enhancement of the role of the private sector.

The government-constituted 'Kelkar Committee' (2005) had recommended the creation of a pro-active framework of government agencies and private players providing, encouragement to Tier I suppliers to assume the role of integrators. To this effect the concept of Raksha Udyog Ratnas (RURs) was to be a gradual step towards formation of a true manufacturing base with active participation of private players. However, fair implementation of this concept on the ground level is yet to be seen. Once put in practice, the nomination of a private player as a 'Production Agency' in the contract stage will provide a true fillip in creation of new system integrators.

The recent invitation of interest by the MoD for development of Future Infantry Combat Vehicles (FICVs) in India under the 'Make' category is seen as an encouraging step by the industry which would also upscale the existing capability of the auto segment into developing niche military combat vehicles. This bid involves four Indian companies, three private and one public. Even if the public company wins the contract it is likely to create an ecosystem of suppliers because certain items are earmarked for private sub component suppliers. Such projects can boost the defence industry in R&D and in developing suppliers from the small and medium industries.

Technical Capability

Technical capability forms the core requirement of any manufacturing related industry comprising manufacturing capability at its centre surrounded by capability in Information Technology/ Information Technology Enabled Services (IT/ITeS) industry, R&D capability and Quality standards.

The aerospace and defence industry is closely linked with the manufacturing industry. For any aerospace or defence equipment, multiple electronic/mechanical/ electro-mechanical sub-components are the raw material, hence, a strong supporting manufacturing/engineering industry is essential.

South Block in New Delhi where the policy decisions are made and directives issued.

The Manufacturing Sector

India has a strong manufacturing sector, as an example, in the automobile industry, India being home to production plants of some global majors including General Motors, Tata, Ford, Suzuki, Hyundai, Honda and Fiat. In the electronics and semi-conductor industry, India has over 120 top chip-designing firms working with leading edge technology to support the industry. In telecommunications, global mobile handset manufacturers like Nokia and LG have established production units in India. There is also some presence of heavy engineering equipment production including commercial shipbuilding (especially tankers and containers) in India and there are plans to upscale such indigenous production.

However, while India has strong presence in the manufacturing sectors as in the automobile and electronics and semi-conductor industry, aerospace manufacturing has not yet been able to mature in the country. However, with more funds being allocated, India is on the cusp of starting contribution in this sector as well. Thus far PSUs like HAL and BEL have been leaders in this sector. HAL has manufactured 12 types of aircraft, over 3550 aircraft, 3600 engines and overhauled over 8150 aircraft and 27300 engines. Some private entrants in this special sector include Dynamatics Aerospace, Taneja Aerospace & Aviation Limited (TAAL) and Tata Advanced Systems Ltd (TASL). Dynamatics Aerospace has one of the largest infrastructures in the Indian private sector for manufacture of airframe structures and precision aerospace components. TAAL manufactures small civilian aircraft, aero-structures and aircraft parts, provides aircraft maintenance services and while TASL has delivered the first Sikorsky S-92 helicopter cabin made in India from its facility at the outskirts of Hyderabad.

The Indian IT Industry

Prowess of the Indian IT industry does not require any elaboration and now reserves a secure spot at the top tier of the global capability map. According to research reports, "the ITO-BPO industry has generated revenues of $ 73.1 billion in FY 2010 with IT software and services accounting for $ 63.7 billion". With maturity and enhanced capability, the Indian IT industry could well serve as a launch pad in the development of the aerospace and defence sector in India. "Best practices for quality, project management, innovation and organisational maturity can all effortlessly be translated to provide Indian Aerospace and Defence the technological edge which will complement its growth", according to the Report.

Indian software majors such as Mahindra Satyam, Wipro Technologies, Tata Consultancy Services (TCS) and HCL have been active in the

Dhruv ALHs in production at Bangalore.

aerospace industry for several years. IT applications have been developed for flight data management systems, power distribution inside aircraft, software for crew signalling, cabin illumination and the Global Positioning System (GPS), etc. There has been successful implementation of advanced technologies by the Indian private sector companies for producing global quality products and designs. Their proven capabilities have now enabled them to forge successful partnerships with global primes for technology transfers as well as suppliers in their global value chains. The capability to leverage is latent as is a strong market, but what remains to be answered is: are we doing enough to explore how such technology could be developed and nurtured for India's aerospace and defence?

Research & Development

R&D focus has remained largely in the public domain, with government institutions such as Hindustan Aeronautics Limited (HAL), National Aerospace Laboratories (NAL), Defence and Research & Development Organisation (DRDO), Indian Space Research Organisation (ISRO) Successful examples include development of a range of missiles (from short range to intercontinental ballistic) by the DRDO, Tejas LCA and Dhruv-ALH by HAL, Saras and Hansa by NAL.

India is an attractive source for R&D owing to inherent advantages of a large number of highly qualified but low-costing engineers and scientists. Over 100 foreign organisations have opened R&D centres in India over the last decade. Some are involved in incremental innovations, with their main aim to support existing products introduced in India. These include DuPont, Ericsson, General Electric, Hewlett Packard, Lucent, Toyota, Texas Instruments and IBM.

Research in academia has always been present, but the lack of funds for development of R&D centres in industry has slowed the flow of academia research into the industry. Going forward, the industry would do well by investing in developing own R&D and the Government could play a role by supporting companies which invest in developing such R&D. Introduction of offset multipliers for global companies intending to invest in R&D could be a positive impetus. Additionally, Indian companies need to ensure that intellectual property is protected by following global 'best practices', which issue needs to be addressed effectively by the Indian government by robust measures and policies.

The Indian manufacturing sector is increasingly adopting international quality standards and operating with better efficiency and enhancing manufacturing facilities. In the automobile sector, where indigenous production has been on for a long time, India has achieved significant quality certifications by using practices like 5S, Total Productive Maintenance (TPM), Total Quality Management (TQM) and Just in Time (JIT). India has the largest number 'Deming Award' winning companies, outside Japan. In the IT/ITeS industry, of the 80 software companies worldwide with a Capability Maturity Model (CMM) Level 5 rating in 2003, 60 are in India (Level 5 is the highest rating that a software company can attain). The quality is also proved in the R&D sector with most major pharmaceutical companies opening their research centres in India.

As per aerospace industry norms, all production divisions of HAL have ISO 9001-2000 accreditation and 16 divisions have ISO-14001-2004 Environment Management System (EMS) certification. Six divisions have also implemented the

aerospace sector quality management system requirements stated in AS 9100 standard and obtained certification. Four of these divisions have also obtained NADCAP (National Aerospace Defence Contractors Accreditation programme–USA) certification for special processes such as Non Destructive Testing (NDT), heat treatment, welding, etc.

Joint Service Guide (JSG) certification for land and marine systems is the key standard, however airborne system manufacturers look at AS22 certification. Aerospace and defence suppliers have additional quality and commitment requirements compared to other manufacturing industries where, the key expectation is zero tolerance norms i.e. 100 percent product reliability and 100 percent on-time delivery. Most of the major aircraft engine manufacturers, such as General Electric's Aircraft Engine division (GEAE), Boeing, Rolls-Royce Allison and Pratt & Whitney, require all their suppliers to be certified to AS9100.

In addition, OEMs have their own quality standards. For example, Boeing has laid down requirement of 100 percent acceptance rate (minimum 98 percent) and 100 percent on time delivery, BAE Systems requires Zero DPMO/Zero defect occurrence and 100 percent On Time delivery, Raytheon requires minimum 98 percent for exceptional rating. General Dynamics looks for minimum quality rating of 98 percent and at least six full lot acceptance in the past one year for automatic approval.

While Indian companies have demonstrated high quality standards in IT/ITeS and manufacturing industries, there is a need to prove that they are capable of quality production for the Aerospace and Defence industry. Indian companies supplying any component/service for Defence would need the necessary quality certifications. Additionally, Indian vendors to OEMs will have to meet their criteria. Improvement in quality production in India can only be achieved by disciplined investment by companies for improving current production facilities, hiring highly skilled manpower and R&D capability.

Supporting Industry framework

Presence of Tier-1 to Tier-3 suppliers as well as maintenance service providers will be key enablers for a robust Indian aerospace and defence industry. According to the Ministry of Micro, Small and Medium Enterprises (MSME), there are well over 13 million MSMEs in the country today providing employment to about 33 million people. These MSMEs contribute about 40 percent of gross industrial manufacturing value of the country, 35 percent to India's exports directly, and 8 percent of India's GDP.

The SME supply chain consists of three major players : global players, sub primes and systems partners, and lower tier suppliers. Sub primes and lower tier suppliers usually perform 60-75 percent of the work content. The Confederation of Indian Industry (CII) estimates that over 6000 SMEs operate in the Indian defence sector, supplying 20-25 percent of components and sub assemblies to

HAL's armed Dhruv helicopter.

Displaying indigeneous production : Nishant UAV and Light Combat Aircraft Tejas (in the background).

the DPSUs, ordanance factories and DRDO. Being lean and "less lethargic" than the bigger enterprises, they have the capability of higher innovation in niche manufacturing, ability to absorb technology and lower labour costs. Importantly, the offset requirements have pushed the global OEMs to work in close coordination with SMEs. This coupled with the fact that these enterprises have high manufacturing expertise and a non-proliferation record, makes SMEs a catalyst in augmenting the role of India as an outsourcing destination. SMEs have the potential of becoming the backbone of not only India's Aerospace and Defence sector but also making India a global outsourcing hub for small manufacturing needs. These SMEs have the potential to serve multiple industries such as automotive and heavy equipment which helps them navigate market fluctuations in individual market segments.

However, SMEs do face certain challenges from the Indian government and the global market which could hinder their development. After the recent global economic slowdown, only those SMEs which can innovate, adapt cutting edge technologies, deliver customised solutions, develop and maintain a global standard in manufacturing qualities and specifications while still maintaining cost advantage, will be successful in becoming an integral part of the global supply chain. Currently, the technology capability in terms of both skills and funding for coming up the curve is not at par with that of the OEMs. The Indian Machine Tool Manufacturers' Association (IMTMA) is still in the process of urging the government to provide funds for the adoption of superior technologies.

For SMEs, supply chain integration is another problem owing to high costs and technology constraints. Still, SMEs can gain competitive advantage by integrating their systems not only with trading partners but also with customers. Supply chain integration brings major changes in the way companies communicate with

each other, from planning to purchase. For the success of supply chain integration, organisations must be willing to share specific data with suppliers and customers. Information, production schedules, forecasts and promotion plans could be shared on a need-to-know basis.

MROs are integral with the aerospace and defence sector. India, with its geographical advantage of being strategically located between Europe and the Asia-Pacific region, has the potential of becoming an international hub for MRO needs, to avail faster turnaround time which can make the sector more efficient and cost effective. Another factor which adds to the effectiveness of India as an MRO hub is the low cost of manpower in the country, which is almost 60 percent cheaper than that in Europe and slightly lower than in other Asian countries. This, clubbed with an 'abundance' of skilled workforce, is the biggest asset for the Indian MRO sector.

Opportunities and scales for MRO activities depend on the demand for defence and civil aircraft in a particular area. Since the fleet size in India of civil and military aircraft is expected to double in the next five years, there are tremendous opportunities in this sector. Moreover, the Indian MRO sector has the ability to absorb technology transfer at depot level for aircraft as well as components given the large resource base and technical abilities of the skilled workforce.

An existing problem for the Indian MRO sector is shortage of land near airports. Since the MRO facility needs to be located near an airport, currently available locations cause supply chain location problems which leads to inefficiency, wastage of resources and delays in execution. Another problem is the complex and multi-structured tax scheme. The tax structure in India hinders the growth of the sector when compared to the world, makes the sector uncompetitive. Moreover, there is a lack of recognised bodies to provide internationally-accepted quality certifications which too hinders global competition.

The government should increasingly plan to allocate land (near major airports) at fair lease rentals to encourage the creation of MRO hubs in the country. A strong supportive MRO sector will give a fillip to the aerospace and defence sector.

As stated earlier, an important enabler for any successful industry is enriched manpower base which is even more indispensable in aerospace and defence owing to its dependence on highly skilled human resources. With over 380 universities, 11,200 colleges and 1,500 research institutions, India has the second largest pool of English-speaking scientists and engineers in the world. Every year, over 2.5 million graduates are added to the workforce, including 300,000 engineers and 150,000 IT professionals.

And this one from HAL: the Light Combat Helicopter (LCH).

India is ranked third globally, after USA and China, in terms of absolute number of students enrolled in higher education institutions at 11.2 million students. Mastery over quantitative concepts coupled with English proficiency has resulted in a skill set that has enabled India to reap the benefits of the current international demand for IT.

But, according to industry feedback, research and training institutes in India are insufficient as compared to the number of students. While, the training provided in these institutes is not uniform across the country. The government needs to invest more into the sector for the development of professionals so as to leverage potential of human resources in an effective manner. Product specific or relevant skills demand an enhanced focused approach. The development of skills in the defence industry needs a guided and wholesome approach between the government, industry and academic institutions to integrate their objectives. There have been global instances where the private sector has taken the lead on working independently or in partnership with the government on setting up infrastructure for providing the necessary skills for the Aerospace and Defence sector.

The conclusion one draws from the presented scenario is that India's aerospace and defence industry today is clearly an effective interplay of three key stakeholders – the government, foreign OEMs and the Indian industry, each having a defined role and a clear set of aspirations and expectations. Evidently, there exist several critical success factors that drive the formation and sustainable growth of this industry and indeed, these stakeholders play an indispensable role in their implementation.

Based on the CII-KPMG Report

NO SURPRIS

Saab Gripen D takes off on a demonstration flight, past Saab 340 and 2000 turboprop airliners on static display.

Aero India 2011 in retrospect

The hype had long reached a crescendo, at least amongst foreign observers, during the months leading to the five day event at Air Force Station Yelahanka, 25km north of Bangalore, along National Highway 7 which leads to the international airport at Devanahali.

As commented upon, senior executives and supporting personnel from almost every major western aerospace firm (and some increasingly from the east) would make their way to Yelahanka, putting their best wings forward, so as to get a slice of India's 'highly-lucrative defence market, valued at $50 billion over the next five years'.

And they were there: Lockheed Martin with six F-16s, two of them borrowed from the UAE Air Force, a WC-130 Weather Bird alongside the IAF's first C-130J-30 Super Hercules; two Boeing F/A-18 Super Hornets from the US Navy, two Dassault Rafales from the French Air Force (detached from Afghanistan), two Eurofighter Typhoons of the Italian Air Force and three Saab Gripens from the Swedish Air Force. The obvious type missing was the Russian RAC-MiG-35 and even the hoped for inclusion of a pair of Indian Navy MiG-29Ks did not come about.

Nor did the F-22 Raptor make its public debut in Asia, in spite of the strong rumours (fanned by the Americans themselves). The justification for such an unprecedented event was being laid on several occurrences which had taken place in the preceding weeks, one in

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Indian Defence Minister AK Antony greeting guests after the inaugural of Aero India 2011 on 9 February 2011. The Minister welcomed delegations from various 'friendly countries' and expressed pride that the show had carved out a niche for itself and acquired international recognition.

Five Tejas LCAs at the inaugural flypast.

Delhi where HAL and Sukhoi signed a contract for preliminary design of the FGFA/PMF and the other at Chengdu when the Chinese almost nonchalantly made the maiden flight of their J-20 new generation stealth fighter. But it was a no show. No surprises!

At Yelahanka 2011, the number of global companies participating were over 300 and the number of exhibitors was 675, including 380 from 29 countries and 295 domestic firms. Close to 100 types of civilian and military aircraft were on display, both static and in the air, most of them, not unusually, being of the Indian Air Force. Pride of the Indian contingent, unanimously agreed, was the Tejas

IAF Sukhoi Su-30MKI in display over Yelahanka.

The Tejas is put through its paces over Yelahanka.

LCA, a five aircraft formation overhead at the inaugural ceremony, followed by a professionally conducted aerobatic display by NFTC test pilots. A lone Sukhoi Su-30MKI from No. 31 Squadron made an awesome demonstration of super manoeuvrability and then, the M-MRCA contenders had the field to themselves all through the afternoon, flying relatively sober sorties with assorted dignitaries on board and letting themselves go when the display pilots did not have to worry about their 'passengers'!

The 'big boys' at Yelahanka included Boeing's C-17 Globemaster III and the Omega KDC-10 air-refuelling tanker but there were few civilian airliners on the tarmac during Aero India this time, proving that the 'splitting' of Indian air shows between Yelahanka (military) and Begumpet (civil) has actually taken effect. The civil aviation ministry have already announced that 'India Aviation 2012' will take place 14-18 March 2012 at Hyderabad.

LCA test pilot Gp. Capt. Suneet Krishna with Dr. Kota Harinarayana, whose stewardship of the LCA programme has left an indelible mark.

Aircrew of No.31 Squadron board Su-30MKI before their flying display.

The few civil aircraft elbowing their way in amongst an unabashedly military presence were the Pilatus PC-12, Dassault's Falcon 7X, 2000DX and 2000LX, while Hawker Beechcraft brought their models 400, 850, 950. The Gulfstream G550 business jet rounded off the biz jets section while Saab flew in (and around) their 340 and 2000 turbo-prop regional airliners. The newest civilian shape in the Bangalore sky was Sukhoi's Superjet 100 regional airliner which is a collaboration between Sukhoi's civil division and Finmeccanica subsidiary Alenia Aeronautica.

The Eurocopter AS550 Fennec lightweight, multipurpose military helicopter on display for the 'Indian Armed Forces'. The type has been repeatedly evaluated to meet the urgent requirements of the Indian Army and Air Force, with 197 examples to replace the present HAL-built Cheetah.

Sukhoi Superjet 100.

Line up of various aircraft types on static display as the Suryakirans climb out after formation take off, trailing the national colours in smoke.

The NAL Hansa light sports and training aircraft on static display.

Lockheed Martin brought 6 of their F-16s to Aero India 2011 including two Block 60s from the UAE Air Force.

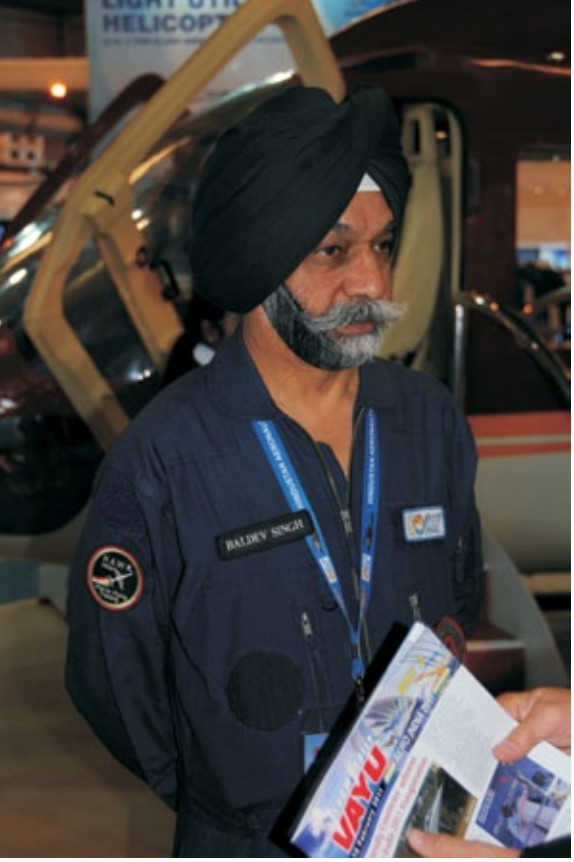
The Lockheed Martin WC-130 Weatherbird takes off for a demonstration flight.

Model of the Indo-Russian multi-role transport aircraft.

The clean look of the Pilatus PC-12 single-engine turboprop passenger and cargo aircraft manufactured in Switzerland is captured in this photograph.

The second prototype of the HAL Light Combat Helicopter (LCH), ZP 4602 was on static display and programmed to make its first flight in March 2011.

HAL on home ground



Sqn Ldr Baldev Singh, CTP and acting Managing Director of HAL's Bangalore Complex at Aero India 2011.

Majority of the aircraft types on static display at Yelahanka had a 'made by HAL' imprint, be they of indigenous design or licence-built. The massive HAL assembled Su-30MKI dwarfed the HAL assembled Hawk Mk.132 parked alongside; the indigenous HJT-36 intermediate jet trainer flew daily sorties as did the first prototype of the light combat helicopter (LCH). The second LCH was in a disruptive camouflage scheme and remained on static display but not so the spirited Dhruv ALHs of the Sarang formation display team which performed to perfection everyday.

The Dhruv ALH surely remains HAL's flagship programme, with 159 ordered, 105 by the Army, which is currently raising its fourth squadron on the type. At Yelahanka, HAL's Director for Corporate Planning & Marketing, P Soundara Rajan handed over five Dhruv Mk.IIIs, powered by the Shakti engine, to Maj Gen PK Bharali, ADG Army Aviation. A day earlier, a single example of the HAL Cheetah was formally handed over to the Defence Minister of Namibia Major General (Retd) Charles Namolah whose delegation included Namibian Air Force Chief, Air Vice Marshal NK Pinehas and their High Commissioner in India. As per the contract signed in April 2009, HAL will also supply two Chetak helicopters to Namibia.

Addressing the media, P. Soundara Rajan, Managing Director of HAL's Helicopter Complex and Director Corporate Planning & Marketing, said that, "In the next ten years, some 1500 helicopters of various types will be produced by HAL, including the ALH, LCH, LUH and the medium helicopter." He revealed that in HAL's planning, the 6-tonne helicopters (ALH and LCH) would continue to be produced at Bangalore while new facilities would be built at perhaps another location for the LUH and medium helicopter.

Earlier, Ashok Nayak, HAL's Chairman had confirmed that the production of Dhruv ALHs was being ramped up to meet the requirements not only of the Indian Army and Air Force, but also the paramilitary forces and State Governments, as also the growing export market. Ecuador has placed an order for a replacement ALH and there are several other potential operators overseas.

The ALH Mk.III has more powerful Shakti engines which give it an extremely important capability at ultra high altitudes, the type able to carry 200kg of useful payload upto 21,000 feet above sea level. On -going development includes provision of a glass cockpit and autopilot plus vibration dampening and monitoring system.

As for various fixed wing programmes, the HJT-36 Intermediate Jet Trainer has resumed flight testing and it is expected that IOC would be achieved by July 2011 when the first IAF pilots will begin conversion to the type, leading to full clearance within the year. The delays in completing development of the IJT are attributed to several circumstances, including mid-way change of powerplant from the French Larzac 04 to the Russian Al-55(I) plus strengthening of structure following static load tests. Compounding the situation as far as flying training is concerned, the complete

The first Limited Series Production (LSP-1) intermediate jet trainer which flew alongside the second prototype during the inaugural function and was later on static display.

'Tiger Bird' is an appropriate name for the HAL LCH but has not received any official appellation yet.

grounding of HPT-32s in 2009 has resulted in early model Kiran Mk.Is being taken out of storage and pressed into service for Stage I training. Flight cadets are then streamed to fly Kiran Mk.IIs, Dornier 228s and Chetaks depending on their discipline but the strain is obvious. As a former head of IAF training has said, "Putting extra load on Kirans is suicidal as that fleet will also collapse. The situation is very grave as the training system in the Air Force is completely in shambles."

HAL have been working on their HTT-40 basic turbo-prop trainer whose images were available in HAL's stand in Hall E at Yelahanka where also were models of HAL's new programmes including the multi-role transport aircraft (MRTA) which is a joint venture with the Russians. N C Agarwal, HAL Director for Design and Development, talked about the various on-going programmes with the Russians, including the MRTA which would be delivered to the customer (IAF) by 2016-17. On the fifth generation fighter aircraft (FGFA), cost sharing will be in the ratio of 35:65, with HAL assuming the former.

Significantly, HAL has embarked on an extensive "total modernisation of its facilities" at an estimated cost of Rs 20,000 crores which will be "self-generated". This was the highlight of HAL's press conference on 10 February 2011 at the Aero India Show with details provided by D Shivamurthy, then Director (Finance) HAL. Taking stock of the situation, HAL have great advantage in accumulating massive orders for nearly Rs 100,000 crores for the production and supply of fighters, trainers, transport aircraft and helicopters over the next decade.

US Commerce Secretary Gary Locke in mock up of HAL's Light Utility Helicopter (LUH), being explained aspects by P Soudara Rajan, Director Corporate Planning, HAL

DRDO programmes shown at Aero India 2011

Above: Model of the 'Rustom H' UAV, as proposed by ADE for meeting the Indian Armed Force's Medium Altitude Long Endurance (MALE) requirement.

Left: Model of ERJ-145 AEW&C aircraft being jointly developed by CABS.

Model of the proposed Advanced Medium Combat Aircraft (AMCA) at the ADA stand in Hall D at Aero India.

Model of the Astra beyond visual range (BVR) air to air missile, as displayed in Hall D.

Akash surface to air missiles on launcher (as Sarang display team perform)

Air Displays at the Show

Suryakirans in immaculate diamond formation.

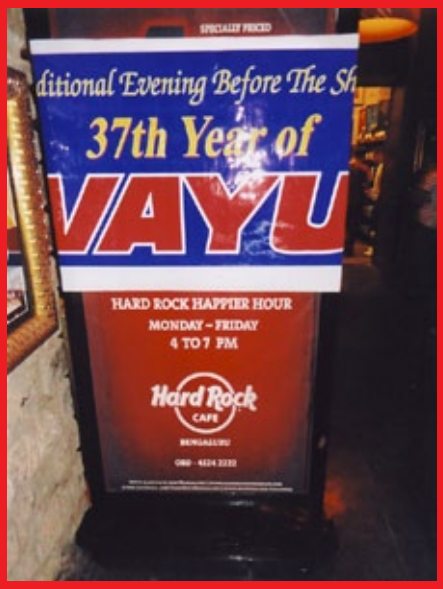
Dramatic display by Dhruv ALHs of the Sarang team.

Not at the beach but visitors at Yelahanka lounge under Kingfisher umbrellas on the tarmac!

No comment !

The aerobatic team of the Czech Republic popularly known as 'Red Bulls' performed for the first time at Aero India 2011.

VAYU at Aero India 2011



The traditional evening before the Show ! As always, Vayu's reception in downtown Bangalore was immensely popular, with hundreds of invitees, both from India and abroad, thronging the 'Hard Rock Café' on 8 February 2011.

Vayu's Show Dailies were widely distributed at Aero India 2011 and virtually became 'a must read'!

The old guard: like Vayu, the ubiquitous team from RE Rogers have remained backbone of every air (and defence) Show in India for the past two decades, beginning with Avia India in 1993 at Yelahanka. Seen here are 'Raja' Ravinder Singh Sethi, Managing Director and his wife Kiran with Surjeet Singh, Country Head.

Dassault Rafale.

M-MRCA overhang at

Aero India 2011 was not just all about the M-MRCA, but promotion of this programme virtually eclipsed almost every other activity at Yelahanka! The competitors were all there (almost) at the eighth edition of Aero India. On the static display, taxiing past the specially built platform where the decision makers sat and watched, taking off in all their thunder and glory, performing set manoeuvres, with matching commentary extolling their virtues and advantages, were the contenders of the Medium Multi Role Combat Aircraft (M-MRCA) contest.

On day one, just after the inaugural, first off the ground was Boeing's F/A-18 Super Hornet (from the US Navy) followed closely by the Dassault Rafale from a French Air Force Detachment in Afghanistan, slipped in between was an IAF Su-30MKI before the Saab Gripen took off from the opposite direction (027) leading many to remark that this truly displayed 'independence', an aspect which has been consistently pushed by the Swedes in offering their NG to India. An Italian Air Force Eurofighter Typhoon rounded off the flying displays by M-MRCA hopefuls that morning.

Eurofighter Typhoon.

Saab Gripen.

Yelahanka

The Lockheed Martin F-16 was very much present at Yelahanka with two Block 60s in UAE Air Force markings and 4 USAF F-16Cs on static display; however its demonstration flights took place later in the afternoon. Significantly, absence of the MiG-35 led to much speculation although the Russians had large scale models of their offering on display in Hall A.

At the Defence Minister's press conference too, inevitably questions on the M-MRCA dominated. One was by a western aviation journalist who prefaced his question with a quote from an (unnamed) US official who felt that this was 'pay-back time', alluding to the US support to India on the civilian nuclear deal, its quest for permanent membership of UN Security Council and so on. Mr Antony was quite deft in handling this provocation and reiterated that the decision would be based entirely on technical and performance merit with "no political interference." In fact, the Defence Minister vehemently rejected any insinuations and reiterated that the selection would be transparent and without bias. He quipped that he was "not an astrologer" but that the M-MRCA decision would be taken "during the forthcoming financial year."

Lockheed Martin F-16.

Boeing F/A-18 Super Hornet.

RAC MiG-35.

Shockwaves at Air Chief's Conference

At supersonic speeds, the shock waves are distinct and trail behind any object that interferes with the airstream in the form of a wedge, or cone. While a shock wave is normally less than 0.001 inch (0.0254 millimeter) thick, the air undergoes large changes in pressure, density and temperature across this boundary. These effects extend to the ground in the form of sonic booms.

Be it in the air or on the ground, the IAF's Chief of Air Staff has certainly created such shockwaves during his career, earlier flying MiG-21s or when, addressing the media at his press conference at Aero India 2011 on 10 February. There were a myriad of questions posed to Air Chief Marshal Pradeep Naik who answered them head-on, no holds-barred! These ranged from the IAF's standard of configuration for its projected fifth generation fighter aircraft (FGFA), imminence of the IAF Mirage 2000H upgradation (total programme cost negotiated down to just under US $2 billion), induction of large numbers of helicopters including the AgustaWestland AW 101 for VVIP transportation and 80 Mi-17 V5 medium assault helicopters (to be enhanced by another 50 of the same type). Still under evaluation are the American Apache and Russian Mi-28 to meet the new attack helicopter requirement while the Chinook and Mi-26 are competing for the heavy lift helicopter requirement.

The Chief was obviously restrained on the Service's frustration regarding the delays in ordering the next batch of mid-air refuellers, with the Finance Ministry having rejected the Air Force choice of the A330 MRTT on grounds of "cost". Re-tendering and going through the same procedures will delay the programme by a considerable period. On the other hand, after some delays owing to structural reinforcement necessitated on the HJT-36 intermediate jet trainer, this programme is now moving ahead swiftly and IOC is expected by July 2011. There were questions on re-engining of the IAF's Jaguar and the Deputy Chief Air Marhsal Ravi Sharma conveyed that the RFP would be responded to by end-February and that re-engining of 60 Jaguars was involved with 200 engines to be procured.

The Chief talked about upgradation of the Sukhoi Su-30MKI which includes incorporation of AESA radar and progress in the evaluation of a basic training aircraft to meet the urgent requirements of the IAF ever since the HPT-32 was grounded. (Even as the CAS was making his address, across the Hall in the other media centre, attributes of the Grob 120TP 'as an intelligent training solution for the 21st century' was being extolled!

However, it was that very last question at the Chief's Conference that generated those virtual shockwaves. A provocative remark on the credibility of signing the M-MRCA contract by September 2011 was answered forthrightly: recalling the process of evaluation which was conducted with absolute professionalism (some 600 specific test points), the Air Force had submitted its final report to the Ministry of Defence in late July 2010, with various clarifications consuming the next six months. "Now, the CNC would begin in the next week or so, giving another six-eight months of commercial negotiations before formal contract." The Chief however cautioned that this could be skewed with "dissatisfied companies putting in some spokes in the wheel, in which case, matters would take their own course."

However, the CNC will only begin once the 'L1' is established and that too after the down selected two or three aircraft types have been announced. Only one of six contenders will be rewarded and the other five can only console themselves in that they 'also ran'.

Interview with

Joseph Ackerman, President and CEO of Elbit Systems

Elbit Systems, Israel's largest defence company is a private holding company publicly traded in New York and Tel Aviv stock exchanges. Its traditional activities so far focused on defence electronics, have expanded in recent months, following the acquisition of the Soltam group, and its sister companies; Soltam is a developer of self-propelled, autonomous artillery and mortar systems and through its activities Elbit Systems is entering the main weapons platforms for the first time. In 2009 the company had a record turnover of more than US$2 billion, a level expected to be maintained in 2010, as its current backlog has grown to more than $5.3 billion.

"Israel being a small country, our growth is derived from export. India, as one of the world's fastest growing nations, opens many opportunities for us, in which we can offer our advanced, proven technologies." Joseph Ackerman President and CEO of Elbit Systems told *Vayu*. "India offers excellent technological capabilities, high technical skills and profound understanding of the applications and military and defence requirements. Hence, teaming with Indian partners and working with them as customers and partners, establishes mutual trusted and understanding of each other's needs, providing long-term benefit for both parties, through a 'win-win' situation.

"We consider India as a major growing market for our company. We intend to broaden our operations here by expanding our existing partnerships and, where applicable, establish new partnerships and joint ventures, addressing specific opportunities."

"To seize promotions opened throughout the transformation of the world defence market, Elbit Systems has established the 'multi-domestic' operational conduct, enabling the company to perform as an international conglomerate, while focusing its operations on strategic local markets, through dedicated local business entities formed to meet the specific regulations of each of our strategic markets. These business formations are responsible in developing the long term growth-strategy in their market. In parallel, we operate through partnerships with local companies, domestic contractors and subcontractors. This is our common operational policy, in all our strategic markets, and India being no exception. The local partnership HALBIT we established with Hindustan Aeronautics Ltd (HAL) is already operating successfully for several years. In other fields we also operate through other partnerships and, as our activities in India expand we intend to add more co-operations here."

Our comprehensive training propositions are definitely a main thrust for us this year. Our portfolio includes everything an air force requires, provided in a modular and flexible packaging. From the design and development of flight simulators, to virtual avionics embedded into the aircraft systems, enhancing in flight training, to full service turnkey programs, it is addressing all the air force's training needs, from syllabus and simulators, to the procurement and maintenance of aircraft trainers served by 'pay per use' scheme.

We are offering a comprehensive, operationally-proven training package that we are currently providing the Israel Air Force, which includes acquisition, operations and support of the training aircraft, virtual training environment integrated in simulators and in the aircraft itself. We have acquired substantial experience in the operation of the Grob G-120 trainer which we are operating for the Israel Air Force. This aircraft can be equipped with advanced cockpit and helmet displays, providing cadets with the advanced cockpit environment they will experience in more advanced phases and in operational flights.

Another field where Elbit has developed market leadership in the region, is the field of electro-optics. Electronics and Electro-Optical (EO) systems, advanced communications and vectronics, EO payloads, lasers, missile warning and self defence systems and other systems are supporting all arms, will be displayed at the present exhibition. Our activities in the EO domain are also conducted through joint ventures, we are working with. Elbit Systems is offering a wide range of avionic equipment, from helmet displays and sights, through full 'glass cockpit' designs, for fighter aircraft, helicopters, trainers and transport planes, electronic warfare and self- protection suites. Avionic modernisation is a key element in all aircraft and helicopter upgrades we are providing for our customers

Tamir Eshel

Interview with

Antoine Bouvier, CEO, MBDA

VAYU : What is the status of the joint development project with BDL for the proposed short range surface-to-air missile? During the French President's visit to India in late 2010, we heard that the project is moving ahead.

Here you are referring to the SR-SAM or Maitri project which involves us very closely with the DRDO. For its progress you will need to discuss with the DRDO.

VAYU : Has the Indian Navy decided to induct the Scalp Naval into their forthcoming Scorpene submarines?

SCALP Naval has had a very successful year in terms of firing trials. It has been ordered by France for its Barracuda-class nuclear-powered submarines but no, it has not been yet ordered for India's Scorpene as it was not part of the operational requirement. The Indian Scorpene will be armed with MBDA's Exocet SM39 anti-ship missile.

VAYU : As for the Indian Air Force Jaguar upgrade programme, which MBDA missiles have been proposed for it?

The IAF is upgrading its Jaguars. Part of this upgrade calls for an above the wing pylon launched air-to-air missile. The ideal solution for this is a missile with exceptionally high launch speed and low drag to ensure clearance from the Jaguar's wing. MBDA's ASRAAM fits the bill perfectly. In terms of its performance, the UK and Australian air force pilots that have flown and tested with it, cannot praise its capabilities high enough. We market it as a "first shot, first kill" missile. It is so fast and agile that the pilot equipped with ASRAAM doesn't need to get into dogfight with the enemy. Once he has launched the weapon, he knows he's won. Importantly for the Jaguar which flies at relatively low altitudes in relation to a possible airborne threat which could come from a much greater height, ASRAAM has an unmatched "snap-up" shoot capability

VAYU : Coming to the IAF Mirage 2000's, has the IAF selected the MICA air-to-air missiles? What about the Meteor?

For more information regarding the Mirage upgrade, you will need to talk to Thales. MICA would be a perfect solution for all the operational advantages associated with the weapon Hence MICA has been proposed for Mirage upgrade, discussions with IAF and MoD are still under progress.

Meteor is not an element of the Mirage upgrade. It is however, a key weapon and associated with Europe's three latest generation combat aircraft, Eurofighter Typhoon, Gripen and Rafale. Of course these European platforms are involved in the IAF's MMRCA competition. The Meteor BVR weapon is capable of defeating any current or developing threat thanks to its range and speed and agility right through the entire flight envelope. Pilots talk about a NEZ or "no escape zone" in terms of air combat. Meteor's NEZ is unmatched. In short, a pilot armed with Meteor will win, end of argument!

VAYU : Which other Indian tenders and competitions is MBDA participating in and what is the status?

We are discussing a wide range of missile solutions with all three Indian armed services. For anti-ship we are proposing Marte ER and Exocet, for land targets PARS 3, for the army we have the innovative yet low cost Fire Shadow loitering munition. Of course we also have a range of weapons linked to the MMRCA competition. In terms of status, in some cases this is very advanced but for reasons of customer confidentiality I do not wish to enter into details.

VAYU : Can you tell us more on your collaboration with BDL and the MILAN missile systems?

As you know, Milan has been manufactured by BDL in India for some time and is used with the indigenous Flame firing post. Over 30,000 missiles have been produced by BDL and our relationship with them represents a major part of our history with the Indian defence industry. Milan plays a key part in Indian defence planning as proven by the recent order of 4,100 of the 2T variant of this missile.

Asraam.

DGAQA ENSURING FLIGHT SAFETY THROUGH QUALITY ASSURANCE

VISION

To create and sustain an environment of mutual trust and "self control" amongst the various agencies involved in develop ment/ production of aviation products for Defence.

MISSION

To transform and perfect the mechanism of DGAQA's regulatory function so that all those involved do the right thing first time and every time.

As a QA methodology, DGAQA ensures aeronautical Quality assurance in aerospace industries through (i) standard operating procedure (process discipline and measurement) and (ii) standard of preparation (design control of configurations and modifications). The vital inputs materials are subjected to analysis of impurities upto the trace elements, consistent refined material structure and its integrity through series of defined destructive and non-destructive tests.

The organization provides engineering inputs to industries and R&D houses for maximizing the efforts towards, design-optimization, proper validation modeling and simulation, stress analysis, materials optimization, state of art fabrication techniques, moving to six sigma level defects through process monitoring and process optimization, usage of proper jigs and fixtures, narrowing the tolerances, latest assembly techniques, excellent finishing methods, effective sub-assembly testing, appropriate load testing, established inspection testing with the state of art gadgets, employing CAD-CAM techniques and three dimensional measurements, product / process failure analysis & prevention, maintenance evaluation etc.

Keeping in view the flight safety ramifications, DGAQA deploys independent critical stage inspection points post quality control (QC) checks on aero products and systems by the DGAQA approved QC personnel of the aero-industries. Barring safety critical stages like engine and flight controls other stage inspection points of DGAQA are kept flexible after process maturity. The flight clearance of aircraft and engine post production or overhaul exercise is invariably coordinated by DGAQA through independent checks and issuance of flight clearance certificate (Form-1090).

Recent achievements of DGAQA and MSQAA organizations are as follows :

a) Three of DGAQA officers received awards for excellent contribution in DRDO's TARANG Project.

b) Two officers of MSQAA were included in the path breaking technology achievements 2009 award of DRDO.

c) A total of 60 officers from DGAQA were deputed to foreign countries like ISRAEL, ITALY, USA, UK etc., during the last year for 'On the job' Training/Product evaluation/ service procurements.

d) DGAQA have focused on training and competence building as key result area by detailing officers and staff regularly to various institutions within INDIA.

e) DGAQA accepted aeronautical stores of value more than ten thousand crores during the last year.

f) DGAQA contributed significantly in design, process and product improvement of various development projects like LCA, ALH, IJT etc.

g) MSQAA rendered rich engineering inputs to DRDO and its vendors on MISSILE projects.

Interview with Ms. Marie Agnes Veve, CEO, Eurocopter India (P) Limited

VAYU : Congratulations on the new India subsidiary. What are your immediate plans with regard to Eurocopter India (P) Limited?

We are very happy to have inaugurated our India subsidiary, which reinforces our commitment to developing the Indian helicopter industry. In fact, we are the first and only foreign helicopter manufacturer to have a fully-fledged subsidiary in India. We believe that it is very important to be physically present and be closer to our customers so that we can provide end-to-end support to their fleet.

Eurocopter India is headquartered in New Delhi and has an existing facility in Bangalore for the management of industrial activity. The Bangalore facility will be expanded under the management of Eurocopter India to define additional manufacturing opportunities in the country. We plan to create an engineering centre in Bangalore next year, along with the opening of a new commercial office in Mumbai. Our current headcount is also expected to grow significantly during the coming years as we evolve our commercial, industrial and services/support presence in the country.

Eurocopter India will address current and future operators' needs for maintenance and support by offering responsive, cost-effective solutions for spares management, technical documentation, warranty claims and training. We will also develop a country-wide MRO network building on our existing local assets and partnerships within India. Another priority for the new Eurocopter India subsidiary is the expansion of the company's industrial cooperation, building on the 40-year relationship with Hindustan Aeronautics Limited.

VAYU : What segments do you consider most promising with regard to India?

Today, helicopter operations in India are primarily dedicated to the Oil and Gas industry for ferrying people and materials to offshore platforms. We believe that the Oil and Gas industry will remain the main driver of helicopter growth in India. Another segment that we are optimistic about is the onshore passenger transportation in remote areas, as well as government and business aviation transportation which should continue to grow following Indian economic rate of growth.

Three new services that we are very bullish about are: Utility (for carrying materials underslung); Helicopter Emergency Medical Services (for rescue and medical transportation); and Law enforcement (for maintaining law and order)

VAYU : How successful are Helicopter Emergency Medical Services (HEMS) in rest of the world?

HEMS is well developed in European countries and in the US as well as some countries of South America, Middle East and Asia. The use of helicopter for rescue and medical transportation drastically increases medical efficiency by saving time, removing obstacles and reducing risk. Many Asian countries are performing EMS roles with Eurocopter helicopters like Malaysia, Indonesia, Thailand, Japan and Korea. We have a very strong presence in Malaysia and Japan. While Malaysia is operating Eurocopter helicopters for HEMS missions under a very interesting business model, Japan also has a big fleet of EC135 helicopters being used for HEMS purposes ("Doctor Heli programme").

VAYU : How do you view the future of HEMS in India? What makes HEMS critical for India in particular?

Currently, there are no real HEMS helicopters flying in India, which means that the potential for such helicopters in India is tremendous. Presently helicopters from the Defence Services are employed to provide air evacuation in natural disasters and other emergencies. Generally, armed forces helicopters are mobilised from the helicopter units located nearest to the location where the event may have occurred. There are instances where helicopters are not available in the vicinity and have to be flown in from distant locations. Even when these helicopters reach the patient, they are only equipped to administer First Aid as they are not configured to offer specialised medical treatment. Therefore, it is critical for a country like India to make concerted efforts to develop HEMS. If we look at HEMS from a global perspective, 15 to 20% of the helicopters sold per year are HEMS helicopters. Approximately 10 to 20 helicopters are sold per year in India. If 15-20% of these are HEMS helicopters, it would be a good start to the development of HEMS in India.

VAYU : What would India have to overcome for HEMS to be sustainable?

Two of the biggest challenges for developing HEMS in India are the cost involved and infrastructure constraints. In some developed markets like the US, the HEMS business model is sustained by insurance. By saving time, these helicopters save lives and make sure that patients are able to get the right medical attention on time. The direct benefit for an insurance company is that if lives are saved, the insurance company saves money that it would otherwise have to pay if the patient had failed to survive. In the beginning of HEMS in the US, HEMS was a relative/competitive advantage. But given the benefits that it provides the insurance companies, HEMS has now become a key factor of success for these companies. India will also need to identify opportunities for tripartite agreements involving helicopter operators, hospitals and insurance companies to make HEMS sustainable. Governments and relatives institutions should also be kept in the loop.

VAYU : How is Eurocopter positioned to address this need?

Currently, 8 out every 10 emergency medical helicopters are from Eurocopters. Interestingly, Eurocopter helicopters are the only ones that have been 'designed' for HEMS, complete with large cabin, rear and side access to easier stretcher loading, protected tail rotor and the lowest noise signature in the world. They are capable of flying at varied altitudes and under the most challenging of conditions. This is why we are confident that Eurocopter India is well placed to address the HEMS needs of India.

Northrop Grumman highlight ISR capabilities at Aero India 2011

Northrop Grumman Corporation highlighted its range of capabilities in intelligence, surveillance and reconnaissance (ISR) including airborne early warning and control systems for maritime reconnaissance, fire control radars and unmanned aerial vehicles, at Aero India 2011.

"ISR systems are critical to effective homeland security and our leadership in multiple-domain ISR strongly positions Northrop Grumman to help create solutions for India's coordinated national defence structure", said Bill Schaefer, vice president, business development, Northrop Grumman Aerospace Systems sector. "Developing our relationship with India and our presence is an important dimension of the company's activities. We look forward to highlighting our range of products and capabilities and to supporting India's defence modernisation objectives."

Showcasing their capabilities in airborne early warning and control was the E-2D Advanced Hawkeye and the Multi-role Electronically Scanned Array (MESA) radar.

Northrop Grumman's airborne surveillance capability was also highlighted with models of the Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS), the Long Endurance Multi-Intelligence Vehicle (LEMV) and Fire Scout, vertical unmanned aircraft system (VUAS) multi-role UAV.

Northrop Grumman is developing up to three LEMV long endurance hybrid airship systems for the US Army. This system is designed to be optionally manned, providing the flexibility to operate with or without a crew onboard, and sustain altitudes of 20,000 feet for a three-week period, to provide persistent ISR capability. Final testing of the first LEMV is planned for the end of 2011.

Northrop Grumman's role on the P-8I Indian Navy Maritime Patrol aircraft programme includes early warning self-protection (EWSP) and electronic support measures (ESM) systems. The EWSP detects and defeats RF and infrared-guided missile threats and the ESM provides passive radar signals collection and location capability. The Embedded GPS/Inertial Navigation System (EGI) provides navigation data for the aircraft.

The company's Active Electronically Scanned Array (AESA) programmes are also being featured with a full-scale model of the corporation's AN/APG-80 fire control radar for the F-16IN Super Viper multi-role fighter aircraft. The AN/APG-80 shares common architecture with the F-35 Joint Strike Fighter's AN/APG-81 radar and is the only AESA fire control radar in India's Medium Multi-Role Combat Aircraft (MMRCA) competition with operational experience.

Northrop Grumman's STARLite a small, lightweight wide area surveillance radar used for supporting tactical operations, is also being highlighted. STARLite features synthetic aperture radar (SAR) and ground moving target indicator (GMTI) capabilities for unmanned and manned aerial vehicle applications.

Raytheon AESA technology and the Super Hornet

With over 250 radars successfully delivered, Raytheon's APG-79 AESA radar is the latest generation of active electronically scanned array technology. The advanced system is a critical part of the Super Hornet integrated sensor backbone keeping the aircraft at the forefront of tactical capability for domestic and international customers. Ongoing radar upgrades and technology advancements will continue in the future due to a robust roadmap in place for radar development and further expansion of capabilities.

The APG-79 AESA radar can provide Indian aircrew with advanced capabilities that allow warfighters to detect and identify targets at longer ranges than ever before, thus delivering critical air superiority when it matters. This long-range capability, along with a host of other cutting edge technologies, allows pilots more time to process, share, and assess information before critical decisions are made.

APG-79 AESA radar.

"The power of Raytheon's innovative sensor technologies has revolutionised combat capabilities and significantly improved situational awareness for aircrew," said Jim Hvizd, vice president international business development, Space and Airborne Systems. "Raytheon's APG-79 AESA radar technology, combined with our other key sensors, electronic warfare systems, advanced targeting pod and sophisticated weapons, offer the Indian Air Force incomparable tools in support of their requirements for today and the future."

A world leader in delivering high-performing AESA radar systems to a variety of global customers, Raytheon, in partnership with Boeing and the U.S. Navy, continually builds on its baseline AESA technology to ensure the radar takes full advantage of ongoing technology enhancements. In full rate production, the combat proven APG-79 radar demonstrates a quantum leap over previous radar systems in providing the F/A-18 with unprecedented situational awareness in all modes including simultaneous air-to-surface and air-to-air operations.

In addition to these enhanced capabilities, AESA radars are easy to maintain. Its innovative front array design features numerous solid-state transmit and receive modules eliminating a common cause of breakdowns in previous radar systems. The APG-79 is one of the most reliable radars available today, providing 10-15 times greater reliability than mechanically scanned array radars, resulting in significantly reduced life-cycle costs.

ITT: leader in Air Traffic Management modernisation

As the skies over India get ever more crowded, Automatic Dependent Surveillance-Broadcast (ADS-B) technology can enable enhanced safety, efficiency, and environmental benefits. With ADS-B technology, both pilots and air traffic controllers have greater situational awareness that allows pilots to fly at safe distances from one another with less assistance from air traffic controllers. The technology also allows airlines to fly more direct routes – saving fuel and reducing their carbon footprints – while making air travel safer and more convenient (by reducing travel delays) for passengers.

"India and its citizens can benefit greatly from ADS B technology," said John Kefaliotis, ITT vice president of next generation transportation systems. "Air traffic management modernisation and improvements to air travel infrastructure can lead to safer skies, enhanced capacity and fewer delays."

ITT is a world leader in next generation air traffic management solutions. For more than 65 years, ITT has been a trusted provider of mission critical products and services that support civil air navigation service providers (ANSPs) and defence organisations globally. ITT has fielded more than 1500 fixed, transportable, and mobile integrated radar solutions to 45 countries and provides comprehensive life cycle support services around the world.

ITT is a high-technology engineering and manufacturing company with more than 40,000 employees. ITT reported 2009 revenue of $10.9 billion, with 2010 total revenue forecast at approximately $11 billion.

Rockwell Collins in India

Rockwell Collins is increasing its presence in India through ongoing investment, strategic partnerships and contributing to the local economy. Their strength in network enabled communications, advanced, integrated avionics and communications for fixed and rotary wing aircraft, as well as unmanned aerial vehicles (UAVs) provide many opportunities here.

In 2008, Rockwell Collins opened a design centre in Hyderabad, India to augment the company's existing engineering capabilities. The India Design Centre was created to help Rockwell Collins expand its global footprint, meet the needs of customers in this region, and increase access to high-quality engineering and design talent. This centre also enables Rockwell Collins' engineering teams to work collaboratively around the world and around the clock to develop innovative solutions.

Rockwell Collins' India Design Centre is dedicated to product development for global markets, with initial work focused on the design of display applications for commercial and military customers and Flight Management Systems. In October 2010, it expanded the IDC with the opening of Phase 2 of the facility in order to accommodate the growth of the IDC team, which today totals 250 employees with plans to double by 2012.

Rockwell Collins is opening a new facility in New Delhi in 2011. This facility will house the business development, programme management, engineering and related support activities for net-enabled communications, navigation, surveillance, displays, sensors, simulation and training, and integrated systems and subsystems for airborne, ground and maritime applications.

Examples of Rockwell Collins customers doing business in India include HAL's Dornier 228 utility aircraft; the SARAS transport being developed by NAL; original equipment manufacturers such as Boeing and Airbus, and numerous commercial airlines.

Thud Chee "TC" Chan is Vice President and Managing Director of the Asia Pacific region. He leads the development of our business interests in Asia Pacific including India and Ram Prasad is Managing Director of India operations.

United Technologies highlights at Aero India 2011

United Technologies are highlighting Pratt & Whitney and Sikorsky which are "setting the standard for performance, reliability and industry-leading innovation around the world". The focus is on Pratt & Whitney military engines which power the most advanced fighter aircraft including the F-15 Eagle, F-16 Fighting Falcon, as well as the world's only fifth generation fighters, the F-22 Raptor and F-35 Lightning II. Four Pratt & Whitney engines also power the Boeing C-17 Globemaster III.

On the civil aviation side, the Pratt & Whitney's PurePower engine family is designed to deliver double-digit reductions in fuel burn and operating costs, and will power new single-aisle aircraft including the Airbus A320neo, Mitsubishi Regional Jet, Bombardier C-Series and Irkut's MC-21.

Sikorsky helicopters are used by military services and commercial operators in 40 nations across the globe, while 25 governments worldwide operate Black Hawk helicopter variants. Sikorsky's S-76 and S-92 helicopters are involved with executive transport, airline operations, offshore oil transport, medical, and search and rescue missions.

Recently, Tata Advanced Systems (TASL) and Sikorsky held a ceremony to mark the delivery of the first S-92 helicopter cabin manufactured in India.

AviOil

The Barak-8 launcher seen here at the Paris Air Show.

IAI programmes in India

Israel Aerospace Industries (IAI), has started 2011 with a swing; in November 2010 the company reported its backlog exceeding $9 billion, derived from growth in both commercial and military sectors, domestic and export.

To continue its growth, IAI is seeking to win more large-scale programmes on its major strategic markets, being the USA, Europe and India. "The future growth of IAI will come from such progammes, similar to those we have recently won." Izhak Nissan, IAI CEO, told *Vayu*. "Large-scale programmes bring together all IAI's unique attributes - state-of-the-art technology, extensive operational experience, system integration methodology, flexibility to understand the user requirements, backed by performance track record and the long tradition of partnership, are key to our success" said Nissan.

Large programmes are indeed the main driver for IAI's growth. Among the company's recent gains are a major sale of the latest Land-based Barak 8 Air Defence System, several orders for Heron unmanned aerial systems, multiple sales of the latest versions of Multi-Mission Radars, signal intelligence and electronic warfare systems from Elta Systems and continued sales and development of IAI's military and commercial satellites.

IAI is seeking to further strengthen its position in India, through winning new customers, more partnerships, extending its offering through the civil, government and defence sectors. IAI has two ongoing partnerships with the Tata Group and Nova, which are progressing well and the company would like to expand on this successful concept with more initiatives. The rapid growth of IAI's operations on the Indian market, despite growing competition, can be attributed to the close and direct relations established, through the successful cooperation with the users, industry and partners, timely delivery of systems, allocating significant work share and fulfilling offset obligations.

In 2006 Israel and India embarked on a strategic cooperation developing a

new naval air defence system to address the specific, common requirements of both Israeli and Indian navies, with revolutionary concept of 'network centric air defence'. This concept incorporated the best technologies India and Israel could offer, including superior missile interceptors, the latest technology phased array radars, state-of-the-art command, control and communications, integrated with missionised land-based and airborne command and control, coupled with unmanned aerial sensors. Eventually, this 'Next Generation Barak' concept evolved as the Barak 8.

Three years ago the programme expanded on this concept, adding another dimension to the Indo-Israeli cooperation, embarking on the Medium-Range Surface-to-Air missile system, protecting strategic targets on land. Then, general manager of IAI's MBT missile and space division, Nissan led this programme from its inception. Today, as IAI's president, he continues to be involved in every detail. Both programmes are progressing well as IAI's partners in India are actively involved and taking part in every phase of the development. *Vayu* was informed that test firing of the Barak 8 missile is expected this year. "Testing will be conducted in India and is part of the responsibilities of our strategic partner in this programme, India's Defence Research & Development Organisation (DRDO)".

The missile is on schedule for completing development and integration on board the first combat vessels by 2012. After being inducted into service, the system will continue development and phased improvement toward full operational capability phase. Barak 8 is designed to be fielded on both Israel and Indian Navy vessels.

Under another programme, IAI is cooperating with partners in India on the development of an optionally, manned helicopter piloting kit. This kit, known as Naval Unmanned Rotary Wing Aircraft (NRUAV) will enable helicopter operations under sea conditions, currently inhibiting manned takeoff and landing on the decks of surface vessels.

Other prospect, for IAI are special mission aircraft, aerial refueling, aerial early warning (AEW) aircraft and aerostats of all sizes. India has requirements for all these applications and IAI, having an impressive track record in providing such capabilities in the region and specifically for India, is ready for these challenges.

Tamir Eshel

Elbit Systems Electro-optics Elop: from full systems to sensors

COMPASS on the Hermes 450.

Elbit Systems Electro-optics Elop Ltd. (Elop), which is a wholly-owned subsidiary of Elbit Systems Ltd as a multidisciplinary electro-optics systems house, has one of the widest product portfolios and fastest growth-rates in the industry extant. Through ongoing cooperation with the Israel Defence Forces and the armed forces of numerous nations worldwide, Elop matches electro-optics system performance to real world scenarios. Elop has five times been awarded the prestigious Israel National Security Award over the last decade and today, Elop systems help contribute to the defence of more than 50 countries worldwide.

The company's high level of vertical integration, covering R&D and manufacture of subassemblies and sensors, production and integration of multidisciplinary systems, and full post-sale support and services, ensures in-depth control of the manufacturing process and enables reliable on-time scheduling. Maintaining all key technologies under one roof enables Elop to satisfy customer demand for advanced and affordable solutions in the fields of Observation and Surveillance Payloads, Space and Airborne IMINT, Lasers, Thermal Imaging, Electro-Optic Countermeasures, Head-Up Displays, Integrated Sights for Ground Forces and Homeland Security.

Elop's stabilised electro-optical payloads provide optimal observation, surveillance, tracking and targeting capabilities under even the toughest conditions. Optimised for fixed and rotary wing aircraft, UAVs, combat vehicles, naval platforms and ground applications, our payloads include up to four sensors, MWIR FLIRs (3rd generation), day channels with zoom, eye-safe rangefinders or laser target designators, and laser pointers in a stabilized turret. Elop's main Observation and Surveillance products include the CoMPASS™ (Compact Multi-Purpose Advanced Stabilised System) which is a 15" stabilised payloads family used for airborne, naval and ground applications. It features excellent stabilisation performance, accurate Line-Of-Sight (LOS) positioning, high quality day and night sensors, lasers, effective image processing algorithms and an exceptionally easy to operate Human Machine Interface (HMI).

Python-5.

Rafael's Python-5 and Derby at Aero India

Now fairly familiar to visitors at air shows, the Python-5 fifth generation air-to-air missile as exhibited by Rafael at Yelahanka in 2011, provides the pilot engaging an enemy aircraft with a full sphere launch capability. The missile can be launched from very short to beyond-visual ranges "with greater kill probability, excellent resistance to countermeasures, irrespective of evasive target manoeuvres or deployment of countermeasures."

Python-5 incorporates a new dual waveband imaging seeker, advanced computer architecture, Inertial Navigation System (INS), sophisticated Infra-Red Counter-Counter-Measures (IRCCM) and sophisticated flight control algorithms. Python-5 maintains Python-4's unique aerodynamic airframe, INS, powerful rocket motor, warhead and proximity fuze. It also provides revolutionary full sphere competence, achieved by a combination of Lock-On-After-Launch (LOAL) and excellent acquisition and tracking capabilities. Its dual waveband Focal Plane Array (FPA) seeker and sophisticated algorithms enable acquisition of even small, low signature targets in Look-Down, adverse background and cloudy environments.

Developmental and operational testing has already been carried out, including extensive captive-carry evaluation tests and free-flight homing tests. The Python-5 IR air-to-air missile complements the Derby medium range air-to-air missile.

The Rafael Derby is an active radar air-to-air missile that provides fighter aircraft with outstanding and effective performance in both short ranges and Beyond Visual Range (BVR) intercepts, enables operational flexibility, multi-shot capability and can be launched at a hostile aircraft day or night and in all-weather conditions. Additional Derby capabilities include look-down/shoot-down, sophisticated fire and forget mode and an advanced ECCM tailored to the customer's operational requirements. Derby's light weight allows it to be adapted to various modern fighter aircraft, including light aircraft, such as F-5, Mirage and F-16.

Rafael unveils the "ImiLite"

Rafael Advanced Defence Systems Ltd., has unveiled the Imilite, a new, multi-sensor, multi-platform intelligence, surveillance, and reconnaissance (ISR) Exploitation System.

ImiLite is a cost-effective intelligence system designed to receive process and exploit multiple standalone imagery video and other intelligence data in a centralised and a unified way. Main system capability includes the reception, processing and exploitation of EO, IR, SAR/GMTI and VIDEO, in various formats, over one desktop. In order to enhance the exploitation process, ImiLite further combines non-imagery data such as targets, threats, COMINT detection and mission status within the system workflow. ImiLite generates a variety of standard and customer tailored ISR reports and IMINT products such as alphanumeric reports, annotated maps, GIS data layers and visual aids, and disseminates them to external information and operation systems over standard and tailored protocols. ImiLite's multi-source data integration and automation capabilities improve the efficiency of utilising available collection and exploitation assets. The system GIS capabilities provide immediate accessibility to relevant imagery and intelligence data, thus shortening the ISR collection and exploitation cycle.

Samtel showcases indigenous technology

Even as the Indian defence industry embarks upon an intensive campaign to increase indigenisation, Samtel Display Systems (SDS) and its joint venture companies are providing the key solutions and partnerships for the avionics requirements. With considerable experience and expertise in manufacturing advanced displays, Samtel has strategically positioned itself as the strategic Indian player in the international and domestic market, manufacturing high-technology products for avionics and military applications.

Samtel straddles the entire value chain from design, development, manufacture, testing, qualification, repair & maintenance to obsolescence management of avionics products and equipment for military as well as commercial aircraft. SDS products and services include Multi-Functional Displays (MFDs), Smart Multi-Functional Displays (SMFDs), Full Colour Displays (FCD) for commercial aircraft, Head Up Displays (HUDs), Helmet Mounted Sight Displays (HMSDs), Automated Test Equipment (ATEs), ISIS Solutions, Multifunction Indicators: 3ATI & 4ATI, Infra Red Search and Track (IRST), Rugged military displays for Land, Naval and Airborne platforms, Built-to-print (BTP) manufacturing, MRO services, and Obsolescence Management.

Samtel-HAL Multifunction Displays for Sukhoi Su-30MKIs

The joint venture between Hindustan Aeronautics Limited (HAL) and Samtel was created in 2006 to address the avionics requirements of HAL, especially cockpit displays of various kinds. The aim of the JV was to indigenise critical primary display technology in India, and create a 'Centre of Excellence' to produce indigenous displays for existing HAL aircraft and those expected in the near future plus also upgrades. Over this period, the JV has been successful in indigenise this mission-critical product. The production facility for the Samtel HAL JV has been established and product deliveries are in progress. This is an achievement of great pride for the country, with such technology available in India and opens up

Puneet Kaura, Executive Director, Samtel Display Systems.

avenues for replicating it on other cockpit displays for HAL's aircraft of the future : this essentially was the mandate of the Samtel-HAL JV when it was set up.

Along with DRDO (DARE Laboratory), Samtel had taken on the challenge of technology development for MFDs for the Su-30 aircraft in 2004. Qualification and flight testing for these MFDs was done under aegis of HAL and CEMILAC and the product was perfected through extensive flight testing by IAF. These colour MFDs are now being productionised for Su-30MKI Block-III & Block-IV production aircraft at Samtel's DGAQA-qualified manufacturing facilities. The Samtel-HAL JV has achieved the unique distinction of being the first public-private partnership in defence avionics in India to have a primary cockpit display qualified and productionised for induction on fighter aircraft. The Samtel-HAL JV is now working on indigenous avionic displays and systems for integration on all future HAL programmes. Colour Multifunction Displays (CMFD55 & CMFD66 for Su-30 MKI) were on display at the Samtel stall at Aero India 2011 and also on display will be next generation large-size multi-function displays being developed by the JV, along with other products in line.

Helmet mounted display (HMD).

The Samtel Thales Joint Venture

Samtel Display Systems also have a joint venture with Thales Aerospace (Samtel Thales Avionics Ltd), which is intended to develop, customise, manufacture, supply and maintain indigenous Helmet-Mounted Sight and Display Systems and modern Avionics Systems for the Indian and export defence markets. Such systems for the Indian Forces' helicopters and fighters represent the main objective of the JV Company, and such activity will expand to include other products. Based in Delhi, the JV provides the basis for all future aerospace development for Thales in India. The resulting Indian avionics systems will serve customer requirements and would also be eligible to meet Thales's offset obligations for its different programmes with the Indian Defence Ministry. The JV Company will also ensure local added value support and integrated maintenance services for the systems it produces for the Indian market. The Helmet Mounted Sight Displays (TopOwl and Divy Drishti), a demo of Infra Red Search and Track (IRST) system, and demo of the Integrated Electronic Standby Instrument (IESI) were on display at the Samtel Thales Avionics section within the Samtel stall at Aero India 2011.

Future Outlook

Over the next few years, SDS expects to be the front-runner in the domestic aerospace segment. With several 'big ticket' defense purchases on the cards, the offsets business will drive growth for SDS and other players in this area. The new Defence Production Policy is also intended to support Indian Industry to build their in-house capabilities in order to meet the future defence requirements. In order to absorb the expected offset requirements, SDS is definitely one of the strongest contenders since it has the capability to deliver high-quality products and within a short period of time.

Mahindra Aerospace makes debut

Mahindra Aerospace Pvt. Ltd. (MAPL), a part of the $ US 7.1 billion Mahindra Group, made its debut at Aero India 2011. The centrepiece of the MAPL stall was the recently launched GA8 TC-320 Airvan which has been designed and built by GippsAero, an Australian company acquired by Mahindra in 2009.

Aside from the GA8 TC-320 Airvan, the acquisition of GippsAero has added two more aircraft models to MAPL's portfolio: the two-seater GA-200, the Airvan GA8 NA-300 and the 18 seater GA-18 Airvan. All aircraft can operate from unpaved runways and make short take-offs and landings which is a big advantage in a country like India where the need is to boost rural connectivity.

Along with GippsAero, Mahindra also acquired Aerostaff Australia in 2009, a Melbourne based manufacturer of precision sheet metal parts and assemblies for the global aerospace and defence industries.

According to Arvind Mehra, Executive Director and CEO, Mahindra Aerospace Private Limited, MAPL aims to further enhance its presence by launching 3-4 aircraft over the next few years, establish a world class aero components, assemblies and aerostructures plant in India and thereby play an important role in the global supply chain. "Our current priority is to consolidate our achievements and build a strong foundation for ourselves in the global aerospace industry," he stated.

On the aircraft side of the business, MAPL wishes to become globally recognised as a manufacturer of cost-effective, efficient and robust utility aircraft, producing and supporting a portfolio of four to six aircraft models. MAPL is thus making substantial investments in GippsAero with a twofold purpose. It aims to ramp up production capacities for the GA8 to meet the market demand and also invest in new products and derivatives to expand its aircraft portfolio.

MAPL also aims to launch the GA8 Airvan on floats, having partnered with Wipaire, of South St. Paul, MN, the world's leading aircraft float manufacturer. The project will see the two organisations cooperate for the design, construction and flight testing to certify the GA8 on Wipaire 3450 seaplane and amphibious floats via STC. Flight testing is expected to occur in October this year.

Both companies are also collaborating on several new aircraft programmes as well as multiple technology initiatives to leverage new engineering and manufacturing technologies across systems, structures and propulsion. This will help enhance the global competitiveness of its aircraft portfolio which will expand to include a range of products in the 2 to 20 seat range.

In addition to aircraft manufacturing, MAPL has also drawn up a comprehensive plan to move up the value chain in aerostructures. As far as the aerostructures business is concerned, the company's goal in the medium term is to establish itself as a Tier 1 supplier to large aircraft OEMs. MAPL is now working on establishing a new aerostructures manufacturing facility in India scheduled to be completed in 2012. This will be a 200,000 sq. ft. facility with comprehensive capabilities for metallic aerostructural parts and assemblies.

GA10 Airvan on floats.

In his address at the keynote session of Aero India 2011, Mr. Anand Mahindra, Vice Chairman and Managing Director, Mahindra Group, mentioned that "India should take the path of collaboration and co-development. This has many advantages. By becoming co-developers of future technology, we establish our utility in the global supply chain, enhance our own capability to generate future new technologies, and simultaneously ensure that we are not left behind by technology growth elsewhere. We will shift from being 'receivers' to 'partners' - part of an overall network, and not an isolated node at the end of a one-way street".

Moreover, he said that risk sharing private-public partnerships could prove to be a great catalyst for the Indian aerospace and defence sectors. In this context, he cited the example of MAPL's tie-up with the National Aerospace Laboratories (NAL) in Bangalore to co-develop the five seat NM5 aircraft which is likely to fly in 2012.

By enhancing its capabilities in engineering services, aircraft and aerostructures manufacture, Mahindra Aerospace will thus work towards establishing itself in key areas of the aerospace ecosystem.

At Yelahanka: Tim Pryse, George Morgan (Director Technology), Arvind Mehra (CEO and Executive Director-MAPL), Hemant Luthra (President Mahindra Systech and Member of GEB Mahindra and Mahindra ltd.), Terry Miles (CEO Aircraft Division)and potential customers.

Maini in long term contract with MTU Aero-Engines

On 10 February 2011, Maini Precision Products Pvt Ltd (MPP), including its subsidiary company in aerospace Maini Global Aerospace Pvt Ltd (MGA), entered into a long term agreement with the Munich based aero-engine major MTU Aero Engines. The contract involves precision aero-engine components for the major engine programmes including GP7000, V2500 and EJ200, these engines being used in the A380, A320 family and Eurofighter Typhoon. This multi-year contract will place MGA as a strategic supplier in MTU's supply chain.

MGA has emerged as a diversified success of Bangalore-based Maini Group and has focus on Aero Structures, Aircraft Systems and Support Equipment to meet various customer needs. It considers the association with MTU as of immense strategic value, positioning it now as a key sub-source for practically all-leading engine manufacturers.

Axis Aerospace and Technologies at Aero India 2011

Axis Aerospace and Technologies (AAT), a vertically integrated aerospace and defence Company, based in Bangalore, participated at Aero India 2011, presenting various technological solutions and platforms. AAT's engineering arm, CADES, offers core competency and domain expertise for a wide range of engineering solutions, and works in collaboration with aerospace OEMs as its clients across the product development lifecycle by constantly innovating its processes. The AAT-CADES team has product design and development expertise that includes Design, Analysis, Simulation, Multi-body Dynamics, Virtual Prototyping & Testing, Manufacturing Engineering, Product Data Management and Technical Documentation.

AAT is establishing a 75 acres Aerospace Park, near the new Bangalore International Airport, to provide manufacturing and allied support facilities along with globally renowned Aerospace & Defence Companies. AAT interests into Aerospace Life Cycle Support includes setting up MRO, Hassan Airport-India's first 100% private airport which would be a M2C2 – Maintenance, Modification, Conversion and Competency. AAT is also the principal Indian offset partner for various offset programmes for global OEM's including Thales in discharging Mirage 2000 upgrade programme offsets.

Avdel Aerospace at Aero India

Avdel Aerospace has recently expanded their product offering to include special raw materials to the Indian aerospace industry which is in addition to their fasteners and other hardware being supplied by them for the past several years.

Avdel Aerospace's specialty raw materials include honeycomb sheets and prepregs, supplying honeycomb core / assemblies, from both metallic and non-metallic raw materials, in various cell sizes and densities sourced from Euro Composites (EC). The EC Product range include honey comb core and also ready to Assemble Parts, Formed and / or milled composite parts, Panels, Laminates and Honeycomb core materials. Panels in various combinations of core and skin like Nomex honeycomb with Carbon, Glass, Phenolic skin. Aluminum / perforated honeycomb with Aluminum skin.

Avdel Aerospace also support and distribute prepregs (used for manufacturing of composite parts) from Gurit (Zullwil) AG. With over twenty years of experience Gurit is a leading global supplier of composite materials delivering innovative applications for cabin interiors, structural application, tooling prepregs.

Airbus Military at Aero India 2011

Airbus A330 refuelling a F-18.

Airbus Military presented the extensive range of its military products at Aero India exhibiting its C295 model, a twin-turboprop military transport aircraft which can carry up to nine tonnes of cargo, land on unprepared airstrips, and perform the widest range of missions ranging for anti-submarine warfare to maritime and border surveillance and any kind of humanitarian aid. Airbus Military also showcased an A330 MRTT model. The A330 MRTT is the "most capable and efficient aircraft" in its class, with the highest and fastest refueling while also being able to be used as a transport or medical evacuation aircraft.

Airbus Military is the only military and civic/humanitarian transport aircraft manufacturer to develop, produce, sell and support a comprehensive family of airlifters ranging from three to 45 tonnes of payload. An Airbus daughter company, Airbus Military is responsible for the A400M programme, as well as the Multi Role Tanker Transport (MRTT) A330 and for further military derivatives based on Airbus civil aircraft. Together with the smaller 'Light & Medium' C295, CN235 and C212, Airbus Military is the global leader in the market for military transport, tanker and surveillance aircraft able to perform the most varied missions. Altogether, Airbus Military has sold more than 1,000 aircraft to some 130 military, civilian and government customers. More than 800 of these aircraft have been delivered.

Airbus Military was formally created in April 2009, following the integration of the former Military Transport Aircraft Division (MTAD) and of Airbus Military Sociedad Limitada (AMSL) into Airbus. Airbus Military builts on the experience developed by the former Contrucciones Aeronauticas Sociedad Anonima (CASA), which became part of EADS, as MTAD, in 2000. Over the years, CASA, which was founded in 1923, had specialised in the development, construction, certification and support of small military transport aircraft, while playing a leading role in the militarisation of civil Airbus platforms. It is now also fully in charge of the development of the all new 21st century tactical and logistical airlifter, the A400M.

Eurocopter brings the Fennec to Yelahanka

Eurocopter's AS550 C3 Fennec helicopter made its Indian public debut at Aero India 2011. Besides the Fennec's presence, the company's participation focussed on the AS565 Naval Panther, a version of the Dauphin family, which is on offer for the Indian Navy and Coast Guard requirements. The Panther is used around the world in a wide range of roles, including combat assault, fire support, anti-submarine warfare, anti-surface warfare, search and rescue, and MEDEVAC. Also at Aero India 2011 was Eurocopter's EC135 in the HEMS (Helicopter Emergency Medical Services) configuration.

AgustaWestland at Aero India 2011

The AW 101 has been selected by the IAF's VIP Communication Squadron.

AgustaWestland, a Finmeccanica company, exhibited its range of helicopters at Aero India 2011, including the AW101, 12 of which have been ordered by the Indian Air Force in early 2010 for government transport. Other helicopters featured include the military variant of the AW119 , transport and coast guard variants of the AW139 and the NH90 naval helicopter.

AgustaWestland is offering the naval variant of the NH90 to the Indian Navy for its new anti-submarine and anti-surface warfare helicopter requirement. The NH90 is the biggest helicopter programme ever launched in Europe, with firm orders now reaching 529 units to equip and modernise 19 services in 14 countries including the Armed Forces of France, Germany, Italy, the Netherlands, Portugal, Finland, Norway, Sweden, Greece, Oman, Australia, New Zealand, Spain and Belgium. Of those 529 firm orders over 100 are for the NFH naval variant for the navies of Italy, France, Norway and The Netherlands.

In 2005 AgustaWestland sold its first AW109 Power helicopter to the Government of Rajasthan and since then sales of its civil product range have taken-off with orders being placed for nearly 50 aircraft including additional AW109 Powers, the Grand light twin engine helicopter, the AW119 Ke and the AW139 medium twin engine helicopter.

AgustaWestland has been doing business in India for 40 years with the delivery, in 1971, of an initial batch of Sea King helicopters to the Indian Navy for anti-submarine warfare. Further batches of Sea Kings were delivered in the seventies and eighties and many remain in service today in the anti-submarine warfare, anti-surface warfare and amphibious support roles.

Bombardier team at Aero India

Simon Jackson (Director Sales), Genevieve Lemire (Manager, Marketing & Communications) and Derek Gilmour (Vice President Sales), Bombardier Specialised & Amphibious Aircraft.

Grob's G120TP as "an intelligent training solution."

At their press conference during Aero India 2011, Andre Hiebeler, Co-Chief Executive Officer at Grob Aircraft spoke about Grob's G120TP as an 'intelligent training solution for the 21st Century'. This is being offered to India as a tried and tested concept by the world's leading air forces, offering great saving in pilot training while improving training quality and pilot skills. This addresses much more than fighter pilot training, "our concept streamlines the whole pilot training process, from the elementary to the basic and advanced phases."

Using its integrated 'virtual avionics' the G120TP can save valuable flight hours on advanced jet trainers such as the Hawk AJT, which comes to an equivalent cost of $200,000 per cadet.

The Grob 120TP is designed with configurable cockpit instrumentation, and virtual avionics such as a head up display projected n the helmet visor, rather than on a dedicated HUD, therefore reserving actual HUD training for the pilots who actually need this skill. The cockpit avionics, along with the Targo helmet and virtual avionics are provided by Grob's team member Elbit Systems, which also operates the G120TP (called *Snunit*) for the Israel Air Force via Private Finance Initiative (PFI).

Tamir Eshel

During the Aero India exhibition in Bangalore, Peter Luff (Minister for Defence Equipment, Support and Technology) and Laurent Collet-Billon (Délégué Général pour l'Armement) concluded their discussions regarding "One MBDA" in an exceptionally positive manner: a clear sign that Anglo-French co-operation is deepening at all levels and even beyond European borders.

Diehl Defence showcases cutting-edge missile technology

The IRIS-T is considered today´s "most advanced short-range air-to-air missile." Series production of the missile started in 2005 within a European cooperation programme under the industrial management of Diehl Defence, the infrared guided missile selected as standard armament of the Typhoon, F-16, F-18, Tornado and Gripen, most of them contenders for the Indian Air Force's M-MRCA requirement.

Ten nations have procured IRIS-T so far. Apart from the six programme nations Germany, Greece, Italy, Norway, Sweden and Spain, export customers include the Air Forces of Austria, South Africa, Saudi Arabia and Thailand. A unique feature of the

IRIS-T is that it provides the basis for an entire missile family with additional applications for ground-based air defence and modern submarine armament.

These include the IRIS-T SL (SL=Surface Launched) guided missile, the IRIS-T SLM (M=Medium Range) based on the IRIS-T SL, launcher vehicles as well as radar and fire control systems. The modular, air-to-ground HOSBO glide missile without propulsion enables combat aircraft medium-range, precise engagement of soft and hardened ground targets as well as naval vessels. The HOSBO glide missile meets Indian capability requirements for medium-range engagement of ground targets.

KAI at the Show

Jun Hyun Jo (Manager, International Business Development) and Enes (Noh Sun) Park (Executive Vice President & General Manager) of Korea Aerospace Industries KAI with the KT-1 model.

Finmeccanica to establish more partnerships

Finmeccanica, the Italian company involved with aerospace, defence, security, energy and transport, "is looking at establishing new partnerships with government and private players to expand its base in India," anticipating new programmes and then seeking early involvement through transfer of technology and capabilities by creating strong synergies with the partners.

Giorgio Zappa, COO, Finmeccanica.

Finmeccanica has been present in India for over 40 years and has developed long term relationships with Indian partners and participated in many pioneering projects, including supplying radar and communications systems, military and civil helicopters, civil aircraft and naval systems.

Speaking about the Indian defence market, Giorgio Zappa, COO, Finmeccanica, said that the "Indian Ministry of Defence's current agenda to expand the defence industrial base, encourage indigenous defence production and reduce defence imports is commendable as that will ensure faster approaching towards indigenisation. India is a key country for us, we seek preferred partnership and we want to expand our presence by showing our technologies with the capabilities of local partners."

Finmeccanica currently has significant partnerships with key public companies such as Bharat Electronics Limited (BEL), Bharat Heavy Electricals Limited (BHEL), Hindustan Aeronautics Limited (HAL) and Bharat Dynamics Limited (BDL) as well as with private companies such as Tata Sons and HCL.

Pilatus PC-7 Mk.II in BTA Contest

Talking to *Vayu* at Aero India 2011, Bruno Cabrini of Pilatus Aircraft Switzerland explained the merits of their PC-7 Mk.II with its "exceptional standard of equipment, performance, and cost-effectiveness." The PC-7 Mk.II is on offer to the Indian Air Force for meeting its basic training aircraft (BTA) requirement. "Offering a reliable and economic training platform, the docile behaviour of the PC-7 Mk.II in the hands of a beginner delivers a confidence-building environment for inexperienced cadets. With its highly cost-efficient Pratt & Whitney Canada PT6A-25C engine, it provides the lowest engine operating costs of all currently certified turboprop trainer aircraft."

Over 800 aircraft (PC-7, PC-7 Mk.II & PC-9/M) have been sold to 21 air forces around the world. The use of airframe and avionic systems common with the PC-9/M means owners and operators benefit from the synergies of a combined infrastructure established at Pilatus to support both aircraft types. "With its modern cockpit, performance and exceptional handling, the PC-7 Mk.II is an ideal training aircraft for air forces around the world."

Eurofighter Naval Version revealed at Aero India 2011

At Aero India 2011 Eurofighter and partner company BAE Systems unveiled for the first time details about the initial definition of the navalised version of the Typhoon. These studies have included the assessment of required design changes, piloted simulations to refine the aircraft's handling qualities and discussions with key suppliers. The studies indicate that these changes are feasible, and would lead to the development of the most advanced carrier-based fighter aircraft extant.

The most important aspect of the navalised Typhoon is its exceptional thrust-to-weight ratio, allowing the aircraft to take off from a carrier without using a catapult but with a simple skiramp. Detailed simulations have shown that the aircraft will be able to take off and land in this way with a full weapon and fuel load. The basic design of Typhoon helps to minimise the modifications needed to allow a Typhoon to conduct naval operations from a carrier. The aircraft's structure is exceptionally strong, having been designed from the outset for the high dynamic loads associated with extreme air combat manoeuvring. The modifications required are limited and include a new, stronger landing gear, a modified arrestor hook and localised strengthening on some fuselage sections near the landing gear, as well as updates the EJ200 engines.

A key design driver for the navalised Typhoon is the commonality at 95 per cent with the land variant. Design changes are minimised, allowing for most of the spare parts and test equipment to be shared across a customer's air force and navy fleets. The sensors, systems and weapons available to both variants will be common, allowing for a reduction in the aircrew training requirements. In addition, the two variants will benefit from a common upgrade path – new capabilities will be available to both the air force and navy in similar timescales.

INDESEC

The Hongdu L-15 supersonic jet trainer.

That 'o'ther Air

Some three months before Aero India 2011 got underway at Yelahanka on 9 February 2011, the other major Air Show in Asia had taken place at Zhuhai in China's southeastern province of Guangdong. *Vayu* readers can do their own assessment of which of these Air Shows can claim to be the most important in Asia!

Domestic participation at Zhuhai reached an all-time high: airliners from CAAC, China Aviation Industry Corporation, China Aerospace Science & Technology Corporation, China Aerospace Science and Industry Corporation and other sponsors displayed their aviation and aerospace products and technology.

The Commercial Aircraft Corporation of China, Ltd. (COMAC) had a stand of 1500 square metres to showcase its products while the Air Force of PLA brought a range of aircraft which had previously been displayed at the 60th National Day Parade, including the *August 1st* Aerobatic Team, newly equipped with J-10 4th generation fighters and their Parachute Jumping Team. A number of private aerospace enterprises and related aviation industrial parks showcased their products while many of the earlier participants increased their exhibiting space at Zhuhai 2010.

International exhibitors included Boeing, Airbus, Rolls-Royce, Rosoboronexport, Roscosmos (IASP), Gifas, Safran, AgustaWestland, Diamond Aircraft, GE Aviation, Kulite Sensor China Inc., Tyco Electronics and Parker Aerospace. At Zhuhai 2010 there were new exhibitors including Moog, Carlisle Interconnect Technologies, Pelican

Nine-aircraft formation display by the PAF Sherdils.

Show in Asia - Zhuhai 2010

MA600 turboprop airliner over Zhuhai.

Products, Groen Brothers Aviation, Acciaierie Valbruna, Schmolz-Bickenbach Group, DMG China, Tital GmbH, LLC Research and Production Enterprise PRIMA and FED Corporation. After years of absence from Airshow China, Honeywell also came back to China.

The majority of aircraft were from the Air Force of PLA including the KongJing-200 (GaoXin 5) Airborne Early Warning & Control Aircraft (KJ-200), also recently delivered to Pakistan (see *Vayu VI/2010)*, J-10 fighters, Xian H-6 medium bombers and Xian JH-7 (Jianjiji Hongzhaji fighter-bombers) were also present.

The China Aviation Industry Corporation displayed its Hongdu L-15 supersonice training aircraft, twin turbo-prop airliner MA600 and others. The Commercial Aircraft Corporation of China Ltd brought their indigenously developed ARJ21 regional jetliner, which flew displays at Zhuhai.

The number of foreign aircraft this time well exceeded that at Airshow China 2008. The aircraft on display included Bombardier's Global Express XRS and Challenger; Gulfstream's G550 and the Legacy 650; also present were the Cessna Citation Mustang, Grand Caravan, Skyhawk 172, Corvalis TT and Excel and Diamond Aircraft's DA40D. Amongst the heavy weights were the Airbus A380 while Boeing brought its BBJ. There were a large variety of helicopters including Sikorsky's S-92, Eurocopter's EC225, Robinson's R44, the EC 120, which were complemented by Chinas's AC 313, Z-8 and Z-9, which is the biggest helicopter ever made by China.

J-10 fighter of the PLAAF.

Formation Aerobatics

Of the formation aerobatic teams at Airshow China 2010, the most outstanding were China's *August 1st* which flew six J-10 fighters and the *Sherdils* aerobatic team of the Pakistan Air Force which made its debut with their new mounts, the Sino-Pak K-8 Karakoram jet trainer which type has supplanted the previous T-37. The *Sherdils* flew nine K-8s in a scintillating aerobatics display of The Pakistan Air Force had also flown in three JF-17 fighters, one on static display, the other two flying daily demonstrations. The Red Eagles Aerobatic Team from the USA brought their colourful biplanes while there was the ASB Aerobatic Team from Great Britain.

UAVs at Zhuhai

There were more than 25 UAV models at the 8th China International Aviation Exhibition at Zhuhai 2010, a record number of UAVs, according to show officials, and continuing evidence of China's growing interest in unmanned technology. Some of the UAVs will serve as combat and battlefield reconnaissance roles.

ASN Technology is the largest UAV production company in China, with a history of developing unmanned aerial platforms, including drones, since 1958. The prime customer remains the Chinese military and the company controls more than 90 percent of the UAV market in China. ASN showed off 10 different UAVs, including the new ASN-211 Flapping Wing Aircraft System, which simulates a bird in flight. The prototype on display has a take-off weight of only 220 grams with a maximum speed of six-to-10 metres a second and an altitude ranging from 20-200 metres. A spokesperson said the micro-UAV would mainly be used for low-altitude reconnaissance for troops in the field.

Three Chinese companies, ASN Technology Group, China Aerospace Science and Industry Corp. (CASIC), and China Aerospace Science and Technology Corp. (CASC) produced most of the UAVs on display.

The largest UAV on display by the company was the ASN-229A Reconnaissance and Precise Attack UAV. Equipped with a satellite data link, it can perform aerial reconnaissance, battlefield surveys, target location and artillery fire adjustment during day or night. With a take-off weight of 800 kilograms and a cruising speed of 160-180 kilometres per hour, it has an endurance of 20 hours.

Sherdils in their new Avtar, flying the K-8 Karakoram.

PAF C-130 Hercules provided logistic support to the aircraft from Pakistan.

The Comac C919 passenger airliner.

Chinese Chequers

From 16–21 November 2010, about 600 exhibitors with about 70 aircraft from 35 countries were at the China Air Show where about 40 summit forums, press conferences, contract signing ceremonies and product briefings were also held.

The exhibition centre occupied an area of 1.3 million square metres, with car parks and one chalet car park, covering nearly 500,000 square metres and provided 60,000 parking spaces. The static aircraft display area was more than 400,000 square metres. The area of afforestation reached 300,000 square metres. The three exhibition halls had a total area of 43,120 square metres, providing 1,800 package stands.

Though ASN had the most UAVs on display, the most sophisticated unmanned platforms are being produced by CASIC and CASC. Both companies displayed models designed to locate and destroy the target.

CASC displayed the CH-3 multipurpose medium-range UAV system suitable for battlefield reconnaissance, artillery fire adjustment, data relay and electronic warfare. The CH-3 could be modified as an attack platform carrying small precision-guided weapons. Weapons outfitted on the display included two air-to-ground missiles similar in configuration to the U.S.-built Hellfire. CASC have developed UAVs capable of "intimidating the U.S. military" which include the jet-powered WJ-600. In a video is seen the

Pakistan Air Force JF-17 Thunder takes off at Zhuhai.


J-10 of the August 1st aerobatic team.

WJ-600 identifying a U.S. aircraft carrier, relaying targeting information for a Chinese attack by anti-ship cruise missiles. The UAV incorporates a variety of payloads, including weapons, synthetic aperture radar, electronic warfare equipment and data relay systems. Air-to-ground weapons featured with the WJ-600 include the Hellfire-like KD-2 and two unidentified weapons, the TBI and ZD1.

Other UAVs displays included a little-known company called Zhuhai X.Y. Aviation, which exhibited two new reconnaissance platforms, the 200-kilogram Blue Arrow (UR-J1-001) and 40 kilogram Sky Eyes (UR-C2-008). A company spokesperson said there were three prototypes of the Blue Arrow now being test-flown and that the prop-driven engine was from "an unidentified German company."

Another Competition is in the Air!

The ZW-10.

Chinese ZW-10 vs. Indian LCH

Harbin Aviation Industry (Group) Co Ltd (HAIG), the China National Aero-Technology Import-Export Corp (CATIC), and the China Helicopter Research and Development Institute (CHRDI), located at Jingdezhen, Jiangxi Province, have 'developed' for the PLA Army's Aviation Corps, a new-generation dedicated attack helicopter, the Zhisheng-10 (ZW-10), which has successfully undergone extensive flight-testing by HAIG and Jiangxi-based CHRDI. An initial two ZW-10 technology demonstrators were rolled out on 29 April 2003 followed by six prototypes in 2004.

In 1996 China and South Africa had signed a memorandum to jointly develop a combat helicopter, when China was in the process of designing its ZW-10 helicopter. After a detailed inspection of the Rooivalk combat helicopter's systems, China wanted to purchase one helicopter from Denel, but the South African company considered the purchase of a single aircraft the equivalent of giving away its technologies. As a result, Denel decided not to sell China the helicopter and any cooperation came to an end. So, what ensued is a typical China-story.

Externally, the twin-engined, 5.5-tonne ZW-10 attack helicopter bears strong resemblance to Denel Aerospace's Rooivalk and features upward-facing engine exhausts, a narrow fuselage with stepped tandem cockpits housing the weapon systems operator in the front seat and pilot in the rear. It also has five main rotor blades made of composite materials and a four tail rotor blades. Powerplant comprises twin WZ-9 engines each rated at 1,250kW. A nose-mounted turret houses a thermal imager, TV camera, and a laser rangefinder-cum-target designator. The all-glass cockpit, integrated communications suite, ring laser gyro-based inertial navigation system and the defensive aids suite are all integrated via a MIL-STD-1553B digital data bus.

What also appears to have been straight forward reverse-engineered is the optical-electronic pod on China's ZW-9 combat helicopter, which bears a strong resemblance to the Leo-II serial O/E pods produced by the Zeiss Company. Technical experts

HAL's light Combat Helicopter (LCH) prototype.

from the Zeiss Company recalled that about seven to eight years ago Zeiss exported two sets of an earlier variant of the Leo-II O/E pods to China, intended for use on helicopters. According to them, the Chinese authorities explained that they needed a large number of this type of O/E pods for civilian helicopters, and therefore would like to purchase two sets initially for testing purposes. The Chinese took no further action after receiving the test pods. Currently, both the ZW-10 and the night-attack version, the ZW-9, are equipped with O/E detectors, very similar to those on the Leo-II.

The ZW-10 has adopted a standard attack helicopter configuration featuring a narrow fuselage, with the gunner in the front cockpit and the pilot in the stepped-up rear cockpit. The fuselage has a stealthy diamond shape to reduce radar cross-section, while the twin engine exhausts are pointed upwards for greatly reduced heat signature. All mission-critical areas of the fuselage, including the cockpit and fuel tanks, are armour-plated. The

HAL LCH

first two ZW-10 prototypes were initially powered by twin Pratt & Whitney Canada PT6C-76C turboshaft engines (each rated at 1,250kW). The twin stub-mounted wings can carry up to eight KD-10A laser-guided anti-armour missiles that are housed within twin box-sized launchers. The chin-mounted 30mm cannon can be aimed via the gunner's helmet-mounted day/night sight. In addition, up to four TY-90 IR-guided air combat missiles can be carried for self-defence against hostile attack helicopters and fixed-wing combat aircraft. The ZW-10 also features a large nose-mounted turret housing the FLIR sensor, TV camera, laser rangefinder and a target designator. Twin missile-approach warning system (MAWS) sensors are installed on both sides of the fuselage behind the nose turret section. Also fitted are an integrated communications/inertial navigation system, a defensive aids suite, and an integrated glass cockpit display system.

The above comparision between the ZW-10 and LCH summarises it all!

The ZW-10.

	Chinese ZW-10	Indian LCH
General characteristics		
Crew	2	2
Length	14.1 m	15.8 m
Rotor diameter	12.0 m	13.3 m
Height	3.85 m	4.7 m
Empty weight	5,540 kg	2,550 kg
Loaded weight	7,000 kg	4,000 kg
Useful load	1,500 kg	2,950 kg
Max takeoff weight	6,000 kg	5,500 kg
Powerplant	2× WZ-9 turboshaft, 957 kw (1285 shp) each	2× HAL/Turbomeca Shakti turboshaft, 1000 kW (1400 shp) each
Performance		
Maximum speed	over 270+ km/h	275 km/h
Cruise speed	230 km/h	260 km/h
Ferry range	800+ km	700km
Service ceiling	6000 m	6500 m
Rate of climb	over 10+ m/s (ft/min)	12 m/s (2362 ft/min)
Armament		
Guns	23 mm or 30 mm autocannon mounted on chin turret with grenade launchers, or 14.5 mm Gatling gun	M621 20 mm cannon on Nexter THL-20 turret
Hardpoints	4	4
Rockets	unguided rocket pods	Unguided rocket pods
Missiles	Up to 8 ATGM air-to-surface missiles, 8 TY-90 air-to-air missiles, 4 PL-5, PL-7, PL-9 air-to-air missiles	MBDA air-to-air missiles, Air-to-surface missiles, Anti-radiation missiles, Helina ATGM(8)
Bombs		Iron bombs, cluster bomb units, grenade launcher

The M-MRCA:

A lucid comparative assessment by Ashley Tellis

Amongst the strategic analysts on the Indo-US horizon, few are as incisive and dilligent as Ashley J Tellis. In this context Tellis has the advantages of an Indian background and, consequently, a profound insight into India's security issues. Uniquely, he is as much at home on Raisina Hill as in Foggy Bottom or the White House. I recall, as a middle-ranking officer, reading, with fascination, his laser-sharp analysis of India's naval build-up of the 1980s accompanied by a compelling, if somewhat surreal, prognosis about our maritime strategy.

In recent times, Tellis has been an influential opinion-maker; his post-26/11 Congressional testimony, as well as his advice and writings during the Indo-US nuclear negotiations have, no doubt, had a deep impact on policy-making in Washington.

His latest offering is a January 2011 report, commissioned by the *Carnegie Endowment for International Peace* (where he is a senior associate), on India's Medium Multi-Role Combat Aircraft (M-MRCA) selection process, currently underway. This elephantine ritual, now said to be in its final stages, is being watched with bated breath by six contending international aerospace companies and eight nations straddling the Atlantic.

getting it right!

Pair of Saab Gripens.

At the end of the M-MRCA competition lies a veritable pot of gold, not only because the Indian Air Force's notional requirement of 126 fighters may actually exceed 200, but also because the winner of the competition will have privileged access to the huge, growing market of a rising power. Just the initial worth of this purchase could be anything from US$ 10-15 billion – with much more to follow. These are lean times, world-wide, and bagging this colossal contract could have a significant impact on economies - especially the smaller ones. For some of the competing European companies it could even spell the difference between prosperity and looming oblivion.

This 140 page monograph is, thus, aptly titled *"Dogfight!"* and its striking cover could serve admirably as a promo for a Hollywood blockbuster. However, optics apart, this is a well-timed document; meticulously researched, thoughtfully composed and logically argued. That Tellis falters in his gallant attempt at objectivity, only towards the end, should not detract from the value of this report – at least for the cognoscenti. He is, no doubt, rooting for the US industry, but he would have performed a valuable service if he succeeds in his attempt to enlighten the uninformed Indian policymaker– both politician and bureaucrat.


Eurofighter Typhoons.

Before discussing the substance of this report, the M-MRCA competition needs to be placed in its proper context.

Peacetime aircraft attrition and creeping obsolescence are the twin spectres which haunt every Air Chief, and make him ask for more. In the case of the IAF the problem has been aggravated by the fact that a significant proportion of its combat strength consisted of Soviet era MiG-21s of which about 850 were licence-produced by HAL. Apart from its high accident rate, the MiG-21 also had many operational limitations. Its planned indigenous replacement, the Light Combat Aircraft (LCA), promised by the DRDO by the early 1990s, has come 20 years later, as a case of "too little, too late." Notwithstanding the up-gradation of a certain number of MiG-21s to the more capable 'Bison' standard, and the ongoing induction of some Sukhoi Su-30MKI, the IAF order of battle has, over the past decade, seen major erosion, in numbers as well as in capability.

The IAF dilemma has been compounded by the ongoing modernisation of the air forces of neighbouring China and its ally, Pakistan, which happen to be significantly complementary. By the end of this decade, the PLA Air Force will deploy a formidable force of nearly 2000 aircraft, of which 500 will be air-superiority fighters from the Sukhoi bureau, with an equal number of Chinese-built 4th generation machines, leavened with a small number of 5th generation stealth aircraft. The Pakistan Air Force is slated to receive 200-250 Chinese fighters in the next few years, in addition to all the F-16 C/D fighters it can squeeze out of the US. Equipped with airborne early-warning & control (AWACS) aircraft, long-range fighter radar and beyond visual range (BVR) missiles, this 4th generation force poses a formidable challenge to the IAF.

Against this opposition, the IAF currently fields approximately 600-700 combat aircraft, only some of which can be classified as 4th generation. Operating in synergy with the newly inducted air-to-air re-fuellers as well as the airborne early-warning AWACS, they represent a substantive capability for homeland defence, close support and limited trans-national operations. In the offing is the

T-50 or PAK-FA, 5th generation fighter to be "jointly developed" with Russia. However, the IAF faces an onerous challenge, and needs to ensure that it can field combat aircraft of appropriate capability in sufficient numbers to fight a simultaneous war on two fronts against well-equipped adversaries.

The initial IAF plan to tackle its problems of obsolescence, attrition and declining strength by inducting substantial numbers of the tried and trusted French Mirage 2000, did not find favour with the Ministry of Defence (MoD). Air HQ was, then, asked to write up the Air Staff Requirement (ASR) for a new aircraft. Six years later, in 2007, emerged a comprehensively drawn up, 211-page Request for Proposals (RFP).

Once the responses to the RFP were examined, the IAF wasted no time in initiating a rigorous 8-stage evaluation process in which each of the six competing aircraft have been assessed over the full range of climatic, altitude and terrain conditions as well as many other environmental, maintenance and operational criteria laid down in the ASR. However an already complex process seems to have been rendered even thornier by the IAF because the RFP cast its net too wide. The six aircraft, short-listed for evaluation, fall into distinctly different categories, but will have to be judged by the same set of criteria.

Firstly, new 4th generation machines, like the Swedish Gripen, European Eurofighter and French Rafale, have got mixed up with others like the US F-16 Super Viper and the F/A-18 E/F Super Hornet, whose early marks first flew in the 1970s, and whose upgraded versions now on offer, are described as "technologically mature". The Russian MiG-35, a derivative of the MiG-29K falls somewhere in-between. Secondly, in a "medium-weight" competition, the participants range from light machines like the Gripen and F-16 (17-21 tons), to middle-weights like MiG-35, Typhoon and Rafale (22-24 tons), to a true heavy-weight like the F/A-18 (30 tons). Finally, single-engined fighters like the F-16 and Gripen, are vying with twin-engined counterparts like the MiG-35, F/A-18, Rafale and Eurofighter.

Perhaps a more stringent RFP – one that specified a weight range or number

The MiG-35

of engines - could have cut down the candidates and simplified selection. But then vagueness has the merit of permitting a lot of flexibility.

As it stands, many of the performance, technical and cost parameters of these competitors are bound to vary hugely, and selecting the "best" will be akin to picking a winner from a mixed box of "apples, oranges and plums": a difficult and hazardous professional task fraught with pitfalls. At a higher, non-professional, level, intense political pressures – internal and external – are likely to cast their shadow on this exercise, to sway this decision one way or the other.

It is into this, somewhat confused, "dogfight" scenario that Ashley Tellis attempts to bring some order and enlightenment with his monograph. He offers to *"help the Indian policymakers and security elites think through the complexities of an acquisition decision with long-range ramifications"* and in this endeavour, he sets out two broad objectives for himself, namely:

- To elucidate the kind of aircraft relevant for the IAF in the foreseeable environment, and
- To synthesise the diverse considerations and evolve a cohesive selection matrix.

Tellis offers the sum total of his advice under the rubric of three broad injunctions or Commandmants for the consideration of policymakers in New Delhi.

He commences his arguments by enjoining upon India's decision-makers to *"Conclude the M-MRCA competition expeditiously."* While this may appear to be superfluous and gratuitous advice, we must remember that we have a pretty dismal track-record of slothful decision-making. Projects involving acquisition of the Advanced Jet Trainer, construction of the Air Defence Ship, re-starting of the submarine production line and the artillery modernisation plan are just a few recent examples where apathy and indolent decision-making has cost us dearly, not just in financial terms but also in terms of eroded security. To buttress his advice Tellis graphically outlines the developing South Asian air threat scenario, and the opportunity-costs of delay.

His next injunction, *"Do not split the M-MRCA purchase"*, arises from the, not unrealistic, apprehension that India's political leadership, might attempt to *"satisfy defence and geo-political objectives simultaneously"* and to *"assuage different international allies"* by splitting the lucrative M-MRCA purchase and buying smaller numbers of two aircraft types instead of one. A very recent example of such a politically driven compromise was the splitting of a large commercial aircraft purchase between Boeing and Airbus Industrie. However, as Tellis rightly points out, the Indian armed forces are already burdened with the immense handicap of excessive diversity in their weapon inventories, and adding two new types to the IAF stable will be yet another unkind blow.

Subsequently, while providing a balance-sheet of the political pros and cons of each aircraft choice, he offers sound advice for the US administration. In order to overcome the disadvantage of fielding relatively older (albeit equally capable) aircraft for the M-MRCA selection, the USA must not only provide assurance of "supplier reliability" but it must *"fight and win in the arena of technology transfer."*

It is for the last, and most unexceptionable, of his three Commandments, *"To buy the best aircraft for the mission"*, that Tellis saves his firepower. In what can only be termed a tour de force, for a person with no aviation background (other than a million miles logged on United Airlines), he defines the operational context in which the IAF seeks a new combat aircraft, identifies the essential performance and hardware capabilities which must be used for evaluating the M-MRCA contenders, discusses the technology and cost issues, and finally provides a lucid comparative assessment of the six aircraft in the field.

Tellis examines the 'multi-role' aspect of the new induction from the IAF viewpoint and discusses the degree of optimisation that can be attained between the air-to-air and anti-surface roles in a single airframe. He concludes that, because of the traditional bias of the Service towards fighter aviation, and the primacy assigned to homeland defence, whichever aircraft is finally selected in the competition, *"…its fundamental worth will be assessed, first and foremost by its air-to-air performance, with its capacity to undertake precision strike missions being……somewhat secondary in assessed importance."*

Detailed discussion follows on esoterica like the air-defence environment, the role of AWACS, as well as the counter-AWACS operations, airborne electronic attack (EA) and within visual range (WVR) as well as beyond visual range(BVR) engagements. Adequate note is taken of land as well as maritime anti-surface mission requirements before concluding that the M-MRCA candidate selected will have to be an utterly versatile platform that can shift from air-combat to ground-attack by day or night with felicity.

Having established the future operational milieu in South Asia, Tellis defines six criteria for judging the M-MRCA candidates, which may well be identical with those used by the IAF: sensors and avionics; weapons; aerodynamic effectiveness; mission performance; technology-transfer and cost. However, he sensibly adds a seventh criterion which is unlikely to figure

The Boeing F/A-18 Super Hornet.

The Lockheed Martin F-16 Block 60.

in any official Indian matrix: political considerations.

Having done his homework conscientiously, Tellis undertakes an enlightened discussion that would be heard with rapt attention in any fighter crew-room. He dwells, knowledgeably, on a range of arcane issues including active electronically scanned array (AESA) and low probability of intercept (LPI) radars, infra-red search and tracking (IRST) systems, defensive avionics suites (DAS), BVR combat, wing loadings, thrust/weight ratios, instantaneous turn-rates and overall mission performance et al.

Acknowledging the great hopes pinned by India on the M-MRCA deal being accompanied by substantive technology transfer – both through offsets and direct knowledge-sharing – he compares the ability and willingness of the competing nations in this regard. At the same time he notes the current limitations of Indian industry to actually absorb technology. Significantly, he urges US industry to *"bend over backwards to offer the most generous technology transfer packages possible to India, because this component – along with lower fly away costs – could make the fundamental difference to their ability to carry the day in the M-MRCA competition."*

The 40 most interesting pages of this slim volume are devoted to a comparative assessment of the six M-MRCA contestants. Tellis first makes a tabular comparison of the competing six under the major heads of: engine, airframe, avionics and weapons and then undertakes a detailed appraisal of individual machines, providing a summary of advantages and disadvantages in each case. It is as fair, comprehensive and professional a comparison of the six diverse machines as one can lay hands on today.

However, at the end of this comparison, he dismisses the MiG-35 for being merely a *"souped up MiG-29K" and a "developmental platform"*; the Gripen

for being overly dependent for its vital systems on *"third parties including the US"*, and the Typhoon and Rafale (in spite of their other merits) for being too expensive!

The last word is, understandably, kept for the US duo of F-16IN Super Viper and F/A-18 E/F Super Hornet. Tellis sees them as the best possible bargain for India, both financially (they claim, by far, the cheapest fly-away cost) and politically. He skillfully wields the availability of a fully developed AESA radar (which finds specific mention in the RFP), offered by both US candidates, as a useful tool to counter common Indian perceptions of their older provenance.

The Dassault Rafale.

The political carrot is dangled rather blatantly by Tellis in the following words: *"The political benefits of buying the F-16IN (or F/A-18E/F) would be unparalleled because of the gains accruing to New Delhi from a stronger partnership with the US. Such a development would … send important signals to all of India's neighbours – especially its adversaries, China and Pakistan."* How well this unsubtle message actually goes down in South Block, remains to be seen.

In the concluding section of his report, Tellis makes an attempt to rationalise the IAF's contemplated force structure, taking into account the 5th generation fighter, M-MRCA selectee, LCA and other known inductions. He goes so far as to offer a few alternative force structure models circa 2020 and 2030.

The M-MRCA contract will be amongst the biggest arms deals ever inked. India's keenness to "get it right" at last, to bring transparency to the selection process and to maximise benefits to the indigenous aerospace industry has also, arguably, made it one of the most convoluted selection processes ever.

The motivation behind the Carnegie Endowment commissioning Ashley Tellis to write this report is obvious: to buttress the case for US industry in the M-MRCA competition. However, as bewildered as India's civilian decision-makers may feel in the unfamiliar and arcane jungle of hardware performance issues couched in military jargon, the US bureaucrat and industry executive is equally at sea in India's complex geo-political scenario, with its unique operational compulsions, and Byzantine rules, regulations and procedures.

Tellis has therefore rendered a public service by compiling most of the factors that have a bearing on the M-MRCA selection process, in one slim compendium which can be read in one sitting. While the eventual decision in the M-MRCA selection may not be based on any of the logic put forth by him, *"Dogfight!"* would have achieved its purpose if it serves to educate all the actors involved in the M-MRCA competition, Indian and foreign.

Admiral Arun Prakash (Retd)

Countering

Chinese Navy frigate Type FFG 054.

Chinese Seapower in the IOR

The Shen Zhen Destroyer.

China is keenly aware that its phenomenal economic rise is based on two factors, both of which are related to the sea. The first is exports, 90 % of which move by sea and have contributed directly to its five trillion US dollar economy. The second is rising imports, again by sea, of crude oil (50% from the Middle East, 30% from Africa, 17% from Russia and South America, and only 3 % from the Asia Pacific region). Indeed today, China is the world's second largest oil importer, while close competitor and the second fastest growing economic power (India) is the fourth largest importer of oil, from almost the same regions as the Chinese. In addition China is the world's largest fish producing nation with an annual catch of over 22 million tons. It has an impressive merchant fleet both for international and coastal trade. Its 492 shipyards build and maintain a 930-warship navy, a massive fishing trawler fleet and one of the largest merchant shipping fleets, if one was to discount the numerous merchant ships plying under FOC (Flags of Convenience).

Ninety per cent of India's commerce too is by sea. Presently 60 per cent of our seaborne trade moves (and comes from) westwards to Africa, Europe and the US, while 40 per cent moves eastwards (and comes from) across the Asia-Pacific region. Hence, maritime developments impacting seaborne trade (e.g. Gulf of Aden piracy or the rising maritime tensions in the Asia-Pacific region) need to be monitored closely, and counter measures taken to safeguard our national interests, keeping in mind that sea power takes generations to build up and is directly linked to our national prosperity and security.

China began asserting its claims over the South China Sea (SCS) since 2009, first imposing a fishing ban for a few months and enforcing it with warship patrols, while it opened a few islands in the disputed SCS for tourism. China's proxy, North Korea, used a 350 ton mini-submarine to sink the 1200 ton South Korean multi-role corvette *CheonAn* on 27 March 2010, raising tensions in the region. The recent spate of events in the seas bordering China and its neighbours (US-South Korea Navy exercises in the Sea of Japan, and the Chinese Navy weapon

firing exercises in the South China Sea), have once again highlighted the importance of sea power in the Asia-Pacific region. A few weeks earlier, the US Navy conducted large-scale exercises with other Asia-Pacific regions, and US secretary of state Hillary Clinton sought to internationalise the South China Sea territorial disputes because global commerce flows through it. As if this was not enough on 27 September 2010, a Chinese trawler collided with a Japan Coast Guard (JCG) ship in the vicinity of the disputed Senkaku islands (eight islands in the East China Sea are under Japan but claimed by China). The resulting arrest of the Chinese trawler and its crew JCG, created a crisis, with the Chinese stopping export of rare earth materials to Japan and also arresting three Japanese businessmen on charges of spying. The crisis was resolved, when the Japanese released the Chinese trawler and its crew. But the lessons of China using 'assymetric non lethal warfare' were not lost on rest of the international community.

Conventional wisdom lists seven 'essentials' for a nation to become a great sea power. These are large size of country, large population, geographic location to dominate sea trade routes, at least two coasts, science-technology-industry, seafaring tradition, and political will of the government to exploit sea power in the national interest.

China does not meet three of the seven 'essentials' for sea power, but is striving to overcome these handicaps. Firstly, China has historically not been a seafaring nation, but is learning fast and today its sailors are sailing the world's oceans on merchantmen, fishing trawlers and warships.

Secondly, though sea commerce flows through the China and Yellow seas, China cannot completely dominate the sea trade routes owing to the presence of other modern littoral states.

Thirdly, China has just one coast facing eastwards, and its exit to the Pacific Ocean "can be blocked" by the 'three island chains' of Japan and Taiwan (first island chain), Japan and Philippines (second island chain) and USA (Hawaii and Guam, forming the third island chain). The Americans in October 2010 announced the building of a massive $12 billion naval base in Guam, to cater for the expected Chinese challenge in the near future. Its exit southwards towards the Indian Ocean requires it to pass close to Vietnam, and then through the choke points of the straits of Singapore-Malacca, Sunda and Lombok. Almost 90 per cent of China's oil requirements are imported from West Asia and Angola, and these move by ship through the Indian Ocean choke points which can be blocked in the event of war.

But China has taken the following measures in an attempt to become a global sea power:

- A combination of technology and innovation is being used by China in an ongoing experiment to detect and target 'enemy' warships at sea, at long ranges using the 1,800-km range land-based DF-21 ballistic missile, with terminal homing. If the DF-21 experiment succeeds, the concept of sea power will change globally since a similar experiment can later be attempted with the 8,000-km range DF-31 and the 14,000-km range DF-41. The target data for the missiles could be provided by a combination of long range 'over the horizon radars' using high frequency 'sky waves' along with indigenous satellites for surveillance, communications and navigation data.
- Ongoing attempts to make the South and East China seas its territorial waters, and thus attempt to control international shipping movement, while exploiting the mineral, oil and fishing wealth. On 16 May 2009, China imposed a "summer fishing ban" in the South China Sea and sent ships to enforce this ban, overriding Vietnamese protests about traditional fishing rights. On 5 January 2010, China announced tourism packages to some disputed and uninhabited islands in the South China Sea. On 9 February 2010, China announced new oil and gas fields in the South China Sea, while its similar "finds" in the East China Sea led to Japan appealing to an international maritime court. On 13 April 2010, a flotilla of 10 Chinese warships and submarines passed between the international waters of Japanese islands of Miyako and Okinawa to exercise in the South East Pacific (On 4 July 2010, two Chinese warships repeated this deployment). On 30 June 30, 2010, China announced a six-day live ammunition firing exercise by its Navy in the East China Sea.
- China has financially, militarily and technologically supported two nuclear armed nations (Pakistan

Type 052A Destroyer.

Type 053H3 Frigate.

and North Korea) to act as its proxies which will, respectively, 'distract and engage' India, Japan and South Korea.

- After the failure of half-a-century of coercive diplomacy, China has set out to woo Taiwan. The 29 June 2010, ECFA (Economic Co-operation Framework Agreement) to reduce or eliminate tariffs on 539 Chinese items and 267 Taiwanese items, is financially advantageous to Taiwan, but if China eventually achieves reunification with Taiwan, than it removes one strategic geographical obstacle for its eastwards move to the Pacific Ocean.
- Flush with over $2.5 trillion foreign exchange reserves, China has invested in South Asian and African littoral states so as to secure its sea lanes of commerce and to avoid sending its oil ships through the straits of Malacca, Sunda and Lombok. In pursuance of its 'strings of pearls' policy, China not only gifted and built the Gwadar Port for Pakistan (which will unload West Asia oil, to be moved by Chinese-gifted roads and pipelines to China through the proposed Karakoram highway), but is now building ports in three countries which are India's neighbours. In Sri Lanka the Chinese are funding and building the $9 billion Hambantota seaport (three times larger than Colombo) and the nearby Mattala International Airport, both to be ready by 2015. In Bangladesh the Chinese are funding and building two deep water terminals at Chittagong and a brand new seaport nearby. Both these terminals and the new port will be linked by road and oil pipelines to Kunming in China and will pass through Burma. Similarly Sittwe deep water port in Burma is being funded and built by China, and will also be connected to Kunming by road and oil pipelines. China has also invested in similar facilities in Tanzania and Angola.
- In 2009, Chinese think tanks suggested that once China gets its own aircraft carrier by about 2015, the US Navy should "look after" the sea area east of Hawaii, while the Chinese Navy would "look after" the rest of the Pacific and Indian Ocean regions. Chinese investment in nuclear submarines too, will aid a 'two ocean deployment capability' in the future.

Strategically-located peninsular India, with 1,197 islands, meets six of the seven requirements of sea power. It only needs to augment its sea power and display palpable political will power to use that sea power in its national interest. After 2030, regular large scale Chinese deployments of warships, submarines and trawlers in the IOR could lead to incidents like the March 2010 South Korean warship *CheonAn* sinking by a North Korean submarine or the September 2010 Chinese trawler collision with a JCG ship. Such incidents could spiral out of control and escalate to war on land.

The only antidote is to deter "deployable Chinese seapower" with a powerful Indian Navy. The Indian Navy of 2030 would need the following units to carry out its various roles (deter war, anti-piracy patrols, coastal security, flag showing, humanitarian aid etc) :

SSBNs : 6

SSNs : 12

Conventional 1500 – 3000 ton submarines : 18

Midget or mini submarines : 6

Aircraft Carriers : 3 (with suitable airwings of fighters, helicopters, AEW aircraft).

Frigates/Destroyers/ 2500-ton corvettes : 36

Offshore Patrol Vessels : 24

Amphibious warfare ships of 20,000 ton LPD types : 4

Tankers : 9

Mine Warfare Ships : 24

Intelligence Trawlers - 12

Patrol boats and missile boats - 24 each.

Maritime Patrol aircraft : 24 long range and 24 medium range types.

Shore based coastal radars of the HF(Sky Wave), Aerostat types and short range X band radars.

Two dedicated satellites each for data link and surveillance.

Vice Admiral (Retired) Arun Kumar Singh.

MIG

The Haft

The Brahmos for the Su-30MKI. What about other options?

The paradox of Great Powerism is the fact that whilst one must be prepared for a prolonged war one must economise and, if possible, avoid actually fighting one. History is littered with Great Powers, from The Delian League to Napoleonic France and Imperial Britain, ruined by fighting Great Wars. Even America's "Cold War" effort to bring down the Evil Empire was a Pyrrhic victory. Their overkill strategy including that of 'Planned Obsolescence' of weaponry sapped the US economy. There is a large dose of Economics in preparing for War. This suggests, like China, dissuasive policies and making do with the simpler of weapons most likely to be useful. Naturally, there are diametrically opposite views: Bekaa Valley or North Korea?

Loch Lomond : Beka Valley or Korea?

The fighting in the Bekaa Valley (BV) is well described elsewhere. Blinking and squinting through the glare of sales publicity emerges the alternate view: it was a triumph of C^3 and 'force multipliers'. The contributions of the platforms and the missiles to the results cannot be quantified because the total disabling of the Syrian ADGES prevented Syrian warplanes from being vectored. Syrian inattention of 'siting' and 'fire discipline' also contributed. This is not all. The Israelis enjoyed numerical superiority. They had a year to perfect their tactics. Finally, the BV is small and the actual combat was in an area perhaps no more than 30 kilometres square. A study concluded that whilst the BV has lessons it was unsuitable for general adoption because the results could have been less one sided. Also the required 'Technology density' was too high to be cost effective. The Vietnam Air Defence is a known case where a combination of 'obsolete' equipment gave effective results. The Chinese 2nd Army's attack on the US Army in Korea November 1950 merits recall. The Chinese PLA after their usual bouts of feinting and confusing a la Lao Tzu struck savagely and rolled back the victorious Americans some two hundred miles in two months in spite of the Americans having complete air superiority. They lost 25,000 combat dead (Haig usually lost more in one morning) but that was small change to the Chairman: no one took China lightly thereafter. Incidentally, the Chinese lost


USAF B-2 Spirit stealth bomber soars high over the Pacific Ocean, a multi-role bomber capable of delivering both conventional and nuclear munitions. A dramatic leap forward in technology, the bomber represented a major milestone in the US bomber modernisation programme.

of the Spear

The air-launched version of the Brahmos is being readied for integration with Indian Air Force Su-30MKIs.

An airborne carrier for the Brahmos – Buff, Bone or the Spirit?

more to the bitter weather underlining how fundamental (and neglected!) good basic equipage, Casevac and Medicare can be in winning wars.

This is half the story. The other half is the thought provoking part. In the offensive the PLA performed better than the North Korean divisions which were substantially better equipped to the Soviet standards in terms of Motor transport, Artillery, Radio communications whereas the light Chinese Divisions were better equipped at the platoon level with the PPSh type 'burp' guns, light mortars and hand grenades – the potato masher type which is probably an iconic PLA weapon, their posters (all in Mandarin, unfortunately, and not a word to be read!) being usually full of very angry and determined looking soldiery hurling those things. The Chinese worked their lacunae to their advantage. Their reliance on land lines and dispatch riders for communications rendered the US efforts to eavesdrop on plans ineffective, their lack of motor transport made it difficult to predict their lines of advance; they countered US air superiority by night attacks and in daylight by 'freezing' on the march making them difficult to spot from the air. They 'reduced' their disadvantages and yet their superiority in platoon level equipment and numbers made them formidable for the most probable kind of fighting. Nearer home, the LTTE was better equipped than our own IPKF. Many of us will remember that terrible *India Today* cover with the picture of jawans of a 'paltan' lying dead in a Jaffna street. They had tried to take on the AK47s with SLRs. Our superiority overall meant for little because our equipment at the most used cutting edge was inferior. Without making being 'ill-equipped' a virtue the priority should be for being well equipped for the most likely kind of fighting. To put into perspective, the delay in introducing the *Nag* ATGM is of more consequence than the recent failure of the *Agni II* regrettable as that may be.

The B-52 Stratofortress bomber has been in service for decades and has seen innumerable actions and continues to be backbone of the US bomber fleet.

Catch up with problems — not technology

Every weapons development programme hypes how this or that will bring us up to date with latest technology. "Catching up with technology" is popular with R&D organisations because it 'sells' and justifies the big budgets and delays. It is a wild goose chase. We do not need to catch up with any one's technology. We need to catch up with our problems. An example would be the Soviet approach to IR AAMs. The first generation tried to "catch up" but soon the Soviets switched over to "problem solving"- in this case "increased effectiveness". The HMS cueing and the thrust vectoring were the result and the consequence was that the R.73 became the weapon to beat though the US still led in technology. Soviet MBT design philosophy traditionally had a low vehicle silhouette as a corner stone. Possibly this was ergonomically unsustainable when gun calibres went beyond 100mm. The Soviets did not 'catch up' by cloning the Leopard 2. They went for the carousel autoloader. That has its trade offs Mais ce Marche! I repeat: "We do not need to catch up with any one's technology. We need to catch up with our problems". This requires intensive interaction with the customer which needs significant improvement. Exotic technological fauna deemed vital can be imported and absorbed. The Japanese fought the Pacific War using Hamilton Standard propellers licensed to Sumitomo for their Zeros. The US could do nothing to stop production. No one "gives" TOT. You puzzle it out! An objective to make the country

totally self reliant at the Brigade level- weapons, transport, kit, communication and medicare equipment is significant because that is the type of equipment most likely to be used. Similarly aircraft suitable for the most likely kind of sorties, even if relatively simple technically, is of greater significance than some "wonderbus" whose "latest and best" potential will occasionally be used. Unlike catching up with technology, catching up with problems means doctrinaire studies and Civil Military co-operation which is not usually our forte! We did not lose the China War at the Se La Pass. We lost it on Raisina Hill.

The Buff, the Bone or the Spirit?

The ability to effectively police and interdict traffic in the Indian Ocean and on the Tibet Plateau is one of our 'problems'. IRBMs are unsuitable and uneconomical for this. A flexible large capacity platform is indicated. For the hardest targets–airbases and carrier battle groups- one can try to catch up with the 'Stealth Technology' of the B-2 Spirit or recognise that the Brahmos can be the tip of the spear and a (simple) carrier aircraft becomes its haft. The missile permits reduction of the capabilities of the carrier platforms which then does not have to be supersonic or totally stealthy: the missile performance takes care of it. The Brahmos is hopefully a proven weapon and an airborne carrier can extend the 'influence zone'. An aircraft with a combat radius circa 2000kms will give us a near strategic capability over Tibet, Shinjiang and South China. If Chinese planners have to contend with the fact that their energy (some fifty percent is imported) and materials supplies through the Indian Ocean would be subject to immediate and effective threat by Indian aircraft roaming the Indian Ocean from the Gulf to the Straits of Malacca they may be dissuaded from being 'active' in Arunachal Pradesh (with its prospects of lower altitude airfields). Armed with the Brahmos and escorted by the Su-30 MKIs such a system can also remove the word 'impunity' from the operation of large aircraft carriers. These possibilities alone would be a victory in that by using a simple and realisable combination we set the agenda and force heavier investments on the 'Other'. It would also give us time to put in place

Russia's Tupolev Tu-16 bomber was one of the most important aircraft for the USSR during the Cold War.

the better dissuaders. No doubt a B-2 a la brochure could be the ideal but how long, how much and what if are questions that have to be squarely faced. On the other hand aircraft available immediately and plentifully by its simplicity but still giving "ninety percentile" interdiction capability makes more sense. The B-52 "Buff (Big, Ugly Fat Feller) is a good example. It is 'obsolete'. A single Buff has the radar signature, so I understand, of the entire Tanzanian Air Force in loose formation, is decidedly subsonic, has suffered casualties even when opposed by SA-2s, required yards of 'band aid' on its flexing wings and yet the Americans plan to keep the Buff in service till 2040. The Buff has already seen off its intended successors like the B-58 and the B-70 and will probably see off the other 'B"s. The reason? High tech. warplanes often lack flexibility because of their hi-tech features and they are also, to revert to the first paragraph, very 'uneconomic' except for second strike sorties against superpowers. Speaking about the "superior" B-58 the formidable


The English Electric Canberra was a bomber from the same design house that produced the English Electric Lightning. An incredibly versatile aircraft with high performance and a distinctive appearance, this was also one of the longest serving aircraft worldwide. The aircraft was a first-generation jet-powered light bomber manufactured in large numbers through the 1950s.

Gen. Curtis Le May is supposed to have said "This here Airplane does not fit my…" and he referred to that part of his anatomy which is synonymous in English with Donkey. He was being succinct. To be supersonic an aircraft is very tightly packed and pays a price in terms of battle damage resistance, low speed handling, comparative short range and ability to pack new systems. Fitting a new weapon into the B-1/B-2 is usually the work of several years of careful engineering and trials. When the ALCMs came along the B-52 could handle it with aplomb. The Luftwaffe preferred the versatile Ju-88 bomber to the Me-110 fighter for their *Nachtjagd* equipment because the former was more adaptable not only for avionics but also for *Schrage Musik* and other *Rustsatze*. The Buff repeats that history; the Russians still maintain their Tu-16s and 20s. Simple aircraft can handle new weapons and equipment better. We are evolving towards a new kind of warplane- the weapons carrier.

The weapons carrier

Arms sales is such that people will fit a small car engine to a 15 tonne howitzer and ,without batting an eyelid, call it "shoot and scoot" whereas "rumble and grumble" or "boom and judder" is nearer the truth. The BVR missiles are something like that. They do not give BVR performance in most situations. Marketing, rather than technology, is the culprit. BVR is hamstrung by the need to tailor the system to fit fighters. Consequently BVR missiles are too small to give BVR when both sides come in low and yet the missiles are too heavy/ draggy for adequate numbers to be carried by, say, an LCA. Also a LCA/MCA can really not carry the large radar and data processing equipment required for real BVR capability nor can a single pilot process the information under combat conditions of fleeting 'firing windows'. There will be enough cases where the missiles will simply be jettisoned. Unreliable IFF is a problem which is unlikely to be solved. The situation changes if we think in terms of a 'Weapons Carrier'. A large missile carrier can carry much heavier missiles, in greater numbers in addition to the radar and fire control equipment plus the crew required to do justice to the capability. The old British joke about the logical replacement for the Lightning is the Vulcan is today realisable. Successive 'Heavy' fighters like the Phantom, Tomcat and the Flanker are the tentative evolutions in this new direction. Though apparently 'Heath Robinson' in concept, as missiles and C³ technology improves, a weapons carrier which can provide both stand off 'covering fire' and EW/AWACS capability- now merits exploration. It is today within the cobbling ability of the Indian Defence Industry perhaps even by modifying existing weapons of the *Akash* genre. To revert to the interdiction role, in the 60's the Sky bolt / Vulcan combination failed possibly because the Skybolt could not be air-launched reliably. We need to settle this vis a vis the Brahmos by actual trials. If that is proved we must develop the concept of the weapons carrier. What should then be its technical menu?

Supersonic capability?

Given improved interception technology, supersonic capability no longer significant to survival. The penalty, a fact of physics, remains. The drag coefficient rise between M=0.85 and M=1.3 is in the order of 3. Any supersonic performance, no matter what the salesmen call it, will be paid for in significantly reduced range. The Americans had the technology to successfully produce the *Bone* (B–One) but the succeeding version was both subsonic and simplified. Another point to note is that though specifically designed for low altitude penetration the *Bone* has spent most of its service life in high altitude roles. The Vulcan did exactly the

A RAF Vulcan bomber. This now withdrawn nuclear weapon capable bomber served the RAF for over 20 years and was powered by the same Rolls Royce engines as the Concorde. The world's first delta-winged bomber to reach operational service, the Avro Vulcan was one of the cornerstones of Britain's nuclear deterrent during the Cold War. In later years it was adapted for conventional bombing and saw active service in the Falklands War.

opposite. This illustrates the delicious wisdom "It is always difficult to make predictions, especially about the future". No one knows what will be needed so it is better to have something that is versatile. The B-52/ Tu-20/Tu-16 histories illustrates this. Anyone recall the mighty supersonic Myasischev '*Bounder*', the sensation of Tushino '61?

Total Stealth?

The total stealth of the *Spirit* provokes thought. The idea of cruising along over the Indian Ocean or PRC completely invisible to frantic search radars is worthy of recruiting posters or Calvin and Hobbes cartoons. But questions remain. Why is it that the Americans, having ostensibly perfected the technology of total stealth restricted the production to just twenty aircraft? Why is the aircraft launched from two (?) selected bases and aerially refuelled rather than being operated from bases closer to the target? Some of the less flattering guesses are:

- Production was limited because there are not enough appropriate targets to strike. The technology is wonderful but "it don't make sense!"
- The aircraft was too expensive to produce. I doubt this. It is the first two dozen that are expensive. Thereafter costs should decline significantly.
- Stealth is difficult to maintain. The bases are extremely special and the aircraft probably have to undergo not only very critical pre-flight preparations and checks but elaborate post launch procedures to ensure stealth is intact during the climb through 'contaminated' lower levels. Guam in mid-Pacific is unlikely to be dusty. How about North Indian summer?
- Stealth is subject to premature geriatrics and bio-degradability. As the aircraft ages, its magic may wear off due to minute airframe distortions: high AR wings flying through severe tropical turbulence would be particularly susceptible.

The most likely cause would be a combination of all. Individual early B-2 nicknames (possibly later forbidden by order?) like 'Murphy's Law' or 'Harold the Pig' reinforces the impression. The aircraft is uneconomical. Also stealth does not make the aircraft invisible. It delays detectable signal strengths which however increase as the fourth power with closure. Stealth has never been tested against an alert professional opponent. What a well trained radar operator and well practised scrambles can do remains to be seen. The idea is not that the stealth research is not worth pursuing but it would be folly repeated to plan a 'totally stealthy' aircraft without generating a data base. The practical step would be to revisit the earlier work including perhaps those of the Horten Brothers and design a simple, non FBW, subsonic, modifiable Flying wing using total systems and units (fuel, electrical, hydraulics, landing gear) from the Hawk or the HJT-36 to speed up the project. The

object would be to only generate 'Stealth Operating Data' not also to build a bomber. The aircraft would examine not just the aspects of signature reduction but also the operational aspects of stealth in the field. Such a programme may not cost a lot. The Horten Brothers proved the concept-for the *Nurflugel* aerodynamics and handling - with their private funds. Once we actually have a stealth aircraft flying we may discover that practicable stealth in terms of stowage volumes, CG limitations, maintainability, age degradation, operating techniques or even tropical operations pose unique Indian difficulties such that even the resourceful IAF 'Chieffie' may have a few things to say to his EO. If the data is encouraging then we are much better placed to get a real stealth aircraft in time rather than diving off the deep end trying to develop technology, on-the-job-training and a warplane all in one go: the way to hell is paved with good intentions! The B-2 design team stood on the shoulders of a lot of work done by Jack Northrop and his wings and the other associated work in propulsion, materials, controls et al. Also a stealth aircraft needs 'stealth' radars. It probably makes no sense to go for a stealth airframe without 'stealth' sensors to a compatible timescale. Finally stealth, apart from a little cosmetic angling of surfaces etc, may become unfashionable (happens every time!) in the next ten years thanks to advances in cheaper counter stealth technology. Go for stealth research before planning a stealth combat aircraft. However for ADA's own future credibility the priority is to get the LCA right .

Composites

Weight savings thanks to composites is typically between 2 to 6% (in extremis) of the basic empty weight (BEW). The

Russian *sukhovaya ves* (dry weight) is graphic. Some readers of *Wisdom & Courage, Vayu* V/2010 apparently defending the LCA's weight, confused(?) 'basic' with the heavier, 'operational' empty weight causing unintended humour. The reliably quoted 5700 kgs basic for the Gripen was actually kinder to ADA. It means, at 5650 kgs ADA was only overcautious. It knew the 'what' if not the 'how'. If the Gripen's BEW was indeed 6650 kilos, as stated, it indicates for two decades the LCA team claimed, composites notwithstanding, a similar airframe at half the weight achieved by the seasoned SAAB team. Then they overshot their target by a tonne. This they were up the creek without a paddle. Despite experience they faced vexing problems in fabrication and assembly. Provided the skill is masterly composites can save about a tonne in a missile carrier and is worth using in later marks as this weight saving results in realisable increase in disposable load in a 'hollow' aircraft.

The 64 ways

Trust the Germans find that if the problem is to produce gummed paper they will first list by a combinations of applicators, papers and their movements (rotary, reciprocating- in three axes, if you please) that there are 64 ways the job can be done. They would then go about allocating to each option points based on performance, producibility, cost, time scales, additional investments and whatever else is relevant to producing gummed paper. Being *Die Herrenvolk* in engineering is laborious business! From the scores allotted the obvious failures are rejected, the 'overlaps' are categorised and the most promising are progressed till the next stage review where may be one winner and two back ups (very important!) are developed further. This may seem some what wasteful to any impatient genius but has great merit until we produce our own Barnes Wallis or Andre Chapelon. The merit lies in the rigour and the 'sterility' or fairness, if you like, in evaluation of options. It permits several competent people to contribute independently and privately as it were to the decision rather than one 'Boss' who sweeps everyone with hierarchical power.

So what is our sixty four ways of carrying the Brahmos and other missiles? To cut down lengthy descriptions, an existing near equivalent aircraft is used to convey the concepts. No Engineer worth his pocket tape measure ever designs something ab initio. Today's e-engineering techniques, tools of physical analysis plus a basis aircraft as a combination can not only speed up detail design and construction but also reduce a lot of test flying regards handling and performance not to mention unquantifiable things like confidence.

A partial list could read something like this:

- The *Spirit* clone, remembering that the aircraft stood on a lot of previous practical research in various fields. It is not going to be easy, cheap or done quickly. Twenty years and Rs.100K crores

An Indian Air Force Canberra PR.57 seen at Yelahanka during Aero India 2005, was a much photographed veteran that survived a missile hit at Kargil. Unfortunately the aircraft was lost during a single engine approach at Agra in December 2005 (photo: Jagan Pillarisetti)

style of functioning causes, to put it politely, 'more than usual' consternation for the prospective customer! The LCA is crippled by overweight Using the same F. 404, the Gripen was widely acceptable. To revert, in a relatively light aircraft the use of composites may not make weighty (pun!) sense. For a larger aircraft it is different. This is why the B-787 and the A.350 became near reckless in the use of composites. Tongue respectfully in cheek and mixing metaphors impudently, both found that having pushed the boat out

corrected for PDV is an asking estimate.

➢ An enlarged four engine version of the Su-34 with an internal /conformal weapons pannier. The idea will be to trade some speed for stowage space whilst retaining handling. We have the license for the Su-30 which gives us a substantial base. 12 years and 35K crores?

➢ A "baby" Bone. The MiG-27 VG technology will be useful.

➢ Using the MiG-21 wing and tail aerodynamics base for a scaled up TSR 2 optimised for a low level high subsonic/ high altitude supersonic profile. One can have a formidable aircraft which sacrifices warload (two semi recessed missiles) for very high dash performance but reliant on aerial refuelling.

➢ An aircraft like the Buccaneer with a large internal bomb bay optimised for sea level high subsonic penetration. The excellent low level handling and ride qualities of the Su-7 wing could be a resource. If VG is deemed necessary have a careful look at Su-20s.

➢ A 'Super Canberra' with the focus on adaptability and the largest war load carried in a large, versatile weapons bay. Five years and 10K crores?

➢ To revive the Australian Ikara concept (you will probably find that some Otto von Kilroysdorffer has been there before!) in which an expendable high speed Delta UAV carries the four Brahmii to a prefixed launch point from where the missiles are launched. ISRO's mastery of telemetry and satellite based control will be an asset to harness, provided parties deign to co-operate. There is, I believe, an ISO on 'sister' organisations dislike of co-operating, perhaps for fear of the plague! The UAV makes more sense for hard targets like large aircraft carriers or interceptor airfields. A good platform to try the Kaveri.

➢ The Su-30 MKI. It is space and volume limited. Fitting- 'tyre flat, oleo collapsed,'- even one Brahmos, safely, will be a tailor's work. With an external Brahmos the Su-30 MKI will be slow, short-legged and a crab to fly.

The above list is by no means exhaustive. The old adage : out of a hundred project studies one may see light of day. The point is that a lot of options between extreme technology and extreme reality have to be explored and at least some simple but adequate 'insurance' options kept open. Generating many alternatives is not wasteful chasing of butterflies. It triggers thinking, broadens the perspective (the Canberra concept was developed en route a 'big Seahawk' with a single engine!) and the rigorous evaluation help to overcome biases, expose flaws, shapes directions by introducing realities and is priceless when difficulties are encountered or the leader changes. Each of the above proposals has merit and discussing the Super Canberra with its surprises is no reflection on the merits of the others.

The Super Canberra

The Mikulin AM3 that powered the Tu- 16 offered a thrust of 87.50 kN and, for illustration, together with one hour's fuel at sea level rated thrust would weigh 11,587 kilos and occupy 18.9 cu. mts. of space. The unreheated AL 31 would give 83.00kN thrust for 6700 kilos weight and 6.0 cu. mts. of space. Half the weight and one third the volume is a first approximation. The reduction in weight, bulk and power requirements of radar and avionics, rotables etc are considerable. The 'Buff' was big because it had to lift heavy and bulky equipment and had heavy and thirsty engines to do the job. The 'Buff' redesigned with today's technology would be a compact aircraft, possibly just twin engined like an enlarged Lockheed SA-3 Viking and yet retain the large equipment volumes and flexibility. The Canberra is therefore a serious basis for our 'Buff' at least as the vital 'second string'. The following provisional estimates are given below a RD-33-powered Canberra and an AI-31 engine version. The wing and power loadings have been kept same as the original Canberra.

Parameters	Canberra B(I) 58	Canberra RD 33	Canberra AI 31
Length (mts.)	19.96	25.54	31
Wing Span (mts.)	19.57	25.04	30.2
Wing Area (sq. mts.)	89.9	147	217
A.R.	4.26	4.26	4.26
Engine Power (kg. p)	2X 3353	2X 5500	2X8307
Basic Empty (kgs.)	10,099	13,000	17,035
Normal T.O.W. (kgs)	19,957	34,290	47,382
M.T.O. (kgs)	24,062	41,806	61,744
Max. disposable load	13,063	28,806	44, 709
Bomb bay dia. (mts.)	1.99	2.5	3.0
Bomb bay length (mts)	6.79	8.5	10.0

An unreheated RD 33/F414 powered Super Canberra would be about the smallest aircraft that can handle three or four (i.e. a good Pk.) of the air-launched Brahmos missiles internally and still have an interdiction radius of around 1800 kms. (hi-lo-lo-hi) plus the missile reach. The radius can be increased with aerial refuelling. The empty weight does not include the weight of the additional equipment and crew stations which would be specific to Mark. Several specialist variants are expected given the outstanding high altitude potential of the design (the PR 9's ceiling is still classified and beyond that, of most fighters). The larger (2.5mts) fuselage diameter and length (+5.5mts) means a reasonable crew – up to seven /eight could be carried in special versions. Some of the roles for such an aircraft could be:

➢ A weapons carrier for next generation of guided weapons.

➢ A high altitude 'long reach' AWACS using the Embraer/ Ericsson type suite. Later planar arrays can be appliquéd to the sides.

➢ Buddy tanker.

➢ Test vehicle for ejection seats and engines (with the test engine fed by a dorsal intake a la B-727 or DC-10. The modularity of the Canberra structure permits these concepts.

➢ Radar and electronics test vehicle

➢ Meteorological and radar calibration

➢ Maritime reconnaissance and conventional /LG bombing.

➢ ELINT with ability to look deep into hostile territory because of the high altitude capability.

The Canberra could fly at a higher altitude than any other bomber through the 1950s and set a world altitude record of 70,310 ft (21,430m) in 1957. Thanks to its ability to evade early interceptors and providing a significant performance advancement over piston-engined bombers then common, the Canberra was a popular export product and served in many nations (B-57 seen with the UASF above). In addition to being a tactical nuclear strike aircraft, the Canberra proved to be highly adaptable, serving in such varied roles for tactical bombing, photographic, electronic, and reconnaissance in conventional warfare. Canberras served in the Vietnam War, the Falklands War, the Indo-Pakistani Wars, and numerous African conflicts.

- ECM/ECCM 'Wild Weasel'
- Anti submarine and anti shipping duties as the 'Killer' to the P-8's 'Hunter'. Handling during the attack will be fighter like compared to the P-8.

The Super Canberra's strong points will be the following:

- It is the simplest, cheapest, surest, quickest and most versatile. It is so simple the biggest challenge will be to design the large weapons bay.
- The design, the work of a Master, is a good base. The simple elegant lines offers outstanding subsonic performance (right in the useful 'sweet spot') combined with brilliant engineering.
- Thanks to the improvements in technology the Super Canberra will have the strategic range payload capabilities of Tu-16 class.
- Unlike the above aircraft the Super Canberra offers outstanding agility and high altitude performance yet the Mach penalty of the unswept wing is all of M=0.03-M=0.07. i.e. around M 0.83 whereas the Tu-16 have a limitation of M=0.86- M=0.90. Intercepting a Super Canberra at its ceiling would require considerable resources, skills and organisation as the fighter would handle very badly and will have expended considerable fuel after the climb.
- The modularity of the structure will enable, as with the original Canberra /B-57, many variants without making large changes to the production set up.
- Given the simplicity, an enlarged Canberra is an ideal 'starting' project.
- It can be introduced with certainty within five years and to a modest budget.

Ripe for (the Gunmetal) Revolution!

Arms may not be needed but when one needs them, one needs them badly! For that reason alone weapons technology development must be separated from the business of re-equipment. Cold fusion was hot technology two decades ago. No doubt our scientists still toil untiringly but fortunately 'Cold fusion' was not tied up with our plans to produce power. A weapon is useless if it remains 'music in the distance' particularly if due to use of unmasterd technology. This argues for the 'insurance' projects. We may need a "ten tonne, two thousand kilometre" (radius of action) warplane. With such a capability it should be possible for us to control shipping in the Indian Ocean, a powerful dissuader to all. With stand off capability e.g. Brahmos a relatively simple warplane can also put a check on unrestricted carrier operations in the Indian Ocean. There will also be targets which require conventional and LGB attention which is why the largest air forces carefully husband and retain a conventional 'large load' capability. In all it would be a very cost effective solution to our problems of policing and dissuasion.

As was seen, there can be many possible solutions to the problem but a balance has to be struck between technology and timeliness. Our efforts at developing aircraft have highlighted fundamental lacunae. These were possible due doctrinaire restrictions of a 'Socialist pattern of Society' which hopefully is dying (hard!) in defence production. The major correction is having several 'calibrated for risk' irons in the starting fire. The effect of competition need not be elaborated .The Indian automotive sector is witness. Pursuing multiple alternatives require multiple resources. The State sector will need supplementing. Their limitations, and this is a personal view, is more due to mindsets, command structures and traditions rather than physical constraints. The ideal would be 'Public Private Partnership' but such mergers require long gestations. The practical step at present would be to select alternative proposals with the Government agencies tackling the 'glamourous' proposals and the private sector being funded the 'insurance' projects. Since active projects 'pulls' fund and the sluggish ones can't use them the net spend will not be too different until one of them 'catches' and truncations are done.

In the 'Sixties, faced with acute food insecurity, the sagacious agriculture Minister C S Subramaniam (on whom peace), decided to inject 'mini kits- seeds, fertilizers, pesticides and encouragement' directly to the farmers. We then had the Green Revolution. The Leadership must now inject, directly to the private Sector, "mini kits" of funds, "likely to be useful" projects, project studies, and encouragement to usher in a *Gunmetal Revolution*.

Prof. Prodyut Das

Pashtun Jaguar

Training For Helmand

SK4 cockpit view.

Richard Gardner reports from Netheravon in the UK during 'Exercise Pashtun Jaguar' as crews and helicopters are prepared for an operational return to Afghanistan.

By the time this article is read, the British No.3 Commando Brigade, comprising a highly mobile fighting force of Royal Marines and also Army infantry units, will be back on active operations in Afghanistan, as part of the UK's regular rotation of ground forces and other supporting military units. While everyone is familiar with the harsh realities of soldiers' lives in the dangerous

Rear ramp view of Chinook HC3.

front line of Helmand Province, not so well appreciated is the massive air effort behind the scenes that makes it possible to sustain the ground forces, every day and every night, so they always have airlift when they need it, so the ammunition, rations and water don't run out, so timely casualty evacuation can be relied on, and when really close air support is on hand when needed. There are massive air bases in Afghanistan, supplemented by operational hubs and forward operating bases, as well as temporary landing zones for helicopters and transport aircraft all over the country. Improvised Explosive Devices, mines, mortars and Rocket Propelled Grenades, as well as man-portable anti-aircraft missiles and heavy machine guns, all add to the considerable hazards facing aviators flying in the country, especially the turbulent Helmand Province in the south, where most of the conflict is concentrated. While there is a continuous air presence in theatre, the need to rotate crews on a regular basis means that intensive training is required to prepare and sustain this level of deployed tactical air support.

The high tempo of active operations in Afghanistan does not provide a suitable environment for large-scale cooperative training between air units and ground forces. They have to arrive in theatre fully prepared for conditions and operations with confidence that procedures and mission tactics are well rehearsed against a realistic scenario. Getting it wrong can cost lives in theatre so the time and expense of large scale training exercises is an essential investment in crew validation. It remains a fact that without such substantial integrated air assets to provide mobility, flexibility and the domination of airspace overhead, then many tens of thousands of extra troops would be needed in Afghanistan to extend protection and influence over such a remote and hostile region.

Two Sea King Mk4s take off.

At first glance, the fertile rolling landscape of Salisbury Plain in England might seem a million miles from Helmand Province, but in February 2011 during Exercise *Pashtun Jaguar*, the men and helicopters of Joint Helicopter Command spent several weeks working up with ground units of No.3 Commando Brigade.

US forces also took part in the exercise, which reflects today's operational reality where JHC is now closely integrated with US units and operates under the command of a 2 star US General. The exercise used the historic Netheravon airfield, with an HQ and units set up to operate as they would at Camp Bastion in Helmand, where UK JHC helicopters of the RAF, Army and Royal Navy fly alongside US Marine Corps helicopters based at their own HQ, Camp Leatherneck. Exercise *Pashtun Jaguar* concentrated on collective training and integrated missions, with much attention on achieving mission objectives, planning, briefing and execution, and judgemental training. As well as the representative base operations, realistic replica Afghanistan-style ground force bases have been set up on Salisbury Plain, complete with protective rock and mesh perimeter walls, gun positions, tents, shelters and vehicle parks, including desert camouflaged armoured vehicles similar to the types actually used in Afghanistan. From the air, these replica bases look just like the real ones in almost all respects, except for the

Between sorties : an Apache Longbow parked beside the trees at Netheravon.

One of the latest Merlin Mk3As to join the RAF in Joint Helicopter Command.

fact they do not disappear under a cloud of sand whenever a helicopter approaches! To give more realistic environmental helicopter training, better suiting UK pilots to local Afghan conditions, separate training exercises have been undertaken in actual desert conditions, with Apaches being dispatched to Arizona, in the USA, and Chinooks and Merlins to North Africa. Exercise *Jebel Sahara* saw some 220 personnel from RAF Odiham, the main UK Chinook base, and RAF Benson, home of the Merlin, deployed to Morocco with four Chinooks and three Merlins. This provided good field exposure to the hot and high conditions that would be experienced in Afghanistan and enabled support crews as well as flyers to get used to setting up camp and logistics activity in a variety of harsh desert and mountain conditions. Crews from the Operational Conversion Unit as well as operational units took part and involved all aspects of day and night helicopter flying, from troop uplift and cargo carrying, to underslung loads, and search and rescue.

An important element in the *Pashtun Jaguar* exercise at Netheravon is what is known as Judgemental Training. This is jargon for the training in 'Use Of Force' and 'Rules Of Engagement' and tests crew response to scenarios that mimic what might arise in the confused circumstances of in-theatre operations. This is done based on real-life incidents and uses replica villages and soldiers dressed in local Afghan-style clothing so crews have the opportunity to make decisions on whether groups or individuals are innocent bystanders or hostiles. Videos are used extensively to debrief crews to examine how successfully they dealt with the challenges. Putting crews into typical mission flight profiles (such as approaching a pick-up point in a threatened landing zone) gives examiners a chance to see how they react and to give them a chance to perfect their skills. Just as forces serving in Afghanistan have had to adapt over the years to changing Taliban tactics– such as the main threat becoming that from Improvised Explosive Devices (IEDs) – the countermeasures also have to evolve to include new tactics.

An example of this is the increasing use of air dispatch to deliver vital stores in high threat areas. Rear Admiral Johnstone-Burt is Commander, Joint Helicopter Command, and he told the author, "We were experiencing increasing ground fire as we approached certain well-used landing zones, taking more and more hits on helicopters. We decided to take a fresh look at how a return to air dispatch instead of drop-off, using the Chinook, might reduce the risk. We wanted to see if new developments in precision delivery might be adapted for Chinook use so that we could guarantee dropping the stores with great accuracy and with no chance of the stores falling into the wrong hands. We worked closely with industry and operational evaluation showed that this could be achieved. The whole project was carried out within weeks using the Urgent Operational Requirements process to fast-track the delivery of a reliable capability that we could rely on to do the job with added safety." This is now in use in theatre and gives added flexibility when deciding

how to meet operational tasks and does not replace existing troop supply tactics.

The helicopters used by JHC in the exercise included the latest RAF Chinook HC3 and Merlin HC3A, Royal Navy Sea King HC4s, Army Apache Longbow attack helicopters, Lynx AH7s and an optical pod touting Gazelle posing as a UAV. The longer term plan for JHC helicopter assets is for the Royal Navy SK4s to be replaced by Merlins, the older Army Air Corps/Royal Marines Lynx 7s and 9s will be replaced by the new Wildcat and the RAF Pumas will be totally upgraded with new engines and cockpit displays and avionics. Because of the altitude and temperature difficulties experienced in Helmand, the lift performance of the participating helicopters was restricted to enable more representative missions to be flown. This meant, for example, that a Lynx could only lift between 2-4 troops and a Merlin between 9-20. In contrast, the more powerful Chinook could still carry between 19-40 passengers. During the Falklands war a Royal Air Force Chinook memorably uplifted no less than 80 Gurkha soldiers in a single aircraft, which demonstrated this helicopter's amazing capacity to over-deliver when required.

The *Pashtun Jaguar* exercise included the latest editions to the RAF Chinook fleet, the Mk 3s, which feature larger side panniers and extra fuel, a legacy from the original intention to use these eight new machines for Special Forces support. Since then, another 12 Chinooks have been ordered to add to the 48-strong RAF fleet, the whole force to be equipped with new generation Thales glass cockpit displays under *Project Julius*. All the older Mk 2 aircraft will also be retro-fitted with more powerful Honeywell T-55-L-714A engines, and will become Mk 4s. It is intended to operate a 60-strong RAF Chinook fleet until 2025.

In Afghanistan, Apache and the upgraded Lynx Mk9 helicopters provide escort duties to troop-lift helicopters and it is almost unheard of to fly over the operational areas without being in a formation of at least two aircraft, so there is always an aircraft available for immediate support if there is a problem with the other. Apaches, armed with cannon, rockets and missiles, have enormous firepower to bring to focus against any hostile ground elements. All the UK's Apaches carry the Longbow radar, whereas US Apaches have Longbow-equipped helicopters allocated to groups of standard machines. Fitted with advanced defensive aids systems and advanced avionics, the UK Apaches are flown by Army and Royal Marines crews and are regarded as probably the most formidable air assets available for immediate air support. Last year the UK Apaches were carrier qualified by their crews so that in future overseas deployments they can operate equally effectively, by day or night, from land or sea.

The author of this article Richard Gardner, in front of SK4 Netheravon.

A Gazelle light helicopter equipped with an electro-optical surveillance pod. During the exercise, this helicopter was used to simulate UAV operations over the battlefield training area.

Operating unseen and at a safer altitude are RN Sea King Mk 7s acting as flying command posts and radar surveillance and communications platforms. Without the confidence provided by air power, the job of providing security on the ground in Afghanistan would be an impossible one. Exercise *Pashtun Jaguar* is part of the ongoing effort by UK air units to make sure all participating units are as well prepared for this challenging commitment as possible.

Article and photos by Richard Gardner

The Civil aviation boom :
3.3 billion air travellers by 2014

Giants of the air : Boeing 747-400 taxiis while an Airbus A-380 comes in to land. (photo: Michael Ziem).

"The focus of the Industry continues to shift eastwards."

The industry consensus forecast released by the International Air Transport Association (IATA) indicates that by 2014 there will be 3.3 billion air travelers, up by 800 million from the 2.5 billion in 2009. By 2014 international aviation will handle 38 million tonnes of air cargo, up 12.5 million tonnes from the 26 million tonnes carried in 2009.

China will be the biggest contributor of new travelers. Of the 800 million new travelers expected in 2014, 360 million (45%) will travel on Asia Pacific routes and of those 214 million will be associated with China (181 million domestic and 33 million international). The United States will remain the largest single country market for domestic passengers (671 million) and international passengers (215 million).

"Despite some regional differences, the forecast indicates that the world will

continue to become more mobile. This creates enormous opportunities but also presents some challenges. In five years we need to be able to handle 800 million more passengers and 12.5 million more tonnes of international cargo. To realise the economic growth potential that this will bring, we will need even more efficient air traffic management, airport facilities and security programmes. Industry and governments will be challenged to work together even more closely," said Giovanni Bisignani, IATA's Director General and CEO.

"The shadow of the global economic recession is expected to remain over parts of the industry for some time to come. Sluggish growth rates in Europe and North America are not only the result of being mature markets. Lingering consumer debts, high unemployment and austerity measures will dampen growth rates," said Bisignani.

Forecast highlights:

★ International passenger numbers are expected to rise from 952 million in 2009 to 1.3 billion passengers in 2014. This 313 million traveler increase reflects a compound annual growth rate (CAGR) of 5.9%.

★ The fastest growing markets for international passenger traffic will be China (10.8%), the United Arab Emirates (10.2%), Vietnam (10.2%), Malaysia (10.1%) and Sri Lanka (9.5%).

★ By 2014, the top five countries for international travel measured by number of passengers will be the United States (at 215 million, an increase of 45 million), the United Kingdom (at 198 million with an increase of 33 million), Germany (at 163 million with an increase of 29 million), Spain (123 million with an increase of 21 million), and France (111 million with an increase of 21 million).

★ Domestic passenger numbers are expected to rise from 1.5 billion in 2009 to over 2 billion in 2014. This 488 million passenger increase reflects a CAGR of 5.7%.

★ China will record the highest CAGR of 13.9% and contribute an additional 181 million passengers. Other countries with double digit growth include Vietnam (10.9%), South Africa (10.6%), India (10.5%), and the Philippines (10.2%).

★ By 2014 the five largest markets for domestic passengers will be the United States (671 million), China (379 million), Japan (102 million), Brazil (90 million) and India (69 million).

★ International freight volumes are expected to grow at a CAGR of 8.2% over the forecast period. Excluding the impact of the rapid post recession rebound in 2010, for the 2011-2014 period, the consensus view for air freight is that it will stabilise at 5% CAGR. This is slightly below the forecast growth in world trade (6%) suggesting a still conservative outlook after the recession shock and possibly some loss of market share to sea shipping.

★ The top five fastest growing international freight markets over 2009-2014 will be Hong Kong (12.3%), China (11.7%), Vietnam (11.4%), Chinese Taipei (11.3%), Russian Federation (11.0%).

★By 2014, the largest international freight markets will be the US (8.8 million tonnes), Hong Kong (5.4 million tonnes), Germany (4.4 million tonnes), Japan (4.4 million tonnes) and China (3.8 million tonnes).

★ The volume growth expected in China and Hong Kong will account for a third of global volume growth over the period to 2014.

Regional outlook till 2014:

★ Asia Pacific's International passenger demand is expected to grow 7.6%. By 2014, China, Japan and Hong Kong will be the biggest international passenger markets in the region, with China being the largest international and domestic market in Asia. The region will see the highest growth rate for international freight at 9.8% with Hong Kong, Japan, China, South Korea, and Chinese Taipei comprising the region's top five markets.

★ The Middle East is expected to have the fastest growth rate at 9.4%. The UAE, Kuwait, Jordon will be among the top 10 fastest growing countries, with the UAE ranked 7th for international passengers at 82.3 million. International freight demand will grow 8.1% as freight links to and via the region continue to develop. The UAE will lead the region, handling 2.7 million tonnes of cargo.

★ Africa is expected to see international passenger growth of 7.7%, the second highest of the regions. International cargo demand is expected to be 5.8%, the lowest among the regions.

★ Europe will see international passenger demand growth of 4.7%. The United Kingdom, Germany, Spain, France and Italy will remain among the top ten largest international passenger markets. International freight demand for the region will grow 6.5%, with Germany, the UK and the Netherlands leading the region in size. The Russian Federation will see the fastest growth rate of 11%

★ Latin America will see international passenger demand grow 5.7%. International freight demand will increase 6.4%, with Peru leading the region freight growth at 9%.

★ North America will grow 4.9% for international passenger demand and 7.6% for international freight. The US will continue to be the largest international and domestic passenger market in the world, and is expected to remain the largest international freight market by some margin.

"The focus of the industry continues to shift eastward. By 2014, 1 billion people will travel by air in Asia-Pacific. That's 30% of the global total and a 4 percentage point increase from the 26% it represented in 2009. The same is true for cargo where Asia-Pacific will account for 28% of global volumes," said Bisignani.

The International Air Transport Association (IATA) also announced the aviation safety performance for 2010 showing that the year's accident rate for Western-built jet aircraft as "the lowest in aviation history."

The 2010 global accident rate (measured in hull losses per million flights of Western-built jet aircraft) was 0.61. That is equal to one accident for every 1.6 million flights. This is a significant improvement of the 0.71 rate recorded in 2009 (one accident for 1.4 million flights). The 2010 rate was the lowest in aviation history, just below the 2006 rate of 0.65. Compared to 10 years ago, the accident rate has been cut 42% from the rate recorded in 2001. A hull loss is an accident in which the aircraft is destroyed or substantially damaged and is not subsequently repaired.

"Safety is the number one priority. Achieving the lowest accident rate in the history of aviation shows that this commitment is bearing results. Flying is safe. But every fatality is a human tragedy that reminds us of the ultimate goal of zero accidents and zero fatalities. We must remain focused and determined to move closer to this goal year by year," stressed Giovanni Bisignani, IATA's Director General and CEO.

In absolute numbers, 2010 saw the following results:

★ 2.4 billion people flew safely on 36.8 million flights (28.4 million jet, 8.4 million turboprop)

★ 17 hull loss accidents involving western-built jet aircraft compared to 19 in 2009

★ 94 accidents (all aircraft types, Eastern and Western built) compared to 90 in 2009

★ 23 fatal accidents (all aircraft types) compared to 18 in 2009

★ 786 fatalities compared to 685 in 2009

IATA member airlines outperformed the industry average with a Western-built jet hull loss rate of 0.25. That rate is equal to one accident for every 4 million flights. The IATA Operational Safety Audit (IOSA) became a condition of IATA membership from 1 April 2009. All 234 IATA member airlines are now on the IOSA registry. The IOSA registry is open to all airlines and it currently consists of over 350 airlines.

"The numbers tell the story. In the first full year after the IOSA became a condition of IATA membership, the accident rate for IATA carriers has never been so low. The data confirms that IOSA is helping to drive safety improvements around the world. It is an important part of a comprehensive safety strategy involving governments and industry working together to further reduce the number of accidents and fatalities," said Bisignani.

Jet Airways in landmark 100th international flight

Jet Airways has announced the addition of two daily flights that will further enhance its growing international network. With the addition of these two direct daily flights, Jet Airways has achieved a landmark milestone of becoming the first private Indian airline to operate 100 daily flights to international destinations across the globe. Jet Airways is introducing this new flight between Dammam and Mumbai. Jet Airways' Gulf network now services over 10 destinations in the Middle Eastern region.

Airbus A330-200.

Jet Airways currently operates a fleet of 97 aircraft, which includes 10 Boeing 777-300 ER aircraft, 12 Airbus A330-200 aircraft, 55 next generation Boeing 737-700/800/900 aircraft and 20 ATR 72-500 turboprop aircraft. With an average fleet age of 4.95 years, the airline has one of the youngest aircraft fleets in the world.

But these are significant regional differences in the Western built jet hull loss accident rate.

★ North America (0.10), Europe (0.45), North Asia (0.34) and the Commonwealth of Independent States (0.0) performed better than the global average of 0.61

★ Asia-Pacific was higher than the global average at 0.80 in 2010 and about the same from the previous year (0.86)

★ The Middle East and North Africa region saw its accident rate fall significantly to 0.72 (compared to 3.32 in 2009) with only one accident involving a carrier from the region

★ Latin America & the Caribbean reported a higher accident rate of 1.87 with four airlines from the region involved in accidents, compared with a zero accident rate in 2009

★ Africa had an accident rate of 7.41, which was lower than the 2009 rate of 9.94. While showing improvement, Africa once again has the worst rate in the world. There were four Western-built jet hull losses with African carriers in 2010. African carriers are 2% of global traffic, but 23% of global western-built jet hull losses.

Safety in Africa

In 2010, the accident rate of IOSA carriers in Africa (for all aircraft types) was more than 50% better than non-IOSA airlines. Among IATA's efforts in Africa, it established the IATA Programme for Safe Operations in Africa (IPSOA). IPSOA ensured that flight data analysis tools are available to all IATA carriers in Africa, and as of the last quarter of 2010, all IATA carriers have this essential safety tool in place. IPSOA will provide IATA with the data needed to develop safety programs targeted at specific challenges in the region. "Flying must be equally safe in all parts of the world. An accident rate in Africa that is over 12 times the global average is not acceptable. Improvements can happen. IATA's African carriers performed significantly better than non-IATA airlines in the region. I encourage all governments in the region to make use of the IOSA tool to boost the region's performance," said Bisignani.

An analysis of accident causes

Runway excursions, which are instances when an aircraft departs the runway during takeoff or landing, were once again the most common cause of accidents, accounting for 21% of all accidents in 2010 (vs. 26% in 2009). The number of industry runway excursions accidents dropped by 13% (20 vs. 23 in 2009) and IATA members have reduced their runway excursion accidents by 43% since 2008 (4 vs. 7 in 2008).

IATA analysis shows about 35% of runway excursions on landing occurred on wet runways. Another leading cause of runway excursions on landing is an "unstable approach," where the aircraft is approaching too fast, too high, or touches down beyond the desired runway touchdown point. IATA is working with industry and regulators to address this safety challenge.

In 2009, IATA released the Runway Excursion Risk Reduction (RERR) toolkit which provides high-level reference material as well as an in-depth analysis of runway excursion accident data and a compilation of significant risk factors. The toolkit also provides recommendations for operators, pilots, airports, air traffic management, and regulators. A major update to the RERR toolkit is planned for the spring of 2011 and will bring together all major international safety organizations in a collaborative effort to eliminate these types of accidents.

Ground damage accounted for 11% of all accidents in 2010, improved from 17% in 2008 when IATA launched the IATA Safety Audit for Ground Operations (ISAGO) to address this challenge. ISAGO is the industry's first global standard for the oversight and auditing of ground handling companies. The programme, containing over 400 standards, was launched in February 2008 and the first audits took place in May of the same year. To date, a total of 288 audits have been conducted and 56 providers operating at 81 different locations are already on the ISAGO registry. The programme has gained broad support from several aviation authorities and airports and has been mandated in Lebanon and Turkey.

Air India clears $1.2 bn Airbus purchase plan

The board of India's state-run national carrier Air India has approved a proposal for the purchase of 21 Airbus A320 aircraft for an estimated $1.2 billion. The board also approved the dry lease of another 10 A320 aircraft for its ageing fleet and two Airbus A330s.

IndiGo to start overseas flights

India's ambitious budget airline IndiGo will start international operations in August, the company said in a statement, a week after it placed a huge order for 180 new aircraft. The aviation ministry has approved IndiGo's proposal to launch services to Singapore, Bangkok, Dubai and Muscat. "IndiGo is delighted to receive these important traffic rights and is grateful to the ministry of civil aviation for approving its application in a timely manner," stated the spokesperson. "This will hasten the process of Indian carriers taking back some of the market share that has been lost over the past many decades to foreign carriers."

Privately-owned IndiGo is the rising star in the booming Indian industry, which saw passenger numbers leap 25 percent year on year in November 2010. It currently has a fleet of 34 Airbus A320s and offers 221 daily flights to 24 destinations across India. The company's $15 billion deal to buy 180 A320 aircraft is the largest number of Airbus aircraft ever bought in a single order.

Airbus A320.

Asia-Pacific to lead demand for new aircraft over next 20 years

Air Asia Airbus A320

Asia-Pacific airlines are expected to take delivery of around 8,560 new aircraft over the next 20 years, according to Airbus. Valued at US$1.2 trillion, the requirement represents 33 per cent of new aircraft deliveries worldwide over the forecast period, with the region overtaking North America and Europe as the largest air transport market.

The Airbus forecast is based on stronger than average growth in both passenger and freight traffic in the region, combined with replacement of many of the existing aircraft in service. In terms of growth, Airbus expects the number of passengers carried by Asia-Pacific airlines to rise by 5.8 per cent per year while the amount of freight passing through the region will increase by 7.0 per cent annually. This compares with global average increases of 4.8 per cent in the passenger market and 5.9 per cent for cargo. At the same time, carriers in the region are expected to replace 78 per cent of the 3,680 aircraft currently in service, ensuring that they continue to operate some of the youngest and most eco-efficient fleets in the world.

Airbus predicts that the region will continue to drive demand for larger aircraft types, reflecting the concentration of populations in the region around the main urban centres and the need for more seats between fast-growing mega-cities. As a result, carriers in the region will acquire around 3,360 new widebody aircraft over the next two decades. This represents 40 per cent of all widebody deliveries worldwide and includes some 780 very large aircraft such as the A380 and around 2,580 twin aisle widebodies such as the A330 and new A350 XWB.

Although a predominantly widebody market, demand for single aisle aircraft in the region is expected to accelerate in the coming years, with a requirement for some 5,200 new airliners in the 100 - 210 seat category, such as the best-selling A320 Family. The increase will be driven primarily by the growth of low cost carriers , as well as the opening of new secondary short haul routes, especially in China, India and South East Asia.

In the cargo sector, the region will continue to dominate the global market, with the dedicated freighter fleet operated by Asia-Pacific airlines growing almost four times to 1,056 aircraft. While many of these will be converted from passenger models, Airbus predicts that around 270 new production freighters will be delivered to the region over the next two decades. This represents over 30 per cent of expected global demand for new production freighters.

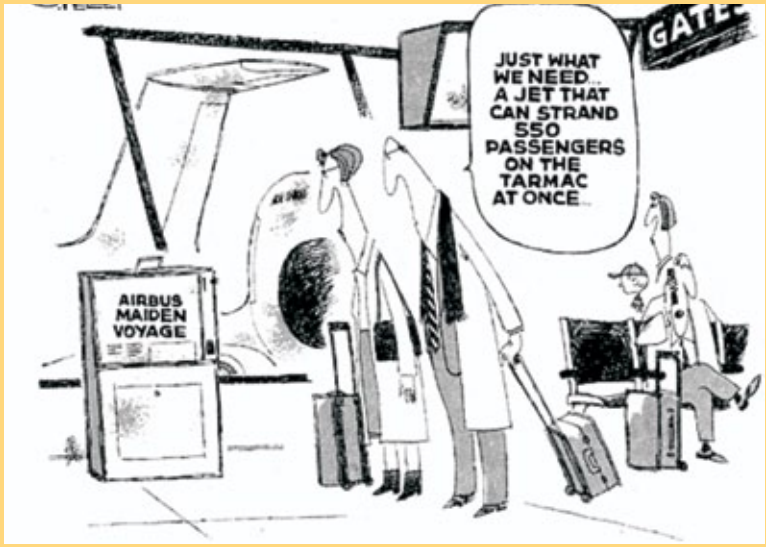
Presenting the forecast, Chris Emerson said that Asia-Pacific airlines would benefit from ongoing strong economic growth across the region, greater liberalisation of the air transport system in Asia and the effect of greater wealth creation enabling more people who have never flown to take to the skies.

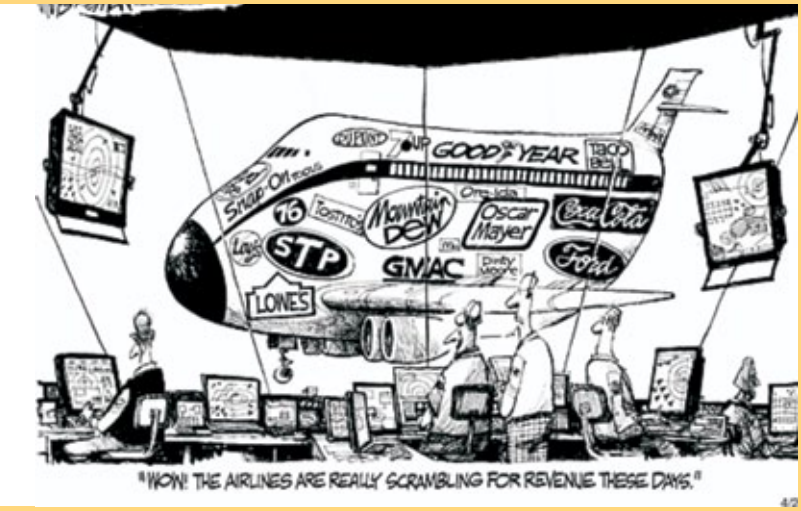
The Asia-Pacific region is a core market for Airbus accounting for over a quarter of all orders recorded by the company to date. Today there are some 1,700 Airbus aircraft in service with more than 70 operators across the region, with another 1,100 on order with customers for future delivery. This represents 32 per cent of the company's total backlog, reflecting the importance of the region as the fastest growing market for new civil aircraft.

Airbus' forecast for the Asia-Pacific region is derived from the company's Global Market Forecast, which foresees total demand for 25,850 new passenger and freighter aircraft valued at US$3.2 trillion over the next 20 years. In the various size categories the forecast predicts total demand for 1,740 very large aircraft, 6,240 twin aisle widebodies and 17,870 single aisle aircraft.

Recaro

Boom alright–but think of the passengers !






ISN'T $500 A BIT STEEP FOR COACH?
AIRFARES
GATE
THAT'S FOR AN OVERHEAD COMPARTMENT.


I'VE BEEN IN LINE TWO HOURS—DOES MY BLADDER COUNT?


Elite Scum Class™
GIMME A $25 "PREMIUM COACH" SEAT WITH 2" OF LEGROOM MINUS $7 MIDDLE SEAT DISCOUNT, $3.25 FOR EXCLUSIVE DIBS ON THE LEFT ARMREST, $1 FOR NO KID SITTING BEHIND ME AND $100 TO SLIP MY HALF-EMPTY 4.3-OZ TOOTHPASTE TUBE PAST SECURITY.
À LA CARTE AIR


I'M TIRED OF THEM TREATING US LIKE AIRLINE PASSENGERS...

ALHTK: The Raptor Factor

Dramatic photo of F-22 at very low level.

On 2 June 2009, a letter from United States Chief of Staff Gen. Norton Schwartz, addressed to the Missile Defence Agency (MDA) director, Army Lt. Gen. Patrick O'Reilly, called for a study of arming United States Air Force F-15s and F-16s, and possibly F-22As and F-35s, with specialised munitions under a concept dubbed Air Launched Hit-to-Kill (ALHTK). The ALHTK concept reportedly gained momentum in response to a 2008 war game, based in the European theatre in 2020. An accompanying white paper stressed on the growing threat of increasing ballistic missiles in smaller nations which could overwhelm United States Armed Forces ability to overcome a missile attack. Out of the airborne platforms, the Lockheed Martin F-22A Raptor Advanced Tactical Fighter (ATF) that entered United States Air Force service in December 2005 and achieved full operational capability in December 2007 appears to be the fittest candidate of the lot, albeit the fact that the ATF programme, initially conceived during the late 1970s and early 1980s with emphasis on agility, all-aspect stealth and range was in response to intelligence reports on the then new Soviet *Ram*-L and *Ram*-K prototypes, located at Ramenskoye which eventually evolved into today's formidable Russian Sukhoi Su-27/30 and MiG-29 family of aircraft. The first operational wing of F-22A Raptors was at Langley Air Force Base (AFB) in Virginia with a fleet of 40 aircraft. Elmendorf AFB, Alaska, became the second operational wing in August 2007 and Holloman AFB, New Mexico the third in June 2008.

Winner of the 2006 *Robert J. Collier Trophy* from the American National Aeronautic Association (NAA) the F-22 was developed at Aeronautical Systems Centre, Wright-Patterson AFB at Ohio. It needs to be seen whether global ballistic and cruise missile proliferation and associated components, combined with a falling technology curve for biological, chemical, or even nuclear agents "reverses the fortune" of the F-22A by restarting its production as in April 2009, production of the F-22 fighter jet was officially terminated when United States Defense Secretary Robert Gates announced that the Pentagon would end the F-22 programme and increase the production of the cheaper (not so cheap after all!) and "more-versatile" Lockheed Martin F-35 Lightning II Joint Strike Fighter (JSF). Funding was made available for only 187 F-22As against the USAF minimum requirement of 243 aircraft.

The ALHTK concept is nothing new. In January 2007 MDA awarded a $ 3-million contract to Lockheed Martin for the risk reduction/concept definition of a programme for an air-launched Patriot Advanced Capability-3 (PAC-3) missile system to intercept hostile ballistic and cruise missiles with a Boeing F-15C fighter as the test-bed. The air-launched PAC-3 is identical to the ground-launched version except for differences in software. The missile is dropped from a canister loaded on to the F-15C's pylon with this opening prior release and launching the weapon against its target. Notably, although the 5.2-metre long PAC-3 is a large missile, its integration aboard the F-15C is not dissimilar to Raytheon's 4.1-metre long AGM-88 HARM high-speed anti-radiation missile. Besides intended to protect the United States

homeland from missile threats, ALHTK is more likely to be frequently deployed to defend deployed United States and allied forces worldwide, especially in the Asian region where cruise and ballistic missile proliferation along the China-Pakistan-North Korean axis have reached alarming proportions. In words of Mike Trotsky, Vice President-Air and Missile Defence at Lockheed Martin Missiles and Fire Control, "Equipping fighter jets with PAC-3 Missiles would provide Combat Air Patrols or scrambled aircraft the ability to defeat cruise missiles and intercept ballistic missiles in asymmetric defence and boost phase applications. Although cruise missile defence capabilities are inherent with this concept, this MDA contract will focus on ALHTK capabilities against ballistic missiles."

The ALHTK strategy would have roving packs of fighters, along with a support network of tankers and Intelligence, Surveillance and Reconnaissance (ISR) platforms to intercept missiles in rapidly established protection zones. The paper stated that the mission could be executed by F-16s and F-15s, with more study needed to explore the possibility of equipping F-35s and F-22As. The fighters would be armed with two types of missiles that could bring down ballistic missiles in their boost phase or higher in the atmosphere. During boost-phase the attacking ballistic missile is comparatively slower and at the same time a source of considerable IR (Infra-Red) radiation and thus easily detectable by aerial source or by satellites. Decoys are yet to be fielded, making interception easier. Moreover, the attacking missile destroyed at that stage falls on the aggressor's territory along its NBC (Nuclear, Biological, and Chemical) payload. In this context the deterrent value of a Boost-Phase Intercept System is well apparent.

Swift and accurate transitions to the battlespace remain a critical requirement for Boost Phase Interception (BPI) of ballistic missiles with the aircraft ideally need to penetrate to within about 160-km of the launch site. While accurate navigation is ensured by Northrop Grumman LTN-100G laser gyroscope inertial reference and a Global Positioning System (GPS) , the F-22As two Pratt and Whitney F119-100 low bypass after-burning turbofan engines with hollow wide chord fan blades installed in the first fan stage providing 156-kN thrust will provide the necessary performance parameters being able to supercruise or to transit long distances at supersonic sustained speeds of over Mach 1.5 without the need to employ fuel-hungry afterburners. Thus while operating from Hickam AFB in Hawaii, Andersen AFB in Guam or more forward Kadena AFB in Okinawa, Japan, the F-22As will be capable of encompassing considerable proportion of the Asian landmass in "one-way missions" if provided friendly airbases in Central, South and West the Asia in time of exigencies. A service ceiling of 65,000ft provides better situational awareness of the battlefield besides enhancing kinematics of the missiles. All-aspect stealth of F-22As will also emerge as a determining factor as stealth attributes confined to frontal aspect (as in case of F-35 Lightning II) will have its own set of limitations while operating against a potential adversary endowed with strategic depth and capable of fielding decent ISR platforms including Airborne Early Warning & Control (AEW&C) aircraft. In spite of its 38,000-kg Maximum Take-Off Weight (MTOW), the F-22A remains a nimble adversary if detected and confronted, thanks to Thrust Vectoring (TV) controlled by a Hamilton Standard dual redundant Full Authority Digital Engine Control (FADEC) integrated with the flight control computers in the BAE Systems flight controls vehicle management system. Even in typical BPI missions the F-22A will retain considerable close-combat capability in form of Raytheon AIM-9X Sidewinder close-combat missiles loaded in the side bays backed up by a variant of the M61A2 Vulcan cannon installed internally above the right air intake. The General Dynamics linkless ammunition handling system holds 480 rounds of 20-mm ammunition and feeds the gun at a rate of 100 rounds a second.

Self defence situational awareness is further ensured by a Radar Warning Receiver (RWR) and a BAE Systems Information and Electronic Warfare Systems (IEWS) missile launch detector. Twin engines additionally provide the much needed redundancy preferred by pilots when required to fly long distances over the sea or over hostile landmass.

Boeing is responsible for mission software and avionics integration.

Early detection of hostile cruise and ballistic missiles or their launchers will be provided by the Active Electronically Scanned Array (AESA) AN/APG-77 radar developed by the Electronic Sensors and Systems Division of Northrop Grumman and Raytheon Electronic Systems. The radar comprises of 2,000 transmitter/ receiver modules, which provide agility, low Radar Cross Section (RCS), Low Probability of Intercept (LPI) modes and wide bandwidth. Details remain classified, yet the AN/APG-77 radar reportedly sport 125 to 150-miles ranges and can discriminate even some stealthy objects including cruise and ballistic missiles

F-22s and F-35 JSFs could be equipped with specialised munitions under a concept dubbed Air Launched Hit-to-Kill (ALHTK).

besides retaining the capability to generate high-resolution, in-flight synthetic aperture radar (SAR) maps. Incidentally the forward fuselage includes structural provisions for future growth in the radar via paired side-looking phased arrays. The radar is backed up by wide-band TRW CNI communications, navigation and identification system including an LPI Intra-Flight Data Link (IFDL) (to permit flights of F-22As to transparently exchange data in combat, including fuel states, weapons remaining, and targets being engaged), Joint Tactical Information Distribution System (JTIDS) link and an Identification Friend or Foe (IFF) system. A modern 'glass cockpit' comprising of Multi Function Displays (MFD), Head-Up Display (HUD) and Hands-On Throttle & Stick (HOTAS) eases pilot workload considerably and enables him to focus on combat and tactical parameters.

The primary F-22A weapon for interception of ballistic missiles may emerge as the Raytheon Network Centric Airborne Defence Element (NCADE) air launched weapon system which reportedly can be accommodated in F-22's main internal weapon bays after requiring only minor modifications. These otherwise carry six short- to medium-range Active Radar Homing (ARH) AIM-120C AMRAAM Air-to-Air Missile (AAM) with a range of up to 50-nautical miles or two AIM-120C and two 1,000-lb GBU-32 Joint Direct Attack Munitions (JDAM) or two AIM-120C and eight GPS-guided, Boeing GBU-40 Small Diameter Bomb (SDB). Designed to be an integral part of Ballistic Missile Defence (BMD) system, the Raytheon NCADE air launched weapon system consists of netted launch aircraft, fire control, cueing and targeting sensors, and interceptors. The interceptors can be launched from manned or unmanned aircraft to provide quick response to changing battle situations and mobile Tactical Ballistic Missile (TBM) launchers, plus being capable of engaging short-range and medium-range ballistic missiles in the boost, ascent or terminal flight phases. The NCADE concept uses modified components of the existing Raytheon AIM-9X and Raytheon AIM-120 AMRAAM Air-to-Air Missile (AAM), including the Imaging Infra Red (IIR) seeker (protected by a nosecone and aerospike during flyout and operation) from AIM-9X and the aerodynamic design, aircraft interface and flight control system of AMRAAM.

Combined with a first stage derivative of the AMRAAM rocket motor and control section, the second stage uses a new less toxic liquid propellant of Hydroxyl Ammonium Nitrate (HAN) fuel with very high density and specific impulse (125-lb of thrust for more than 25 seconds), for all upper-stage propulsion including axial, divert and attitude control system to provide endo-atmospheric and exo-atmospheric flight. Thus the missile capable of boost-phase interceptions, with the launching aircraft as mentioned earlier only need to penetrate to within about 160-km of the launch site with targeting provided by radar and Infra Red Search & Track (IRST) sensors to enable a upwards steep angled high-altitude launch. At high altitude, the IIR seeker is programmed to acquire a target, subsequently using its long burning second-stage motor for the intercept. The missile is expected to enter operational service by 2013. The F-22A has four external hardpoints on the wings, each rated to carry 2,270-kg, which can carry NCADE, AIM-120 AMRAAM or external fuel tanks on missions where stealth attributes are not obligatory and conceptually can accommodate PAC-3 in BPI and Terminal Phase Intercept (TPI) missions capable of striking down even Intermediate Range Ballistic Missiles (IRBM). However integrating the PAC-3 with F-22A will require upgrading the F-22A with an IRST system essential for tracking targets at exo-atmospheric altitude.

As apparent, the F-22A retains considerable advantage over F-35 in terms of all aspect stealth, combat persistence, power plant redundancy and inherent growth potential a reality adequately reflected by the Japan Air Self-Defence Force (JASDF) that aspires for a customised F-22 in its service especially in context of potential threat of Chinese and North Korean cruise and ballistic missiles. Japan has displayed clear disinterest on being offered F-35 or a 4.5th generation fighter with advanced weapons, sensors and networking, yet minus stealth as a bridge to the fifth-generation F-35.

Japan incidentally is a key provider of United States forward bases in the North East Asian region as well as dispersal and rapid deployment options in case of a military confrontation with Kadena AFB occasionally providing semi-permanent base of Raytheon AN/APG-63 (V3) AESA radar equipped F-15Cs from Elmendorf AFB, Alaska.

Sayan Majumdar

DraganFlyer-X6.

The Dream Machine

of Explosive Ordnance Disposal Operators (EOD)

"Give me some sunshine….." so sang Joy Lobo, one of the characters in the movie *Three Idiots*. One could wonder if that spirit behind the yearning for 'sunshine' has inspired some UAV helicopter manufacturers to conceive and build a UAV helicopter for Explosive Ordinance Disposal (EOD) Operators.

The defence forces of India are going through a dynamic process of modernisation assimilating state-of-the-art technologies for ensuring foolproof security of our borders and protection of our assets throughout the country.

In this context, among other weapon systems and platforms, what has come about is a new invention, the UAV helicopters. These fully automatic machines are capable of carrying payload ranging between 1.5kg to 350kg with endurance of 30 minutes to over 6 hours.

Such a UAV is capable of traffic surveillance, border and coastal security, chemical, radiation, explosive detection, gas/oil pipeline, electric line inspection, mapping and surveying, search and rescue operations, riots and crowd surveillance, emergency goods delivery, fire detection and surveillance, forestry and agriculture, convoy and motorcade escort, automatic surveillance and patrolling of pre-defined areas and search for hostages.

Of special relevance is the UAV helicopter's capability of detecting explosive ordinance for survey of battle area, assess weather conditions and facilitate remedial measures against bird menace. The remotely operated UAV helicopter provides increased safety distances from unexploded bombs thus eliminating need for human operators.

UAV helicopter with camera.

An unexploded bomb (UXB) could be found near a vital installation and its destruction on-site may not be feasible, making it necessary to transport the UXB to an earmarked location for disposal action. UXB disposal involves detection, identification and disposal and the process is time consuming, requiring a dedicated team of specialised personnel especially if the UXB is not correctly identified and specific technical knowledge is not known.

Generally, whenever an UXB is reported, all personnel or civilian must maintain safe distance which depends on the size and explosive quantity. In case the unexploded bomb is on the surface the search and identification becomes a simpler process as compared to that if buried. However for both detection and identification of an UXB, either a physical or remote search is required, and now globally, robotic vehicles are being used with cameras mounted on it for this purpose.

Presently, the Indian Air Force uses one such robotic vehicle (HOBO) manufactured by Kentree Limited of Ireland. This six-wheeled small crane kind of a machine has articulated arms with a claw. The fully moving claw-like hand can pick up small Improvised Explosive Devices (IEDs) and small explosive mines. The machine is powered by batteries with limited life and requires recharging. In case of continuous requirement it can run on an electrical cable but the range gets restricted. The operating console has various switches and keys along with a Joy Stick with which various operations including firing of a 12 bore gun is performed. The gun is loaded with 5 cartridges and can be used for breaking vehicle door/diggy locks or window glasses to get access into vehicles to collect IEDs. The machine-mounted camera provides the operator with visuals from various angles so that it can be operated remotely by monitoring live images on operating console monitor.

However, the EOD equipment with the IAF inventory is of old technology and requires upgradation and as the IAF pursues modernisation, re-equipping its EOD personnel with the latest state-of-art technology to ensure safe bomb disposal must also be considered top priority.

Remote camera console for operator.

UAV helicopter for bigger loads.

Within the process of detection and identification of any unexploded bomb, the UAV Helicopter plays an important role in its identification. The UAV can take high resolution photographic images and can be equipped with various types of cameras: day camera, thermal camera, infrared or ultraviolet cameras. Various sensors and electric devices can also be mounted on it subject to limitations of weight. Considering the challenges, the IAF may deploy radio controlled helicopters which can carry a small video camera. These helicopters come in various sizes with variety of engines (also run by petrol) and are designed for video filming, aerial photography, surveillance etc. These helicopters can lift small video cameras from which live video can be watched for detection and identification and can fly over any terrain or obstacles, can hover and provide live images to an EOD operator to plan a proper disposal action.

The helicopter can also be deployed at night, mounting portable search lights, but this is only for short ranges, as the operator has to keep the helicopter in sight, to avoid any accident. These helicopters can also be used for rapid surveillance of the perimeter fencing at military stations to enhance the security system.

UAV helicopter operationalisation is easy, training is not complicated, nor is deployment. It is time that the defence forces progressed the procurement of these versatile machines.

Wg Cdr R S Chauhan(Retd)

Airbus Military A330 MRTT on a high note

The Airbus Military A330 Multi Role Tanker Transport is poised to be delivered to three different customers in 2011, following a flurry of activities which ended 2010, and with its position cemented as the only tanker offered that is "real, certified, flying and refuelling today."

In a major exercise with the Portuguese Air Force on three days in November 2010, 25 F-16A/B pilots underwent air-to-air refuelling training, conducting more than 70 dry and wet

contacts in different weapons configurations, and expressing their satisfaction with the refuelling systems including the proven Aerial Refuelling Boom System (ARBS).

The operation came soon after the A330 MRTT´s first real-life refuelling mission involving two PoAF F-16s which were airborne when their home base of Monte Real was suddenly closed because of an emergency. The fighters, call-signs Tiger 71 and Tiger 72, had been conducting trials with the A330 MRTT and were accepted back to receive more fuel, enabling them to stay airborne until the end of the emergency and avoid having to divert to another airfield.

On 13 December the A330 MRTT Future Strategic Transport Aircraft (FSTA) for the UK´s Royal Air Force successfully completed a series of dry contacts for the first time, performing simulated refuelling with a F-18 fighter using the FSTA´s Fuselage Refuelling Unit. The Fuselage Refuelling Unit is the same that is offered on the EADS North America KC-45, the configuration of the A330 MRTT that is being offered to the U.S. Air Force.

The delivery process of the first aircraft to the Royal Australian Air Force is on-going. Final hand-over will take place once the lengthy review of all related documentation and activities are complete. The second aircraft for the Royal Saudi Air Force recently entered the conversion process in Madrid and the first is progressing smoothly towards delivery in 2011. The first aircraft for the United Arab Emirates has completed its structural conversion and is now undergoing systems installation in preparation for delivery in 2012.

Boeing contracted for new USAF aerial tankers

On 24 February 2011, the US Government formally announced the contract to Boeing for building the next-generation aerial refuelling tanker aircraft that will replace 179 of the USAF's 400 KC-135 tankers. The contract requires Boeing to design, develop, manufacture and deliver 18 initial combat-ready tankers by 2017. The KC-46A tankers will be built using a low-risk approach to manufacturing by a trained and experienced U.S. work force at existing Boeing facilities. The KC-46A tanker will also fuel the economy as it supports approximately 50,000 U.S. jobs with Boeing and more than 800 suppliers in more than 40 states (which seems to have been the main reason for the selection).

Cobham Aerial Refuelling Systems for KC-46A and C-130

Cobham has been selected by Boeing to provide hose and drogue aerial refuelling systems for use on the US Air Force's new KC-46A Tanker Aircraft. These systems will be manufactured by Cobham Mission Equipment at its new specialist air-to-air refuelling facilities in Davenport, Iowa. The USAF plans to acquire 179 KC-46A tankers from Boeing. Cobham expects to equip each aircraft with a centreline drogue system. Approximately 30 tankers will also be provided with a pair of wing-mounted aerial refuelling pods.

Cobham has also been awarded contracts in excess of $25 million from Lockheed Martin to supply aerial refuelling systems and external fuel tanks for that company's C-130 Hercules aircraft. Cobham's 48-000 series aerial refuelling pods and 1360-gallon external fuel tanks are standard equipment on all Lockheed Martin HC-130J, MC-130J, and KC-130J tanker models.

GE Aviation Secures Systems on Boeing Next-Generation KC-46A

GE Aviation will provide advanced technologies in mission control systems for the Boeing KC-46A aircraft, 179 of which will replace the current USAF tanker fleet. GE Aviation was selected for the mission control system, which includes flight management systems. GE's flight management system (FMS) provides the ability to fly shorter flight paths and idle-thrust descents which reduces fuel consumption, thereby lowering emissions and community noise levels.

First production F-35 Lightning II flies

First production model of the Lockheed Martin F-35 Lightning II made its inaugural flight on 26 February 2011 in preparation for delivery to the U.S. Air Force later this year. Test pilot Gigliotti flew from Naval Air Station Fort Worth Joint Reserve Base. The fighter will later move to Edwards Air Force Base, California, to support developmental testing shortly after the Air Force takes delivery.

During the flight, the conventional takeoff and landing (CTOL) F-35A variant, known as AF-6, underwent basic flight manoeuvring and engine tests. The aircraft will continue flight tests in Fort Worth for about a month before it is accepted by the Air Force. The F-35A CTOL variant, designed to meet U.S. Air Force requirements, is also the primary export version of the Lightning II to be employed by the air forces of Italy, the Netherlands, Turkey, Canada, Australia, Denmark, Norway and Israel.

Russia launches $650 billion military spending drive

The Russian Government has launched its long-awaited $650 billion rearmament plan in February 2011, adding eight nuclear submarines and hundreds of warplanes to its increasingly obsolescent inventory. The programme revealed by Deputy Defence Minister Vladimir Popovkin has Russia building 100 new ships and acquiring 1,000 helicopters, figures

that would dramatically swell the number of modern and battle-ready craft.

The Kremlin has repeatedly announced a boost in spending on the military whose status were scoffed at by the United States' mission to NATO in cables published by the WikiLeaks website. The new strategy has Russia funnelling much of its resources on nuclear submarines and next-generation anti-missile defences to replace the already-deployed S-300 system that has been sought by nations such as Iran. It envisions the nuclear submarines equipped with a new generation of ballistic missiles and supported by highly manoeuvrable frigates and other small destroyers. However, Russia's strategy of regaining naval parity with the United States was hurt by confirmation that the military did not earmark any new aircraft carriers which will leave Russia with just one carrier for the coming decade compared to the 11 in operation and six kept in reserve by the United States. The Russian Air Force also appears to be delaying plans to launch its next generation of strategic bombers, a project that has been speculated through the media for much of the past decade.

France orders new-gen Sagem drones

The French defence procurement agency DGA has contracted Sagem (Safran group) for the modernisation and expansion of the French army's force of Sperwer tactical drones and associated equipment. Developed and produced by Sagem, the RVT comprises a touch screen and portable transmitter-receiver, either a manpack version or installed in a vehicle. The RVT is used by forward observers or front-line troops and provides a high-resolution, real-time display of geo-referenced images sent by the drone, against a digital map background. The RVT features a modular, open and scalable design and can operate at different frequencies with different waveforms. This latest contract will bring the number of Sperwer drones produced by Sagem's Montlucon plant in France to 130.

Boeing EA-18G Growlers deployed by US Navy

The EA-18G Growler airborne electronic attack aircraft was deployed by the U.S. Navy for the first time on 21 February 2011. The EA-18G is the only air combat platform that delivers full-spectrum airborne electronic attack (AEA) capability along with the targeting and self-defence capabilities derived from the Navy's frontline fighter, the F/A-18E/F Block II Super Hornet. A derivative of the two-seat F/A-18F Block II, the EA-18G's highly flexible design enables fighters to operate either from the deck of an aircraft carrier or from land-based airfields. It is replacing the Navy's current AEA platform, the EA-6B Prowler, which has been in service since 1971. The EA-18G joined the Navy's aircraft fleet in 2008, when it was introduced to fleet training squadron VAQ-129. Boeing, acting as the weapon system integrator and prime contractor, leads the EA-18G Growler industry team, which also includes Northrop Grumman, Raytheon and General Electric Aircraft Engines.

$726.6m contract for 'sustainment' of Raptors

Lockheed Martin has received a $726.6 million contract modification from the U.S. Air Force for sustainment of the F-22 Raptor fleet. This modification is for the 2011 Follow-On Agile Sustainment for the Raptor (FASTeR) sustainment contract, which was awarded initially in 2008, with an option for 2009 that was exercised. FASTeR is a Performance-Based Logistics contract providing weapon systems sustainment of the F-22 fleet at all operational bases for the 2011 calendar year, including training systems, customer support, integrated support planning, supply chain management, aircraft modifications and heavy maintenance, sustained engineering, support products and systems engineering.

In 2010, the U.S. Air Force deployed the Raptor around the world, including to Guam, Japan and the United Arab Emirates. In January 2011, F-22s from Elmendorf AFB, Alaska, flew 100 percent of scheduled sorties during a deployment to Kadena Air Base, Japan.

Rolls Royce engine support for C-130

Rolls-Royce has received two major support contracts, worth a total of US$ 246 million, to cover support for engines powering C-130 Hercules in operation with the US and UK militaries. Rolls-Royce will provide the US Air Force with comprehensive propulsion system services for its fleet of C-130J aircraft, flown by the US Air Force, US Air Force Training Command, Air National Guard, US Air Force Reserve and US Air Force Special Operations Command. Rolls-Royce has also signed a one-year contract extension, valued at over $43 million, for the support of the RAF's C-130 military transport fleet. The agreement was signed with Marshall Aerospace, the prime contractor for the Hercules Integrated Operational Support (HIOS) programme, and provides continued support for both 'J' and 'K' aircraft variants in service with the Royal Air Force.

Debut of the AgustaWestland AW139M

Debut of the AgustaWestland AW139M, customised military version of the multi-role AW139 helicopter, integrated with U.S. military technology for the U.S. Air Force's Common Vertical Lift Support Programme, has taken place. Manufactured in the company's Philadelphia, Pennsylvania facility, the AW139M includes a high-definition FLIR, self protection equipment including infrared detection and countermeasures, avionics and heavy duty landing gear. For military missions, the AW139M features a low thermal and acoustic signature and is available with a full ice protection system, allowing all-weather operation at the U.S. Air Force's northern-tier missile bases.

The AW139M CVLSP also includes dedicated equipment such as armoured seats to improve crew protection; ballistically-tolerant, self-sealing fuel tanks and an external stores system for carrying gun pods, missiles and air-to-ground rockets. With the highest power-to-weight ratio in its class, the AW139M sets standards of multi-mission performance in hot and high conditions with a cruise speed of 165 knots. The AW139M provides 30 percent more cabin volume and 50 percent more payload than the legacy CVLSP platform, while maintaining a similarly-sized external footprint.

Upgraded S-70A Black Hawk simulator with Australian Army

CAE Australia, prime contractor under the Management and Support of the Australian Defence Force's Aerospace Simulators (MSAAS) contract has upgraded the S-70A Black Hawk FFMS with electronic warfare capabilities which includes the addition of a new missile warning system, countermeasures dispensing system, and missile warning sensors. CAE also recently completed a visual upgrade of the simulator by adding the CAE Medallion-6000 image generator.

Airbus Military A400M refuelling trials with RAF VC10

Airbus Military has begun air-to-air refuelling trials of the A400M airlifter using a Vickers VC10 tanker of the Royal Air Force operating from Toulouse. A400M development aircraft Grizzly 1 performed a series of dry contacts with the VC10´s fuselage-mounted hose drum unit (HDU) on the first day of the trials on 15th February. The RAF is one of the launch customers for the A400M.

Raytheon demonstrates JSOW-C from F-16

Raytheon have completed a series of free-flight demonstrations of the Joint Standoff Weapon (JSOW) AGM-154-C from an F-16, as part of the Indian Air Force's Medium Multi-Role Combat Aircraft (M-MRCA) competition. JSOW is a family of low-cost air-to-ground weapons that employs an integrated GPS/Inertial Navigation System and terminal infrared seeker that guide the weapon to the target. The system has a maximum range of 130 kilometres (80.5 statute miles) from high altitude and can penetrate more than 1.5 meters (approximately 5 feet) of reinforced concrete.

US Navy Awards GE F414 PBL contracts

GE Aviation has been awarded a three-year (2011-2013), $576 million Performance Based Logistics (PBL) contract from the U.S. Navy covering the repair, replacement and programme support for F414 engine components for the F/A-18 E/F and EA-18G Growler aircraft. These contracts build on the success of a series of previous F414 PBL contracts dating back to 2002. Since the introduction of PBLs, the Navy has realised significantly lower acquisition costs with improved readiness while GE added considerable value to the military aftermarket. Twin F414 engines power F/A-18E/F Super Hornets and EA-18G Growlers. The F414 engine for the F/A-18E/F and EA-18G is rated at 22,000 pounds (98 kN) thrust and is in the 9:1 thrust-to-weight ratio class. The U.S. Navy has taken delivery of more than 1,000 F414 engines with more than 1.5 million engine flight-hours accumulated to date.

The F414 has also been selected as powerplant for the Saab Gripen NG and India's Light Combat Aircraft (LCA), and is a candidate for other combat aircraft under development.

Rolls-Royce delivers milestone Typhoon Engine

Rolls-Royce has delivered the 750th EJ200 engine to be produced on behalf of the Eurojet consortium, the engine assembled at the Rolls-Royce facility in Bristol. The EJ200 engine recently reached 200,000 hours of in service-operation with air forces in the UK, Germany, Italy, Spain, Austria and Saudi Arabia. The EJ200-powered Typhoon is currently being evaluated for India's Medium Multi-Role Combat Aircraft requirement. In 2010 Rolls-Royce concluded an innovative service contract worth £865 million with the UK Ministry of Defence to provide the RAF with a guaranteed level of availability for its EJ200 engines. Rolls-Royce has now delivered 265 EJ200 engines to the RAF.

E-2D Advanced Hawkeye first Carrier landing

Northrop Grumman's E-2D Advanced Hawkeye, the U.S. Navy's newest airborne early warning and command and control aircraft, has carried out landings on the USS *Harry S. Truman* (CVN 75) and begun carrier suitability testing. With 99 percent of radar testing complete, the purpose of this phase of testing is to assess the aircraft's effectiveness in an operational environment. While onboard the *Truman*, all aspects of aviation/ship integration will be addressed, including logistics, manpower and interoperability, as well as catapult and arrested landing structural tests. The new aircraft will be able to scan a larger area, detect smaller objects and process information more quickly than its predecessor. E-2D aircrew will accomplish these tasks through improved all-glass cockpits and tactical operator stations.

Raytheon APY-10 Radar for Boeing's P-8A Aircraft

Boeing has awarded Raytheon a low rate initial production contract to develop six long-range, multi-mission maritime and overland surveillance radars plus spares for its P-8A Poseidon aircraft. The P-8A replaces the P-3 Orion to be used for maritime surveillance. The APY-10, the premier sensor for maritime and overland missions, was designed for the Navy's Poseidon aircraft and will replace the APS-137 radar.

Building on more than 40 years of proven Raytheon technology, the APY-10 delivers accurate and actionable information in all weather, day and night, for anti-submarine warfare, anti-surface warfare and intelligence, surveillance and reconnaissance missions. A member of the Boeing-led industry team for the Navy's P-8A programme, Raytheon has previously delivered four APY-10 systems and spares to Boeing and is contracted to deliver an additional nine systems for the Navy's P-8A.

Initial P-8A production contract

Boeing has been awarded a $1.5 billion contract by US Naval Air Systems Command for Low-Rate Initial Production (LRIP) Lot 1, procurement of six P-8A Poseidon Multi-mission Maritime Aircraft, plus associated spares, support equipment and tools, logistics support, trainers and courseware. Contract completion is anticipated in January 2013. Firming of the contract follows an initial $109 million advance acquisition order for long-lead items for these aircraft awarded on 13 April 2009.

Boeing has announced that it has completed full scale static testing of the P-8A airframe. The series of tests, which began in May 2009, have confirmed the airframe's structural integrity. Aircraft S1, the programme's full-scale static ground-test vehicle, underwent 154 different tests, sustaining loads equal to or in excess of those anticipated during operational flights. During the 74th trial, the airframe was subjected to 150% of the highest expected flight loads. In September, Boeing will begin refurbishing S1 so that it can be used for live-fire testing at the Naval Air Warfare Centre at China Lake, California. Fatigue test on the second ground-test vehicle, S2, will begin later this year.

The US Navy intends to purchase 117 P-8As for the anti-submarine warfare, anti-surface warfare, intelligence, surveillance and reconnaissance roles, replacing the current P-3 Orion fleet. Initial operational capability is scheduled for 2013 at NAS Jacksonville, Florida.

527 Eurocopters delivered in 2010

Eurocopter generated an increased turnover in 2010 with the delivery of 527 helicopters, the year was also marked by achievements in innovation, new products, services and the company's SHAPE transformation programme, all of which position the group for a future upturn of the civil and military rotary-wing marketplace. The 2010 deliveries provided a turnover of 4.8 billion euros, representing a growth of six percent compared to 2009. These included 28 NH90 multi-role military helicopters and 15 Tiger attack helicopters, twice as many as in 2009 for both aircraft, as well as the first three of 50 EC725s for the Brazilian Armed Forces and the 100th UH-72A delivered to the U.S. Army. New orders for 346 Eurocopter rotary-wing aircraft last year were equivalent to the company's business volume of previous years prior to the peak periods of 2007/2009, and represented a value of 4.3 billion euros. These bookings included key Super Puma family contracts for Malaysia and Mexico, along with strategic Ecureuil orders in Russia and the United States.

First Gripens in Asia

The Royal Thai Air Force has become the first arm in Asia to induct the new generation Saab Gripen multi-role combat aircraft, the first six of which being flown to their base at Surat Thani in the last week of February 2011. The fighters were flown by Swedish pilots, having left Sweden on 18 February with stops at Hungary, Greece, Egypt and India (Port Blair) en route to Thailand. They are the first batch of 12 Gripen 39 C/D fighters which will replace the ageing F-5A/B jets of the RTAF.

The Thai Air Force commander Air Chief Marshal Itthaporn Subhawong welcomed the aircraft at Surat Thani. Two RTAF pilots, who have converted on the Gripens in Sweden, flew in the two-seaters. "Thailand is the first country in Asia to have Gripens," said Gp Capt Putthipong Phonchiwin, who had earlier completed Gripen training. He said his experience with the fighter was unforgettable. "The Gripen is very cool indeed. For me, it's the number one fighter."

In comparison with the earlier F-5, "this is like comparing a sedan and a sports car." The Thai Air Force is deputing 10 more pilots to convert on the Gripen with the remaining six jets scheduled to arrive in Thailand in 2012. One of six pilots who underwent the basic flight course on the Gripen, Wing Cmdr Duangsoongnern said, "The RTAF's addition of Gripen is a significant addition to air power in the region. With full use of its support systems, including weaponry and air defence, Gripen is regarded as a fighter of the future."

Wg Cdr Jakkrit Thammawichai, Commanding Wing 701 in Surat Thani where the first six Gripen will be stationed added,

"another six Gripen jets and their support systems would be handed to Thailand later. Four of the fighters are two-seaters for training, while the other eight, the C model, are single-seaters." With real-time data links through encryption among all aircraft, the Gripen is superior to other fighters which can be engaged at a ratio of one to four, or even one to eight "which well explains why we don't need to employ them in large numbers," he quipped!

Unlike US-made fighters, in which technology regarding electronics warfare has been classified, Gripen offers open training including electronic countermeasures. "This means we can stand on our own in terms of mastering difficult and advanced technologies. This is a great leap forward for the RTAF," he concluded.

Sukhoi adds 2nd PAK FA prototype to flight tests programme

First flight of the second prototype of the fifth generation aviation complex (PAKFA) took place in Komsomolsk-on-Amur on 4 March 2011. The aircraft piloted by distinguished test pilot of the Russian Federation Sergey Bogdan, was airborne for 44 minutes, and in full compliance with the flight plan. Stability tests were conducted during the flight as well as evaluation of the power plant systems'.

The maiden flight of the PAKFA prototype had taken place on 29 January 2010, also in Komsomolsk-on-Amur. Acceptance tests of the prototype were completed end March 2010, and on 8 April 2010 the prototype was flown to the flying test centre of the Sukhoi Design Bureau in Zhukovsky, near Moscow. Upon completion of the required volume of preliminary tests on the stands of systems and components, including static strength tests of the static prototype, ground tests of the aircraft stand and the flight model, the aircraft had started flight tests on 29 April 2010 in accordance with the preliminary tests programme. The prototype PAKFA has completed 36 sorties.

Airbus Military completes A400M tests for EASA certification

Airbus Military has completed the number of required simulated flight-cycles on a full scale test airframe to achieve civil type certification of the A400M by the European Aviation Safety Agency (EASA). The test programme is required to simulate flights at least one year ahead of the actual operations performed by the aircraft. The test specimen at Dresden (MSN5001), has undergone 1,665 cycles, about five times the maximum number of flights expected to be recorded annually by each A400M in service, in order to give a large safety margin. By mid-2012, 25,000 simulated flights will have been performed, equating to 2.5 times the A400M´s design-life.

Saab Gripen System "backbone of Swedish Air Defence until 2040"

The Swedish Armed Forces have recently released their budget proposals that include planned spending and planned procurement for the coming four years within which a clear commitment to the JAS 39 Gripen for another 30 years is expressed. The Swedish parliament has previously decided that the Gripen system will provide the back-bone of Swedish air defence until 2040. In the budget proposal the Armed Forces have contended for an upgrade of the JAS 39 Gripen fleet during 2020-2030 to remain competitive.

"This clear commitment to the Gripen system is of course positive for us. We are part of the capability upgrades and can support the needs of the Swedish Armed Forces. This is also a cost efficient way for Sweden to have a competitive fighter aircraft over the coming 30 years," said Jonas Hjelm,

Senior Vice President and Chief Marketing Officer, and added, "At the same time it is important to remember that the budget proposal is part of a larger process and political standpoints."

Sri Lanka Air Force's 60th Anniversary

Sixty years of the Sri Lanka Air Force (SLAF) were celebrated at SLAF Base Ratmalana on 2 March 2011 with a commemorative parade and a fly past. The President and Commander-in-Chief of the Sri Lankan Armed Forces, Mahinda Rajapaksa took the salute as Chief Guest alongside Commander of the Air Force, Air Marshal Harsha Abeywickrama.

1,400 Officers and Airmen slow marched under the SLAF ensign at the parade which also carried the 9 Presidential Colours awarded to the SLAF and its integral units for 'excellence in service'. As the parade concluded there was a fly past led by a Bell 412 carrying the National Flag, then transport and attack helicopters, concluding with training aircraft and fighters in formation. Tragically a day earlier, two SLAF Kfir fighters had collided midair over Gampaha, a district to the north of Colombo, about 30 km from the Capital during a practice flypast.

China enhances defence expenditure by 12.7%

On 4 March 2011, just days after India's own defence budget was presented to Parliament, China announced a 12.7% hike in its 'declared' defence budget, which will be $91.5 billion, in comparison to which India's annual defence expenditure is one-third, at $36 billion. However, 'China experts' believe that the country possibly spends double the declared amount, so as to modernise and support its 2.25-million strong People's Liberation Army.

J-IIs of the PLAAF.

Analysts opine that the primary reason for China's hike in its declared defence budget and rapid modernisation of its armed forces is to deter US from interfering in its neighbourhood, especially Taiwan but also to keep India off-balance especially in its north-eastern region and Ladakh in eastern Kashmir.

Indian defence planners and geopolitical observers continuously monitor China's unrelenting position on the boundary issue and the occasional assertive behaviour all along the 4,057 km Line of Actual Control, China's expanding strategic moves in the Indian Ocean Region and assistance to Pakistan in building its nuclear, missile and conventional military arsenals.

Li Zhaoxing, spokesman of the Chinese parliament, justified the increase by pointing to the levels of military spending by India and the US. "It's true that China's defence budget is raised a bit, but the ratio of the defence spending in the country's GDP remains very low, much lower than those of many other countries", he said.

Defence expenditure is 1.4% of GDP in China, added Li, while that ratio in India is much higher than 2%.This, however, is factually wrong since India's defence expenditure is 1.83% of the projected GDP for 2011-2012.

China and Pakistan to conduct joint exercises

China and Pakistan have announced their military exchanges schedule for 2011, which includes two joint exercises, the first being multinational naval exercises in March, apart from two bilateral army and air force exercises. During the 8th round of China-Pakistan defence and security talks in Beijing in February 2011, Chinese Peoples Liberation Army chief Gen Chen Bingde informed the visiting Pakistan Army Lt. General Khalid Shameem Wynne that "China is willing to work with his country to develop the mechanism of defence and security talks, deepen strategic cooperation and contribute to the peace, stability and common development in the region and the world".

People's Liberation Army (PLA) soldiers take part in a parade during an open day at a PLA naval base in Hong Kong.

Gen Wynne said ties between the two countries are based on the principle that China has a role in maintaining regional peace and stability. "That's why we can move forward on joint efforts, on the development of sophisticated weapon systems, including aircraft and tanks, and in the area of anti-terrorism", he said.

"China can go to war for national interests"

Terming US attempts to woo India and other neighbours of China as "unbearable," an article in a Communist Party magazine has said that Beijing must send a "clear signal" to these countries that it is ready to go to war to safeguard its national interests. The article published in the *Qiushi Journal*, the official publication of the ruling Communist Party of China ruled that China must adhere to a basic strategic principle of not initiating war but being ready to counterattack.

"We must send a clear signal to our neighbouring countries that we don't fear war, and we are prepared at any time to go to war to safeguard our national interests," suggesting an aggressive strategy to counter emerging US alliances in the region. "Throughout the history of the new China, peace in China has never been gained by giving in. Safeguarding national interests is never achieved by mere negotiations, but by war". The article went on to focus on the fact that countries like Japan, India, Vietnam, Australia, the Philippines, Indonesia, and Korea are trying to join the anti-China group because they either had a war or a conflict of interest with China. "What is especially unbearable is how the US blatantly encourages China's neighbouring countries to go against China".

Chinese MBT.

The article suggested that China should use its economic clout and trade as a weapon to rein in neighbours. "China's neighbouring countries need China's international trade more than China needs them, with the vast majority of China's trade deficit caused by these countries," it said. "Therefore, they, but not China, will suffer greater damage by antagonising China. China should make good use of these economic advantages and strategic power. This is also the most effective means to avoid a war."

According to the article, "the US has adopted a series of strategies to contain China like through an exchange rate war, through a public opinion war, besides launching military exercises and simulated warfare, and the development of an anti-China alliance. China on its part, can consider the idea of launching economic warfare through strategies to contain the US dollar and making effective use of forums like the IMF and initiating a space war by developing strong space weapons."

"China's military might doesn't worry India much"

Following inauguration of the Asian Security Conference organised by the Institute of Defence Studies and Analyses (IDSA) at New Delhi on 27 February 2011, Defence Minister AK Antony said, "Modernisation of armed forces of China and its ever-increasing military spending is a matter of serious concern,

but we are not unduly worried because we will modernise and strengthen our armed forces."

The Indian Defence Minister said the review of capabilities of the country's armed forces was an "ongoing and a constant" process and the defence preparedness was being reviewed on regular basis. "If there are any gaps, they will be filled up," Antony assured. He said India was strengthening its capabilities and infrastructure in that area. The government was also modernising armed forces and strengthening infrastructure in border areas, he added.

After China started deploying missiles and strengthening its military infrastructure along the northern borders, India has also upgraded its roads and aviation infrastructure there. The first step in that direction was the upgradation of existing but defunct air strips at Daulet Beg Oldi, Fukche and Nyoma, in northern and eastern Ladakh with intent to also forward base combat aircraft there. There are also reports on the raising of two new mountain divisions, both in the North-East. Asked if the Indian military modernisation was moving at a slower pace than China's, Antony said, "We are not modernising our armed forces by keeping in mind any other country. We are modernising our forces on the basis of a comprehensive review of the emerging security scenario around us."

On the reported Chinese objections over the trilateral *Malabar*-series of naval exercises among India, the USA and Japan, he said, "This was started 15 years ago and we hold it every year. There is nothing against a particular country. It is to increase capabilities of our Navy."

NH90 TTH first flights

The Tactical Transport Helicopter variants of the NH90 for France and Spain carried out maiden flights from Marignane on 17 December 2010. The one-hour flight by the French TTH included evaluation of dynamic systems and handing qualities and initial avionics tests, then flying on to flight test centre at Istres for further testing. France has 34 NH90 TTHs on order, with a first deliver due in late 2011.

The Spanish TTH is equipped with General Electric CT7-8F5 turboshafts, selected in preference to the standard RTM322 or GE T700. Spain will receive 45 NH90s, with the first helicopter to be handed over in 2012. The first two Spanish aircraft are to be completed at Marignane, before production begins at Eurocopter's Albacete facility.

Philippines to receive Hercules and Broncos

The Philippine Air Force is to buy a refurbished C-130H and also receive an undisclosed number of OV-10 aircraft being donated by the Royal Thai Air Force. Meanwhile, the 205th Tactical Helicopter Wing has accepted the latest five ex-US Army UH-1Hs after their arrival in the Philippines on 18 December 2010.

A400M 'Grizzly 4' in first flight

The fourth Airbus Military A400M (MSN004) made its first flight on 20 December 2010 with 'Grizzly 4' completing its 5-hour 10-minute maiden flight from Seville with test pilots Klaus-Dietrich Flade and Christophe Cail in command. By the end of 2010, the development of aircraft fleet had completed 300 flights amounting to just over 1,000 from a planned total of 3,700 flight hours. MSN004 will be chiefly used for cargo and aerial refuelling developments.

Indonesian Air Force re-equipment plans

In addition to more F-16s, the Indonesian Air Force is to receive new jet trainers, transports and helicopters, even as the US is offering 24 surplus USAF F-16A/Bs or six new F-16C/D Block 52s. The Indonesians have short listed the Aero Vodochody L-159, Korea Aerospace Industries T-50 and Yakovlev Yak-130 for its advanced jet trainer requirement, with plans for an initial buy of 16 aircraft. As well as supplementing the Hawk fleet, which suffers from lack of spares, the new trainer will be used for light attack and air defence. It is learnt that the Grob 120TP has been selected as the basic training aircraft of choice.

As for transports, Indonesia wants to acquire new C-130s and locally built CN235s in addition to replacing it F.27 fleet and upgrading existing C-130A/B's. Rotary-wing upgrades will come in the form of 24 Bell 412Ep utility helicopters and additional locally built AS332s. The Indonesian Navy is meanwhile looking to replace the Bo105 helicopter onboard its new corvettes.

Eitan squadron established

A formal ceremony was held at Tel Nof Air Base on 20 December to officially inaugurate the Israeli Aerospace Industries Eitan high-altitude long-endurance UAV, indigenously developed jointly by the Israel Air and Space Force (IASF) and Israel's homeland security industry. The type had officially been commissioned into IASF service at Tel Nof on 21 February 2010. The twin-boom Eitan is the largest UAV to have been developed in Israel and is a scaled-up version of the IAI Heron, although with a wingspan of more than 85ft (26m), it is more than four times the size of the Heron. The Eitan is powered by a Pratt & Whitney Canada PT6A-67 turboprop, has a maximum take-off weight of 11,022lbs (5,000kg), including a 3,968lbs (1,800kg) payload and can stay on station for more than 20 hours at altitude in excess of 40,000ft (12,200m).

UAE to resume Rafale negotiations

Reports in the French media suggest that the United Arab Emirates is prepared to resume talks concerning a possible order for the Dassault Rafale, although earlier talks had been suspended owing to various reasons. The UAE has now apparently stipulated that the Rafale it would consider for acquisition must be equipped with upgraded M88 engines, active electronically scanned array radar, Meteor missiles, Damocles targeting and Reco NG reconnaissance pods. The UAE also wants France to find a buyer for its current 60 Mirage 2000s in service with the UAEAF.

Orions for Singapore?

Singapore is reportedly considering acquisition of ex-US Navy P-3C Orions for which a letter of request has been issued, for the acquisition of 4-5 aircraft. These would likely be to the same configuration as 12 second-hand Orions due to be delivered to Taiwan from 2012. Lockheed Martin is also considering offering several upgrades for its P-3C including the 3.5 version of Rolls-Royce's T56 engine plus new propellers. The new equipment would improve reliability, fuel efficiency and performance and increases the aircraft's endurance. The contractor is also looking at the possibility of installing winglets on the aircraft and hopes to conduct wind tunnel evaluations of several different configurations in late 2011.

Final deliveries of F-16C/Ds to Pakistan

On 13 December 2010, the Pakistan Air Force inducted its fourth and final batch of F-16C/D Block 52+ fighters from the USA. The six aircraft were the last batch of the 18 fighters ordered under *Peace Drive* I in 2005 and their arrival was marked by a ceremony at Shahbaz air base, near Jacoabad. Meanwhile, the PAF is in the process of establishing a second JF-17 Thunder squadron (No.16), with plans to order a second batch of 50 aircraft in 2011. The follow-on aircraft are likely to feature new avionics and weapons.

Ecuador gets Cheetahs, options for transports

South African company Denel Aviation have confirmed the sale of 12 Atlas-built Cheetah fighters to Ecuador, the former South African Air Force aircraft having been retired from active service in April 2008 and since stored. The deal with Ecuador will see Denel provide single-seat Cheetah Cs and two-seat Cheetah Ds together with associated maintenance and support for five years, with an option for renewal. Contract talks between Denel, the state-run Armscor agency and Ecuadorian Air Force began in 2009, and an FAE team visited South Africa in April 2010 to inspect the Cheetahs and witness evaluation flights. The fighters will be fully refurbished and flight-tested in South Africa prior to delivery to South America.

Meanwhile, China and Ecuador have begun talks with a view to supplying the Ecuadorian Air Force with two Xian MA-60H-500 transports, plus two options, worth around $38 million. The Ecuadorian Air force would use the MA-60s to replace its last three HS748s.

As elsewhere reported in this Issue, Ecuador has ordered another HAL Dhruv ALH to replace the example lost during a parade a year ago.

Hongdu K-8 Karakoram for Bolivia

Delivery of six Chinese Hongdu K-8 Karakoram jet trainers and light combat aircraft for the Fuerza Aérea Boliviana (FAB – Bolivian Air Force) is scheduled to take place in April, as announced by FAB Commander Genereal Tito Gandarilla.

The contract for purchase of the K-8s had been formally signed on 30 September 2009. However, at the time no details of the planned delivery schedule were revealed for the aircraft. The aircraft, which are expected to remain in service for around 15-20 years, are intended to replace the FAB's nine remaining veteran Canadair T-33A/Ns. The K-8s will be used primarily in counter-narcotics operations in particular around the Cochabamba area in central Bolivia, where there is a very high level of illegal production of the coca plants that are used to make cocaine.

Brazilian AF orders Hermes 450 UAVs

Elbit Systems Brazilian subsidiary, Aeroelectronica, has been awarded a contract to supply Hermes 450 unmanned aircraft systems (UAS) to the *Força Aérea Brasileira* (FAB – Brazilian Air Force). It was earlier reported that two air vehicles and one ground station would be ordered, the deal following previous in-country testing of two Hermes 450s on a one-year lease from the manufacturer.

Seychelles Coast Guard expands

The Seychelles Coast Guard Air Wing is to acquire five additional aircraft over the next few months, which includes the HAL-Dornier 228 and two HAL-Chetak helicopters being gifted by India. Details of the remaining two aircraft that are being acquired are unknown.

Russia to acquire 'Mistral'-class helicopter carriers

Russia is to acquire up to four French *Mistral*-class amphibious assault vessels, each capable of carrying up to 16 helicopters, the Russian Defence Ministry having selected a consortium comprising French company DCNS and Russia's United Shipbuilding Consortium to provide new amphibious assault ships for the Navy. In the first phase of the programme, two vessels will be built jointly by France and Russia at the STX shipyard in Saint Nazaire, France. A further two will then be constructed later at the Admiralty Shipyards in St Petesburg, Russia. The vessels will be deployed in the Northern and Pacific fleets, probably with navalised Ka-52MD, Ka-29 Helix-B, Ka-27M and Ka-31 helicopters embarked.

Singapore inaugurates Seahawk squadron

At an official ceremony held at Sembawang Air Base on 18 January 2011, the Sikorsky S-70B Seahawk went into service with the Republic of Singapore Air Force's 123 Squadron, presided over by Minister for Education and Second Minister for Defence Dr Ng Eng Hen. The unit became the Singapore Armed Forces' first naval helicopter squadron and will be part of the Helicopter Group under the RSAF's Participation Command, which was formally set up in 2007 in order to develop and deploy air power in support of land and maritime operations.

Singapore purchased six S-70Bs for the Republic of Singapore Navy under a contract signed in January 2005, and as the Navy has no previous aviation experience, these are being operated on their behalf by the RSAF. Deliveries commenced in 2009, but the helicopters remained in the USA for 12 months as the RSAF's *Peace Triton* detachment, based at Naval Air Station North Island, California, to undertake crew training. All six S-70Bs finally arrived in Singapore in October 2010.

Originally formed in 1979 as a basic training wing for the RSAF, 123 Squadron was latterly operational in support of the Army with Singapore's first dedicated armed helicopter, the AS550 Fennec. After the Fennecs were withdrawn in May 2006, the unit has had no aircraft assigned, until now. Following its official commissioning, 123 Squadron will now continue to work towards achieving full operational capability with its S-70Bs. Each helicopter operates with a crew of four, comprising two RSAF pilots, plus two Navy personnel, a sensor operator and a tactical coordination officer.

Third Il-78 MP for PAF

Maiden flight of the third Ilyushin Il-78 MP aerial refuelling tanker for the Pakistan Air Force (PAF) took place in Ukraine on 11 December 2010, following completion of overhaul and conversion. The aircraft, R10-003 will join R9-001, delivered in December 2009 and R10-002 delivered in October 2010. A total of four are on firm order, while there is an option for a fifth aircraft.

Philippines gets ex-US Army Hueys

An additional five UH-1Hs were handed over to the Philippine Air Force in a ceremony on 10 January 2011 at Col Jesus Villamor Air Base, Pasay City, Manila to be operated by the 205th Tactical Helicopter Wing. These were shipped from Jacksonville, Florida by sea and arrived in Manila in mid-December. After being test flown, these were then accepted by a PAF Technical Inspection and Acceptance Committee.

The five UH-1Hs form the final element of a batch of helicopters being donated to the Philippines as 'Excess Defence Articles' under a programme initiated in October 2003 by former US President George Bush. The first ten were handed over to the PAF in the Philippines on 9 June 2007. Although the current PAF inventory includes 63 UH-1Hs, many are non-airworthy and awaiting spare parts.

F-22A Raptors deployed in Japan

According to US Air Force officials, 15 F-22A Raptors have been deployed to Kadena Air Base, Japan from January 2011 for a four-month assignment. Deployment of the aircraft, from the 3rd Wing's 525th Fighter Squadron at Joint Base Elmendorf-Richardson, Alaska, is a routine detachment to support US Pacific Command's security obligations in the region. Additionally, Kadena is also to host F-16s from the 18th Aggressive Squadron at Eielson Air Force Base, Alaska, until mid-February for adversary training with Kadena F-15 pilots.

It is surmised that if Raptors were to make an appearance at Aero India 2011, as was widely rumoured before the event, these would have come from Kadena.

Pakistan-Saudi joint exercise *Al Saqoor II*

The bi-lateral Pakistan Air Force and Royal Saudi Air Force air power employment exercise Al Saqoor II took place from 6-19 January 2011 in Saudi Arabia. The PAF contingent deployed to Saudi Arabia for the exercise included F-16 and Mirage aircraft, while the RSAF deployed its F-15C/Ds. The PAF F-16s were from No.11 Squadron *'Arrows'* at PAF Base Sargodha (Mushraf). The exercise took place at Taif-King Fahd Air Base, which is home to the F-15C/Ds of No.5 and No.34 Squadrons of the RSAF.

Combined air operations were undertaken in "a realistic environment to assist the aircrews from both air forces to hone their skills and further enhance military cooperation between the two countries." Earlier, on 15 December, PAF chief Air Chief Marshal Rao Qamar Suleman visited Saudi Arabia to fly with the RSAF as a prelude to the exercise and to discuss further enhanced cooperation with RSAF chief Gen Mohammed Abdullah Al-Aish.

First Korean Air A380

The first A380 for Korean Air has been rolled out of the Airbus paint shop in Hamburg bearing the airline's distinctive livery. The aircraft is the first of ten A380s ordered by the airline. Korean Air will become the sixth operator of the A380 when it takes delivery of its first aircraft in the second quarter of this year.

Lion Air adds 15 new ATR 72-500s

Indonesia's Wings Air and its parent company Lion Air have signed an operational contract for the purchase of 15 additional ATR 72-500s, bringing the total fleet of ATRs operated by Wings Air to 30. ATR and Lion Air had previously inked a contract in 2009 for the purchase of 15 ATR 72-500s and options for 15 additional aircraft. The deal represents the conversion of all 15 options, resulting from a strong growth of Wings Air's and Lion Air's markets.

Gulf Helicopters order five AW139s

Gulf Helicopters of Qatar have ordered five AW139 helicopters, the aircraft being equipped for offshore passenger transportation operations. This latest contract adds to the one for twelve aircraft placed by Gulf Helicopters in 2007 as part of its fleet renewal programme.

300th Bombardier Challenger 300 Jet enters service

Bombardier's 300th Challenger 300 business jet was handed over to an 'undisclosed' North American customer during a delivery event at Bombardier Aerospace's headquarters in Dorval on 18 February 2011. This super-midsize aircraft offers transcontinental range and superior long-range cruise speed, with eight passengers and can fly Los Angeles-New York non-stop with a full payload and its superior airfield performance allows it to operate out of 4,810-foot (1,466-m) runways with ease. The Challenger 300 offers a dispatch reliability consistently over 99.7 per cent.

Airbus Corporate Jets

Airbus delivered 15 ACJ corporate jets in 2010, setting a new record for this facet of its business. The aircraft comprised 13 A318 Elites, Airbus Corporate Jetliners (ACJs) and A320 Prestiges, plus two VIP widebody A330/A340s. Airbus also got eight orders for its corporate jets in 2010, taking total orders to date to more than 170 aircraft. The new orders comprised seven aircraft from the A318 Elite/Airbus ACJ/A320 Prestige Family, plus one widebody A330/A340. The orders and the deliveries were both for customers and operators in Asia, Europe and the Middle East, for private customers and governments, whose identity remains 'undisclosed'.

Milestone Aviation Group to acquire 5 Sikorsky S-76s

Sikorsky Aircraft Corp. and Milestone Aviation Group have announced the scheduled deliveries of five Sikorsky S-76C++ helicopters to Milestone in the second half of 2011 under a firm order contract signed in December 2010. Milestone, the first global finance company focused exclusively on the helicopter and private jet markets, will offer these aircraft for lease to high-quality operators around the world. The S-76C++ helicopter is the current production model in the S-76 aircraft line and serves a multi-mission role that includes offshore oil, VIP transport including head of state, emergency medical transport, search and rescue and civil defence. The next variant in the S-76 aircraft line, the S-76D helicopter, has entered production, with first customer deliveries scheduled for 2012.

SonAir order six Sikorsky S-76C++

Sikorsky Aircraft Corp. and SonAir Servico Aereo, S.A. (SonAir) have signed a contract for six S-76C++ helicopters. SonAir has been flying Sikorsky products for more than 15 years in support of offshore oil operations in Angola. Currently, SonAir operates five S-76C++ aircraft and four S-76C+(tm) helicopters in that capacity. With the signing of the new contract, SonAir will have a total of 15 Sikorsky S-76 aircraft servicing offshore oil operations in Angola.

CHC AW139 helicopter fleet achieves 50,000 hours milestone

The AW139 medium twin helicopter fleet operated by the CHC Helicopter group of companies is the first to achieve the milestone of 50,000 flying hours. CHC is the largest AW139 operator worldwide with 25 units in service and an undisclosed number of aircraft on order. CHC introduced the AW139 into service in 2005 as part of its fleet renewal and expansion plans and the aircraft is now performing roles such as offshore transport, emergency medical service and search and rescue around the world.

NetJets order 120 Bombardier bizjets

The largest business aircraft sale in Bombardier's history has been the firm order from NetJets Inc. for 50 Global business jets with options for an additional 70 Global aircraft. The transaction for the firm order is valued at approximately $2.8 billion. If all the options are exercised, the total value of the order will surpass $6.7 billion.

The firm order comprises 30 Global 5000 Vision and Global Express XRS Vision aircraft, with deliveries scheduled to begin in the fourth quarter of 2012. The sale also includes 20 firm orders for Bombardier's newly launched Global 7000 and Global 8000 jets. Deliveries of these aircraft will begin in 2017.

NetJets is the world's largest business aircraft operator, with a fleet of over 800 aircraft worldwide. The company's new large aircraft programme is centered on providing NetJets Owners with non-stop capabilities around the globe.

NordStar Airlines first ATR 42-500

Russia's Taimyr Airlines (NordStar Airlines) has taken delivery of the first ATR 42-500, of a total order for 4 firm aircraft, plus 3 options placed in 2010. The Krasnoyarsk-based ATR 42-500s will fly to new regional destinations within Krasnoyarsk Region also to destinations such as Novosibirsk, Irkutsk and Ekaterinburg. The 46-seat ATR 42-500, equipped with PW127M engines, will also be fitted with additional features to facilitate operations in Siberia and Russian Far North (ETOPS 120 minutes, operations down to - 45°C, special fuselage protection).

Tibet Airlines to start operations in India

The newly launched Tibet Airlines Company (TAC) is considering scheduled flights to India and Pakistan when it launches services later in 2011. The state-owned airline is also gearing up to compete with airlines operating in neighbouring Nepal. Tibet Airlines has ordered three Airbus A319 airliners and intends to order more airliners from the same family.

A320 (not of Tibet Airlines) at Lhasa

TAC general manager Liu Yanping stated that the company would launch flights to other destinations in South Asia and South East Asia by 2013 and European destinations by 2015. The company is also contemplating 'mountain flights' in the Mount Everest region and other Himalayan destinations. Liu did not specify the destinations the airline would fly to as it involves a long process of getting landing rights but officials in the Tibetan Autonomous Region government have sought Tibet's air connectivity with India to attract tourists to the holy Mansarovar Lake.

Tibet Airlines will begin operations in July with flights from Lhasa to Beijing which will be followed up with more services after the induction of two more A319s in August.

Cathay Pacific Airways orders 15 more A330s

Cathay Pacific Airways has placed a firm order with Airbus for 15 more A330-300s, scheduled for delivery from 2013. The aircraft will join the airline's existing A330 fleet flying on services across the Asia-Pacific region and will be powered by Trent 700 engines from Rolls-Royce. "The A330 has proved itself to be an extremely efficient and versatile aircraft for Cathay Pacific, flying on Asian regional services and longer operations to the Middle East and Australia," said Tony Tyler, Chief Executive, Cathay Pacific Airways.

ILFC selects 100 A320neo Family aircraft

The world's premier aircraft leasing company, ILFC, has signed a Memorandum of Understanding for 100 A320neo Family aircraft, comprising 75 A320neo and 25 A321neo types. ILFC becomes the first customer for the A321neo, the largest member of the A320neo Family. In a separate agreement, Pratt & Whitney will provide power for up to 100 Airbus A320neo family aircraft ordered by International Lease Finance Corporation (ILFC) as part of a contract announced recently. The agreement includes 120 firm PurePower PW1100G engines for 60 aircraft and options for up to 80 engines for the additional 40 aircraft with deliveries scheduled to begin in 2016

UTair for 15 EC175 helicopters

Russia's UTair Aviation has signed a firm contract for the acquisition of 15 EC175 helicopters, extending its long-term strategic partnership with Eurocopter and the Eurocopter Vostok subsidiary in Russia and the CIS. This agreement, signed at the Heli-Expo 2011 exposition in Orlando, Florida by UTair Aviation General Director Andrey Martirosov and Dr. Lutz Bertling, President and CEO of Eurocopter, firms a letter of intent announced at Heli-Expo in 2008, and covers the deliveries of 15 EC175s in 2013 and 2014.

Turkish Airlines order 13 Airbus

Turkish Airlines has signed a order for the purchase of ten Airbus A321s and three A330-200F freighter aircraft to meet their growth plans in the passenger and cargo markets. The airline has a further 27 aircraft on order with Airbus from contracts placed in 2009 and 2010. The new aircraft will join Turkish Airlines' existing fleet of 75 Airbus aircraft, including four A310 freighters, 50 A320 Family aircraft, 11 A330s, one A330-200F and nine A340s.

8 more AW139s for Japan

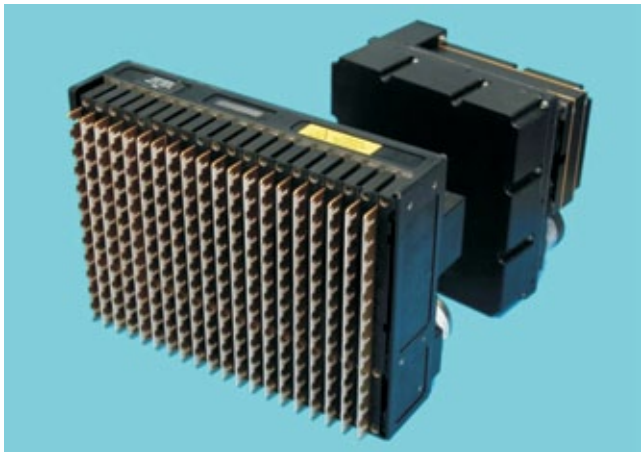
Eight more AW139 medium twin helicopters have been ordered by Japan, to be operated by the Japan Coast Guard and the Japanese Fire Fighting and Disaster Relief Organisation. With these contracts, the number of AW139 helicopters ordered for the Japanese market increases to thirty, with ten helicopters already in service with the Tokyo Metropolitan Police Department, the Japan Coast Guard, Air Nippon Helicopter and Kansai TV. One helicopter for the Japan National Police Agency is currently undergoing local customisation and nineteen helicopters are now on order for the Japan Coast Guard, Japan National Police Agency and the Japanese Fire Fighting and Disaster Relief Organisation.

NGC Fire Scout first unmanned test flights on LCS

The Northrop Grumman Corporation-built MQ-8B Fire Scout vertical takeoff and landing tactical unmanned aerial vehicle (VTUAV) achieved a significant development milestone in November 2010 when it flew its first test flights from the U.S. Navy's littoral combat ship, USS *Freedom* (LCS-1). The Navy conducted the activity, known as dynamic interface (DI) testing, off the coast of southern California to verify if Fire Scout control systems have been integrated on the ship properly. DI testing started 13 November and concluded on 24 November 2010.

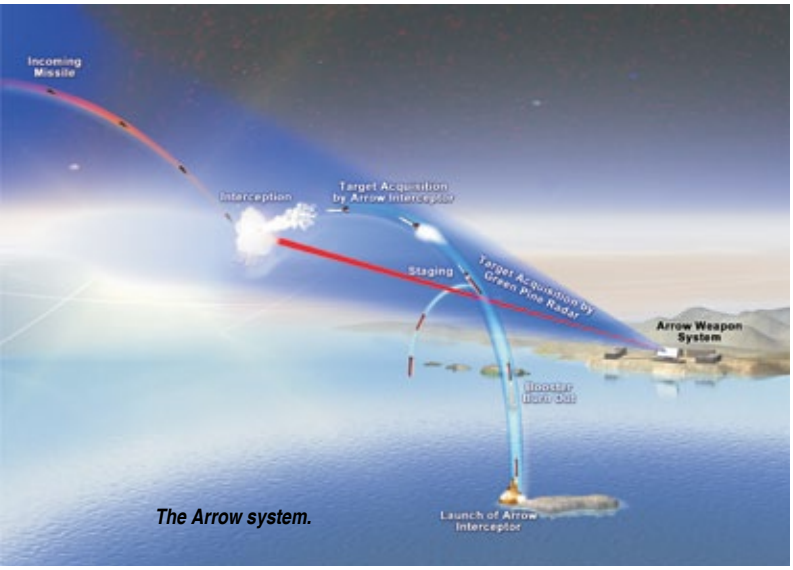
SELEX Galileo contracted for PicoSAR AESA radar

SELEX Galileo has been given a new contract for its PicoSAR AESA surveillance radar, with three PicoSAR radars being sold to a non-NATO export customer as evaluation models, and the potential for a full production run upon successful tests. PicoSAR will be integrated into the customer's lightweight, tactical Unmanned Aerial System (UAS). The key to PicoSAR is the use of AESA technology in a small, compact configuration. Using low power, solid state Transmit/Receive Modules (TRM) within its array, the PicoSAR radar is more reliable than conventional radar systems. Its compact size, low weight and low power consumption permit installation in parallel with electro-optical/infrared sensors even on platforms with limited payloads.



Joint U.S.-Israel Arrow intercepts target missile

The joint U.S.-Israel Arrow Weapon System successfully intercepted a ballistic target missile during a flight test conducted on 22 February 2011, the test being part of the Arrow System Improvement Program (ASIP) conducted jointly by the Israel Missile Defence Organisation and the U.S. Missile Defence Agency at the U.S. Naval Air Warfare Centre, Weapons Division-Pt.Mugu Sea Range. The Arrow Weapon System's



The Arrow system.

Green Pine radar successfully detected and tracked the target and transferred information to the *Citron Tree* battle management control system. The Arrow Weapon System launched an interceptor missile which performed its planned trajectory and destroyed the target missile, which represented a realistic scenario with all the elements of the weapon system performed in their operational configuration. The main contractor for the integration and the development of the Arrow Weapon System is MLM of the Israel Aerospace Industries (IAI). The *Green Pine* Radar is developed by Elta Industries and the *Citron Tree* BMC is developed by Tadiran Electronic Systems, Ltd.

Israeli Minister of Defence, Ehud Barak with the Arrow interceptor in the background.

MBDA introduces Ground Based Air Defence Capability

MBDA has presented a new combination of systems to coordinate the firing of Mistral and VL MICA missiles with IMCP (Improved Missile Control Post) being the first element of this set up. It integrates, within a shelter mounted on an all-terrain vehicle, a command and control unit and latest generation 3D radar capable of detecting and identifying aerial targets at ranges of 80 km. IMCP is an evolved version of the Mistral Coordination Post and comprises an operator console ergonomically designed to provide a work space within which the unit commander can carry out missions under optimum conditions.

The second new system presented by MBDA is the PCP (Platoon Command Post), a modular command system which is a direct derivative of the VL MICA Tactical Operations Centre (TOC), developed in close cooperation with the French Air Force. PCP allows the commander to control multi-layer surface-to-air defence units, linking Mistral and VL MICA missile launchers. The first deliveries of IMCP and PCP are expected in 2014.

Northrop Grumman's X-47B UCAS-D's first flight

Northrop Grumman/U.S. Navy Unmanned Combat Air System Demonstration (UCAS-D) programme's X-47B achieved first flight at Edwards Air Force Base, California on 4 February 2011, a significant milestone in the programme by the U.S. Navy and the Northrop Grumman-led industry team. Evolved from the former Joint Unmanned Combat Air Systems (J-UCAS) programme, the X-47B is the Navy's chosen air vehicle for demonstrating and validating that a tailless fighter-sized unmanned aircraft system can operate safely to/from aircraft carriers. Lockheed Martin brings its expertise and experience in all aspects of low observable design and air vehicle survivability to bear in the design and manufacture of X-47B's aerodynamic edges, inlet lip and control surfaces.

Rafael Active Protection System 'Trophy' completes evaluation

An Israel Defence Forces (IDF) Stryker Armoured Fighting Vehicle fitted with Trophy, a Rafael Advanced Defence Systems Active Protection System, was subjected to numerous missiles and rockets attacks under a six-week test and evaluation programme. Trophy, the operational Active Protection System (APS) for Armoured Fighting Vehicles and Military Battle Tanks (MBT), developed by Rafael Advanced Defence Systems for the Israel Ministry of Defence (IMOD), have also completed an evaluation by the U.S. Office of Secretary of Defence (OSD).

For the OSD evaluation Rafael has integrated the Trophy System on an IDF Stryker Armoured Fighting Vehicle. The six-week intensive test programme evaluated the system under complex combat scenarios against a variety of advanced, Anti-Tank Rockets (ATRs) and Guided Missiles (ATGMs), including tandem warheads. The Trophy System demonstrated "outstanding performance" in the test series, defeating different types of threats.

Japanese 'Spirit' stealth fighter test flight in 2014

Japan will join the United States, China and Russia with a stealth fighter that senior Japanese air force officials say can be ready for a prototype test flight in just three years, significantly upping the ante in the intensifying battle for air superiority in the Pacific. The prototype will likely be able to fly in 2014, Lt Gen Hideyuki Yoshioka, director of air systems development at Japan's MoD, said. He said Japan has put 39 billion yen ($473 million) into the project since 2009, after it became clear the U.S. was not likely to sell it the F-22 Raptor, because of a congressional export ban. "We are two years into the project, and we are on schedule," Yoshioka said but stressed that a successful test flight of the prototype, dubbed Shinshin or *Spirit*, does not mean Japan will immediately start producing stealth aircraft. The prototype is designed to test advanced technologies, and if it is successful the government will decide in 2016 how to proceed.

CFM's LEAP-X testing continues

In 2010 CFM continued testing the LEAP-X, the engine selected by Comac and Airbus for their new aircraft, the C919 and the A320neo respectively. Two types of tests were carried out on the LEAP-X in 2010, one of which focused on certification tests, such as blade-off and bird ingestion, proving the ability to certify the RTM fan technology. This is an innovative, proprietary technology, based on 3D woven carbon-resin fan blades, which had to be validated very early in the process. The year ended with a successful blade-off test on a 3D woven composite case, demonstrating the requisite mechanical properties.

Meanwhile, Snecma's LEAP-X partner, GE, continued tests on the engine core, completing tests on eCore 1, the first core demonstrator. In the second half of the year it started the production of eCore 2 parts, incorporating feedback from the first demonstrator. The first ground test of eCore 2 is slated for late June 2011, making CFM right on schedule for engine development, leading up to service entry of the LEAP-X on both the C919 and the A320neo in 2016.

Elbit Head up Displays for USAF C-17

Elbit Systems of America has been awarded a contract from The Boeing Company for the development of the C-17 Replacement Head Up Display (RHUD) for the United States Air Force. The contract also contains options for recurring production, depot support and repairs. The C-17 provides rapid strategic delivery of troops and cargo to main operating bases as well as tactical airlift and airdrop operations within a theatre of operations. The collective efforts of Boeing and Elbit Systems of America will provide the United States Air Force with a new C-17 RHUD that will enhance the ability of the aircraft to fulfil the United States' worldwide air mobility requirements.

nEUROn receives its wings

Designed and manufactured by EADS-CASA (Spain), the specific wings have been delivered to Dassault Aviation, Prime Contractor of the Programme. It was transported to Istres where nEUROn, the European UCAV demonstrator's final assembly will take place. This delivery in due time, represents a major step in the development of this advanced stealthy and unmanned demonstrator, which gathers six European countries and their Industry : France/Dassault Aviation, Spain/EADS-CASA, Sweden/SAAB, Italy/ Alenia Aeronautica, Greece/HAI and Switzerland/RUAG.

Turkey seeks to develop indigenous fighter

According to Turkey's Minister of Defence, the country will develop an indigenous fighter to replace the Turkish Air Force's F-4E Phantoms and older model F-16s in the 2020s. Turkey's defence procurement agency, the *Savunma Sanayii Müşeğarli* (SSM- Undersecretariat of Defence Industries), has directed Turkish Aerospace Industries (TAI) to undertake a two-year conceptual design study for the new fighter.

Earlier, Turkey had looked at teaming with Indonesia and South Korea on the latter's KF-X project, but the Defence Minister has now indicated that Turkey wants to develop its own design for a next-generation fighter. Turkey had been looking at an equal 50-50 partnership on KF-X, which South Korea was unlikely to agree to, therefore it has stepped back from this option. The Minister stated that the Eurofighter Typhoon was now also "off the agenda" for Turkey and the future fighter mix for the Turkish Air Force now looks to comprise the 100 F-35A Lightning II Joint Strike Fighters that are still planned for purchase, alongside Block 50 F-16s and the proposed new indigenous fighter.

More orders for BAE M777 Howitzers

An order for 46 M777 howitzers from the U.S. Department of Defence takes the total number of guns ordered to 1001. The order comes as BAE Systems continues deliveries of M777 to Canada and Australia, in addition to the U.S. Weighing less than 4200kg, the M777 is the world's first artillery weapon to make widespread use of titanium and aluminium alloys, resulting in a howitzer which is half the weight of conventional 155mm systems. As a result, it can be deployed by medium-lift helicopter quickly and beyond the reach of roadside bombs to otherwise inaccessible areas, extending its reach over the theatre of operations.

Thales new Ground Surveillance Radar GO80

Thales has unveiled its new long range Ground Observer 80 (GO80), the world's highest performing ground surveillance radar, 'made in Germany'. It is the high-end follow-on to the BOR-A series, suitable for army, border/coast guard and security applications, providing reliable service in large numbers to 20 customers around the globe. The Ground Observer 80 with cutting edge radiofrequency and processing technology is specifically designed for border surveillance, target acquisition for indirect fire adjustment and the integration to surveillance/recce vehicles. "The GO80 ensures high levels of operational efficiency and precision in any operational and climatic environment. Easily deployed, it provides excellent performance levels in a sandy hot desert, cold tundra, or any foggy coastal environment."

Cassidian's SPEXER-Security Radar

Cassidian, the renamed defence and security division of EADS, have introduced new security radar which uses new technologies to create completely new opportunities for the surveillance of border areas or sensitive industrial installations. The radar which has been marketed as part of a major border protection system under the designation TRGS Sec (Tactical Radar Ground Surveillance, Security) forms the nucleus of a whole product family of security radars named SPEXER(tm). The first batch of 40 radars has been delivered for integration in a major border protection system and a military version delivered to the German Army.

Kongsberg introduces Multibeam Sonar

Kongsberg Mesotech Ltd. has introduced the M3 MultiMode Multibeam Sonar(tm), characterised by "innovative design, versatility, and ease of use in a light, compact design." The first two models of the M3 series are intended for the underwater vehicle market, in particular, work class ROV operations. The M3 MultiMode Multibeam Sonar combines imaging, profiling and true zoom modes in a single design. Short range (0.2 meters) and long range (100 meters) imaging capability plus multiple true zoom windows are now possible. Dynamically variable bandwidth provides optimised images and target detection with high resolution and enhanced shadows.

Rockwell Collins Athena family exceed 1 million hours on UAVs

Rockwell Collins' Athena family of flight control and navigation systems have exceeded 1 million flight hours on several

Unmanned Aerial Vehicles (UAVs) performing surveillance operations primarily in the Middle East. Rockwell Collins Athena systems include solid-state gyros and accelerometers, magnetometer, GPS receiver, air data sensors and optional flight control software integrated into units ranging from as small as four ounces to nine pounds. These highly reliable, strap-down systems provide navigation, attitude and heading measurements with superior accuracy. With low size, weight, power and cost advantages, multiple Athena systems can be used in redundant configuration to increase automation and reliability in manned, unmanned and optionally manned aircraft.

Navantia delivers the Frigate F-314 'Thor Heyerdahl'

On 18 January 2011 Navantia commissioned the frigate F-314 *Thor Heyerdahl* to the Royal Norwegian Navy. After the protocol and the change of flags, the Chief of Navy inspected the crew and the crew marched on board. Later the guests had the opportunity to go on board the *Thor Heyerdahl* which is the fourth of the series of five F-310 class frigates, ordered to Navantia by the Royal Norwegian Navy.

Launched in February 2009, this is the last unit of the programme, defined as a success by NDLO and the Royal Norwegian Navy. The contract for the construction of 5 frigates was signed in June 2000, after an international tender and with the main occidental shipyards as competitors, and means the biggest export contract of the history of naval construction in Spain.

Raytheon delivers 250th APG-79 AESA Radar

Raytheon has delivered its 250th APG-79 active electronically scanned array radar to Boeing, this being installed on U.S. Navy F/A-18E/F and EA-18G aircraft and on the Royal Australian Air Force F/A-18F Super Hornet. "The APG-79 radar has revolutionised fighter combat capabilities and dramatically improved situational awareness for aircrews. This combat-proven, advanced radar technology has also logged more than 175,000 operational flight hours," said Eric Ditmars, F/A-18 programme director, Tactical Airborne Systems. The APG-79 AESA hardware offers 10-15 times greater reliability than mechanically scanned array radars, which results in lower life-cycle costs. In addition, it provides capabilities that allow warfighters to detect and identify targets beyond the reach of most missiles.

Cassidian contracted for Swiss Army soldier modernisation

Cassidian has been contracted from the Swiss defence procurement authority Armasuisse for the advanced production engineering of the IMESS programme (Integrated and Modular Engagement System for the Swiss Soldier). The Cassidian Warrior21 product is expected to deliver significant capability enhancement, future viability and modularity in the infantry sector giving the Swiss Army "one of the world's most powerful advanced soldier systems." It will fit smoothly into the Swiss Army joint reconnaissance, command and action forces and can also be integrated with systems already in use.

Sukhoi aircraft designer passes away

Legendary aircraft designer Mikhail Simonov, whose supremely manoeuvrable, heavily weaponised and long range Sukhoi Su-27 family of fighters became an icon of the Soviet defence industry and a significant success for post-communist Russia, has passed away in Moscow at the age of 81.

Developed to counter the US F-15 Eagle and other new types, Simonov's twin-engined, twin-finned Su-27 joined the Soviet Air Force in the early 1980s and immediately awed the West for with its over 3,500km range, impressive agility and ability to fly at 2.35 times the speed of sound. It was the star at international air shows, performing aerobatics that few other fighters could match. The Su-27's excellent thrust-to-weight ratio and sophisticated control system allowed it to perform exceptional manoeuvres at very low speeds. After domestic defence orders came to a near halt after the 1991 Soviet collapse, Simonov played a key role in winning export deals first with India, then China and other Asian Air Forces, including Vietnam, Indonesia and Malaysia.

While Simonov fathered the original Su-27 design, he was also involved with the concept of the prospective fifth-generation fighter to compete with the US F-22 Raptor. The PAKFA or Sukhoi T-50 made its maiden flight in January 2010 and has become the basis for the joint Indo-Russian fifth generation fighter aircraft (FGFA).

25 Years back

From Vayu Aerospace Review Issue II/1986

Il-76 Operations to Leh

The recently acquired Il-76 strategic airlift transport aircraft of the IAF made trial landings at Leh on 24 May 1986, bringing in troops and supplies. Present on the occasion were Air Marshal MM Singh, Air Officer Commanding-in-Chief, Western Air Command and the Chief of Staff, Air Marshal BS Sikand. The Il-76 aircraft is presently fitted with CAT II ILS and has provisions for incorporating the updated CAT III ILS which will enable the aircraft to land in zero visibility conditions.

MoU on MiG-29 supply

The Governments of India and the Soviet Union have finalised a MoU for the supply of MiG-29s for the Indian Air Force. A high-level delegation consisting of senior officials from the Ministry of Defence, the Indian Air Force and Hindustan Aeronautics Limited recently visited Moscow to conclude the MoU on the MiG-29s, while the formal contract is expected to be exchanged through diplomatic channels. It is reported that more than two squadrons of MiG-29s would be purchased outright in flyaway condition and "substantial" numbers are likely to be assembled and produced indigenously by HAL as a follow on to the present MiG-21bis/MiG-27M licence-manufacture programme at Nasik. India will be the first country outside the USSR to receive the advanced technology MiG-29 fighter (coded "Fulcrum" by NATO) with its contemporary avionics and weapon-systems including the pulse-doppler radar with look down/shoot down guidance capability and AA-10/11 air-to-air missiles. The MiG-28 is powered by two Tumansky R-33D turbofan engines each of 81KN thrust.

First Dornier 228 for Coast Guard

The first two Dornier 228 Coastal Surveillance Aircraft, fitted with special sensors, were formally handed over to the Government of India by Dornier GmbH at their Oberpfaffenhofen airfield, southwest of Munich, on 7 July 1986.

The Managing Director of Dornier GmbH, Dr Fritz Mader officially handed over the keys of the two aircraft to Dileep Kamtekar, Ambassador of India to the Federal Republic of Germany. Shortly thereafter Mr Kamtekar handed the keys to the leader of the Coast Guard Acceptance Team Commander, NS Gujral.

The Coast Air Squadron 750, now formed on the Dornier 228, is commanded by Commander G Theograj and will be based at the new Coast Guard Air Station on the Western Coast of India. The aircraft are expected to be ferried from West Germany to India mid-July by Coast Guard air crew who have completed their training at Munich.

Boeing and Japan agree on the 7J7

On 5 March 1986 Kenku Hasegawa, president of the Japan Aircraft Development Corporation (JADC) and Frank Shrontz, president of Boeing, announced the signing of an agreement on development and production of the future 7J7 medium haul airliner, which is scheduled for operational service in 1992. The Japanese industry will be taking a 25 percent share in the new programme. The main companies involved in the production and development of this aircraft will be the JADC partners Mitsubishi, Kawasaki and Fuji.

China's new RPV

China has produced a large turbojet powered UMA, developed by the RPV department of the Nanjing Aeronautical Institute (NAI) and known as the Chang Kong IC or CKIS. Described as China's first high-manoeuvrability UMA, it is the result of research work begun in 1960s.

The first CKI prototype was completed in late 1976, followed in 1977 by the CKIA with twin underwing pods and in 1982 by the CKIB, in which the wing pods were replaced by non-releasable auxiliary fuel tanks. This in turn provided the basis for CKIC, which was flown for the first time in the autumn of 1984.

Northrop/Dornier ND-102 as basis for LCA

The West German Ministry of Defence has ordered interim studies into alternative design variations to ensure that the European Fighter Aircraft (EFA) remains within the agreed weight, performance and cost limits. This means that there is likely to be a delay in clearing funds for full scale development of the EFA.

It has been reported that both MBB and Dornier have been asked to conduct independent studies for the MoD, while the EFA four-nation design team continues refining the present designs for the aircraft, of which there are three. Dornier has been instructed to look back at its previous joint proposal with Northrop for the ND-102 (which also became basis of the offer to India for the LCA).

The industry had hoped to get funding to start full scale development soon after the definition studies were over. The present delay and its effects on the EFA programme could be serious, particularly to the RAF which needs the EFA in the mid-1990s to replace its F-4 phantom fleet and supplement its Tornado fleet.

A340 and A330 Integrated Task-Force

Definition of the A340 and A330 is continuing at an increased pace in Toulouse, under the guidance of an integrated task-force comprising technical and industrial core-teams. The work involves the Airbus Industrie partners to an increasingly greater extent and is aimed at finalising the technical features and performance of the aircraft, as well as evaluating how they will be built. The integrated task-force currently comprises up to 50 people, some of whom have been seconded from the partners. The task force is in addition to the A340 and A330 research and development effort already under way at Airbus Industrie and its partner companies.

TALE SPIN

Meow !

It took a young Chinese journalist Li Miao representing China Central Television (CCTV) to publicly air her distress in the manner in which the organisers of Aero India 2011 handled the matter of invitations and passes, be it for exhibitors or the media. Directly addressing the Defence Minister at his Press Conference in Yelahanka, the young lady was immediately assured that she would get all the assistance needed.

But there were hundreds of others frustrated by the system which still hasn't got to grips with the handling of international air shows at this Air Force Station, now in its eighth edition. Will 2013 be any different?

Maruti Airborne

No, not the Marut fighter-bomber which first flew in Bangalore near 50 years ago but its near namesake, the Maruti 800 small car, manufactured in the millions at Gurgaon. An enterprising primary school science teacher of Bangalore claims to have developed the prototype of a flying Maruti which he promised to demonstrate at Aero India 2011. He named it the 'Avishcar', which means innovation in Sanskrit.

In the event, this did not fly but still there is no harm in trying. Back to the drawing board !

Safe cave on the moon

Chandrayaan-I, India's first scientific mission to the moon, discovered more than water in this heavenly body, also finding a cave situated just above the lunar equator. Excited ISRO scientists envisage that such a hollow could accommodate a large number of spacemen and scientific equipment, as a potential site for human habitation in future missions, with protection from hazardous radiations, micro-meteoritic impacts and extreme temperatures.

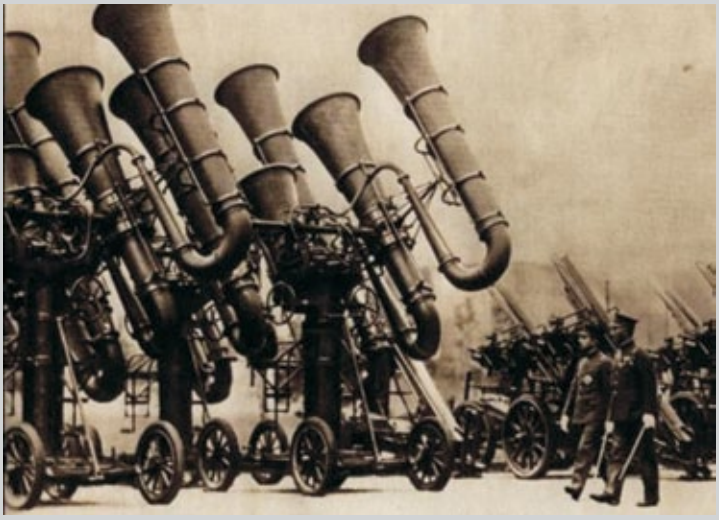
Have the country's realtors caught on? At times the real estate world can be out of this world !

MCP

An IndiGo flight to Mumbai was held up for 40 minutes as a passenger refused to fly, as he would not endanger his life as the airliner was piloted by woman. *Ghar nahi sambhalta, plane kya sambhalegi ?*

The MCP was later allowed to re-board the aircraft after due apologies.

Air Defence Ground Environment System, circa 1917



"We know you are there" ! Acoustic detection of French Spads and British Camels by the Germans in 1917-18 before radar was invented. (*Thanks to Col Harindar Singh Bedi*)

Ho, Ho, Ho

The pirates of yore sailed the Caribbean for looting treasure from other ships, with a swig of rum and flash of the cutlass. Today's pirates from Somalia in the Indian Ocean have moved further away from the littorals

towards India itself, requiring the Indian Navy to proactively flash its own cutlass in the form of 30mm cannon. That such deterrence is working in the bottleneck between the Lakshadweep Islands and the Maldives, where ships sailing from the Gulf to South-East Asia are funneled, was demonstrated by the plucky crew of INS *Cankarso*, guided to the area by an IN Dornier 228. *Shabash* !

Afterburner

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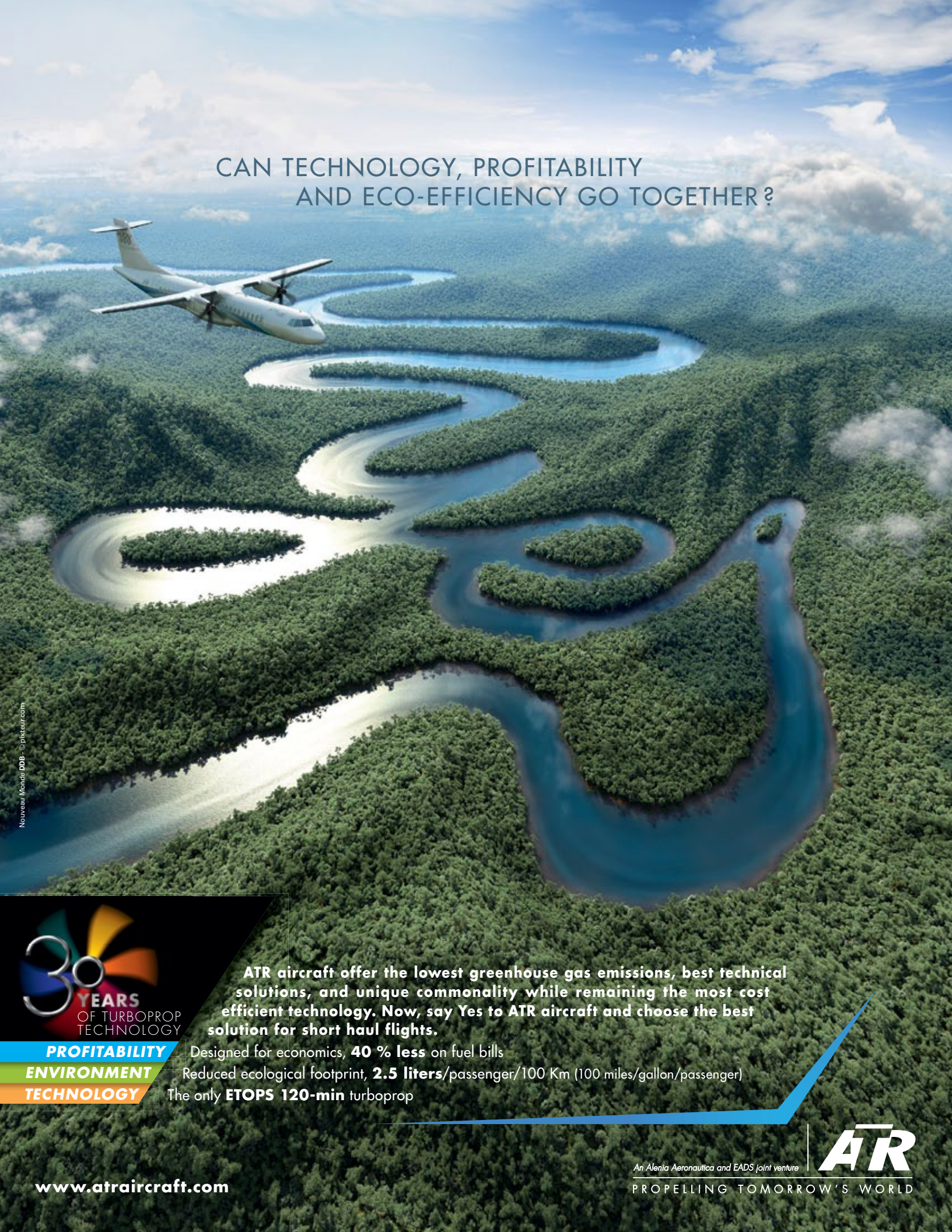
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