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Aerospace & Defence Review

III/2011

Maritime Vigilance, 24x7

Golden Cobras

Agapanthe 2010

M-MRCA down selection

Airbus Military in Spain

50 years of Space Flight

CFM

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Cover : Airbus Military C-235 MPA of the Spanish Air Force (Photo Airbus Military)

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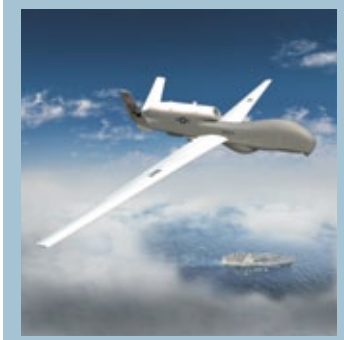

Selecting a fighter

The Ministry of Defence has shortlisted two out of a total six types of medium range multi-role combat aircraft evaluated for induction into the Indian Air Force (IAF). The IAF has projected a need for 126 such aircraft to make up for shortfall in its fighter strength and also to modernise its fleet in keeping with rapid changes in military aviation technology and the country's security requirements.

By shortlisting the Eurofighter Typhoon and the Dassault Rafale after evaluating 643 parameters listed under the IAF's Qualitative Requirements, India has effectively ruled out two formidable and strategic players in a deal estimated at a staggering $ 10 billion – Russia, which has been the country's traditional weapon supplier starting from the Cold war period, and the United States, which, in recent years, has emerged as a major supplier of defence armament. Instead, by shortlisting two aircraft types, both of them from Europe, the IAF is set to add a variant to its already uniquely diverse fleet comprising over a score different aircraft types bought from half-a-dozen countries ranging from Russia, the US, Poland, France, UK and Brazil. Quite expectedly, the evaluation and shortlisting was preceded by intensive lobbying by companies and governments through their politicians and officials.

Irrespective of which aircraft is eventually selected, the government must ensure that the final decision is taken with due propriety and in keeping with national interest. The government must not succumb to external pressures while ensuring that the deal goes through without complications. This is important considering that in the recent past, agreements for purchase of critical weapon systems have either had to be scrapped following allegations of kickbacks or are facing inquiries resulting in excessive caution in decision making. Consequently, this has resulted in not only a setback to the armed forces modernisation programme, but, more seriously, caused a setback to its capabilities vis-a-vis adversaries in the neighbourhood. This is a situation that a country of the size and importance of India can ill-afford.

From: The Tribune

Taking off

After doing little for years, things are moving in AK Antony's Ministry of Defence. First the armed forces spent the entire defence budget for fiscal 2010-11, after returning approximately Rs 5,000 crore in 2007-08, Rs 7,000 crore in 2008-09 and Rs 5,200 crore in 2009-10 unspent. Then the MoD asked for more, and the 2010-11 defence budget saw an 11.6 per cent hike - with 12 per cent more for capital expenditure meant for procuring, among other things, 126 medium multi-role combat aircraft (MMRCA). For the MMRCA, French Dassault Aviation's Rafale and the Eurofighter consortium's Typhoon have been asked to extend their commercial bids. In the process, Boeing's F/A-18 Super Hornet and Lockheed Martin's F-16 IN Super Viper were rejected, along with Russia's MiG-35 and Sweden's Saab JAS-39 Gripen. The MMRCA contract is worth $10 billion, and the diplomatic investment made by bidding nations meant rejections could leave a sour taste.

The salient facts of the process this time round must be noted and cheered. First, it has been transparent, with rejections made on technical grounds. The two MMRCA selected performed the best in trials and were seen to be closest to the Indian Air Force's requirements. Second, it was the IAF's technical expertise that determined which contenders stayed on, without political interference. Third, the spectre of scandal in defence procurement that has haunted the UPA government would stop arms purchase at the slightest hint of controversy. As a result, while trials and tenders were falling prey to such fears, the Indian armed forces were being undermined as an institution, blunting our conventional response capability. The IAF itself has seen a sharp decline in squadron numbers. The MMRCA bidding process so far is encouraging, and it should mark a new beginning.

Large-scale military procurement must also consider offsets and indigenisation, access to technology, long-term time and cost optimisation. However, it is dangerous to reduce, or elevate, any military procurement to a purely political decision — as might have been the case if the MoD had chosen Boeing and Lockheed Martin despite the IAF thumbs down. Those who will use the equipment must have the word on what best answers their needs.

From: The Indian Express

How to stay fighting fit

Buying a weapon would seem to be a simple enough decision. Arms are destructive. Whichever is more destructive should be better. Would it were that easy. There are probably few things more difficult than purchasing weapons. Because they lie at the core of national security concerns, choosing a major weapon system must factor in more than mere firepower. The surety of spare parts, the issue of life-cycle costs, training and interoperability must also be assessed. What is probably the most important factor, and the most difficult to assess, is the strategic context of the weapon. Though men in uniform complain bitterly about this, strategic context is an inevitable part of an arms purchase. It is a political judgement and highly subjective.

Strategic context matters little in the buying of small arms or helmets. It matters hugely in the purchase of major weapons platforms — fighter aircraft, warships and heavy armour. These are at the heart of battlefield dominance. If India or any country buys such weapons from overseas, it implies a degree of commitment from both sides that can run into decades. This is especially true for the technologically most advanced platform: the fighter aircraft. An additional concern these days is the issue of offsets. India is the world's largest arms importer, according to the Stockholm International Peace Research Institute. Between 2006 and 2010 its imports represented 9% of the world's total arms transfers. Bringing more of these purchases home is both an economic and a strategic need. It is also important because

Rafael

a wise offset policy lays the seeds, over time, for domestic capacity in high-technology development.

The so-called medium multi-role combat aircraft contract has been a matter of global interest not merely because of its size, but also because it is expected to serve as a signal of where India sees its strategic future. Russia, the source of 80% of India's purchases in the past, is on a declining technological trajectory and has a new primary client in the form of China. The recent shortlisting of two European-origin fighters and the resignation of the US ambassador to India have weaved an exciting but strategically ambiguous tale around the aircraft contract. But arms procurement in India has tended to be a long and tortuous process so the final word on the matter may not have been said. However, Europe, which runs to the US whenever it has a serious military problem and is unable to project power into Asia, cannot be a long-term strategic partner for India. Thus whatever the plane that is inducted into the air force, what has been postponed and left open is India's strategic future in a 21st century that has already been marked by remarkable international flux. Weapons can be bought, mothballed and replaced with new ones. Strategic partnerships need to be selected and developed because they are the stuff of national security and the product of years of cultivation.

From: Hindustan Times

Feeling Airsick

Just when you thought the Directorate General of Civil Aviation (DGCA) could stun you no more, there comes the revelation that the DGCA, responsible for regulating the nation's aviation sector, has no pilots on its rolls. The pilots who do work with the overseeing organisation are in fact employed by airlines and aviation groups , functioning only part-time with the DGCA to provide it technical expertise. The situation reflects a dangerous conflict of interest. It also endangers those flying.

The facts of the ongoing 'fake pilots' imbroglio – those who have trained in irregular flying schools or fudged their papers to show the required number of flight hours or forged their pilot licence exam marksheets – have caused enough of a furore for thousands of pilot licences to be re-checked. But who is doing the checking? If the DGCA has no pilots of its own, instead borrowing such expertise from the airlines it is supposedly investigating, how can a clear and correct investigation take place? How can there be certainty that greed and pressure will not influence the process? How can ordinary flyers rest assured that those overseeing flight safety will not depend on a murky mix of corruption, collusion and remarkable obtuseness?

The problem goes beyond just pilots. Given the financial volatility of the aviation sector, airlines as a whole are affected. This is a factor the DGCA itself has recognised in the past. Due to the dire financial straits airlines found themselves in when the global recession hit, it carried out a financial audit to ascertain the impact of lowered revenue on safety procedures. And the findings were troubling enough – two airlines including Air India severely strained and a number of them cutting corners on safety infrastructure – to make the DGCA formulate a draft for regular audits in the future. But how are such audits to be considered trustworthy when the auditing body may well contain personnel on loan from airlines, which the DGCA is supposed to regulate?

The problem is essentially one of a low priority accorded to safety by the aviation ministry. In the wake of the ongoing fake marksheets imbroglio, the Director General of DGCA Bharat Bhushan has admitted that the major problem facing the organisation in carrying out its designated role is a lack of manpower. For now, a possible solution is outsourcing safety and financial audits to third parties. But that is a temporary solution at best. Aviation minister Vayalar Ravi must move towards initiating a long-term solution by allotting funds for DGCA to bring in the required personnel. In any sector, aviation or financial, the overlap of actors and regulators is asking for trouble.

From: The Times of India

Space and Beyond

Yuri Gagarin's historic space flight 50 years ago was more than a remarkable scientific breakthrough. Besides kicking off a 'space race' between the erstwhile USSR and the US, it fired the latent human desire to explore uncharted territory. Since then, not unlike the great naval expeditions of the age of discovery, space exploration has continued to be an object of exciting research and an index of technological prowess. From landing on the Moon to sending robotic probes to every planet of the solar system, man has steadily increased his footprint in outer space. The International Space Station, a perennial laboratory for astronauts, orbiting the Earth bears testimony to how far we have come. And given the almost exponential rate of technological advance, manned expeditions to Pluto and beyond over the next 50 years cannot be ruled out.

Change too is inevitable in the form and structure of space programmes. They have traditionally been funded by national governments. But thanks to budget cuts brought on by the recent economic slowdown Nasa, America's premier space agency, has been financially hamstrung and unable to push some of its ambitious projects. The deficit can only be made up through private sector participation and creating a viable commercial model for furthering space exploration. Space tourism, being pioneered by private entities such as Virgin Galactic, could pave the way for greater interest and investment in space. With ambitious space programmes of their own, the implications are significant for India and China. Their desire to send manned missions to the Moon over the next decade is proof that Gagarin's legacy lives on.

From: The Times of India

Eurofighter

OUTLOOK

Soldier, Sailor, Airman, Scam

"It is dangerous to ignore corruption in the armed forces"

The Army recently held a three-day exhibition in Ahmedabad named 'Know Your Army'. Reportedly, the seniormost army officer posted in the state showered praises on the Chief Minister, who was the Chief Guest, likening him to an army commander who sets targets and then sets about to achieve them. Praising him for his vision for the development of the state and the nation, the Major-General then requested the state to follow the example of other states in allocating land for the Army Welfare Housing Organisation to help serving and retired military personnel. Looked at objectively and not through heavily tinted political lenses, all that the General was doing was softening up the Chief Minister before going in for the request. Perfectly fair tactics.

Judging by media reports, this rather innocuous incident pushed up eyebrows in Lutyens' Delhi and the Ministry of Defence sought an explanation from the Major General for allegedly violating the army code of conduct, which does not allow soldiers to make political statements of any kind.

When this writer was commanding South Western Air Command, then located in Jodhpur, the area of responsibility extended through the states of Gujarat, Maharashtra and Goa. This was in the early 1990s and the then Gujarat Chief Minister had been supportive in offering the Air Force a large tract of land in the Ahmedabad area to set up permanent headquarters for the command, which has since shifted there (Gandhi Nagar). On more than one occasion the undersigned had openly acknowledged the generosity and help that the chief minister and the state government were extending to the services. Earlier, when commanding Eastern Air Command, one recalls public occasions when similar platitudes were exchanged. The national political climate was relatively benign then.

None of these instances drew unnecessary debate because they were seen for what they were: genuine respect by the armed forces for the civilian leadership in the wider context of civil-military relations. Indeed, in the true apolitical ethos of the armed forces, all that mattered was to use civil-military relations for the larger good of the forces serving within the State's borders and maintaining a good working rapport should a situation warrant unforeseen aid to the civil authority. The recent episode in Gujarat possibly followed the old spirit. It is the fractious and recriminatory politics of the country that is drawing the armed forces into its ever-strengthening vortex.

Since healthy civil-military relations are the bedrock of a vibrant democracy, this brittleness at a time of mounting security challenges, both internal and external, does not bode well for the Indian State.

Today, unbridled corruption has become the hallmark of the democracy. It is no longer limited to the political, bureaucratic and corporate worlds, but has engulfed the fourth estate and the armed forces too. Yet the nation across political dispensations has shown no determination to stem this rot. The conclusion is obvious — all are to some degree complicit and are beneficiaries.

So it was with considerable cynicism that the nation watched the two Houses of Parliament indulging in a supposedly serious debate over what is called the 'cash for votes scam'. The incident occurred in 2008 in the run-up to the debate on the controversial nuclear deal. It was public knowledge that trading in members of Parliament had taken place. A Parliamentary Committee to look into the allegations did not find conclusive evidence and recommended further investigation. For three years, the law was taking its own course. And this happy state would have continued, had not the cables from the American Embassy in New Delhi been revealed by the media courtesy WikiLeaks.

Suddenly the conscience-keepers of the nation were aroused — leading to a futile debate in Parliament. The only meaningful point in it was when the Prime Minister expressed sadness that he was addressing the House when the country faced enormous challenges: "I thought that this august House would use this opportunity to reflect, not in a spirit of partisan upmanship, but as one, as people charged with the responsibility of governing this country to work out a viable strategy as to how we should and we can deal with these emerging events."

The Prime Minister, having made a point of national import then failed to follow up — presumably because even he does not really care. Otherwise, he could have drawn the attention of the House to the decline in the one national institution that must remain untouched by the rot that is eating into the vitals of our polity, the Armed Forces.

To drive home the point, he could have said that in the recent past no less than three erstwhile service chiefs, six Lieutenant Generals and three Major Generals have been put under investigation for gross irregularities. Of these, one Lieutenant General has been committed to trial for divulging sensitive information to vendors, and another to three years' rigorous imprisonment for a scam relating to rations. An Indian Air Force officer was found taking bribes to show favours to a French company at the Aero India show and a top secret file relating to the lucrative M-MRCA purchase was found on the roadside. These are not individual aberrations but reek of systemic rot. It is possible that just this one statement would have aroused a clamour for a full debate. The Prime Minister, in turn, would have emerged a moral crusader for offering a constructive platform to prepare for the challenges he cautioned against.

The brittleness of civil-military relations is evident from the unresolved issues relating to the Armed Forces Special Powers Act and the Army's consequent unwillingness to commence training in Chhattisgarh until the government issues clear rules of engagement with respect to any Maoist interference — something the civil authorities will find difficult to resolve in the climate of trust deficit that prevails.

Dassault

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“Great seats,

A380. Love at first flight.

80

lots of space, very nice.”

Ingrid, Singapore

Grievances of veterans have been ignored for years even when the Supreme Court has issued favourable judgments. Today, at regular intervals, veterans are returning their medals to their Supreme Commander — who has not once thought fit to meet them. No self-respecting democracy is so callous towards the sentiments of its veterans. This lack of respect is not lost on those serving; it is also received with some glee across our borders. But to our politics and parliament, this means little.

The fragility of civil-military relations has other adverse effects. Modernisation will continue to be sabotaged by vested interests which will raise the bogey of wrongdoing at critical times in the process of procurement. The lack of consensus on the appointment of a Chief of Defence Staff ensures that we cannot develop an integrated fighting capability so crucial to combating modern security challenges. Inability to set up a national defence university ensures that we are denied the opportunity to educate and train leaders, both military and civil, who will be better prepared for the emerging security challenges.

It is crucial for the nation to decide what place it wants to accord its armed forces in the national scheme of things. This writer had pleaded ("Through thick and thin", 3 June 2009) for a Blue Ribbon Commission to make recommendations to Parliament, which could then take a final call.

Now that the debate in Parliament has shown the country how fragmented our polity is and how unreal our priorities, perhaps on the issue of national security and the role of the armed forces there is an opportunity for our polity and Parliament to redeem themselves and display that elusive unity. This is one debate that the guardians of our nation's borders — the armed forces — will watch with great interest as will our friends and potential foes. But it will need more than poetry and innuendoes.

Air Marshal (R) Brijesh Jayal

Antony "warns" Defence commanders against corruption

Defence Minister AK Antony has called upon the Army and Air Force senior officers not to succumb to corrupt practices indulged in by "vested interests in the garb of aggressive marketing". Addressing commanders of the two forces on 26 April 2011, Antony asked them to strive for probity and fair play. "The government remains fully committed to the modernisation of the Armed Forces and upgrading infrastructure," he said. Antony added, "for far too long, we have remained over dependent on foreign equipment".

Speaking to the Air Force Commanders Antony said, "At times, vested interests bring about unnecessary pressure and resort to corrupt practices that can wreak serious havoc upon our security in more ways than one."

Boeing

ANALYSIS

India's defence budget 2011-12 : Vital Statistics

The Phalcon AWACS.

In his Budget Speech on 28 February 2011, Finance Minister Pranab Mukherjee set aside Rs 164,425 crore ($36 billion) for defence during the new financial year (FY 2011-12). This is less than 2 per cent of the country's GDP despite the recommendations of successive Standing Committees on Defence in India's Parliament that it should be at least 3 per cent if the emerging threats and challenges are to successfully countered.

Meanwhile, China has increased its official defence expenditure for 2011 by 13 per cent to $91.5 billion, while its actual expenditure on defence is likely to be close to $150 billion (3.5 per cent of its GDP). The United States' defence expenditure in the fiscal year 2010 was $530 billion, excluding funds allotted for the wars in Afghanistan and Iraq.

Of the total allocation for defence, on the revenue account the Army will get Rs 64,250 crore (Rs 642.50 billion), the Navy Rs 10,590 crore (Rs 105.90 billion), the Air Force Rs 159,300 crore (Rs 159.30 billion) and the Defence Research and Development Organisation Rs 5,624 crore (Rs 56.24 billion).

The total revenue expenditure planned for the year is Rs 95,216 crore (58 per cent of the budget).

The remaining amount of Rs 69,199 crore (13.75 per cent increase, 42 per cent of the budget) has been allotted on the capital account for the acquisition of modern weapon systems, including the pending medium-range multi-role, combat aircraft, light reconnaissance and surveillance helicopters, 145 air-transportable-light howitzers and C-17 heavy-lift transport aircraft.

It is projected that the Government of India plans to spend approximately $100 billion over the next 10 years on defence modernisation.

Giving his reaction to Finance Minister Pranab Mukherjee's Budget Speech, Defence Minister A K Antony guardedly said, "We welcome it as our concerns have been by and large addressed and the finance minister has stated that if we have any fresh requirements, they would be made up without any difficulty."

However, while the reactions of the armed forces are not publically known, they are unlikely to be satisfied as their plans for modernisation have been stymied year after year by the lack of committed budgetary support.

Curiously, the 11th Defence Plan, which will enter its fifth and final year from 1 April, has not yet been accorded approval in principle by the government and, therefore, lacks committed budgetary support!

The only silver lining on the horizon is that the funds earmarked on the capital account for FY 2010-11 have been fully spent by the government for the first time in many years.

In addition to the defence budget, the government has also earmarked adequate resources in the annual budget of the ministry of home affairs for homeland or internal security. A portion of these funds will be utilised for setting up a National Intelligence Grid and the National Counter-terrorism Centre–measures which are considered necessary consequent to the Mumbai terror strikes in November 2008. Also, funds for the modernisation of central police and para-military forces will be provided from the budget of the MHA.

Tejas LCA.

This year's defence budget is 1.83 per cent of the projected GDP and 13.07 per cent of the total central government expenditure. In fact, according to the recommendations made by the 13th Finance Commission, the nation's defence expenditure should progressively reduce to 1.76 per cent of the GDP by 2014-15. Quite clearly the finance ministry appears to have decided to pay heed to this advice!

Brig. Gurmeet S.Kanwal
Director, CLAWS

Sea King helicopter comes in to land on INS Viraat, with Sea Harriers in the background.

M-MRCA contenders 'down selected'

On 27 April 2011, just days before the commercial bids submitted by the six contenders for the M-MRCA programme would have become invalid, the Ministry of Defence, in what is described as a 'sleight of hand', asked Eurofighter and Dassault to extend the validity (or re-submission) of their offers till end of the year. As reported by various sources, the other four companies (Boeing, Lockheed Martin, Saab and RAC-MiG) instead received somewhat dismissive letters that their aircraft did not qualify. Expectedly, there was immediate reaction ranging from "disappointment" to resentment as companies (and governments) reacted particularly on the manner in which their proposals had been summarily dismissed after seven years of "grueling effort" with many multiple millions of dollars expended.


Eurofighter Typhoon.

Perhaps coincidentally, but dramatically timed, was "resignation" the same day by the US Ambassador to India even as this was soon de-linked to the M-MRCA decision. Reports have it that all reactions notwithstanding, the Government will go ahead and formally open the commercial bids from Eurofighter and Dassault in the next few months so that negotiations with the selected company begin by July leading to contract signature by December 2011. According to sources, the first M-MRCA squadron equipped with 18 'flyaway' aircraft would be based in the western sector, "probably at Ambala" by the end of 2015. Production of the balance 108 aircraft would be taken up at the new production facilities at HAL's Bangalore complex, the production rate going up from 6 to 20 per year, with delivery of the first tranche being completed by 2018 or so. It is expected that the initial 126 M-MRCAs will be supplemented by another 63 aircraft, produced by HAL.

The acronym M-MRCA (medium–range multi role combat aircraft) has become most familiar to both professionals and observers in India and internationally but it was *Vayu*'s Issue V/2004, near seven years earlier, when the Government of India's intention to procure "over 100 new fighter aircraft to replace its ageing fleet of MiG-21 variants, MiG-23BNs, and MiG-27s" that first brought this into public awareness. The


Dassault Rafale.

Government's intention was to give the Indian Air Force a new aircraft type to bridge the increasing gap between phasing out of the obsolescent types and induction of Tejas LCA.

Shortly thereafter, the then VCAS stated that the tender would be "global" and various aircraft types, including the MiG-29, F-16, Gripen and Mirage 2000 were shortlisted. The Air Marshal then put it in correct perspective when he focused on issues like "continued freedom of action, threats of sanctions and the like were of concern. In addition, we will also be looking at transfer-of –technology agreements for certain key components, and transfer of software source codes in the avionics and flight control systems."

However, following the issue of RFIs to the four 'medium category' fighters in 2004, two years later when the RFPs followed, three 'heavy category' fighters were included of which the Eurofighter Typhoon and Dassault Rafale have now been 'down selected' even as the IAF's order for the 'heavy' Sukhoi Su-30MKI has doubled from 140 (in 2004) to 270 (in 2011) and the 'light' Tejas is still many years away from induction.

An IAF dilemma: upgrade Mirage 2000s ?

Even as the prolonged wait to upgrade the IAF's fleet of 51 Mirage 2000Hs with new avionics and weaponry at an estimated cost of US$ 2.1 billion (near Rs 10,000 crore) has been virtually cleared, with CCS approval imminent, there are alternative views that for this amount, a score or more additional M-MRCAs could be procured.

One argument of course is that the majorly upgraded Mirage 2000s (with new avionics, radars, mission computers, glass cockpits, helmet-mounted displays, electronic warfare suites, weapon delivery and precision-targetting systems) would give the IAF a cutting edge with this type for another two decades. There would also be 450 MICA missiles contracted to arm the Mirages. The counterview is that the "cost is too high" with only 20 years of frontline service left for the Mirage 2000H as there will be no airframe modifications nor replacement of powerplants.

Eurocopter

Tejas LCA in night flying trials

To validate the Tejas LCA's night operational capability, its multi-mode radar and Litening pod, as well as Helmet Mounted Display System (HMDS) and Instrument Landing System (ILS) systems were evaluated during night flying in moon phase as well as dark phase.

Tejas LSP-5, with the required cockpit lighting standard to support night flying, was used for these trials. First phase of the night evaluation in which six night flight sorties were conducted, concluded on 26 April 2011 and is a definite step towards achieving night attack capability for Tejas in the near future.

Kaveri engine flying test bed trials

The GTRE Kaveri engine, which has been integrated with an Il-76 flying test bed (FTB) at the Gromov Flight Research Institute (GFRI) in Russia has completed eleven flight tests for about 20 hours duration by end-April 2011.

The flight tests carried out include up to 12 km maximum altitude and a maximum forward speed of Mach = 0.7 and testing for engine performance under different operating conditions.

Record performance by HAL

Hindustan Aeronautics Limited produced and delivered 78 aircraft of various types during the financial year ending 31 March 2011, as against 48 aircraft in FY 2009-10. This is the highest number of aircraft and helicopters produced by HAL, whose turnover at Rs 13,061 crores reflects 14% growth over the previous year.

HAL is now building the Sukhoi Su-30MKI in full series production at Nasik.

The largest number of aircraft type produced was the Sukhoi Su-30MKI, twenty five in number, followed by twenty three Dhruv ALHs and fifteen Hawk Mk.132 advanced jet trainers. Other types included four Dornier 228s, three Tejas LCAs, two HJT-36 intermediate jet trainers and six Chetak/Cheetah light helicopters.

In his earlier statement at the 47th AGM, the Chairman Mr Ashok Nayak had highlighted numerous achievements which included maiden flight of the Light Combat Helicopter (TD-1) while the Dhruv ALH Mk.III, powered by Shakti engines was being manufactured for the IAF and Army to meet their high altitude operational requirements. The ALH Mk.IV, which is an armed variant, is undergoing weapon trials.

The HJT-36 IJT programme has progressed with the integration of a new AL-55(I) engine and limited series

Mr Ashok Nayak, Chairman, HAL.

production launched. Preliminary studies on the development of a new basic turboprop trainer (HTT-40) have commenced as have those on the futuristic Fifth Generation Fighter Aircraft (FGFA) in collaboration with Russia. The Multi Role Transport Aircraft (MRTA) will also be co-developed with Russian partners at

Agusta westland


HAL Dhruv advanced light helicopter.


HAL HJT-36 Sitara intermediate jet trainer.


BAE Hawk Mk.132 advanced jet trainer.


Indian Navy Dornier 228 information warfare aircraft over Naval exercises.

an estimated expenditure of US$ 600.72 million which will be implemented through the JVC.

Major achievements during the year include the first Su-30MKI manufactured from raw material as also first raw material phase engine for the Su-30MKI successfully completed the long test at Koraput, the 100th Dornier 228 manufactured by HAL's TAD at Kanpur, one Cheetah helicopter exported to Namibia and Initial Operation Clearance (IOC) for LCA received. Design for the Light Utility Helicopter (LUH) was frozen in co-ordination with the Army and Air Force and the detailed design phase commenced.

HAL delivers 100th Dornier 228

The 100th Dornier 228 light transport aircraft manufactured by Hindustan Aeronautics Limited at its Transport Aircraft Division, Kanpur, was formally handed over to the Indian Coast Guard during a ceremony at Chakeri airfield on 26 May 2011.

Ashok Nayak, Chairman HAL in presence of SK Jha, Managing Director (A) and D. Balasubramanian, General Manager (TAD), presented the symbolic key of the aircraft CG778 to Vice Admiral Anil Chopra, Director General Coast Guard, followed by the documentation.

The Indian Coast Guard, with 40 Dornier 228s in service or on order, is the largest operator of the type in the world, followed by the Indian Air Force and Indian Navy. Additional orders for the HAL-Dornier 228 are expected from both Indian and international customers.


(left to right)
Vice Admiral Anil Chopra, Ashok Nayak, Commandant Suresh Rana (CO CGAS 750).

Coast Guard to re-issue RFP for MMM aircraft

The Indian Coast Guard are presently revising their air staff requirements for the 'Multi Mission Maritime' (MMM) aircraft following cancellation of the earlier RFP and subsequent technical and flight evaluation of the shortlisted Bombardier Q-400 and Beriev Be-200, which took place earlier in 2011.

The Coast Guard plan to acquire six MMM aircraft in the next 5-year plan period, followed by another three so as to expand their maritime surveillance capabilities with a larger aircraft with more payload and range than provided by its present fleet of Dornier 228s. The MMM should be capable of prolonged low level surveillance at 350 nautical mile distance from base. Meanwhile, the Government has cleared a number of new Coast Guard Air Stations along both the western and eastern sea boards where additional Dornier 228 squadrons would be based.

Indian Army to induct attack helicopters

The Indian Army's Aviation Directorate is to be expanded with attack and tactical assault helicopters embedded with the three Strike Corps. As per the long term plan, to be implemented by 2022, each Strike Corps would have an Aviation Brigade with two squadrons of 12 attack helicopters each plus two squadrons with 15 reconnaissance and surveillance helicopters for tactical battle field employment and casualty evacuation.

HAL light combat helicopter (LCH)

For the latter role, the Army has a requirement for 133 light utility helicopters to replace the present Chetak/Cheetah fleet for which the Eurocopter AS550-C3 Fennec and the Kamov Ka-226 are in competition. While considerable numbers of the Dhruv advanced light helicopter are presently being delivered to the Indian Army, HAL's new light combat helicopter (LCH) is also under consideration. The Indian Air Force have ordered 64 LCHs and the Indian Army have issued an intent for 114 LCHs.

Air Force Commanders' Conference

The first bi-annual Air Force Commanders' Conference for 2011 was held at Air Headquarters from 25 April 2011, inaugurated by Defence Minister AK Antony in the presence of Chairman, Chiefs of Staff Committee (COSC) and Chief of the Air Staff (CAS), Air Chief Marshal PV Naik.

The Air Force Commanders, 2011.

Mr Antony specifically commended the IAF for conceptualisation and operationalisation of various assets and force-multipliers. He also reiterated that primacy of operations had to be foremost in view of the prevailing security situation and stressed on consolidating the operational availability of weapon systems and sensors and declared the period ahead as the 'Year of Consolidation'.

The conference reviewed of operations, acquisitions, aerospace safety, maintenance, administration and personnel matters concerning IAF's human resources. Later, presentations were made by AOC-in-Cs of each of the seven IAF Commands during the conference. Also interacting with the IAF Commanders was National Security Advisor (NSA), Shiv Shankar Menon.

Army Commander's Conference

The bi-yearly Army Commanders' Conference was held at New Delhi from 25 to 30 April 2011, chaired by the Chief

Gen VK Singh, COAS introducing the VCOAS, Army Commanders and other Senior Army Officers to Defence Minister AK Antony.

of Army Staff Gen VK Singh, and attended by the VCOAS, all Army Commanders, Principal Staff Officers, Director Generals & Heads of Arms and Services.

The conference addressed the prevailing security environment through updates and discussions to include traditional and asymmetric threats at strategic level and reviewed the existing strategies. Other issues discussed included a review of 'Infrastructure Development' in the North East as also Budget Management, Border Roads Development and Land Management.

With respect to "Budget Management", the conference addressed the improvement towards efficient and timely utilisation of defence budget, which forms part of the ongoing study on 'Financial Management in the Indian army'. Another issue reviewed was the 'Medical Support System' by taking a holistic look at the existing medical infrastructure, address its incongruities and recommend improvements to support the 'transformed Army' of the future.

Army-IAF joint exercise 'Vijayee Bhava'

T-72 main battle tanks and Dhruv advanced light helicopters of the Army were amongst equipment employed in very high temperature desert terrain of northern Rajasthan near Suratgarh during the joint Army-IAF Exercise 'Vijayee Bhava', meaning 'blessed to win'. The month-long exercise of a simulated battlefield environment involved the II Corps and aircraft of Western Air Command (WAC).

Army Aviation Dhruv ALH.

GOC-in-C, Western Command, Lt Gen SR Ghosh flew in an IAF Jaguar trainer over the large exercise area covering nearly 2,400 sq km. "The dynamic process of operations, both offensive and defensive, integrating and validation of concepts of modern warfare that have emerged during the transformation studies of Indian Army, network centricity, testing and evaluation of new equipment" were some of the objectives achieved in the exercise. Integration with the Air Force in all stages and employment of

T-72 tank with BMP-2 infantry combat vehicles.

T-90 main battle tank.

Army Aviation Chetaks and Cheetahs in formation.

airborne and heliborne Special Forces was the highlight of the Exercise 'Vijayee Bhava'. The IAF aircraft types involved in the exercise included MiG-29s, MiG-21 Bisons, Jaguars, Il-76s, An-32s, Mi-17 1Vs and Mi-25/35s.

Offensive Air Defence was integral in the exercise and some 100 fighter sorties were flown. Over 300 paratroopers and 50 heavy loads were air dropped from one Il-76 and six An-32 transport aircraft in stealthy night operations, while Mi-17 1V helicopters were employed for special heliborne operations (SHBO).

Saab Ad Gripen

India – Singapore in Exercise *Bold Kurukshetra*

The Chief of Army Staff, General VK Singh visited the 31st Armoured Division (*White Tigers*) in late March 2011 and also witnessed the joint Indo-Singapore Exercise *Bold Kurukshetra,* where tanks and Infantry Combat Vehicles of both Armies jointly executed precision firing and manoeuvres at the field ranges. The exercise was also witnessed by Lieutenant General AK Singh, Army Commander, Southern Command and Lieutenant General Sanjeev Langar, II Corps Commander.

Warning on Chinese at LOC

Meanwhile, GOC–in-C Northern Army Command Lt-General K T Parnaik has warned that India not only faces the threat from Chinese troops along the Line of Actual Control (LAC) with China but this could well extend to the Line of Control (LoC) in Kashmir resulting from the expansive Beijing-Islamabad military nexus. The massive build-up of Chinese military infrastructure all along the 4,057-km LAC, especially in the Tibet Autonomous Region, as well as the expanding Chinese footprint in infrastructure projects in PoK is well-documented, but this is the first time a senior Army commander has publicly expressed apprehensions about People's Liberation Army troops being actually stationed along the volatile 778-km-Iong LoC between India and Pakistan.

"It poses military challenges to India and not only along the Sino-Indian border but also along the LoC. And we hear many people today who are concerned about the fact that if there were to be hostilities between us and Pakistan, what would be the complicity of the Chinese. Not only because they are in the neighbourhood but the fact that they are actually stationed and present on the LoC," said the General at a seminar in Jammu.

Naval Commanders Conference

The Naval Commander's Conference took place on 24 – 27 May when various aspects involving acquistions, operations, personnel and logistics were discussed by the senior leadership of the Indian Navy.

While reviewing the acquisition plans of the Indian Navy, stress was laid on close monitoring of ongoing projects to ensure timely completion and prevent cost over runs. Attention was also drawn to timely fruition of infrastructure development associated with operationalisation of new inductions and projects already approved by the Government, particularly, Operational Turn Round bases in A&N Islands, Forward Operating Base at Tuticorin and Naval Air Enclaves.

Various aspects of the induction and fleet integration of INS *Vikramaditya* along with its air element of MiG-29K fighters was also discussed, particularly training and infrastructural preparations.

Singapore and Indian Navies conduct SIMBEX 2011

The Indian and Singapore Navies conducted the annual Singapore Indian Maritime Bilateral Exercise (SIMBEX) from 18 to 25 March 2011. Hosted by Singapore, this year's exercise was the 18th in the series of bilateral exercise held since 1994. The exercise comprised a shore phase, already held at the Changi Naval Base and a sea phase then carried out in the South China Sea.

Singapore Navy stealth frigate with Indian Naval vessels.

SIMBEX 2011 saw the RSN and IN conducting advanced naval warfare training involving air, surface and sub-surface dimensions, aimed to enhance the interoperability and mutual understanding between the two navies. The RSN participated in SIMBEX 2011 with three frigates, a missile corvette, a submarine and a maritime patrol aircraft, while the Republic of

Singapore Air Force deployed fighter aircraft for the exercise. Joining them were three destroyers, a corvette, a fleet tanker as well as a maritime patrol aircraft from the Indian Navy.

Vice Admiral Sunil Lanba, AVSM takes over as the Chief of Staff, Eastern Naval Command from Rear Admiral Karambir Singh on 2 May 2011.

Karwar Naval Base Phase I Completed

On 21 May 2011, Defence Minister AK Anthony inaugurated the civilian township at Amadalli, marking completion of all construction activities associated with Phase-I of the Naval base at Karwar. He highlighted the fact that "the growth of the Karwar naval base provided considerable impetus to the economy of the Uttar Kannada region and the Ministry of Defence had allotted a sum of Rs 126.96 crores to the State for rehabilitation of local inhabitants; pukka houses provided to the families with electricity, drainage and also pukka roads and schools have been set up in the rehabilitation centres". Even as Phase-I of the Karwar naval base project is completed, planning for the second phase of the project involving augmentation of facilities at the Naval base to cater for basing of additional ships and submarines at Karwar is well underway and work is likely to commence once the Cabinet approves the expansion.

1,000th Dauphin helicopter for Pawan Hans Helicopters

Eurocopter's 1,000th Dauphin helicopter was delivered on 19 April 2011 to Pawan Hans Helicopters Limited. This is an AS365 N3 version, configured for offshore oil and gas drilling missions, and it brings the Indian operator's fleet to a total of 35 Dauphins.

Marking the 25-year association of Eurocopter with its key Indian customer, present at the delivery were Eurocopter President & CEO Lutz Bertling and Sanjiv Bahl the Executive director of Pawan Hans, who were joined by Joseph Saporito, Eurocopter's Executive Vice President for Commercial Programmes and Cécile Arnaud, the Sales & Marketing director

AS365N3 of Pawan Hans.

of Eurocopter India Pvt Ltd. Pawan Hans' Dauphin fleet has logged more than 375,000 flight hours, with an availability rate of over 80 percent.

Review of Air India order for B-787 Dreamliners

A panel set up by Air India and the DGCA are examining Boeing's offer of US$ 500 million as compensation against the three-year delay in deliveries of the 27 Boeing 787 Dreamliners ordered several years back. The first UPA Government had ordered 111 new airliners worth Rs 50,000 crore and while all 43 Airbus 320 family aircraft have been delivered, the B-787s remain in limbo at Seattle.

Meanwhile the national flag carrier have notched debts of Rs 40,000 crore, of which Rs 18,000 crore is working capital loan with the rest against aircraft purchases. According to Government officials, the Finance Ministry could provide a 'comfort letter' to Air India to help the beleagured airline access to funds at 10-10.5% interest under a debt restructuring programme.

Soaring Biz aviation market in India

According to Centre for Asia Pacific Aviation, the general aviation market in India, comprising business jets, as also those turboprop and piston-engined, plus helicopters is expected to touch $12 billion in aircraft sales by 2020 with a fleet inventory growing to 2,000 aircraft from the current 680. According to the Directorate General of General Aviation (DGCA), the general aviation fleet in India comprises 1,140 small aircraft and 300


Hawker Beechcraft Kingair.

helicopters. The business jet fleet is a relatively small component of this may be totalling140 jets.

The business aviation market is growing with new owners from the real estate sector, offshore gas exploration and mining companies. India's growing roster of high net worth individuals and demand from corporates are accelerating sales of business jets in the country. Aircraft companies including Hawker Beechcraft, Gulfstream, Dassault and Bombardier are competing for sales in India's burgeoning business aviation market. "The demand for Gulfstream G450 and G550 remains robust because of the rapid expansion of global business ties," according to Roger Sperry, regional senior vice-president of international sales for Gulfstream whose fleet in India has grown from a modest 5 aircraft in 2001 to 17 today. Similarly, Canada's Bombardier expects 325 new jet deliveries to India by 2020.

Air Works India is authorised Service Centre for Dassault Falcon

Air Works India (Engineering) Pvt. Ltd has been appointed Authorised Service Centre (ASC) for Dassault Falcon. Initially, Air Works India will serve as a Line Service Centre, capable of providing 24-hour troubleshooting, line maintenance and inspections, up to 2B, for all Falcon 900EX and 900 EASy series aircraft. The 47,000 square foot Mumbai service centre has 10 technicians dedicated to working on Falcon aircraft and the company has been maintaining Falcons for 15 years. Air Works India has made significant investments in Falcon specific tooling.

Ministries in row over Safdarjung Airport land

Since the day of closure of scheduled air operations at Safdarjung Airport for security reasons, the historically important airfield has turned into a 'disputed land', with more than two ministries laying their claims for owning it. The fact is that the 'valuable' land belongs to the aviation sector, being the first airport when New Delhi became the capital of India, the much larger airport at Palam coming much later.

The latest to lay its claims are the Urban Development Ministry which, according to its plans, wants to develop the spacious area for 'recreational purposes'. However, Safdarjung Airport is the ideal location for the proposed National Air and Space Museum (see *Vayu* Issue VI/2010).


Where better than in a dedicated area within Safdarjung Airport, the heart of New Delhi and the home of the very first flying club and airport in the country!

Kingfisher averts showdown with MIAL, clears airport dues

Debt-ridden Kingfisher Airlines has averted a major showdown with the Mumbai International Airport (MIAL), which had threatened to ban its operations over a payment default, by clearing the dues towards airport charges. Kingfisher, which had restructured Rs 750 crore of its debt last November, is still sitting on a debt pile of Rs 6,900 crore, and even after six years into operations, Kingfisher is yet to turn profitable. Industry analysts say the airline will record losses in the fourth quarter too, as oil prices have increased.

IndiGo select Pratt & Whitney PW1100G for Airbus A320neo

IndiGo has selected Pratt & Whitney PurePower PW1100G engines to power its fleet of 150 new Airbus A320neo family aircraft. This represents 300 firm PW1100G engines with options for additional engines. In addition, IndiGo has also chosen Pratt & Whitney to provide maintenance for these PurePower engines.

"Our selection underscores the confidence in the Pratt & Whitney PurePower engine and is another important milestone in IndiGo's history," said Rakesh Gangwal and Rahul Bhatia, co-founders of IndiGo. "At IndiGo, we are committed to maintain low fares while reducing our impact on the environment through the use of green technology such as these PurePower engines. The PurePower engine's benefits will allow us to make dramatic improvements in environmental performance with reduced emissions and significant savings in fuel consumption," emphasised IndiGo President Aditya Ghosh.

HAL Marut

ADRDE aerostat at Aero India 2011

The Aerial Delivery Research & Development Establishment (ADRDE), Agra Cantt, have publicly displayed their 2000 cubic meter Helium-filled Aerostat based Surveillance System with Electro-optic(EO) payload and Communication intelligence

(COMINT) payload at Air Force Station, Yelahanka during Aero India 2011. ADRDE are exploiting this platform for integration of new payloads including electronics intelligence (ELINT) and surveillance radar as per user requirements.

Successful test flight of Rustom UAV

The second test flight of the Rustom1 UAV was conducted on 21 May 2011. Being developed by the Aeronautical Development Establishment, the Rustom 1 has a projected endurance of 14 hours and altitude ceiling of 8000 meters.

Additional defence programmes with USA

The $4.1 billion contract for ten Boeing C-17 Globemaster-III strategic heavy airlift aircraft for the Indian Air Force is imminent while negotiations for six more Lockheed Martin C-130J-30 Super Hercules tactical transport aircraft are also expected to commence soon. The Globemaster-III is capable of carrying a payload of almost 170,000 pounds and operating from limited length runways including those semi-prepared. While India needs to augment its strategic airlift capability to swiftly move combat systems and troops over large national and international distances, the decision is seen to be imbued with strategic significance even as the Government of India is already conducting commercial negotiations for the "follow-on contract" worth $1 billion for four more P-8I Poseidon maritime patrol aircraft, eight of which were earlier ordered for $2.1 billion in 2009.

The Pentagon's $27 billion 'near term' Indian wish list *

A US Embassy cable titled 'Scenesetter For USD(P) Flournoy's Visit To India', sent on 29 October 2009 to the State Department by Ambassador Tim Roemer lists military equipment "that the United States should try and sell India" and confirms various programmes underway.

Indian Air Force

510 Sensor Fuzed Weapons (SFW)	-	FMS, $ 379 million
20 air-launched Harpoon Missiles	-	FMS, $ 74 million
6 + 6 C-130J-30 Super Hercules	-	FMS, $ 800 million
10 Boeing C-17-Globemaster III	-	FMS, $ 4billion
306 Honeywell F-125IN jet engines (re-engining of IAF Jaguars)	-	$ 4.3 billion
148 GE-414 turbofan engines (for LCA)	-	$ 800 million
15 Boeing CH-47 Chinook heavy lift helicopters	-	$1 billion
22 Boeing AH-64 Apache attack helicopters	-	$1 billion

Indian Navy

Network Centric Operations Prototype — Raytheon was the low bidder for this system, but competition has requested a review.

16 multi-role helicopters : Sikorsky S-70B and Lockheed MH-60R are in competition	-	$ 1 billion

Indian Army

145 M-777 Light Weight 155mm Howitzer	-	$ 900 million
9,000 Javelin Anti-Tank Guided Missiles	-	$ 1.4 billion

*** [Wikileak extract from cable 232002: secret, sent by U.S. Embassy on 29 October 2009]**

Pawan Hans

PSLV-C16 in successful launch

On 20 April 2011, the PSLV-C16 rocket successfully launched into orbit a new remote sensing satellite which will study and help manage natural resources, along with two nano satellites. The ISRO Polar Satellite Launch Vehicle placed into polar sun synchronous orbit the *Resourcesat-2, Youthsat and X-Sat* about 18 minutes after it blasted off from the Satish Dhawan Space Centre launch pad, 90 km from Chennai. The three satellites were placed into orbit 822 km above earth in the text book launch.

The 1,206 kg *Resourcesat-2* with a space life of five years replaces *Resourcesat-1* launched in 2003 and would provide data with enhanced multispectral and spatial coverage on natural resources.

Air Works receives prestigious award

Air Works India Engineering Pvt Ltd have received the *Aviation Week* award for the 'Leading independent MRO of 2011', presented to Air Works during the MRO America Conference and Exhibition in Miami, USA on 12 April 2011. Air Works is the only third party MRO in India with an EASA Part 145 certification. Commenting on this milestone achievement, Vivek Gour, Managing Director of Air Works said, "Air Works receiving the leading independent MRO of the year award is phenomenal. This award is a huge achievement and recognition of our contribution to the Indian MRO industry."

BEL registers Rs 5,550 crore turnover

Navratna defence PSU Bharat Electronics Limited (BEL) has recorded a turnover of Rs 5,550 crores (provisional) for the fiscal year 2010-11, registering a growth of 6.3 per cent over Rs.5,219.77 crores during 2009-10. BEL achieved exports of $

Ashwani Kumar Datt, CMD, BEL, receiving the SCOPE Meritorious Award for Corporate Governance from the President of India, Pratibha Devisingh Patil, in New Delhi on 11 April 2011. In the picture is Praful Patel, Union Minister for Heavy Industries and Public Enterprises.

41.69 million, which is an increase of 76 per cent over last year's figure of $ 23.65 million. The turnover per employee during 2010-11 was Rs 50 lakhs as against last year's Rs 45.2 lakhs.

Prominent among the new products introduced and supplied during 2010-11 is the Akash missile system, the new generation hull mounted sonar, mobile communication terminal, hand held thermal imager, semi-ruggedised automatic exchange, instant fire detection & suppression system, surveillance jammer vehicle, low power jammer, ATM-based integrated ship data network, combat management system, laser seeker, hf transreceiver, panoramic all-day surveillance system and gap measuring device Mk III.

Avi oil

Air Vice Marshal (R) AJS Walia conferred with *The Breakthrough Market Award*

AVM Walia flanked by Mr.Jeff Pino, President, Sikorky Aircraft and Carey Bond, President Sikorsky Commerical Aircraft while receiving the award.

In recognition of the aerospace potential within the subcontinent, Sikorsky has constituted the first ever *The Breakthrough Market Award.* This symbol of recognition was presented to AVM (R) AJS Walia, MD, India and South Asia, Sikorsky Aircraft, at the World Wide Sales Conference held at Palm Beach USA for his accomplishments, leadership and guidance combined with his tremendous knowledge of the commercial and military market.

Sikorsky is expanding its presence in India, teaming with local industry, and delivering S -76C++ helicopters for VVIP transportation to the Maharashtra Government, which is also considering the S-76 for homeland security purposes.

Chemring and the Hinduja Group in JV

The Chemring Group plc and the Hinduja Group India are in advanced discussions to establish a defence joint venture based in India. Chemring Group, an established supplier to the Indian armed forces, and the Indian Hinduja Group plan to develop a business to serve the Indian defence and security markets with the full range of Chemring products: countermeasures, electronic warfare, high energy materials, munitions, pyrotechnics and end of life ordnance destruction, with the transfer of appropriate technological capabilities. The joint venture will also look to local sourcing and seek to develop an indigenous manufacturing capability.

The technologically advanced products, local manufacturing and related transfer of technology will enhance the defence and internal security capabilities of the Indian armed forces and government in a cost effective manner. The joint venture is expected to commence operations in 2011 on receipt of the required regulatory approvals.

Tata Strategic Electronics Division to modernise IAF airfield infrastructure

The Tata Power Company Limited, through its Strategic Electronics Division (SED) have been selected to modernise the airfield infrastructure of the Indian Air Force by the Ministry of Defence. The Modernisation of Airfield Infrastructure – Phase I (MAFI-I) aims to improve capability of the airfields for supporting the modern combat air fleet being inducted by IAF.

Rahul Chaudhry, Chief Executive Officer of Tata Power SED said "Tata Power SED has been closely working with MoD and DRDO to provide state-of-the-art solutions to India's Armed Forces for the past four decades. This contract won against a Global Defence tender of MoD, is a watershed moment, not only for us, but also for increasing Private Sector participation in India's Defence Sector."

BEML into aerospace domain

BEML is to enter a qualitatively new dimension, aerospace business, whose CMD has maintained that "BEML will not be in competition with established players like HAL/ DRDO but join hands with them to complement their efforts in view of its competence in the heavy engineering sector".

BEML's Aerospace Manufacturing Division at Mysore was inaugurated by the Defence Minister and is the latest addition to the existing infrastructure for manufacture of GSE and GHE including weapon loaders, crash fire tenders and aircraft towing tractors. It also undertakes manufacture of complicated gears, jigs for aircraft assy, maching of aero space components, etc. BEML has also acquired 25 acres of land in the aerospace park SEZ near Bangalore International air port for establishing an exclusive aerospace manufacturing complex.

Air Marshal NAK Browne to be next CAS

On 20 May, the Government officially announced that Air Marshal NAK Browne (popularly 'Charlie' Browne) will take over as the next Chief of Air Staff on retirement of the present incumbent Air Chief Marshal Pradeep Naik on 31 July 2011.

During his 38 years service with the IAF, Air Chief Marshal held various operational and staff appointments that included Joint Director at the Air War Strategy Cell at the Air Headquarters, Chief Operations Officer and Air Officer Commanding of a Su-30 base, Air-I at Western Air Command (WAC) and Assistant Chief of the Air Staff (Intelligence) at Air Headquarters.

Then AOC-in-C Western Air Command Air Marshal NAK Browne and Northern Army Commander Lt Gen P C Bhardwarj with An-32 at Nyoma advanced landing ground in eastern Ladakh, just 23 km from the Line of Actual Control (LAC) with China, on 18 September 2009.

Earlier, in April 1997, he established the Indian Defence Wing in Tel Aviv and served as the Defence Attache till July 2000. Between 2007 and 2009, as the Deputy Chief of the Air Staff at Air Headquarters, he was responsible for various major modernisation programmes including the M-MRCA. The Air Marshal was AOC-in-C Western Air Command before taking over as Vice Chief of the Air Staff. The future CAS has an impressive operational flying record and was one of the pioneers on the Jaguar strike fighter, being Commodore Commandant of No. 16 Squadron equipped with the type.

'The way we were' ! Charlie Browne (second from left) with fellow pilots during Jaguar conversion training. At the centre is Wg Cdr (later Air Marshal) D Nadkarni first CO No.14 Squadron, and others including 'Bundle' Tyagi (later Air Chief Marshal) and 'Mike' McMahon (later Air Marshal).

In Remembrance

Air Chief Marshal Denis Anthony La Fontaine, Chief of the Air Staff from 3 July 1985 to 31 July 1988, passed away 6 April 2011 at Brahmanpalli village in Medak district of Andhra Pradesh. He was 82 and is survived by his wife and three daughters.

Commissioned in the Indian Air Force in April 1950 in the fighter stream, Air Chief Marshal La Fontaine first joined No.7 Squadron *(Battle Axes)* flying Tempest IIs and converted to Vampires in 1951. Soon after, La Fontaine was selected to undergo the All Purpose Instructors Course and over the next three years, he spent his career imparting elementary, intermediate and operational flying instructor in a variety of aircraft including the Tiger Moth, Harvard, Spitfire and Vampire.

In 1956, he returned to operational flying, when he was posted to No.2 Squadron flying Toofanis, then moved to No.29 Squadron *(Scorpions)* as Senior Flight Commander. Command of his own unit came in 1960, when he was promoted to Squadron Leader and was entrusted with raising a new squadron, No.47 *(Black Archers)*. No.47 Squadron, flying the Toofani, won the Mukherjee Trophy in its first year of raising. After the upgradation of ranks of Squadron Commanders to Wing Commander, La Fontaine took over command of No.14 *(Fighting Bulls)* Squadron at Kalaikunda, flying Hawker Hunters.

Air Chief Marshal Denis Anthony La Fontaine

Taking part in the Indo-Pak operations fighter in 1965, La Fontaine led a fighter sweep over Jessore. Hunters of No.14 Squadron intercepted Pakistani Sabres over Kalaikunda shooting down one in classic air combat.

As a Group Captain, La Fontaine was Chief Instructor with the Air Force Academy, responsible for developing a system of graded performance standards that improved the quality of flying training. At the outbreak of the 1971 War, he was a Senior Air Staff Officer at the Maritime Air Operations Cell in Bombay. Throughout the 1970s, he held a variety of staff appointments with Western Air Command, was Ops 1, Air 1 and later Senior Air Staff Officer (SASO). In between these staff appointments, he held operational appointments plus command of two fighter air bases.

Promoted as Air Marshal, he took over as Air Officer Commanding-in-Charge of Personnel (AOP) at Air Headquarters and later became AOC-in-C, Central Air Command and thereafter AOC-in-C Western Air Command.

On the untimely demise of the then CAS, Air Chief Marshal LM Katre, Denis La Fontaine took over as the Chief of Air Staff in July 1985. As the CAS, he oversaw the induction of the Mirage 2000 and the MiG-29 into IAF service.

We recall the late Air Chief Marshal's comment in his Foreword to the book *'The Black Archers' – Illustrated History of No.47 Squadron'* published by The Society for Aerospace Studies. Very graciously he wrote : "There is a lot of history behind the 'Black Archers' and I believe Pushpindar Singh is the best Air Force historian for putting it on record"!

View Point-I

"De-politicisation" of the M-MRCA decision

Major and strategically important defence purchases have rarely, if ever, been purely technical decisions. In the 1950s, Jawaharlal Nehru made political choices in opting to seal deals with the British, the Americans and the French. Nehru's and Indira Gandhi's switch to the Soviet Union in the early 1960s was a political and strategic decision. In her second stint in the 1980s, she turned westwards to Europe and Rajiv Gandhi followed suit. Narasimha Rao allowed Israel to open shop and Atal Bihari Vajpayee took the first step towards a strategic partnership with the United States. In each case, geo-political considerations took precedence over techno-economic evaluations.

No government decision to spend upwards of $11 billion on defence equipment could have been devoid of political and strategic calculations. Few will, therefore, readily accept the explanation that the decision to disqualify bids from the US, Russia and Sweden for a medium multi-role combat aircraft (M-MRCA), and shortlist European jets, was purely technical. Even if that was the case, the decision to allow only technical considerations to dictate the choice was a political one.

Technical considerations must get priority. Also, one should not jump to the conclusion that it will mark an irreversible turning point in India's relations with the US, which is visibly upset, more "angry" than "disappointed". The least important part of the disappointment for the US would be the money lost because not only has the US done well in the past couple of years selling defence equipment to India, but it is also likely to get other big orders, like the $4-billion purchase order for Boeing's C-17 transport aircraft, which according to US Ambassador to India Timothy Roemer would benefit "30,000 American workers and 650 American suppliers located in 44 states".

However, international relations experts and strategic analysts have already commented that the very "de-politicisation" of this decision could well be a manifestation of a downslide in the India-US bilateral political relationship, compared to the heyday of the second Bush administration and the first Manmohan Singh government. Such a perception will have its own political and geo-political consequences.

What exactly is the deal about? The best analysis of the M-MRCA tender has been offered by an Indian-American scholar of defence studies, Ashley Tellis, who also served as a policy advisor to the US State Department and the White House. In his lucid and, obviously, partisan analysis, *Dogfight: India's Medium Multi-Role Combat Aircraft Decision* Dr Tellis sums up: "The M-MRCA bid has been one of the hottest recent aviation procurements not just in India, but internationally, too. Eight countries and six companies eagerly await the outcome of this contest. This has turned into such a sizzling affair not only because of the size of the contract. Indeed, there are bigger procurement battles raging internationally. Rather, this procurement bid has been incandescent because it involves geopolitics, the economic fortunes of major aerospace companies, complex transitions in combat aviation technology, and the evolving character of the IAF itself."

Over several months in 2009-10, the Indian Air Force (IAF) conducted trials along India-Pakistan and India-China borders to test six different aircraft: Boeing F/A-18E/F Super Hornet and Lockheed Martin F-16IN Super Viper (US), Dassault Aviation's Rafale (France), MiG-35 (Russia), the Eurofighter Consortium's Typhoon (Germany, Italy, Spain and UK) and Saab's Gripen (Sweden). By all accounts, the tests were extensive and exhausting.

Of the six jets which were rated on around 650 specs, the Rafale and Typhoon were shortlisted based on technical parameters. Interestingly, neither the weightage or evaluation methodologies of the vital technical specifications nor the costs of aircraft have so far been considered a variable. Another "technical" consideration that seems to have been ignored so far is the extent to which the indigenisation of production, technology transfer and financial support would be offered by different suppliers. After all, the deal is not just to procure 126 or more jets, but to help modernise India's aerospace industry.

Were the technical factors favouring the two European jets so overwhelming that they prevailed over any political considerations weighing in favour of either the US or Russia? Or, put differently, were political considerations so weak that they could not override technical factors? Was the M-MRCA verdict an assertion of an "independent foreign policy", as some gratuitous commentators suggest, or a manifestation of either political weakness or changing strategic preferences?

The decision to favour Europe in this deal could also have been prompted by concerns about European economies falling like ninepins and being bailed out by cash-rich China. Building partnerships in Europe is important, even if less so than building one with the US. Moreover, while promoting Europe as a partner of the IAF, the US can still emerge as the key partner for India's increasingly important Navy.

Few will believe that politics played no role in the M-MRCA decision. Instead, most will assume that the political factor in India's strategic relations with the US has weakened since the days of the historic civil nuclear energy cooperation agreement. Has President Barack Obama's "successful visit" to India not helped repair the damage done to the bilateral relationship in his first year in office? Are issues of strategic importance to India getting short shrift from the US? Equally, and importantly, is the drift in India beginning to take its toll in terms of our long-term strategic planning?

The domestic political preoccupation of the leaders of the world's largest democracies seems to have weakened the political foundation of an as yet evolving strategic partnership. That alone would explain the politics of a technical decision.

Dr Sanjaya Baru

Editor of The Business Standard. From May 2004 until August 2008 he was the Official Spokesman and Media Advisor to the Prime Minister of India.

View Point-2

An airline hijacked

Air India (AI) is in an ICU and there are strident voices demanding its demise. Governments and most people have short memories. AI in the 1950s and 1960s was one of the finest airlines in the world and mentored Singapore Airlines. It is true that after the 1970s, AI and Indian Airlines (IA) often had turbulent flight paths. But never were these airlines in the state that the merged airline is in today.

In the early 1990s, IA faced rampant and endemic industrial unrest, with strikes being an annual feature. Come winter, there were fogs, strikes by employees and exits of chief executives. The airline suffered huge losses, market share plunged, passengers voted it the 'least preferred airline' and there was a massive exodus of pilots and engineers to private carriers.

However, within a few years there was complete industrial peace, the airline made a modest profit, there was a reverse flow of pilots, employee productivity increased and IA was declared the 'most preferred airline' in every survey. The marketing efforts of the airline bagged 22 awards, including two prestigious international ones, and the market share rose from 58% to 69%. What exactly happened after that to create the total mess the airline is in today?

The fault, dear friend, lies not in the skies, but in *Rajiv Gandhi Bhavan.* This is now official, with the Comptroller and Auditor General (CAG) of India stating that losses of the airlines were mainly due to wrong decisions regarding the purchase of aircraft, made under pressure from the ministry of civil aviation.

During my tenure as chairman and managing director of IA, I had served under several ministers, the longest tenures being those of Ghulam Nabi Azad and CM Ibrahim. I can state without any hesitation that there was not a day's interference from either of them or their offices. Subsequently, when there were attempts to pressure IA to purchase turbo prop aircraft, successive managements informed the ministry that since the operations of these aircraft on the routes suggested were uneconomical, the airline was not prepared to go in for the purchase unless continuing subsidies were provided by the government. Some ministers had the wisdom not to interfere. When others tried, the IA management insisted on its 'right to manage'.

To return to the CAG report which, though bold and path-breaking, hadn't touched upon the unfortunate manner in which IA and AI were merged and the subsequent collapse of morale in the employees of both airlines. Till 2005-06, IA registered profits. The first decision to shake employee morale was to change the name of IA to 'Indian'. In 2003 and 2004, the AC Nielson survey rated Indian Airlines among the 50 top brands at 7 — Taj Hotels was rated at 12 and Jet Airways 48. When brand equity was at its height, should the name of the company have been changed? Yet, this was done for reasons entirely unknown to both its employees and customers. In 2006-07, the airline suffered a loss of Rs. 234 crore. This was followed by the merger.

The NP Sen Committee in 1972, the MP Wadhawan Committee in the mid-1980s, the committee of secretaries in 1986 and AF Ferguson in 1988 concluded that while a merger was necessary, its implementation must be gradual, spread over a period of years if a "disastrous collapse of morale" was to be avoided. The Ferguson Report recalled that the immediate mergers of Vayudoot with IA and the National Airports Authority with the International Airports Authority resulted in chronic problems of personnel that persisted over the years. However, for reasons unknown to anyone other than the civil aviation ministry and the airlines' senior management, both airlines were merged without any prior attempts to take the employees into confidence. As a result, losses rose from Rs. 234 crore in 2006-07 to Rs. 226 crore in 2007-08, an almost tenfold increase, and again doubled to Rs. 5,000 crore in 2008-09.

When British Airways was merged, the process took several years, and it is said that the chairman, Colin Marshall, attended most training sessions and was able to meet with thousands of the employees of the airline. Without any communication regarding the basis of their fitment in the merged airlines, employees of both IA and AI are a bewildered, frightened and lost tribe.

Former chairman and managing director of Tata Steel Russi Mody used to often repeat the adage, 'morale is to other factors, as four is to five'. Richard Branson of Virgin Airlines, in a lecture delivered in India, remarked that his focus was always on the employee and not the customer since customers were bound to be served better if employees were well-trained and motivated. HCL CEO Vineet Nayar's book *Employee First Customer Second* is a prescribed text at Harvard University. There is almost total unanimity in all modern management teams that employee morale is critical for the success of any organisation.

The government may pour thousands of crores into AI, but if employees remain dispirited, service will be poor, market share will drop and losses will persist. Now that the national carrier is in the condition it is in, is there any hope of revival? The path to health will be long and arduous, if at all. But of the measures that need to be taken, the most critical will be the restoration of morale by continuous communication with employees, the introduction of total transparency in decision-making, having an organisation that is board-driven and increasing professionalism.

What can be done immediately is to reverse the merger, by both airlines functioning under a holding company — a decision that can be taken as swiftly as the decision to merge, without any financial consequences. If this is affected, and the steps mentioned earlier taken, there is a chance that most of the current problems plaguing the national carrier would be significantly reduced. In any case, there is no harm in trying these measures, since things can't get worse.

PC Sen
(former Chairman of Air India and Chairman/Managing Director of Indian Airlines)
From: Hindustan Times

Alternative View
The Merits of Fighter Upgrades

As the cost of procuring new aircraft soars exponentially, upgrading an existing fleet, not only to extend its useful life but also to enhance its effectiveness, becomes almost an imperative. But to do so with every aircraft that enters its middle age, needs more deliberation than has been the recent case. If we study some recent examples, it will become apparent that given a second chance, the decision to follow this path would have been quite the opposite. Whilst it is too late to undo the past, maybe, we could consider learning from it.

The MiG-21bis rechristened the BISON in its reincarnated state, is a classical example of too little too late. After almost six years of being scrutinised and at a well-concealed cost, we have an aircraft with better avionics, leading to carriage of better air-air weapons. Whilst this has helped in not allowing the complete force of MiG-21s to be suddenly depleted, it has not added significant value to the overall betterment of the IAF and the problems that beset day to day serviceability remain very debatable.

The MiG-27 upgrade added a new generation of avionics and EW equipment, which contributed to more accurate navigation and weapon delivery, but did nothing to resolve the engine problems, that continue to result in poor serviceability, at best and occasionally loss of chronic aircraft. As a percentage of the flying done by this fleet, the accident rate and the serviceability levels may be highest and the lowest in the fleet, respectively. So, was it worth the money, time and effort to upgrade this type, without addressing the well-known problems that beset the engine? The contract to upgrade the MiG-27s was signed in May 2001 with HAL, but the fleet was only fully available in 2008.

The MiG-29 is reportedly being upgraded after a contract in 2008. Whilst a few aircraft have been shipped to Russia, they are far from ready and the date of shifting of the major portion of the work to India is yet to happen. The upgrade involves both airframe and avionics that would increase the versatility of performance and weapon carrying. The first MiG-29UPG flew in February 2011.

The Jaguar upgrade with the DARIN III is yet to begin. Re-engining is also being planned, but the selection of a suitable engine is still to be decided. Again the avionics, when incorporated, will add to the weapon delivery capability, but the question is WHEN?

Finally, the mother of all upgrades–51 Mirage 2000s–at a mind boggling demanded price of $2.1 billion, as reported in the media. Whilst negotiations are still in progress, essentially about this exorbitant price, how much will the OEM reduce this? Certainly not by a significant value. So what are our options, should we go ahead? The need of the hour is to weigh the options. We have once said NO to the Qataris, who wanted to sell sparingly used Mirage 2000-9s to us at a price three times that of what they had offered it to a "Brother" country. This price was reportedly almost 75% of the price of a new aircraft. We need to remember, that in the past two and a half decades, the Mirage 2000H has been the best aircraft for weapon delivery and also has an enviable safety record. Such good performance, as proven in battle, continues. Even the Su-30MKI does not have such a distinguished record, but in all fairness, has not been tested in battle yet. Nevertheless, the Mirage 2000H will continue to hold its own for many years to come, in its present avtar.

The IAF has two initial mandates:

- To defend India with its existing fleet.
- To enhance the fleet to 39.5 squadrons progressively, in order to take on additional responsibilities, dictated by the geo-political situation in and around us.

Whilst the first aim is undoubtedly met, the second one appears a bit nebulous, with the fleet depleting at a rate not commensurate with the inductions. This is not the forum to discuss the inordinate delay and non-adherence of time lines, as dictated by the DPP 2006, which is being continuously revised by the authors of this document. Suffice it to say that we need to think outside the box and shatter the shackles that do not permit Revenue and Capital funds to be intra transferable, as though they originate from different sources. This often leads to wastage of funds, either through infructuous expenditure or return of unspent funds, while gainful expenditure, against another head goes abegging. The price that we pay for the Mirage 2000H upgrade can buy us approx 60 brand new fourth generation aircraft, from amongst the aircraft that we have already evaluated for the M-MRCA! Have we ever considered this option, even once?

The benefits that would accrue are:

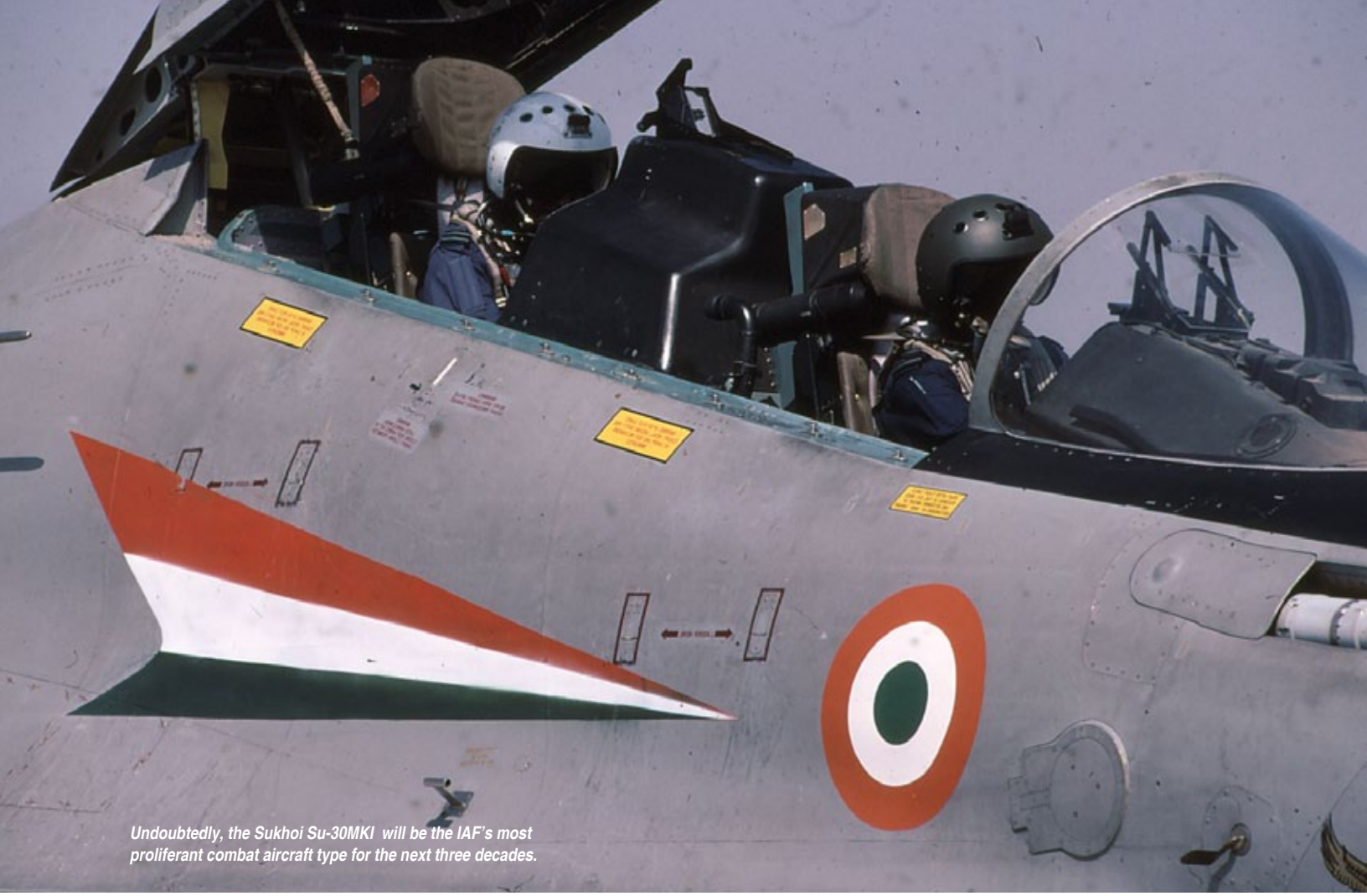
- The Mirage 2000H with its present capabilities, which continue to be the best in the fleet, can continue in service for another 15 years, without any major expenditure.
- An additional fleet of 60 new generation fighters would be added in due course, with the first two squadrons of a similar type being inducted within this year and later upgraded, when the newer aircraft come in (a practice followed with the induction of the Jaguar and Su-30K).
- Instead of the fleet being depleted, even temporarily, given that the French would take less time than the Russians, there would instead be additions, at a rapid pace. The Mirages would continue to be available in full strength.
- The M-MRCA, when it comes, will only bring more value to this equation.

What then needs to be done?

- Give serious consideration to such a proposal, with an open mind.
- The government, and more so the financial wizards, need to tailor their water tight monetary compartments to address the changing world. As long as the sum total allotted to the Services, under whatever head, stays unchanged, leave it to the Services to make mid-stream changes as the situation obtains in an ever changing threat scenario.
- Encourage out of the box thinking in the Armed Forces, across the board. Whilst experience is invaluable, brilliance is not the prerogative of the General Staff! Several solutions worthy of implementation will flow out of fresh minds. The fact is that Private Sector Industries, that are flourishing today, with the brain-inputs of the younger generation, not the Captains of the Industry.

Paraphrasing, with apologies to the great bard, the question still remains, "To do or not to do". Finally, the IAF, while rightly aiming for a 39.5 squadron air force, hopefully, must never forget that there is a Quality in Quantity!

Libran



Undoubtedly, the Sukhoi Su-30MKI will be the IAF's most proliferant combat aircraft type for the next three decades.

Right Choices For Wrong Reasons

Admiral Arun Prakash (Retd) on the M-MRCA

Media reports that the Ministry of Defence (MoD) has asked two of the six aspirants for the ongoing Medium-Multi Role Combat Aircraft (M-MRCA) competition to extend the validity of their quotes would seem a clear indication that these two, the French Dassault Rafale and the Eurofighter Consortium's Typhoon II – both of European provenance – have overhauled their rivals, to reach the finals. This development coupled with US Ambassador Roemer's recent resignation, related or not, is likely to cast a pall of gloom, at least temporarily, over Indo-American relations.

These are lean times, world-wide, and bagging this huge contract will have a positive impact on the relatively small economies of the European nations involved. Conversely, the loss of business worth $ 11 billion (running into many times this figure on account of product-support extending over the full 30-35 year life-span of the aircraft) would come as a blow to the aerospace industry of even a major economic power like the USA.

More than anything else, it could be interpreted as a rebuff to the sustained efforts of three successive US Presidents who have gone out of their way to bring about unprecedented warmth and proximity in Indo-US relations. There is a view that awarding the M-MRCA contract to one of the two US contenders, the F-16 Super Viper or the F/A-18 Super Hornet, would have been an appropriate *quid pro quo*, a suitable expression of gratitude, ensuring strategic convergence between the two nations. Such a buy would have brought the respective industries and armed forces into much closer engagement, and possibly gained entry for the IAF into the world-wide US military logistics loop.

However this may merely be a simplistic view, because the affairs of State are guided by diverse weighty considerations, and things, especially in India, are not always as they appear to the man on the street.

The Good News and the Bad

On the other hand, let us look at the positives. The IAF is now guaranteed a versatile, highly-agile and potent - albeit expensive - fourth generation combat aircraft in its inventory which can dominate the regional skies for the foreseeable future. Having flown both the F/A-18 and the Rafale, I can say that while the former would certainly have met all the IAF requirements competently and economically, the breathtaking performance of the latter leaves one in no doubt that it is a 'generation-next' machine. The Eurofighter Typhoon, by all accounts, is equally impressive.

The complex and elaborate selection process involving field trials for six competitors in diverse locations in a compressed time-frame seems to have been pursued without a hitch by the IAF. Short-listing of the contenders has been undertaken meticulously, by the rules of the game, framed under the Defence Procurement Procedure (DPP). Given the dismal track-record of delays in earlier projects, if the M-MRCA contract is signed by year-end, the MoD would have broken some Indian records for 'quick' decision-making. To crown it all, there has – so far – not been a whiff of scandal that one has come to expect from contracts of such magnitude.

IAF MiG-29s in formation : the type is now being upgraded.

By itself, the M-MRCA decision is not a matter of huge significance and we can safely assume that our thoroughly professional air force has chosen a combat aircraft that will capably discharge the multiple tasks of defending Indian airspace, conducting strikes inside enemy territory and providing aerial cover to ground and maritime forces for the next four decades or so. Furthermore, Indo-US relations will weather this minor turbulence and soon resume an even-keel.

However, in the midst of breathless speculation and gossip relating to the M-MRCA contract, we are likely to miss the forest for the trees. What we really need to worry about is a deeper malaise in India's national security framework which has been starkly highlighted by the unfolding of the decade-long M-MRCA saga. This is an opportune moment to reflect on the flawed processes and procedures that India follows in the critical areas of force planning and weapon system acquisition.

There are two deeply disturbing aspects here. Firstly, India's huge defence expenditure, which represents a significant proportion of the central budget, is spent with cavalier abandon and fails to accrue proportionate benefits for national security. And secondly, into its 64th year of independence, and having become a trillion-dollar economy, India remains abjectly dependent on foreign sources for its security needs. And yet nobody seems to be bothered.

India's blinkered vision

Most major powers undertake periodic Strategic Defence Reviews or issue defence White Papers which clearly highlight national interests, identify vital goals and objectives, and undertake an evaluation of the security environment. A deliberate exercise of this nature helps visualise the kind of armed forces the country needs, and pinpoints the specific capabilities they must field.

India, for all its fiscal constraints and competing demands on scarce resources, is one of the few countries which neither undertakes such introspection, nor generates security doctrines. In such a vacuum the Services tend to produce equipment wish-lists which focus on numbers (one for one replacement) rather than technologies or capabilities. Such demands take little or no account of force-multiplication, jointness, or duplication.

Moreover, such is the nature of the Chiefs of Staff Committee (COSC) system that a determined Service Chief can demand hardware for his Service by invoking the mantra of dire "operational necessity". No provision exists, in the current dispensation, for the three Chiefs, the generalist bureaucracy or the Raksha Mantri (RM) to engage in a doctrinal discussion relating to the operational need of a requisitioned weapon-system, and the priority that must be accorded to it. After many instances of internecine sniping, an unwritten understanding has emerged in the COSC that no Service will comment on another's plans in the interests of harmony.

The MoD has neither the expertise nor the inclination to call for professional studies regarding national security issues. Therefore no critical examination or cost-benefit analysis has ever been undertaken on (for example) the continuing future relevance of weapon-systems such as battle-tanks, aircraft-carriers or short-range ballistic missiles in the Indian context, or the impact of an anti-ballistic missile defence system on deterrence stability. In such a scenario all wish-lists from the Services (and DRDO) become sacrosanct and, eventually, receive MoD approval.

The IAF Inventory

It is against this background that the IAF force-planning process, in general, and the M-MRCA case in particular need to be examined, on the basis of information available in the public domain (IISS *Military Balance* 2010 edition). I must emphasise that the M-MRCA case is being used only because it happens to be a current issue. This critique may also hold good for the acquisition programmes of the other two Services.

The mainstay of the IAF inventory, at its lower end, continues to be the vintage force of about 200 MiG-21 interceptors. Of these more than half have been upgraded to the Bison standard, encompassing a ground-attack capability. At the top end

of the inventory are 140 Sukhoi-30 MKI air-dominance fighters which also have a significant strike capability. Additional Su-30s have been contracted and their eventual number will reach 272. Dedicated to the ground-attack role are 100 MiG-27 ML and 110 deep-strike Jaguar aircraft. Fifty Mirage 2000 multi-role fighters and Sixty MiG-29 air-superiority fighters are available for combat tasks as required. The Jaguar, Mirage-2000 and the MiG-29 are all awaiting upgrades which will give them enhanced capabilities and extended life. This assorted force of about 650-700 combat aircraft is supported by air-air refuelling (AAR) and airborne warning and control system (AWACS) squadrons.

Assuming that the MiG-21s are withdrawn by the end of the decade, to be replaced by the Tejas, the M-MRCA, when it joins the fleet, will become the 8th type of combat aircraft in IAF service. The increasing diversity of aircraft types (mostly of foreign origin) being accumulated by the IAF is going to become a nightmare in the spheres of training, maintenance, logistics and inventory-management.

The IAF had decided, in the early years of the last decade, that the logical answer to its problems of obsolescence, attrition and declining strength was to induct additional numbers of the Mirage 2000. With a few upgrades, this excellent machine could become the future multi-role aircraft; bridging the gap between the heavy-weight Su-30 and the light-weight Tejas. It was the MoD's rejection of this proposal that gave birth to the M-MRCA project. However, a lack of clarity has prevailed about the specific space that the M-MRCA is meant to occupy in the IAF order of battle, given the growing fleet of Su-30s, and the planned induction of the PAK-FA and the AMCA.

In this context, it is interesting to note the contrasting approach of two other medium sized air forces: the British and French. Both are equipped with about 300 combat aircraft, with which they meet operational commitments, not just at home but also world-wide. Their inventories are restricted to two or three types of aircraft: Typhoon and Tornado in the Royal Air Force, and Rafale, Mirage F1 and Mirage-2000 in the *Armee de l'Air*. Versions of these aircraft undertake all combat tasks, including air-defence, ground-attack and strike & recce.

Foreign Dependence

One of the most deeply disturbing aspects of India's national security policies is the nonchalance with which the country continues to spend colossal sums of money in acquiring weapon systems from foreign sources. There does not seem to be adequate realisation of the fact that every such purchase makes India hostage to the seller nation, and seriously undermines our security as well as autonomy. For example, if the aircraft-carrier *Vikramaditya* arrives in 2012, the Indian Navy (IN) will remain captive to the whims and fancies of Russia's creaky supply chain till at least 2052 for spares, and maintenance support.

In similar fashion every foreign aircraft that the IAF acquires, will place the Service at the mercy of another nation for 30-40 years thereafter. The denial of a tiny aircraft component can ground fleets, and we should be in no doubt that our dependence for spares, product-support and weapons on sources as diverse as Russia, UK, France, Israel and South Africa constitutes a crippling strategic

Formation of HAL HF-24 Maruts : potential of this 'multi-role combat aircraft' was not exploited.

In addition to these combat aircraft of Russian, British and French origin already in service, the IAF has placed an order for 40 indigenous Tejas combat aircraft, with possibly another 80-100 more to follow. In December 2010 India signed a deal worth $ 300 million with Russia for the "joint development" of a 5th generation fighter aircraft. It is understood that about 250 of these aircraft, designated PAK-FA in Russia, will enter IAF service during the next decade. Finally, the Aeronautical Development Agency (ADA) is reported to have commenced design work on a fifth generation indigenous Advanced Medium Combat Aircraft (AMCA) expected to fly by 2025.

vulnerability. We may soon be adding Italy, Spain and Germany to this list.

It is true that no third-world nation can aspire to be completely autarchic in advanced weapon-systems. And yet China has demonstrated that resolute pursuit of self-reliance can produce wonders. By deploying their scientific resources to "steal" technology and resort to reverse-engineering, the Chinese produce everything they need from AK-47 assault rifles, cruise-missiles and stealth fighters to carriers and nuclear submarines. They also export $ 2 billion worth of arms annually. While it is sometime appropriate to disparage and berate the DRDO for its many delays, failures and false promises, the armed forces need to undertake some soul-searching themselves. Very often it has been their own their own detached attitude, and penchant for the illusory 'fast-track' import option that has caused them to bypass any attempt at indigenisation, and perpetuate foreign dependence.

Delving a little into history, it is interesting to note that it was at about the same time in the mid-1950s that two significant initiatives were taken towards self-reliance in defence. The IAF issued an Air Staff Requirement for an indigenous jet fighter, and the IN established a Corps of Naval Constructors (later to become Directorate of Naval Design) with the aim of starting indigenous warship production. HAL delivered the first twin-jet HF-24 Marut, designed by Dr. Kurt Tank, to No. 10 Squadron in 1967. Mazagon Docks Mumbai launched the first, licence-built, *Leander* class frigate, INS *Nilgiri* in 1968.

The stories diverge thereafter. Having delivered near 150 Maruts, HAL doggedly persevered with further development of this elegant looking fighter. The designers, however, lost heart as successive versions like the HF-73, HF-24-M.53 and the single-engine HF-25 had to be shelved for lack of IAF interest and government support. Finally, HAL gave up when the IAF opted for the Jaguar and the MiG-23 BN, and the Marut programme was shut down. The LCA project taken up by DRDO, 30 years after the Marut, did not, till recently, evoke much enthusiasm from the IAF which accounts for its tardy and halting progress.

On the other hand, Mazagon Docks went on to build four more *Leanders* before Indian naval architects stepped in to re-design the hull and add weapons and sensors to produce three different classes of warships. Today, the navy's perspective plans rely heavily on the regular delivery of frigates, destroyers, amphibious ships and submarines by carefully nurtured Indian shipyards. A nuclear submarine was launched in 2010, and an indigenous aircraft-carrier will follow in 2015.

Backing self-reliance

It may be somewhat late in the day, but there is still time to ensure that India's aerospace industry does not completely miss the technology bus, and leave the nation forever dependent on foreign sources for combat aircraft. The M-MRCA contract provides an invaluable window of opportunity, but via the Offset Clause.

For far too long, have Indian defence PSUs claimed "transfer of technology" when they were only assembling components received from abroad using 'screwdriver technology'. For the M-MRCA offsets to be beneficial to India, they must be selectively chosen to fill known gaps in key technologies or provide high-end production-engineering skills lacking in our aerospace industry today. The USA had conveyed a distinct message that selection of either American candidate would open a cornucopia of technology to India – including the F-35 Joint Strike Fighter. The Europeans must be reminded of this and prevailed upon to follow a similar paradigm.

As far as the FGFA "joint development" contract is concerned, there is need for us to be even more careful because the prototype made its maiden flight early this year at Komsomolsk-on-Amur. The developmental process of this aircraft is, obviously, at least a decade old, and has been guided by the requirements of the Russian Air Force rather than the IAF. Thus, even if the "joint development" is no longer possible India must ensure that key technologies in areas such as stealth, super-cruise and active electronically scanned radar are actually transferred to the

Hunters of the IAF's No.20 Squadron in their 'Thunderbolt' markings.

Irkut

The Saab JAS39 Gripen NG was also evaluated by the IAF for their M-MRCA requirement.

DRDO in return for the heavy investment made. The Russians are known to be parsimonious with technology transfer, and the pointless licence-production of 850 MiG-21s and aero-engines, as well as many BrahMos missiles is proof of this.

The IAF, on its part, can reinforce India's aerospace self-reliance endeavours by articulating a 25-30 year capability-cum-force-planning vision, if possible, jointly with DRDO. This vision must use the LCA, AMCA and FGFA experiences and technologies as the basic building blocks for futuristic combat aircraft – manned or unmanned. Perhaps the establishment of a small Aero-space Design Cell in Vayu Bhavan may help.

The advantage of numbers

The IAF has justly complained, for many years, that its long-standing requirement of 45 fighter squadrons has never been met. Worse still, even the arbitrary "authorised" strength of 39.5 squadrons has been steadily eroded by attrition and obsolescence, so that today it is a force of less than 30 squadrons.

A point repeatedly made by the IAF leadership, in the context of declining force-levels, has been that while technology may have its place, "numbers have their own logic". This is a valid argument for a force required to divide its strength between the western sector facing Pakistan, the north-eastern sector facing China, and the northern sector facing both adversaries. It must also be borne in mind that the Strategic Forces Command does not own any aircraft assets, and relies on dual-tasked IAF machines to be withdrawn for nuclear delivery missions. However the numbers argument has its limitations.

The IAF Hawker Hunter FGA Mk.9 that I flew in the 1970s could deliver a ton's worth of rockets and iron bombs out to a little under 200 miles and weapon accuracies of 15-20 yards were considered reasonable. The Jaguar, inducted in mid-1980s, was a great improvement and could deliver a 4 ton payload to over 300 miles. Today's combat aircraft carry 6-8 tons of lethal weaponry to ranges of over 400 miles and deliver them with pinpoint precision on the target. Such is the accuracy and lethality of 'smart' weapons that a single modern fighter can achieve the same effect in one mission as 15-20 earlier generation aircraft using 'dumb' weaponry. This was amply demonstrated by the Mirage 2000 on Kargil heights in 1999. The 'multi-role' appellation represents the ability to switch rapidly between interceptor, strike and recce tasks.

It is a moot question that if numbers are indeed so critical for the IAF, then why have the cheaper M-MRCA options been discarded? Given that all six aircraft seem to have qualified in the flight-trials and technical evaluation processes, the line-up, in ascending order of price as publicly assessed (shown in parenthesis) is as follows: MiG-35 ($42m), Gripen ($45m), F-16 ($55m), F/A-18 ($60m), Rafale ($89m) and Typhoon ($110m). The IAF could have, for example, added, 350 F/A-18s or 450 Gripens to its inventory for the price of 200 Typhoons/Rafales, and thus resolved many of its problems.

From this it becomes obvious that the time has now come for the IAF to undertake an exercise to determine the 'capabilities' that it needs to discharge its roles and missions rather than insisting on a fixed number of squadrons. At between Rs. 350-550 crores per aircraft it would be unrealistic to demand the numbers contemplated in the 1960s, especially when technology opens up so many operational vistas.

Integrating the Expertise

There is no doubt that the General, Naval and Air Staffs at the three Service Headquarters embody in themselves the highest levels of field experience, domain knowledge and professional expertise. However, rhetoric apart, future wars are not going to be fought or won by a single Service. Whether we like it or not, concepts like 'sea control' as well as 'air dominance' are mere preliminaries for 'boots on the ground'. It was for this reason that the post-Kargil Group of Ministers convened to 'Reform the National Security System' recommended, in 2001, the creation of an Integrated Defence Staff to support the Chief of Defence Staff (CDS).

The CDS was to constitute the "single point of military advice to the Government", and apart from administering the Strategic Forces Command (SFC), his two main functions, as Chairman COSC, were to be:

» To enhance efficiency and effectiveness of the force planning process through intra and inter-Service prioritisation.

» To ensure the enhancement of capabilities by engendering Jointness, demanded by modern warfare, in the armed forces.

A combination of bureaucratic resistance and political indecision bolstered by scare-mongering from within a section of the armed forces, unfortunately, stalled the institution of a CDS. An IDS HQ was, however, created and has been functioning under a 3-star Chief of Integrated Staff to Chairman COSC (CISC for short) since 2001.

The Integrated Defence Staff (IDS) with a large number of 2 and 3-star officers from the army, navy and air force constitutes a most valuable pool of inter-Service expertise. It can play a crucial role in rendering advice to the RM on all issues relating to capability creation, force planning and inter-Service prioritisation of acquisitions. However, in the absence of a CDS, the functioning of the CISC remains severely constrained and the IDS HQ grossly under-utilised.

Fixing the System

In the current system of India's higher defence management the Chiefs feel that the critical scrutiny of their respective Services will not permit any re-organization or inter-Service integration if it involves down-sizing of forces or surrender of high-ranking billets. This obsession with numbers militates against technology induction and jointness, and the consequent enhancement of combat efficiency as well as economy. No significant reform is, therefore, likely to take place, and jointness will remain a distant dream unless imposed by the political leadership – as has happened frequently in other democracies like the USA, UK and France.

With China bearing down hard on us, and Pakistan ready to descend into chaos, India's external security scenario is fraught with hazard. Internally, the Indian state, which has been struggling to cope with Naxalism and terrorism, is now confronted with a restless civil society seeking relief from all-pervasive corruption and administrative ineptitude. National security is, therefore, in parlous straits.

The political leadership in India has overwhelming political preoccupations which obviate focused attention on national security issues. The bureaucracy is only too happy to step-in wherever it can, but does not know enough about operational issues to make drastic interventions. Under these circumstances, there is a strong element of tunnel-vision and ad-hocism in our defence planning and expenditure; dictated by the compulsions of individual Service HQs. Consequently, our colossal defence expenditure of $ 35 billion (and growing), does not contribute effectively to national security, and some urgent re-engineering is called for.

The Indian Air Force ensign at Air Headquarters.

At the conclusion of this, somewhat lengthy essay I have, regrettably, no 'silver bullet' to offer. However the national security establishment needs to pay urgent heed to four salient recommendations:

» Create a source of advice which is not merely 'single point' but conveys a non-parochial, inter-Service view of issues for the RM's consideration. This source can be designated the 'Permanent Chairman COSC' (or PCC) rather than CDS. The PCC will have no forces to command, but will administer the SFC and Andaman & Nicobar Command. His advice to the RM will be a distillate of the combined wisdom of the COSC, tempered by the counsel of the CISC and IDS HQ staff who represent all three Services.

» Progressively integrate the IDS HQ and the MoD, so that the uniformed and civilian staffs work in harmony rather than as adversaries. This will enhance efficiency, cut down processing times for acquisition cases, and ensure that the defence budget is fully utilized.

» Give utmost priority to attaining self-reliance in weapon system acquisition. This will require radical reforms in the structure and management of the DRDO and defence PSUs. It will also call for much closer integration of the DRDO with the IDS HQ, so that a meaningful and time-bound programme for attaining self-sufficiency in key defence technologies can be pursued even at this late stage.

» Management of the DRDO budget should be placed under a board which has the three Service Chiefs as members. All defence R&D projects should be subjected to periodic user reviews for a decision on their continued relevance and viability.

Returning to the M-MRCA issue as a post-script, no matter which aircraft eventually emerges as the winner in the competition, there can be only one litmus test for the decision. Has this choice been made for the right reasons, and does it serve India's vital national interests? As a corollary one might also ask: how much longer must India remain dependent on foreign sources for security?

Maritime Vigilance, 24x7

The Indian Navy and Indian Coast Guard are the largest operators of the Dornier 228 Maritime Patrol Aircraft, with nearly three score in number, all built by Hindustan Aeronautics Limited, apart from a handful received as 'fly-aways' from the erstwhile Dornier Luftfahrt Gmbh in Germany in the mid-1980s.

The Indian Navy MRMR requirement

For coastal defence and anti-piracy operations the Indian Navy (IN) currently relies on its fleet of around twenty-four HAL-Dornier Do 228s (described in great detail in an earlier ***Vayu*** Issue) and Heron UAVs (IN recently commissioned its second UAV squadron) to monitor India's 7,516-km long coastline, 1,197 offshore islands and a two-million square kilometre exclusive economic zone. Fresh Requests for Information (RFI) has been issued for Medium Range Maritime Reconnaissance (MRMR) aircraft capable of maritime patrol, anti-surface warfare, Electronic Intelligence (ELINT) and Search & Rescue (SAR) operations with time on station of at least 4-hours, while 740-km from base, in full mission configuration. The surveillance radar should be capable of 360-degrees coverage to detect and track ships, submarine periscopes and low flying aircraft/missiles, against sea clutter.

While Boeing has proposed a "simplified" variant of its P-8I Poseidon for the role, new aircraft under consideration include the AirTech CN-235MP/MPA Maritime Patrol Aircraft with the two manufacturers, CASA EADS in Spain and Dirgantra in Indonesia, proposing to supply the aircraft with different mission systems. The Spanish developed CN-235 MP Persuader is fitted with the Northrop Grumman APS-504 (V) 5 radar, the Indonesian developed CN-235 MPA with either the Seaspray 4000 from BAE Systems, the AN/APS-134 from Raytheon or the Ocean Master 100 from Thales.

This aircraft is of conventional semi-monocoque design and mainly aluminium alloy construction. Composite materials, Kevlar and glass fibre have been used extensively in the construction of the wing and tail leading and trailing edges, engine nacelles and the nose radome. Two General Electric CT-9C3 turboprop engines each developing 1,305kW, are wing-mounted

IAI Elta

The CN-235 is in service with the US Coast Guard, Spanish Guardia Civil, Irish Air Corps, Mexican Navy and has been ordered by the South Korean Coast Guard.

in composite nacelles. The engines produce 1,394-kW with automatic power reserve and drive Hamilton Sundstrand 14RF-21 four-bladed, propellers of 3.35-m diameter while the propellers are of glass fibre construction with a metal spar and urethane foam core. Whichever type is selected for IN service, IN specific mission avionics and weapons will be integrated.

The new C-295, a stretched derivative of the CN-235, with its characteristic high-wing, rear-loader design is powered by two Pratt & Whitney Canada PW127G turboprop engines, each rated at 1,972-kW. The engines drive six-bladed composite propellers, type HS-568F-5 developed by Hamilton Sundstrand are of 3.89-m diameter with autofeathering and synchrophasing. The aircraft carries a 7,700-l fuel load, giving a maximum range of 5,630-km but can be equipped with an optional probe for probe and drogue refuelling, so the range can be extended. The maritime patrol variant can be fitted with EADS CASA FITS mission system, which consists of four multi-function consoles and integrates data from sensors including search radar, Forward-Looking Infra Red (FLIR), TV cameras or other sensors, with two Head-Up Displays (HUD), also as an option. The C-295 is equipped with a dual Thales flight management system, controlled through two Multifunction Controller Display Units (MCDU), dual air data units type ADU 3000, dual Attitude Heading & Reference Systems (AHRS), two radar altimeters and an optional Honeywell ground proximity warning system. Other navigation equipment includes two multimode receivers, two Automatic Direction Finders (ADF), one Direction Finder (DF) and two Distance Measuring Equipment (DME) units. There are three possible configurations for long-range and autonomous navigation, including two integrated Inertial Navigation/Global Positioning Systems (INS/GPS), two GPS or two GPS plus one INS/GPS. The colour weather radar, a Honeywell RDR-I400C, has search, beacon and vertical navigation ground mapping modes. Portuguese Air Force C-295s are fitted with Northrop Grumman AN/APN-241 colour weather radar.

The CASA C-212-400 Patrullero Maritime Patrol Aircraft was considered by the Indian Government in the early 1980s but not selected owing to several shortcomings in the MR role including the inability to mount a 360° radar, 'floatability' and other aspects. A 360-degrees scan search radar is now fitted in a radome on underside of the fuselage, the ventral installation of the radar eliminating the distinctive platypus nose radar, which provided a 270-degrees scan in earlier versions of the Patrullero. A six-station internal telephone system is linked via the operator's console to the external communications system. An EO turret with FLIR and television camera provides day and night capability. The aircraft is powered by two Honeywell TPE-331-12JR turboprop engines each of 925-shp.

A maritime surveillance variant of the Bombardier Q 300 Dash 8 has been ordered by the Swedish Coast Guard with the prime contractor being Field Aviation Company. L-3 Communications Integrated Systems is providing the mission systems, including surveillance radar, FLIR and IR linescanner. The first of three DHC-8-Q300 MSA aircraft was delivered to the Swedish Coast Guard in May 2008, this variant also ordered in March 2006 by National Air Support (NAS) of Australia on behalf of Australian customs. Three aircraft have been delivered and another two have been converted from the fleet of National Jet Systems.

The Japanese Coast Guard selected the Q300 MSA in December 2006, initially for three aircraft and a follow-on contract for three more Bombardier Dash 8 Q300 MSA was awarded in February 2009. Field Aviation modified the original

Saab Ad Saab 2000 MPA

The Bombardier Q300 Dash-8 has been ordered by the Swedish and Japan Coast Guards, while a variant is operated on behalf of Australian Customs.

Q300 in to Bombardier Q300 Dash 8 maritime surveillance aircraft for Japan, the modifications including an air-operable rear cargo door and a fuselage drop hatch, both facilitating airborne dispersal of life rafts, survival supplies and paratroops. The variant also features crew-station interior, large, conformal observation windows and fuselage structural modifications.

The Bombardier Q300 is equipped with two Pratt & Whitney Canada PW123 turboprops, each providing 1,775-kW, the engines driving Hamilton Sundstrand 14SF-23 four-bladed propellers. A high gross weight variant of the Q300, the Q300HGW, is powered by PW 123B turbo engines which give increased power for operation from cold and low airport conditions, the PW123B engines rated at 1,864-kW. The HGW aircraft can carry a greater maximum payload, 6,126kg compared to the 5,166kg payload of the standard baseline Q300 version. Another engine option, the Pratt & Whitney PW123E, rated at 1,775-kW, provides sustained and increased power at ambient temperatures up to 40-degrees

The ATR-42MP is operated both by the Italian Coast Guard and Guardia di Finanza, with the Nigerian Air Force ordering two while the Libyans ordered one in 2009.

The Airbus Military C-295 is a stretched derivative of the earlier CN-235

Centigrade, for operation in hot-and-high conditions.

The wing tanks store up to 3,160-litres of usable fuel and optional auxiliary tanks provide an additional 2,540-litres of fuel, giving a total fuel capacity of 5,700-litres.

Italy's defence ministry has ordered four ATR 72 Maritime Patrol Aircraft (MPA) from Alenia Aeronautica, with deliveries scheduled to commence for the Italian Air Force in 2012. Selex Galileo's Airborne Tactical Observation and Surveillance System (ATOS) mission system includes a Seaspray electronic-scan surveillance maritime search radar, electro-optical multi-sensor turret for the identification of boats in all weather conditions and a sophisticated datalink, transmitting information in real time to ground command and control centres and other platforms, both in flight and at sea, for coordination and maximum effectiveness of the operations.

Flown by mixed aircrew from the Italian Air Force and the Navy, the new type will augment the Italian current MPA inventory, which includes sixteen Dassault-Breguet ATL-1 Atlantics. Alenia Aeronautica has previously delivered seven modified ATR 42s to the Italian customs agency and Coast Guard for maritime patrol duties. The Turkish Navy was the lone previous operator for the special-mission ATR 72, having signed for ten such ASW aircraft.

The ATR 72MP is also currently on offer to additional potential operators including Greece and the United Arab Emirates. The ATR 72 ASW integrates the ATR 42 MP (Maritime Patrol) mission system with the same on-board equipment

The ATR 72 ASW is a derivative of the ATR 72-500 commercial aircraft integrating the same maritime patrol capabilities of ATR 42 MP in addition to Anti-Submarine Warfare (ASW) and Anti-Surface Warfare (ASuW) capabilities. Four aircraft were ordered by the Italian Aircraft followed by Turkey for ten ATR 72 ASW.

but with additional ASW capabilities including a long Magnetic Anomaly Detector (MAD). An ASW variant of the -500 (itself a version of the Maritime Patrol variant of the ATR 42-500) is also in production and has been selected by the Turkish and Italian Navies for ASW and anti-surface warfare duties. For ASW and anti-surface warfare missions, the aircraft will be armed with lightweight aerial torpedoes, anti-surface missiles, and depth charges. They will also be equipped with the Airborne Maritime Situation and Control System (AMASCOS) maritime surveillance system of Thales, as well as electronic warfare and reconnaissance systems.

Another candidate is the maritime patrol variant of Saab 2000 high speed (665-km/h) turboprop platform, which approaches the speed of jet aircraft while retaining the efficiency provided by turboprop engines. The Saab 2000 was the first commercial aircraft to use the Rolls-Royce (then built by Allison) AE 2100 turboprops providing 4,591-shp, driving six-bladed Dowty Rotol propellers. (see following article).

A separate RFI has reportedly been issued for multi-engined powered amphibians, possibly for deployment in the Andaman and Nicobar islands having a range of some 800-nautical miles to fulfil the role of visual and radar surveillance of both coastal areas and the offshore islands, supplying spare parts to naval units at sea and rapid response missions. To be operated by Indian Coast Guard, the RFI includes an extensive electronic warfare suite, including FLIR sensor, Sideways Looking Airborne Radar (SLAR), Radar Warning Receiver (RWR) and Missile Approach Warning System (MAWS). The Russian Irkut-manufactured Beriev Be-200 multipurpose amphibious aircraft with high-wing T-tail monoplane with a single-step design hull to perform littoral and blue water operations, has emerged as a strong contender. Be-200 is powered by two D-346TP high-bypass ratio engines delivering a higher performance at hot-and-high conditions, a TA 12-60 auxiliary power unit, an engine control system and engine vibration monitoring system. The Be-200 can fly at a maximum speed of 680-km/h, has a range of 3,300-km and service ceiling of over 25,000 ft.

Sayan Majumdar

Artist's drawing of the Boeing P-8A Poseidon, ordered by the US and Indian Navys but also a simplified version is proposed for the MRMR role.

Russian Beriev Be-200 is a multi purpose amphibian and has been offered as a Maritime Patrol Version incorporating the 'Sea Dragon' system and has been ordered by the Peoples Republic of China.

Competitor in the MRMR ring

The Saab 2000MPA

The Saab 2000 Medium Range Maritime Patrol Aircraft has been offered to the Indian Navy to meet the security and surveillance requirements across Indian seas under the medium-range maritime reconnaissance (MRMR) programme. The special mission platforms are derivatives of the regional airliner, including the Saab 340 and the larger Saab 2000 platform, which provide more spacious cabin, long-range and persistence at an affordable cost. The company has proposed the larger Saab 2000 for longer range MPA.

The Saab 2000 MPA is a high performer providing operational flexibilities for various operation scenarios. The aircraft has a cruising speed of 350 knots, can climb to an altitude of 20,000 ft in 10 minutes, reaching operating area 1,000 nautical miles distance within three hours. It can operate from high altitude airfields, taking off with maximum load and fuel even at very high temperatures. Flight safety is maintained throughout all flight conditions, including single engine operations, where the aircraft can maintain altitude at 20,000 ft. The Saab 2000 MPA has a maximum range exceeding 2000 nautical miles, with mission endurance exceeding 9.5 hours. It can carry out a mission covering a 200 nm Exclusive Economic Zone (EEZ) for 5.5 hours at an altitude of 2,000 ft, or longer patrol times at higher altitudes up to 31000 ft.

The main sensor is a modern, state-of-the-art, high performance Active Electronically Scanned Array (AESA) radar with comprehensive mode suite, including a full range of maritime surveillance and coherent imaging modes to be used for both naval and over-land operation. The radar system is connected to an IFF – Identification Friend-or-Foe – system containing a transponder and an interrogator function. To support the surveillance radar in locating and identifying naval activity, a Saab R4A AIS transponder receiver/transmitter system is installed. The primary function of the Airborne AIS transponder is to identify and locate boats, naval vessels, commercial ferries and freight ships equipped with the AIS transponder and broadcasting data on the VHF maritime band. In addition to the standard AIS transponder functionality, the AIS system also provides an encrypted data link (Secure-AIS.)

For close range detection, identification and recording of surface objects and activities, the baseline Saab 2000 MPA system incorporates electro-optic (CCTV) and thermal imager sensors housed in a turret installed in the fuselage belly. The Saab 2000 MPA system incorporates an ELINT system providing the capability to intercept and collect intelligence information consisting of detailed information for example, of complex emitters active signal components, and relationship and dynamics between active signal components. It is also equipped with an ESM system for automatic identification of RF signal sources and Direction Finding of RF signal sources with high accuracy. For self protection, a SPS system is installed including radar warning receivers, missile approach warning sensors, laser warning sensors as well as chaff and flare dispensers.

The Saab 2000 MPA is also equipped with a COMINT system that complements the baseline ELINT system for enhanced SIGINT capabilities. The installed COMINT system includes both a Direction Finder function and an Intercept System. The Saab 2000 MPA is equipped with a Command & Control (C2) system that integrates and assists in controlling all mission sensors and provides the user interface to mission operators, via four workstations installed side-by-side in the cabin facing starboard, and to the pilots via a dedicated tactical display. The workstations also provide access to the mission communication system.

The mission communication system consists of VHF, UHF and HF voice radios as well as a satellite communication sub-system providing Voice IP, chat and e-mail access. Up to four VHF/UHF mission voice radios are available for the mission operators as well as access to HF voice radio. An audio integration system is installed allowing intra aircraft communication between all on-board crew members as well as facilitating external voice communication.

The Saab 2000 MPA and its C2-system are also connected to an L-Band satellite communications system using the SwiftBroadband service provided by Inmarsat, one of the major commercial global satellite network providers. Other datalink solutions can be integrated based on customer preference such as

Link 11 and Link 16. The aircraft offers installation of observer positions in the forward left and right side of the cabin. The observer positions are equipped with large, observer windows with minimum optical distortion allowing not only visual observation of surface activities but also allowing excellent opportunity for taking photos and video recordings. The observer positions are equipped with swivelling chairs, audio control panels and are also shielded to allow the use of Night-Vision Goggles (NVG) for observations during low light conditions. All exterior aircraft lighting is NVG compatible.

The Saab 2000 MPA is able to operate as a Search & Rescue asset. A V/UHF Direction Finder system compatible with GMDSS is installed so as to find the direction of radio transmissions on international distress frequencies. The system is also able to act as a tactical direction finder for a larger band of radio frequencies. The Flight Management System offers a selection of predefined search patterns via the C2 system to be selected for optimum rescue operations. The installed AIS transponder can be used for Search & Rescue coordination activities. A guard radio functionality provides constant access to both air and marine distress frequencies. The aircraft is equipped with life rafts, survival kits and other supplies that may be deployed from the rear Air Drop door which can be opened in flight. For crew safety a crew restraint system and drop indicator is included. Life Rafts and Survival Kits are stowed on board in the rear of the aircraft.

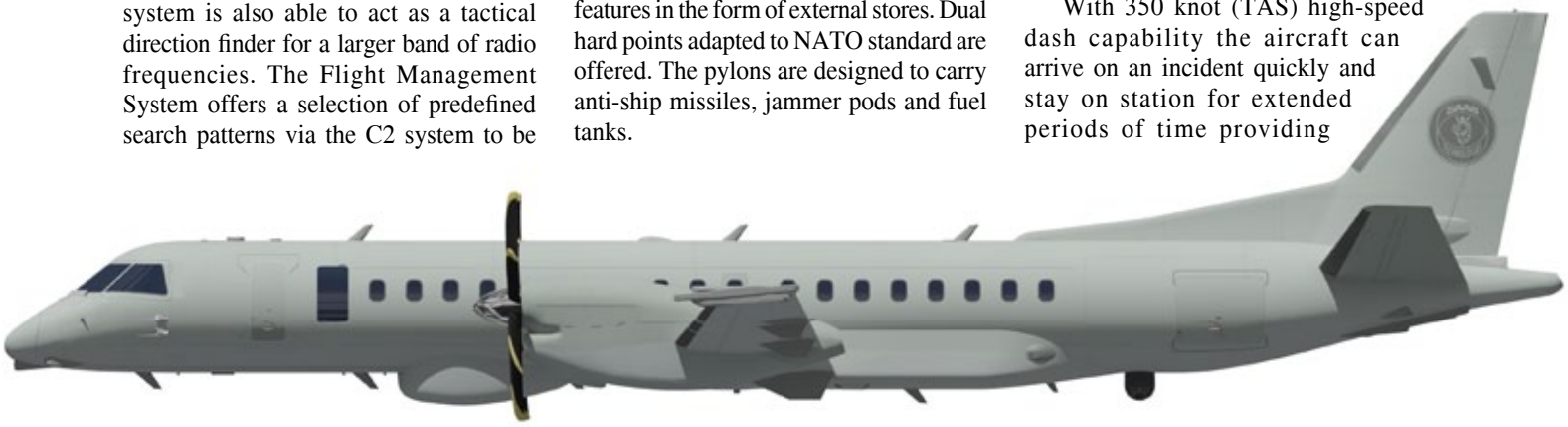
As the Saab 2000MPA can remain on patrol for many hours, certain crew comfort installations have been added such as a lavatory, rest area and galley. The lavatory is installed in the front of the cabin, while the rest area and the galley are installed in the aft section of the cabin. The rest area offers club seating with a table and four seats. Audio control panels are available for intra-aircraft communication as well as listening to external communication. The galley offers hot jugs, an oven, refrigerator, fresh water tank and storage space for food and beverages. As an option, customers can select additional operational enhancement features in the form of external stores. Dual hard points adapted to NATO standard are offered. The pylons are designed to carry anti-ship missiles, jammer pods and fuel tanks.

The Saab 2000 MPA system has been designed to operate with the Saab RBS15 anti-ship missile. Planning for the missiles launching zones, trajectories and target seeker settings are performed in the C2 system. The missiles launching sequence and priming are controlled by a Store Management Unit (SMU) for safety reasons.

Saab will use commercial Saab 2000 airliners to convert into special mission aircraft purposes. During such conversion extensive structural and electrical modifications are performed with the aircraft as well as system overhauls, aircraft refurbish etc resulting in similar to new condition leaving the conversion line. After conversion to a Saab 2000 MPA the aircraft will have a new defined structural life of at least 35,000 flight hours with 25 years support guaranteed.

With 350 knot (TAS) high-speed dash capability the aircraft can arrive on an incident quickly and stay on station for extended periods of time providing continuous surveillance coordination and communication.

The Saab 2000 is self sufficient, equally home at a major airbase or remote posting and has an Auxiliary Power Unit (APU), battery start (no ground power needed), pressure refuel or gravity feed through over-wing refuelling ports, self push back with reverse pitch and onboard mission planning.



Self AD

Ocean Hawks over

MQ-4C, the maritime version of RQ-4 Global Hawk offered to the Indian Navy

During Aero India 2011, this ***Vayu*** correspondent was privileged to hold a one-to-one discussion with Former United States Navy (USN) Admiral Walter Doran who is presently the President of Raytheon Asia. Discussions briefly touched upon the emerging strategic cooperation between the Indian Navy (IN) and United States Navy (USN) in the Indian Ocean Region (IOR) and some future scenarios. Indeed, among the multi Services cooperation, the close cooperation and synergy between the IN and USN have progressed to the extent that such nature of cooperation has the potential to turn India into one of United States closest allies in the same league that of Great Britain, Israel and Japan, and implicitly place her as the prime strategic partner in Asia-Pacific.

While state-of-the-art surveillance assets are to simultaneously enter IN and USN service in shape of Boeing P-8 Poseidon Multi-mission Maritime Aircraft (MMA) and, potentially, the E-2D Advanced Hawkeye Airborne Early Warning & Control (AEW&C) platforms, more significant from the strategic point of view is that Northrop Grumman have received and responded to a Request for Information (RFI) from the Indian Ministry of Defence for Northrop Grumman MQ-4C Broad Area Maritime Surveillance (BAMS) Unmanned Aircraft Systems (UAS) for the IN (after having obtained necessary clearances from United States Government). The maritime MQ-4C BAMS UAS (previously known as the RQ-4N) is a modified maritime version of the combat proven RQ-4 Global Hawk High Altitude Long Endurance (HALE) Unmanned Aerial Vehicle (UAV). Walter Kreitler, Director of Northrop Grumman BAMS UAS programme noted the similarity in operational roles and requirements of the USN and IN and

the IOR

stressed optimum interaction between the Northrop Grumman MQ-4C BAMS UAS and Boeing P-8 Poseidon MMA in both USN and IN operations. (In addition Northrop Grumman is set to offer MQ-8B Fire Scout Unmanned Aerial Vehicle (UAV) to IN).

The USN initiated investment in BAMS as an appropriate response to the evolving dynamic and uncertain maritime security environment demanding a system that can provide highly demanding and persistent maritime Intelligence, Surveillance & Reconnaissance (ISR) data collection and dissemination capability to the Maritime Patrol & Reconnaissance Force (MPRF). This would be in support of strike, signals intelligence (SIGINT), and communications relay with worldwide assets. Continuous and transformational ISR capabilities over the vast areas, both open oceans and littoral seas, became obligatory to accurately identify and track threats hiding even amongst small contacts and thus reduce vast amount of surveillance data to 'actionable information' in near-real time to obtain effective maritime domain awareness.

Managed by NAVAIR Persistent Maritime Unmanned Aircraft Systems Program Office PMA-262, Northrop Grumman entered a version of the RQ-4B in the USN BAMS UAS contract competition. On 22 April 2008 was announced that the Northrop Grumman RQ-4N had won the contract worth $1.16 billion. In September 2010, the RQ-4N was officially designated the MQ-4C and when fully operational, the system will operate with twenty UAS at five operating locations. The fleet ultimately will grow to sixty-eight UAS to augment the P-8 Poseidon MMA in the USN Maritime Patrol and Reconnaissance Force. Northrop Grumman's MQ-4C BAMS UAS will

provide the USN with unprecedented persistent and consistent maritime ISR capabilities over large maritime distances (mission radius of 2,000-nautical miles) for long periods of time with 80-percent Effective Time on Station (ETOS) for up to five simultaneous orbits worldwide. It will complement the USN P-3 Orion Long Range Maritime Patrol/Anti-Submarine Warfare (LRMP/ASW) fleet and the new P-8 Poseidon MMA force.

In addition, the MQ-4C is capable of self deployment at a range of 8,200-nautical miles. The MQ-4C BAMS UAS missions include, but are not limited to, maritime surveillance, collection of enemy Order of Battle (ORBAT) information, Battle Damage Assessment (BDA), port surveillance, communication relay, and support of maritime interdiction, surface warfare, battlespace management, and targeting for maritime and littoral strike missions in the process expanding maritime battlespace awareness and permitting wide distribution of naval striking power. Not yet apparent, but the MQ-4C BAMS UAS may well acquire the *Ocean Hawk* appellation for its stellar capabilities.

The Northrop Grumman BAMS system will also bring a fundamentally new element to the USN Net Centric Warfare (NCW) architecture with the onboard communications sweep providing a scalable net-ready published and subscribed system that will adapt to the available bandwidth. The maritime data will be sent simultaneously to multiple fleet users through multiple communications pathways that are prioritised to best support operational demands. The advanced information architecture or server in the sky will provide fast simple solution for all tactical users to access and share mission critical data. Maritime tracks, imagery and signals intelligence will be processed on board and relayed to shipboard, land based and airborne users in line of sight or through satellite communications (SATCOM), in near-real time. Fleet Commanders will receive continuously updated information on numbers and types of vessels present in their designated search area. With the Northrop Grumman BAMS system orbiting far overhead like a dedicated Low Earth Orbit (LEO) satellite, naval commanders will have control of their own organic means of broadband data and communications.

Carrying operations at sensor payloads optimised for the maritime environment, the high altitude maritime MQ-4C up to 60,000-ft, far above strong winds, severe weather and commercial air traffic providing a continuous view of wide areas of both open oceans and littoral seas. Flying at these higher altitudes allows onboard sensors to detect targets at greater range for earlier warning and keeps the MQ-4C UAS above the lethal altitude of most Surface-to-Air Missiles. High altitude flight also brings the advantage of higher speed allowing rapid revisits of critical areas preventing threats from leaking through allied defences undetected, increases the detection of high speed mobile targets and ensures optimal engagement of time sensitive targets. Although capable of unmatched high altitude operation at any time during its mission, the maritime MQ-4C UAS can rapidly descend to 1,000-ft, and below, to positively identify and relay images of any maritime target and then quickly climb back to 60,000-ft to regain the overall common operating picture for the Maritime Force Commander. The MQ-4C UAS systems 360-degrees airborne sensors provide unsurpassed spectral persistence through the Multi-Function Active Sensor (MFAS) Active Electronically Scanned Array (AESA) radar. MTS-B multi-spectral targeting system includes high resolution at multiple field-of-views Electro Optical /Infra Red (EO/IR) sensor with multimode full motion video, and AN/ZLQ-1 Electronic Support Measures (ESM) with Specific Emitter Identification (SEI) capability all weather round the clock whereas Automatic Identification System (AIS) provides information received from Very High Frequency (VHF) broadcasts on maritime vessel movements.

The new 360-degree MFAS AESA radar will provide the USN with state-of-the-art radar that will find and identify hundreds of targets at longer ranges much more rapidly and accurately with better reliability thanks to the attributes of 2D AESA and maritime and air-to-ground modes. Northrop Grumman's MQ-4C has an internal payload of 3,200-lb, with the ability to carry additional 2,400-lb externally and a new generator that delivers 25-kvam power plus additional growth margin that is already available. By combining exceptional sensor performance with high and low altitude flight, 310-knot cruising airspeed and greater than 36-hour endurance, the Northrop Grumman's MQ-4C UAS system provides "unsurpassed global access, persistent surveillance and mission flexibility at the greatest distances from its operating bases".

Importantly, the multiple cross-queued sensors carried by the maritime MQ-4C can survey much broader area at the fraction of the cost of any other manned or unmanned alternative, allowing the USN to achieve global maritime coverage from only five main operating bases namely Oahu, Jacksonville, Sigonella, Qatar and Guam, thereby reducing the USN dependence on foreign basing. Linked by the Northrop Grumman BAMS system, dispersed networked naval system will project unsurpassed offensive power and achieve defensive assurance and operational independence as envisioned in USN transformational sea power 21 concepts.

The MQ-4C in Indian Navy service will cover the entire Indian Ocean besides monitoring potentially hostile surface and sub-surface incursions from the South China Sea (submarines are likely to reveal their positions while transiting through shallow straits) besides continuing the key role of "unreachable" high altitude reconnaissance which, until 2006, were carried out by Indian Air Force MiG-25Rs.

Sayan Majumdar

10 Years on: NGC Global Hawk's historic Trans-Pacific flight

Ten years ago, Northrop Grumman Corporation's Global Hawk unmanned aircraft system (UAS) entered the Guinness Book of Records for the longest nonstop unmanned flight, when it flew from Edwards Air Force Base in California to RAAF Base Edinburgh in South Australia. A decade on, the long endurance UAS continues to display its strength and versatility in military and civilian tasks in the Australia region and across the globe.

The record-breaking flight in April 2001 by the RQ-4 Global Hawk was the first nonstop crossing of the Pacific Ocean and the longest journey ever undertaken by an unmanned aircraft. Later that year, following 11 September the Global Hawk system was pressed into early operational deployment in the Middle East, thanks, in part, to the mission planning undertaken for the Australian trials. The UAS performed exceptionally well in those conflicts and since then, and with several generational upgrades in place, Global Hawk has amassed an impressive list of military and civilian applications reinforcing its value as a key national security asset.

Most recently, Global Hawk has been providing vital aerial surveillance in support of the earthquake and tsunami relief efforts in Japan, providing vital support to national security and humanitarian relief operations.

The Australian Government is committed to acquiring a high-altitude long-endurance unmanned aircraft system, such as Global Hawk, and has worked closely with the U.S. Navy on the Global Hawk maritime derivative-the Broad Area Maritime Surveillance unmanned aircraft system (BAMS UAS) system currently being developed by Northrop Grumman. "While the BAMS/Global Hawk system can conduct land surveillance, it's ideal for watching over vast maritime territory and areas of interest. In Australia's case, BAMS is well suited for whole-of-government tasks such as monitoring borders; assisting in search and rescue; fisheries management; environmental monitoring; drug interdiction; and of course, responding to natural disasters including bush fires and floods."

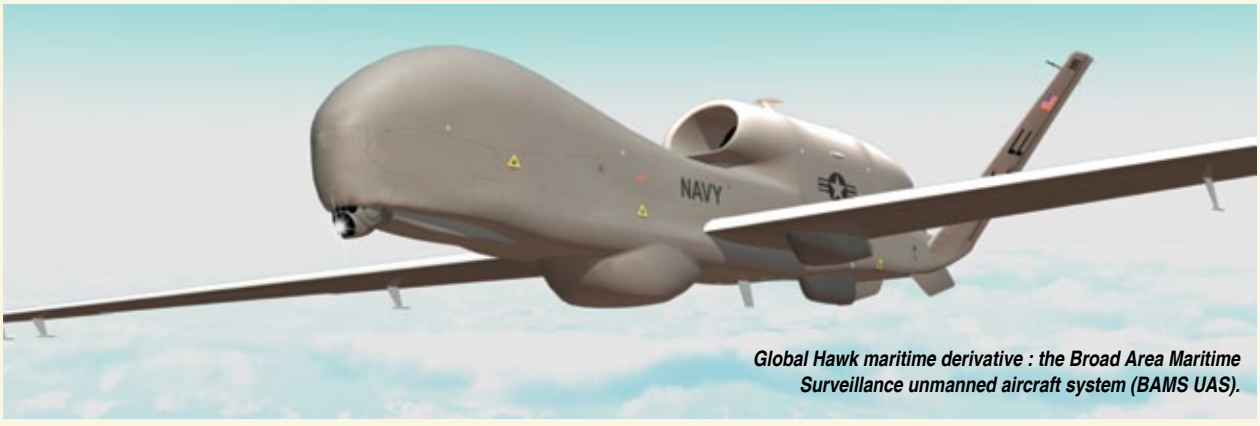
Operating out of bases in the continental United States, Italy and Guam, Global Hawks are performing "beyond expectations". Currently supporting operations in Afghanistan and Libya, the Global Hawks are performing more sorties at a faster rate and covering more area than earlier test and evaluation results predicted.

According to Walt Kreitler, while the military uses for the BAMS UAS are well recognised and without question-providing indispensable intelligence, surveillance and reconnaissance information to coalition forces, the civilian applications are becoming increasingly apparent. "The Global Hawk UAS has helped authorities respond to wildfires in California and the Haiti earthquake. Now in Japan, Global Hawk is helping emergency responders and those involved in humanitarian relief to determine where assistance is needed most."

"The unmanned aircraft can examine huge areas in a very short space of time and provide detailed imagery of affected areas. Authorities then use that information to prioritise their efforts, helping, ultimately, to save lives," said Kreitler.

US Navy and Northrop Grumman representatives were in Australia earlier in April to provide the government with an update on the BAMS programme. "When, at the height of the global financial crisis, the Australian Government deferred further participation in BAMS, they made it clear that they would watch as the programme matures before deciding when to formally re-engage," said Kreitler. "Since then, the BAMS programme has gone from strength to strength with BAMS aircraft and its advanced sensors on track to enter U.S. Navy service from 2015." "We hope to see Australia once again working alongside us, and our US Navy customer, as we bring BAMS into service. We hope too, that before the decade is out, there will be BAMS aircraft with Royal Australian Air Force roundels helping to secure the region, as a true whole-of-government asset," said Kreitler.

The 2009 Defence White Paper states that Australia will acquire up to seven high-altitude long-endurance unmanned aircraft to complement manned maritime surveillance assets. Global Hawk/BAMS systems are either in service or entering service with the U.S. Air Force, the U.S. Navy, Germany and NATO.



Global Hawk maritime derivative : the Broad Area Maritime Surveillance unmanned aircraft system (BAMS UAS).

The Golden Cobras

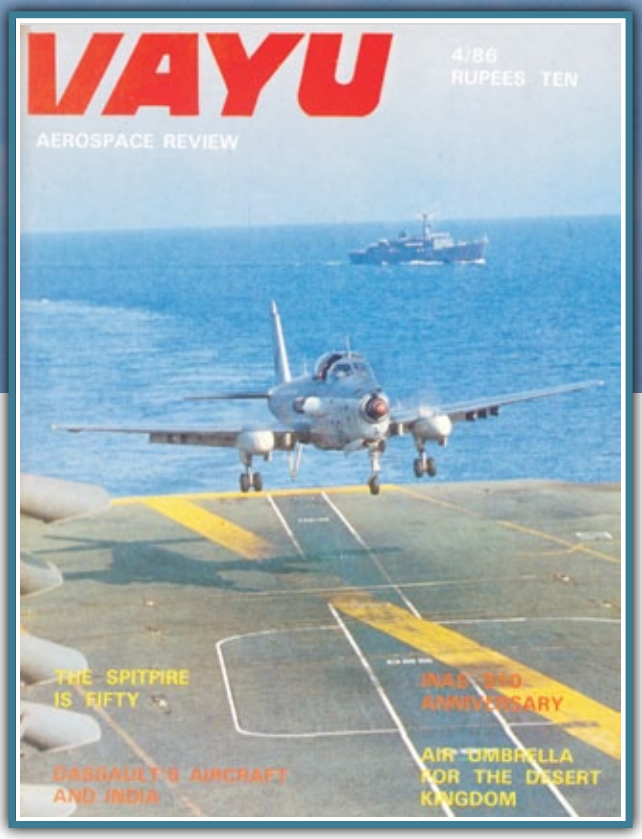
INAS 310 Half Century

Twenty five years back, *Vayu's* Issue II/1986 carried a cover story on the Indian Navy's Air Squadron 310, then flying Alize carrier-borne ASW aircraft, as it marked its Silver Anniversary. Twenty-five years on, *Vayu's* Editor was with INAS 310 at their Golden Anniversary, the *Cobras* now operating HAL-Dornier 228s from INS *Hansa*.

'First In–Last Out' is the motto symbolising the constant dedication and dynamism of the Indian Navy's Air Squadron 310 ('Cobras'), with their onerous task of safeguarding the vast expanse of maritime areas surrounding India. But what is more pertinent is the aptness and topicality of this phrase chosen with a sense of vision, as this motto of INAS 310 reflects its genesis, progress, modernisation and sophistication over the last five decades. Exemplary performance of this Naval Aviation Squadron, not only over the seas, but at the other geographic extreme along the high Himalayas in 1965 and 1999, completely changes one's perception of military aviation in India as normally identified with the Indian Air Force. In fact, Indian Naval aviators have many pioneering deeds to their credit, a fact which can never be grudged by the IAF.

INAS 310 were raised at Hyeres, near Toulon in southern France under the command of then Lt Cdr Mihir K Roy (later Vice Admiral), who was the first 'King Cobra'. The Squadron was commissioned by the Ambassador of India to France, Nawab Ali Yavar Jang on 21 March 1961. It was in Alize IN203 which Lt. Cdr Mihir K Roy and Lt. R Anderson carried out the first deck landing on board the carrier INS *Vikrant* off Yeovilton on 23 May 1961. After workup and various sea trials, INS *Vikrant* sailed from the Mediterranean Sea and arrived at Bombay on 6 November 1961, with four Alizes (and twelve Sea Hawks) embarked. The squadron was shore-based at INS *Garuda* at Cochin.

The Indian Navy acquired 12 Breguet Alize aircraft (and later three more) from France. Armed with torpedoes, bombs, rockets or depth changes, the Alize was operated by INAS 310 for maritime reconnaissance and ASW patrols during various operations. The aircraft remained in front line service, operating from the INS *Vikrant* till the installation of a ski ramp on the ship meant it being relegated to shore-based operations from 1987, till they were phased out 1991, the last Alize flight taking place on 12 April 1991. The Cobras were slated to get the brand new HAL-built Dornier 228 twin-engined light transport aircraft, the first of which



was handed over at HAL's Kanpur Division on 29 August 1991.

But going back to 1961, the Cobras were in operations within just a few weeks of their arrival in Indian waters when the INS *Vikrant*, with its complement of Seahawk and Alize aircraft, was deployed off the western coast, taking part in 'Operation Vijay', the liberation of Goa from Portuguese occupation. Through the 17-18 December 1961, the Alizes flew day and night and every contact on which there was the slightest doubt, was investigated.

The Indo-Pak war of September 1965 had the *Cobras* at the fore; INAS 310 was entrusted with a four fold task: defence of the Fleet, defence of Bombay and Cochin and extensive MR/ASW patrolling. Since the INS *Vikrant* was under refit during the period, the *Cobras* operated in two detachments, flying aircraft simultaneously from Bombay and Cochin. On the other end of the sub-continent, one Alize was tasked to undertake highly classified ESM operations along the entire western border from Jamnagar to Pathankot. The enemy preferred to remain within her territorial waters and the Cobras were denied an opportunity to spew their venom.

The situation in 1971 was quite different. Four Alize and 18 Seahawk aircraft, operating from the carrier *Vikrant,* mounted intensive strikes on East Pakistan from 4 December 1971 onwards, destroying more than 100,776 tons of enemy shipping, interdicting maritime traffic, targeting harbour installations, runways, infrastructure, vehicles, buildings, fuel dumps, oil storage facilities and troop concentrations, with over 291 sorties flown within 10 days. The *Cobras* struck silently at night and flew for a total of 158 hours, earning six Vir Chakras, six Nao Sena Medals and three Mention-in-Despatches.

HAL–Dornier 228-202K preparing for mission from INS Hansa

The end of the eighties saw the Cobras disembarking from the mother ship (INS *Vikrant*) for shore-based operations, the last launch on 13 April 1985 and then shore based at INS *Hansa*, Goa but there was no let up in flying. The end of 1988 witnessed the Squadron actively participating with the IPKF against the LTTE in what came to be called *Operation Pawan* over Sri Lanka. The Squadron was detached to Madurai, and carried out extensive flying from that remote location.

In their planning for the future, the Indian Navy had firm requirements for a large force of twin-engined, light transport aircraft with adequate range and endurance, and equipped with Information-Warfare (IW) systems, surveillance radar, advanced navigation systems and key avionics. The Dornier 228 fulfilled this requirement in most cost-effective manner. In collaboration with Israeli firms, the type was fitted with special sensors for the Information Warfare role. Collaborating with Israel Aircraft Industries Tamam Division, HAL integrated the Airborne Observation System AOS, the heart of which is the Elta EL/M2022A radar and the Airborne Multi-mission Optronic Stabilised Payload (AMOSP) which can be used as an electro-optical sensor or as part of a stand-alone AOS. Equipped with such sensors and systems, the Navy's Dornier 228s can simultaneously transmit data to several ground locations and receive data from multiple sources.

Vice Admiral Mihir K Roy , the first King Cobra with Cdr Sanjay Chauhan, present CO INAS 310.

After re-equipment with Dornier 228s, INAS 310 was formally designated the 'Information Warfare Squadron' and has continued to distinguish itself, silently, in carrying out its tasks with excellence.

The squadron was back in action during the 1999 Kargil war, for the first time with Do-228s. Three aircraft and about fifty officers and men of INAS 310 were deployed to the forward air base at Naliya in the state of Gujarat, close to the Indo-Pak border. The Cobras quickly swung into action when IN 225 and IN 223 operating from Naliya and Daman, carried out MR/ELINT missions and worked in close coordination with the Army and the Air Force. The Squadron undertook extensive operations by flying close to the IBL in Rajasthan, Gujarat and over the sea off Karachi, Gwadar and Bombay High. The *Cobras* covered the entire area along the Karachi FIR from Muscat FIR to Kori Creek up north to Jaisalmer. For the first time, the Dornier was deployed as an EW platform in support of the Army and the Air Force for integrated ELINT operations. Data pertaining to the Pakistani shore based radars was collected and their locations were identified. The MR (Maritime Reconnaissance) missions were carried out south of the Karachi FIR to monitor Pakistani units and merchant traffic in the area.

The Squadron was also tasked to undertake surveillance missions for the Army to locate battle surveillance radars and troop concentrations. The aircraft operated form Bhatinda to cover areas

The Cobras spell out their 50th year, bounded by five Dornier 228s.

from Jaisalmer right up to the foothills of Jammu. Military Intelligence Officers were so impressed by the capabilities of the Dornier that they admitted that the information gathered by the Dornier in three days would have taken them three months on ground.

The *Cobras* received this unique Unit Citation from the CNS after the Kargil operations in 1999. *"INAS 310, the Information Warfare Squadron of the Navy flying HAL-Dornier 228s was deployed at forward Air Force bases from 17-23 May 1999, as part of 'Operation Vijay'. During the period of deployment the squadron flew a total of 228 hours by day and 130 hours by night, undertaking ELINT data for air defence radar collected by the aircraft was successfully utilised to suppress the AD radars and press home strikes at bunkers with complete impunity against SAMs positioned closed to the LoC. In addition, such data also served to enhance the database on the enemy. In performing its role, the squadron proved to be an invaluable asset towards the operation undertaken by Indian armed forces in 'Operation Vijay'. For its dedicated and tireless efforts during the operation, 310 Squadron is awarded the unit citation for the year 1999".*

As the Squadron celebrated its Golden Jubilee on 21 March 2011, its officers and seamen recalled with immense pride the path carved out by the predecessors, their achievements in various operations, battles and wars they fought shoulder to shoulder with the Army and the Air Force. The honour conferred by a grateful nation was represented by the numerous medals won by its officers and seamen during the last fifty years. Lt Cdr Santosh Gupta was awarded Mahavir Chakra and Cdr R D Dhir, Lt Cdrs S P Ghosh, S. Ramsagar and Lts. A Roy, B B Bhagwat, RS Dhir and KS Panwar won Vir Chakras in the Indo-Pak war 1971 while Nao Sena Medals were awarded to Cdr Hardev Singh, Lt Cdrs R S Garde, L Narain and Lts U L Deshpande, MV Pant and A Roy, Cdr R K Singh, Lt Cdr Ashwini Kumar and Lt J J Nijhawan were honoured with Nao Sena Medals in Operation Pawan, 1988-99.

The *Cobras* were part of the continued operational deployment that commenced after the 13 December 2001 attack on the Indian Parliament. In January, 2002 the Squadron participated in Operation *Parakram* for which the Squadron was detached to Naliya. The paint scheme of all Naval Dorniers was changed to grey at the commencement of Op *Parakram*. Praise was received from all quarters for the Naval ELINT air effort undertaken by the *Cobras* in an extremely professional manner.

Once again, INAS 310 was honoured with the Chief of Naval Staff's Unit Citation for its *exceptional and professional competence, organizing ability, speed of execution and proactive approach among other attributes elevating the status of the Navy in the eyes of the country, both in terms of its involvement in humanitarian missions as well as display of military prowess.*

The magnificent five : Cobras line-up for take off at Dabolim

From June 2002 onwards, Muscat figured prominently on the *Cobra's* itinerary, being tasked pioneer missions off the Makran Coast with a turnaround at Muscat and Oman. The sorties are usually eventful, but the *Cobras* have had 'close encounters' with USN carrier-borne fighters from the coalition task forces operating of the Makran coast.

All was not well on the southern front towards the end of 2005 and on 19th December 2005 the *Cobras* moved out in quick time to the small airfield at Ramnad with a two- aircraft detachment anticipating heavy flying. Though the assignment was initially for a week or two, the detachment continued through December and well into January. The *Cobras* contributed substantially to the success of the ensuing operations against the LTTE.

The *Cobras* in the new millennium soon spread their wings overseas, being tasked around the world from the Middle East to the small island nations of the Indian Ocean to South East Asia. Most of these missions were of a classified nature, but suffice it to add that the *Cobras* continued to draw praise and admiration from all quarters for a job "well done".

In their Golden Jubilee year, the *Cobras* remain as active as ever, remaining backbone of the Maritime Reconnaissance force flying almost 3000 hours annually. The Squadron has been instrumental in extensive trials, testing, and development of various new sensors, technologies and the resulting changes in Operational Procedures. The Cobras have participated in all Naval operations both major and minor, have exercised with foreign Navies, and rendered assistance to littoral and neighbouring island nations. With a glorious 50 years in their wake, the *Cobras* look to the future with wings (and hoods!) spread and propellers spinning !

The Navy has at present 26 Dornier 228s in five different variants depending upon the sensor and equipment fit. Besides INAS 310, the Dornier 228 is operated by INAS 311, INAS 318, INAS 550 and 318 Flight.

Gp Capt. J C Malik with inputs from the 'Cobras'

In lethal company : Cobra 228 with Black Panther MiG-29K and White Tiger Sea Harrier at INAS Hansa.

PEN MAN

Agapanthe 2010

On board the carrier Charles De Gaulle

The aircraft carrier represents a powerful deterrent enabling the country which possesses such capability to project power almost anywhere on the planet, without the need for host nation support. Dr Séan Wilson embarked aboard the *Marine Nationale's* (French Navy's) flagship the *Charles De Gaulle* (R91) during the Agapanthe 2010 deployment to report on the Aéronavale's potent mix of both old and new assets.

Grumman E-2C Hawkeye.

Commencing at the end of October 2010, 'Agapanthe' was the major four month long deployment that once again had the *Charles De Gaulle's* embarked air wing participating in operations over Afghanistan in support of coalition troops as well as contributing to the EU's *Atalanta* anti-piracy mission off the coast of Somalia. Strengthening ties with friendly nations in the region was just as important and accordingly the deployment provided the Aéronavale with the opportunity to train alongside the Indian Navy *(Exercise Varuna)* as well as the air forces of Saudi Arabia *(Exercise White Shark)*, the United Arab Emirates *(Exercise Big Fox)*, Greece and Italy.

Dassault Rafale M of Flottile 12F.

"Off the coast of Pakistan we conducted air operations over Afghanistan, however most of our areas of operations are outside the Persian Gulf. We consider that as soon as we enter into the Red Sea we are in the area of operations dedicated to the *Agapanthe* deployment", explained Captain Jean-Philippe Rolland, commanding officer of the *Charles De Gaulle*. "The Red Sea is bordered by countries that are facing some problems, such as Yemen. The Horn of Africa is also threatened by instability, with piracy and trafficking problems. Part of our mission involves deploying to the Indian Ocean in order to provide our military and civilian leaders with a view of the evolution of the situation in an area which is very important for France's interests. The Indian Ocean is a causeway of several lines of communication and is bordered by some countries facing difficulties, war or instability. With the air wing we are able to gather information that is absolutely necessary to assess the evolution of the situation."

Although operations over Afghanistan formed only a small part of the *Charles De Gaulle's* overall mission, the Agapanthe deployment nonetheless provided an opportunity to test combat readiness of the carrier and its air wing. Captain Rolland went on to say: "I think that our goal to fulfil the required contribution to ISAF [International Security Assistance Force] operations in Afghanistan was achieved because we completed almost 200 sorties during one month. We had a very high level of availability with more than 93% of missions fulfilled. We were very quickly at a level in which we could cooperate with the FAC [Forward Air Controller] or JTAC [Joint Terminal Attack Controller] and we succeeded in producing young pilots that were able to operate at the required level. Since we only have one carrier and one air wing and it has been three years since we have been in this area of operations you always wonder whether you will be able to fulfil the missions. The result is clearly that we were at a good standard and this is my highest point of satisfaction."

Super Etendard still a capable strike asset

Operating in the strike/CAS/recce/buddy-buddy refuelling roles is the Dassault Super Etendard Modernisé (SEM), an aircraft that has received a number of upgrades over the years ultimately resulting in the latest enhancement package, Standard 5.

Standard 4 saw the introduction of Have Quick UHF and VHF radios. During the Standard 5 enhancement package, which was started in 2008 and completed in 2010, the VHF radio was replaced by a V/UHF Have Quick/SATURN radio. Also included in Standard 5 were new capabilities for the Thales Damocles M targeting pod, a new autopilot, the capability to carry 250lb (113kg) GBU-58s on the outer wing pylons and the capability to carry two 500lb (227kg) GBU-49s on a dual-pylon. Standard 5 has been implemented on all SEMs still in operational service, of which there are approximately 35.

Dassault Super Etendard Moderaise (SEM).

Rafale Ms on the 'Charles de Gaulle'

The capability to utilise the Damocles M targeting pod was introduced in 2004 as part of the Standard 4 upgrade. In total 15 targeting pods, which are compatible with laser and GPS/INS-guided weapons, were delivered to the Navy in 2004, and these are now shared between the SEM and Rafale units. Damocles is equipped with an infrared (IR) sensor, the FLIR (Forward Looking Infrared) imagery from which can be displayed on the HUD, in addition to a laser pointer and laser spot-tracker.

Although Damocles is a newer pod the older ATLIS (Autopointeur TV Laser Illumination du Sol) laser targeting pod is still a useful tool over Afghanistan as the commanding officer of Flottille 17F explained: "We carried out most of our mission with ATLIS and because we flew only day missions the definition of the [ATLIS] pod is better. Damocles M is IR so it depends on temperature contrasts between objects which can itself depend on the time of day. Damocles is very good at night but can sometimes not be as good as the ATLIS pod during the day depending on the temperature. It is easier for pilots to see people on the ground during the day using ATLIS as it utilises a TV camera. To further enhance our mission we need a new targeting pod. We are behind in targeting pod capabilities when we compare our targeting pods to the Sniper pod for example."

In September 2010, eight SEMs were equipped with ROVER (Remotely Operated Video Enhanced Receiver), a system which allows targeting pod imagery to be data-linked in real-time to a FAC or JTAC on the ground. In addition to making target talk-ons much easier ROVER enables the FAC or JTAC to positively identify that the correct target has been selected thereby greatly reducing the possibility of fratricide, a feature that all aircrew agree is of the utmost importance. As ROVER has been installed directly into the SEM, as opposed to being associated with a specific pod only, it enables data from both the ATLIS and Damocles pods to be transmitted.

The SEM first saw action over Afghanistan during December 2001-June 2002, while operating from the *Charles De Gaulle* and has since returned with the ship in 2004, 2006 and 2007. The capability to carry the 500lb (227kg) GBU-49 Enhanced Paveway II GPS/laser-guided bomb came in 2008, and the SEM became the first French type to use the weapon over Afghanistan that same year when three aircraft from Flottille 17F deployed to Kandahar.

During current operations over Afghanistan the SEMs flew together as part of a two-ship with one aircraft equipped with a targeting pod and a single GBU-49 and the other carrying a single 250lb (113kg) GBU-58 laser-guided bomb in addition to the two 30mm internal guns for strafing. Damocles M-equipped SEMs also flew as part of a mixed fighter force operation (MFFO) alongside the Rafale

On the CDG aft flight deck.

until the latter was declared operational with the Damocles. However, sorties over Afghanistan only represented a small part of the SEMs task during the *Agapanthe* deployment with the type also playing an important role in the *Atalanta* anti-piracy mission. "We prefer to use the ATLIS and Damocles pods. We have a pretty good air-to-sea radar and we can slew either pod to the radar track enabling us to identify a boat a long-range. If we identify a possible target then we can call upon the Rafale equipped with the Reco NG pod to capture high resolution images" explained the commanding officer of 17F.

The SEM is currently in service with two Aéronavale units, Flottilles 11F and 17F, and although it is still a highly capable platform some of its previous missions, including the nuclear and reconnaissance roles, are now being transferred to the Rafale. Ultimately this means that the SEM will soon be phased out of service as the commanding officer of 17F explained: "The SEM will maintain the strike at sea role as this is not yet completely covered by the Rafale. The SEM is also an excellent platform for conducting CAS missions. Therefore these missions will be maintained by the SEM until the end. The first squadron [11F] converts to the Rafale in summer 2012. Next year the plan is for 17F to become a large SEM squadron, similar to the Rafale unit 12F, with at least 15 aircraft and 23 pilots. In 2015 the SEM will then be retired before which time all SEM pilots will have converted to the Rafale."

Rafale M on deck.

The Omni-role Rafale

Flottille 12F are currently the only Aéronavale unit to operate the Dassault Rafale M and during the *Agapanthe* deployment the latest fully swing role Standard F3 made its operational debut, although this was not the first time that Rafales had operated over Afghanistan. Currently employed in the CAS/recce/buddy-buddy refuelling roles the type first deployed to the region in 2002, but on this occasion 12F only conducted combat air patrol (CAP) sorties over the *Charles De Gaulle* with no actual missions carried out over Afghanistan. The Rafale returned with the carrier in 2004 and 2006, this time to perform buddy-buddy tanking missions over Afghanistan. The type's first fully operational deployment took place in 2007, when 12F returned to the region with the upgraded air-to-ground-capable Standard F2 Rafale M.

The Aéronavale had an original requirement for 60 aircraft but relinquished two in order to have a fully functional simulator in Landivisiau. So far 31 jets have been delivered, ten of which are early F1 models that are currently stored awaiting upgrade to F3, a process which is expected to be completed during 2014-16. In November 2009, the final F2 jet was upgraded to the current Standard F3 bringing the Navy's current complement up to 18. So far three aircraft have been lost due to crashes, the most recent of which occurred on 28 November, 2010, off the coast of Pakistan during the *Agapanthe* deployment thankfully without loss of life.

The new Standard F3, which was declared fully operational by the *Armée de l'Air* and Navy on 3 December, 2009, introduced amongst other things an improved Thales Spectra electronic warfare suite, software enhancements to the radar, new targeting and reconnaissance pods and the capability to employ the AASM (Armement Air-Sol Modulaire/Modular Air-Surface Armament). This precision-guided weapon features an IMU (inertial measuring unit)/GPS, IR/IMU/GPS or laser/IMU/GPS guidance kits. Future weapons will include the AM39 Block 2 Exocet anti-ship missile, Meteor active radar guided beyond-visual-range air-to-air missile (BVRAAM) and ASMP-A nuclear missile. The latter was successful

Rafale M launched.

Super Etendard launched.

tested for the first time, without a warhead, on November 23, 2010, by a French Air Force Mirage 2000N and when it comes into service the Rafale will take over the nuclear role previously assigned to the ASMP-equipped SEM.

Flying two to three CAS missions per day over Afghanistan the Rafales were operating with four bombs, either 500lb (227kg) GBU-12 Paveway IIs or AASMs, and the internal 30mm cannon. For targeting the Rafale now utilises the same Damocles M targeting pod carried by the SEM, with the first operational flight of a Damocles-equipped Rafale taking place on 2 January, 2011. Referred to as *Nav Raf Damocles* by Rafale aircrew, only software modifications were required to enable it to be carried by the Rafale. However, as the Rafale had not been declared fully operational with the Damocles pod during the beginning of operations over Afghanistan at the end of November 2010, the type worked in conjunction with the SEM as the commanding officer of 12F explained: "The Rafale is a very effective airplane. We are carrying up to four bombs. When you compare this to what the Super E was able to do by itself, it was operating with either one or two bombs. The only thing we were missing was a laser targeting pod to enable us to act autonomously. We were flying MFFO, with the Super E carrying the targeting pod. We were leading the section around theatre and as soon as we started to talk to troops on the ground we gave the lead to Super E for talk-ons using ROVER and the pod."

The Standard F3 Rafale M now in service with Flottille 12F is a much more capable aircraft than the F2 version that operated over Afghanistan during the unit's last deployment to the region in 2007. With further enhancement planned this trend is set to continue as the commanding officer of 12F went on to explain: "In 2007 we were tricking the system using a jettison procedure to drop bombs as well as shooting the guns using air-to-air symbology which was not the best [for strafing ground targets]. For almost a year now we have had fully integrated air-to-ground symbology for dropping bombs along with fully integrated air-to-ground symbology for the gun. Better accuracy and easier to use."

"We are working on ROVER and Damocles right now and next year will


Rafale M before launch.

Super Etendard.

have some more gear coming down the line. If you look at other pods on the market it's clear that we need something else and we are asking for it. Thales is working on it and I guess in two or three years we will have a new pod with better accuracy."

"We will also get an AESA radar [Thales' RBE2] two or three years from now. Some new EW gear and a new FSO [Front Sector Optronics] are also planned. We are getting rid of the IR FSO altogether and replacing the camera from the TV FSO with a more powerful one."

"We also have everything for the Exocet including the new radar software which is much better for sea targets. We have the full symbology and software required to shoot the missile. Full integration with Exocet should come around 2013 but we can train for this mission right now."

Another important evolutionary step will see the introduction of ROVER. So far only two or three Rafale Ms have been equipped with this system which, like the SEM, has also been installed directly into the aircraft although at the moment it is only linked to the Damocles pod. This combination has been evaluated and tested in France but the first carrier flights were not expected to take place until the middle of January 2011.

Thanks to the introduction of Thales' Reco NG pod the Rafale is now able carry out reconnaissance missions previously performed by SEMs equipped with the CRM 280 *(Châssis de Reconnaissance Marine modèle 280)* pod. Flottille 12F first flew with the new pods in May/June 2010, to train pilots and used them operationally for the first time, over Afghanistan, during November and December 2010. A total of twenty pods have been ordered, 12 by the Air Force and eight by the Navy. During the *Agapanthe* deployment the Aéronavale were making use of Air Force pods although the Navy have recently taken delivery of their first pod. The Air Force was declared operational with the Reco NG pod in November 2010, and when the next two pods are supplied to the Navy at Landivisiau they too will be declared operational.

Reco NG-equipped Rafales were involved in the *Atalanta* anti-piracy mission during the Agapanthe deployment, flying Surveillance and Sea Control (SSC) sorties in order to locate ships of interest before passing the relevant information on to military or civilian ships in the area to enable them to reposition themselves accordingly. SSC missions involved either two Rafales or one Rafale operating with a SEM wingman equipped with the Damocles M targeting pod. In the latter situation the Damocles pod was used to identify ships from long-range and if a target of interest was identified the Rafales then moved in to capture images with the Reco NG pod. "Now with the Damocles we may be able to do that by ourselves. By having Damocles we are looking into the future, we are filling the gap with regards to being an autonomous platform", stated the commanding officer of 12F.

Easing the burden

In order to ease some of the burden placed on Flottille 12F a joint Air Force and Navy Rafale conversion unit, *Escadron*

SA-365F1 Dauphin hovers over the deck.

de Transformation Rafale (ETR) 2/92 'Aquitaine', was formed at Saint Dizier in October 2010, to which the Navy have so far committed a single Rafale M.

The next major step will come when the second Rafale unit is formed later this year as the commanding officer of 12F explained: "11F is a big challenge for us. For almost the past ten years 12F have been doing pretty much everything - trials, operational planning and preparation as well as training new pilots and transitioning older guys. It's a lot to do for a single squadron. This summer 11F, which is flying the Super E right now, is going to transition to the Rafale. That's a huge challenge for us but it's very promising as this additional squadron will be able to take some of the load. The transition has already begun as we have a couple of pilots and technicians with us on board just now who will form the core of the new squadron. Hopefully by the summer of 2012 they will be fully operational. The next step will be in 2015 when 17F will transition to the Rafale."

Airborne Battlefield Command and Control

The Aéronavale operates three Grumman E-2C Hawkeyes. Although the basic mission of the Hawkeye is airborne early warning (AEW) for the protection of the carrier and task group, the fact that there is no real aerial threat over Afghanistan has meant that the Hawkeye is called upon to effectively act as Air Traffic Control as the executive officer of Flottille 4F explained: "Our main mission during operations over Afghanistan was to provide support to naval aircraft, what we refer to as Airborne Battlefield Command and Control. Here our main goal, rather than carrying out airborne early warning, was to provide a communication link between our aircraft operating over Afghanistan and the carrier. The airspace over Afghanistan can become quite congested. During a three hour slot we could see at least 200 aircraft operating over Afghanistan."

Fine shot of Super Etendard just clearing deck.

As the Hawkeye's radar was initially designed to detect Russian warships the aircraft's anti-surface capabilities were called upon during *Atalanta* anti-piracy sorties. To aid in this mission the Hawkeyes were fitted with an Automatic Identification System (AIS) in 2008, which was first used later that same year during counter-drug missions in the Caribbean. This tracking system enables the Hawkeye's crew to obtain information about a ship such as port of origin, flag, shipping number and port of destination.

In 2007, all three E-2Cs were fitted with eight-bladed Hamilton Sundstrand NP2000 propellers resulting in less vibration, ultimately leading to an increase in reliability and serviceability.

In 2010, just prior to the *Agapanthe* deployment, a single aircraft received the Garmin 500 civilian-standard GPS system. Within the next two years the remaining aircraft will be similarly equipped.

The E-2Cs are also equipped with Link 11 and Link 16. Within the next two to three years the plan is to upgrade these secure datalinks to enable forwarding between the two systems as well as to allow Link 16 data to be transmitted via satellite.

Rotary assets

There is one service that every fighter pilot hopes never to have to call upon but one which they are glad is ever present, namely search and rescue (SAR). On board the

The 'Charles De Gaulle' (R91) in harbour.

Charles De Gaulle rescuing pilots who have ejected, referred to as the 'Pedro' mission, is carried out by Flottille 35F, equipped with the Sud Aviation SA316B Alouette III and Aerospatiale SA365F1 Dauphin.

The Alouette has been in service with the Aéronavale since 1961. The SA316B variant, of which approximately 15 remain in service, lacks an autopilot or automatic hovering system and is therefore tasked with all of the day SAR sorties to save Dauphin airframe hours for night missions. Within the next two to four years they are due to receive GPS systems and navigation system upgrades to enable them to continue in service until 2020/21.

In February 2011, the Aéronavale celebrated 21 years of Dauphin 'Pedro' operations. Of the Dauphins in service with the Aéronavale three SA365F1s are equipped for the 'Pedro' mission. The Dauphin 'Pedro' features an automatic hovering system and is therefore reserved for SAR mission at night although the type is not NVG compatible. The Aéronavale initiated a communication and navigation systems upgrade programme for its Dauphin fleet one year ago, a process which is expected to be completed within two to three years time.

All Aéronavale helicopter crews are trained to participate in Force Protection missions which include anti-piracy and counter-drug sorties. Flottille 35F are qualified for basic anti-piracy missions which limits them to day operations using the Alouette III or Dauphin to disrupt piracy, whereas the tracking of specific vessels is carried out by AS565 Panther crews.

Equipped with the Aerospatiale SA330 Puma, the somewhat less glamorous yet essential role of transporting personnel and supplies is carried out by a detachment from the *Aviation Légère de l'Armée de Terre* (ALAT / French Army Air Corps). The Puma is a helicopter that is more commonly used by the ALAT in the tactical transport role. Although they are NVG compatible and can be armed with either 12.7mm or 20mm machine guns the Puma played no part in any combat/anti-piracy operations during the Agapanthe deployment. Of the Pumas that are currently in service with the ALAT 45 are expected to receive communication and navigation system upgrades to enable them to continue in service until 2022-25.

Joint carrier ops

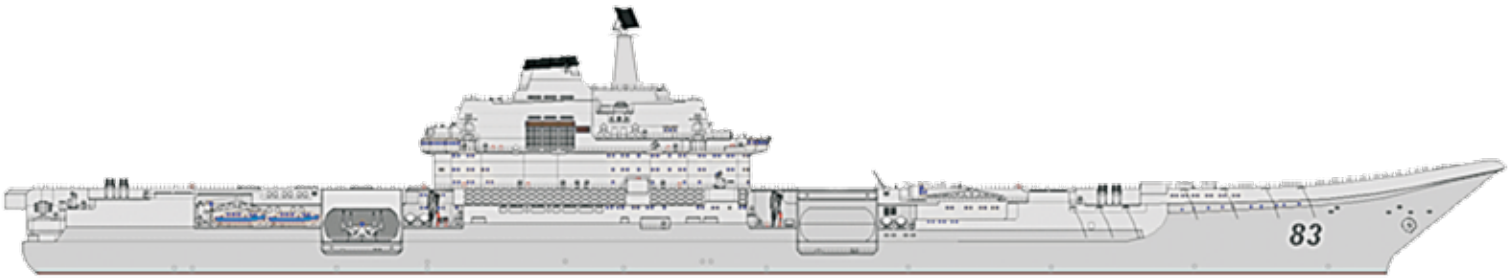
In November 2010, the heads of the French and UK governments signed a defence treaty which covered, amongst other things, joint carrier operations. Captain Rolland gave his thoughts on this: "I was very satisfied to see that the Royal Navy has decided to go with catapult and arresting gear carriers because in my opinion it's a good decision and the best technical solution. This choice will open up a new area of cooperation between our two navies. With regards to many security subjects I think France and the UK have a similar approach. If you have the technical capability to cooperate it's good but it's not enough. You also need to have a similar political approach and a similar comprehension of strategic problems. There is a chance now that within the next decade we will take major steps forward in our efforts to operate together and between 2020 and 2030 I think that we will regularly have French Navy aircraft operating on a UK carrier and vice versa."

Following the recent retirement of the Harrier, the UK faces a fast jet maritime strike capability gap until the arrival of the Lockheed Martin F-35C Joint Strike Fighter (JSF), referred to as the Joint Combat Aircraft (JCA) in UK service. This is not expected to happen for at least another decade during which period the Royal Navy will have completely lost all of the experience of operating fast jets from a carrier. Joint operations with an ally like France, with its experience and highly proficient approach to carrier operations, is just one of the steps that will be required in order to regain that knowledge.

The author would like to thank CA Jean-Louis Kérignard, CV Jean-Philippe Rolland, LV Colomban Errard, LV Sabine Rivayrol, LV Stéphanie Lugrin, EV Typhaine Grall, ASP Elsa Latil, Mr Jérôme Kupczak and all on board the *Charles De Gaulle*.

Dr. Sean Wilson

(The author was on board the *Charles De Gaulle* carrier from Abu Dhabi to Goa at the start of January 2011)



‘Shi Lang’ is China’s first aircraft carrier

In 2009, the Russian aircraft carrier *Varyag* was renamed *Shi Lang* (after the Chinese General who took possession of Taiwan in 1681, the first time China ever paid any attention to the island) and given the pennant number 83. The Chinese for several years now have been refurbishing the *Varyag,* one of the *Kuznetsov*-class carrier that Russia began building in the 1980s. The *Shi Lang* is expected to be ready for sea trials by the end of the year.

The *Varyag* has been docked at a Chinese shipyard at Dailan since 2002 and local military and naval observers have noted that some kind of work was being carried on, including the new paint job (in the grey shade used by the Chinese Navy) and work on the superstructure (particularly the tall island on the flight deck.) Many workers were seen on the ship, with material going in and out of the ship. The Chinese have continuously been in touch with Russian naval construction firms, and could well have purchased plans and technology for equipment installed.

The *Kuznetsov*-class was originally conceived of as 90,000 ton nuclear-powered ships, similar to USN carriers (complete with steam catapults).

Its antecedents clearly seen, photograph of the Shenyang J-15 ‘Flying Shark’ (note tail hook) which the PLANAF (People’s Liberation Army Navy Air Force) is to receive for operation from the aircraft carrier Shi Lang. The Chinese had acquired a single example of the Su-33 via Ukraine in 2001; the latter country in known fashion has been transferring Soviet-origin weaponry to China and Pakistan over the past decade. The ‘Chinese copy’ only differs in configuration of the trailing control surfaces.

PLAN sailors on parade.

However, because of the cost and the complexity of modern (American-style) carriers, the Russians scaled back and ended up with the 65,000 ton (full load) ships that lacked steam catapults, but used a ski jump type flight deck instead. Nuclear power was dropped, but the *Kuznetsov*-class was still a formidable design. The thousand foot long carrier carries a dozen navalised Su-27s (Su-33s), 14 Ka-27PL anti-submarine helicopters, two electronic warfare helicopters and two search and rescue helicopters.

2,500 tons of aviation fuel allow it to generate 500-800 aircraft and helicopter sorties. Crew complement is 2,500 (or 3,000 with a full aircraft load.) Only two ships of this class exist, the original *Kuznetsov* which is in Russian service and now the *Shi Lang*.

"Submarine Operations: Strategies for the 21st Century"

Admiral Nirmal Verma at the NMF Seminar at New Delhi.

At the outset, it seems abundantly clear as we step into the second decade of the 21st century that submarines continue to remain vital elements of the military and security strategies of many nations and an important component of international security calculus. This is despite fundamental changes to the strategic environment in the past two decades, the overall threat perception in various parts of the world and the emergence of new challenges the world-over that we term 'unconventional threats'. It is logical, therefore, to assume that the strategies for submarine operations will continue to be driven by the overall geopolitical and military strategies of nations. Submarines continue to provide unique capabilities and inherent advantages to the arsenals of those that possess them.

What makes submarines important instruments of a nation's security architecture and 21st century geopolitical objectives? To my mind, it is because of the fact that despite today's operational environment being defined by rapidly changing technology and enduring strategic uncertainty, submarine operations continue to be governed by certain constants and I flag four of these for attention.

The first constant is that countries see credible and comprehensive defence preparedness as the means to fulfilling their national aspirations. The current international security environment demands of navies and maritime forces roles of extremely high importance and relevance, and to balanced maritime forces, opportunities to contribute significantly to defence preparedness. As a component of a balanced maritime force, submarines provide a Commander with significant operational flexibility. Deployed in concert with other surface and airborne assets, submarines could generate many military-strategic options that constrain or even eliminate some of an adversary's freedom of action. Given the increasing ability of most nations to monitor vast ocean expanses through space-borne, airborne or surface platforms, it is even more important to deploy submarines as an integral part of a balanced force, in order that each platform complements and multiplies the effects of the other.

The second constant is that modern navies continue to spend a considerable percentage of their budgets to build, train, maintain and modernise their submarine force due to the element of stealth and clear asymmetric advantage that submarines offer. The mere news of a submarine at sea requires an asymmetric response to locate her, tying down thereby a large number of naval assets. This was demonstrated during the Falkland War, where British nuclear attack submarines deployed before the war restricted the freedom of the Argentinean Navy and shaped a favourable outcome for Britain.

It worked the other way too. The official history of the Falklands Campaign tells us that the possible presence of Argentine submarines kept the British Task Force on its toes and engaging a large number possible – and as it turned out, false – submarine contacts, till all Argentine submarines were accounted for. Today, the utility, potency and versatility of submarines continue to expand the list of 42 submarine operating nations. In fact, *Jane's Fighting Ships,* which keeps track of such developments, records in its 2010-11 edition that despite uncertainty about the future, the remoulding of naval forces in recent years has been remarkably coherent, of which the increased acquisition of submarines has been a firm trend.

Thirdly, the traditional roles of submarines, such as sea denial, littoral operations, intelligence gathering and trade warfare continue to be relevant today, either by themselves or in support of larger operational objectives ashore.

And finally, an aspect that defined military posturing and national defence during the Cold War – submarines continue to form the backbone of strategic deterrence. The sea-based leg of the nuclear triad will undoubtedly continue to remain central to credible nuclear deterrence, especially for those with a declared 'No First Use' policy. The power of nuclear weapons and their strategic impact continue to be a key driver in the geopolitics of the 21st century. The possession of comprehensive strategic deterrence, which includes nuclear and conventional capabilities, continues to be seen as important to national security.

If these are the constants, what then are the variables that could influence future strategies for submarine operations? The first variable I see is, of course, technology. Submarines have evolved over the years and will continue to do so, posing to and facing from their adversaries, new challenges. Technological developments will trigger tactical changes, which in turn will shape the deployment pattern and operational utility of submarines. Let me touch upon a few that are visible today.

The first, of course, is air independent propulsion (AIP), which has now been around for several decades. In my opinion, we are still seeing this technology in its infancy. As the pressure to 'go green' increases, the focus will continue to remain on the development of highly energy-efficient batteries and cost-effective fuel cells. A large part of this may be driven at present by the requirements of the automobile industry, but submarines of the future could benefit enormously, piggy-backing this technology wave.

Second, the growing maturity of submarine launched off-board sensors, which would also mitigate many limitations associated with shallow water operations. Unmanned Underwater Vehicles launched from submarines could make probes into waters whose depths could be in single digits.

Third, submarines have hitherto been limited in their ability to utilise their weapons effectively to maximum

ranges due to identification concerns. New technology may soon offset this identification dilemma too, through the ability of submarines to launch and integrate their operations with UAVs.

Fourth, enhanced sensor capabilities will be accompanied by enhanced payload capacities. Apart from the now fairly ubiquitous fit of torpedoes, mines and missiles, submarine payloads of tomorrow would include off-board vehicles, acoustic decoys, swimmer delivery vehicles and Special Operations personnel, to name a few. Submarines are also being enabled to attack ASW helicopters with underwater-launched short-range missile systems. Submarines could continue to retain mission flexibility by having multi-mission payload tubes that are configured for the specific job on hand. While this may be more feasible on larger boats, the concept could be extended equally to smaller submarines.

This brings me to the next variable: Mission Growth. Locked for decades into extremely well-defined and narrow mission sets, submariners have had the luxury of refining and perfecting their tunnel vision for several decades. While surface ship commanders have had to adapt to an increasing array of roles ranging from HADR to maritime security operations, and irregular warfare to complex operations in all three dimensions, submariners have continued to hone their skills in their long established missions: anti-ship and anti-submarine warfare or intelligence gathering. This is not to belittle the enormous strides made in these fields, that have posed major challenges to ASW forces, but to flag the point that the scope of security challenges has increased multifold. Hence, as their integral capabilities continue to evolve, the potential roles of the submarine will continue to expand.

This will not only demand of submariners the ability to rapidly adapt to an increasing number of mission-sets, but also of navies, corresponding changes in their submarine war-fighting concepts and doctrines. As a matter of fact, submariners should not rest content just adapting to changes brought about by technology. Putting themselves in the driver's seat, they have to steer technological developments in directions that assist them in better executing their growing and evolving missions. What this august gathering could perhaps do is deliberate on whether the growing sub-conventional and irregular warfare threat would carve out new roles for submarines, or indeed limit the utility of submarines in the overall security calculus.

The third variable is the right force-mix of submarines. In the past, nuclear submarines were noisier, while conventional submarines were limited in range and reach. Today, AIP provides considerable reduction in the indiscretion rates of conventional submarines, while nuclear submarines have become considerably more silent. The real impact of the Nuclear Attack Submarine is its capability to maintain prolonged high speed, an attribute that allows it to transcend the traditional submarine paradigm of *wait and watch* to a more proactive *seek and destroy.* On the other hand, an AIP capable submarine has its own advantages, especially in littoral warfare. Today, many modern navies operate only conventional submarines. Some major submarine operating navies started with conventional platforms, but later opted to operate only nuclear submarines. Perhaps the planning dilemma of achieving the right force-mix would need an indigenous solution for each Navy.

For instance, the Indian Navy envisages the utility of submarines not only for littoral operations, but also for sea-based deterrence and a fleet support role. Therefore, our submarine force structure would be an appropriate mix of conventional and nuclear submarines, and our future building and operating strategies will reflect this reality. We have been operating submarines for over forty years and are now enhancing our capacity to build submarines.

With launching of the *Arihant* and the rolling out of the Scorpene production line, we have made further progress on the path of self-reliance. In the coming decades, we hope to have developed a vibrant submarine building programme. Given the strategic importance of this field, it is important for us to strengthen indigenous capabilities to design and build submarines and become self-reliant in doing so. The spin-offs for the industry and country are obvious, but I see a day not too far in the future, when we can assist other countries in building their own submarines.

Lastly, I would like to highlight some other issues that will influence future strategy. Contrary to conventional wisdom, submarines have been a catalyst for international cooperation. Consequent to the tragic sinking of the *Kursk*, the world closely watched as Russian, British and Norwegian teams cooperated during the rescue mission. Submarine rescue, being a highly skilled and cost and technology intensive field, will continue to be an area in which navies worldwide could continue to cooperate. Apart from submarine escape and rescue, commonality of equipment, procedures and purpose could draw like-minded nations together. We in the Indian Navy, for instance, have gained from the experience of operating Soviet and German submarines with British command and control procedures. In sharing our expertise with friendly countries that sought training assistance from us, we have intensified our bilateral engagements with them. Submarining will thus continue to be an important element in strengthening the bonds of friendship. In a small way, the presence here today of many foreign members of the submarine community also demonstrates this.

I sum up by saying that submarines are amongst the most complex craft made by mankind. They operate in an environment far removed from what most human beings are familiar with. Because of their complexity, they are expensive to procure and challenging to operate. The fact that they have been built in large numbers through history and continue to figure high in the wish-list of most navies bears testimony to their continuing ability to impact naval warfare in profound ways.

This, however, comes with the caveat that submarines must be able to adapt to rapidly changing requirements and developments, especially those brought about by changing technology. In today's age of inelastic and increasingly scrutinised defence budgets, role-relevance is an essential prerequisite not only for growth, but even for survival. Submariners, therefore, need to widen their horizons well beyond the field-of-view of their periscopes. If they succeed in doing so, they will ensure that the relevance of submarines as key instruments of national strategy, security and policy remains undiminished and that submarine operations will continue to engage the attention of technocrats, planners and war-fighters in the years to come.

The Indian Navy and its (diminishing) Submarine Force

A little publicised event took place on 9 December 2010, when Indian Navy Submarine *Vagli* was formally decommissioned in Vishakapatnam, after 36 years of service. This decommissioning marked the end of a glorious era, since INS *Vagli* was the last of the eight Soviet origin *Foxtrot* (or Project 641) submarines to be decommissioned. From 1967 to 2010, apart from training Indian Navy anti-submarine forces, eight *Foxtrots* had trained generations of Indian submariners, who then went on to operate our first SSGNs (cruise missile submarines), the *Charlie* class, INS *Chakra,* the 10 *Kilo* or *Sindhughosh* class subs, and the four German type 1,500 or *Shishumar* subs. Indeed, some senior crew of our first SSBN (the yet to be commissioned INS *Arihant,* which may commence sea trials in 2011), and our first SSN (media reports mention an *Akula* class SSN, the INS *Chakra,* will also commission in 2011) would have received their basic submarine training on the legendary *Foxtrots*.

The end of the Foxtrot era also marks a new era of very low levels of submarine force levels for the Indian Navy. It may be noted that in December 2010, the British government decided to drastically reduce the size of the UK military, due to economic reasons. The last Royal Navy aircraft carrier (HMS *Ark Royal*) was prematurely decommissioned, along with its complement of Sea Harrier jet fighters, while the surface fleet was reduced to 19 frigates-destroyers, and the Royal Air Force is being downsized to six fighter squadrons by 2020. However, the British government has decided to retain its nuclear submarine force of four SSBNs (15,000 ton *Vanguard*-class), each of which can carry 16 Submarine Launched Ballastic Missiles (SLBMs) with a range over 8000 Kms, and each missile can carry 3 to 5 nuclear warheads to destroy major cities.. The UK has also two modern SSNs (8,000 ton *Astute*-class) and is building five more of the same SSNs - these SSNs can destroy enemy warships and submarines with torpedoes and anti-ship missiles, while they can also attack land targets with 2200 km range Tomahawk cruise missiles with conventional warheads.

Even the global US Navy has about 60 nuclear submarines, as compared to 10 aircraft carriers. In any case, given China's experimental 'game changer' the, land-based 1,500 km range DF-21D 'aircraft carrier killer' ballistic missile, the lesson is that the modern submarine is both the backbone and spearhead of a nation's tactical and strategic capabilities, though the aircraft carrier will remain an important platform for most blue water operations, but some of its land-attack roles are being taken over by the American 18,000 ton *Ohio* class SSGNs (four in service with the US Navy), each of which can fire 156 Tomahawk land attack cruise missiles (2,200 km range). Needless to say, the submarine is invulnerable to attacks by D-21D type weapons.

It is ironic that despite the Comptroller and Auditor General reports of 2008 and 2010, warning of severe depletion of

Indian Navy submarine force levels, little has been done to remedy the situation, while China (60 conventional subs, seven SSNs, three SSBNs) and Pakistan (five conventional subs) continue to expand their submarine force. Indeed, Pakistan is purchasing four Chinese *Yuan*-class conventional subs (with Air Independent Propulsion System) while China, by 2025, is expected to have 100 conventional subs, a dozen SSNs and a dozen SSBNs. In stark contrast, our present ageing force of 14 conventional subs (10 Russian-origin Kilos and four German origin SSKs) will be reduced to only four totally obsolete units by 2020 (two *Kilos* and two SSKs, which will also be phased out by 2025), along with the six 'new' MDL (Mumbai) built *Scorpene* class subs.

As per media reports, India's 30-year submarine building plan, approved by the government in 1999, originally envisaged construction of 24 conventional submarines by 2030, in three phases. Unfortunately Phase 1, i.e. the *Scorpene* submarine licence production line of six subs, under Project 75, at MDL (Mumbai) will have the first *Scorpene* only ready by 2015, while the contract for the second (Phase 2) licence production line, under Project 75 (I), may be signed only by 2014. The third phase, which envisaged construction of 12 indigenously-designed submarines, is nowhere on the horizon. Also, in addition to building the *Arihant* type SSBNs, a second production line needs to be set up for SSNs. Hence the nation needs multiple submarine production lines for conventional and nuclear submarines.

Just a handful of nations today (France, Spain, Russia, China and a consortium of Germany-Italy-Sweden) are involved in building and exporting ocean-going blue water capable conventional submarines. Japan builds conventional submarines but not for export. Only four countries make nuclear-propelled submarines of the SSN and SSBN variety (USA, UK, France, Russia and China). In addition, Iran, Italy and North Korea have built midget submarines of about 100 to 350 tons for "special saboteur operations".

In 1982, India sent numerous officers and MDL workers to Germany for training in the construction of SSK submarines at a great expense. Sadly, after the TOT and construction of two subs in MDL, this expertise was lost, due to the HDW scam and we are now painfully "re-learning" the art and science of submarine building, with the *Scorpene* project signed in 2005.

Building nuclear subs (both SSNs and SSBNs) requires a lot of money, time and skilled manpower, specifically with regard to metallurgy, stealth and long-life miniature nuclear reactors. Today, the Americans, British, French and Russians make submarine nuclear reactors with an operating life of over 25 years, thus removing the need to periodically change reactor fuel.

In 2010 the Russians introduced a 'mono block' concept in their latest fourth-generation nuclear subs (SSNs and SSBNs) wherein the reactor and turbine compartment are in a single sealed unit, which is 'plugged in' to the submarine.

In case of any defect in the reactor or propulsion turbine or the turbo alternators, the mono block can be quickly unplugged and replaced by another unit.

Modern conventional and nuclear submarines are built in different pressure hull sections, with a typical submarine comprising five (conventional sub) to 12 (SSN or SSBN) sections , which are finally joined or welded together. The Indian government needs to urgently take the following decisions:

* We should utilise all the assets in the public and private sector, to ensure that modern modular construction techniques are optimally used (i.e. time and money is saved by building different sections of the submarine in different public and private shipyards, and finally integrating these parts in a dedicated shipyard).

* To ensure maximum foreign ToT in sensitive submarine metallurgical, stealth, weapons, sensors and propulsion fields (e.g. in the 30 per cent direct offsets), it is essential that the present 26 per cent FDI limit is raised to 49 per cent, so as to provide sufficient incentive to the foreign equipment manufacturers.

Vice Admiral (R) Arun Kumar Singh

'Cheonan' sinking stirs new interest in coastal submarines

According to Forecast International's *The Market for Submarines* analysis, the torpedoing and sinking of the South Korean corvette *Cheonan* in March 2010 by a North Korean coastal submarine will prompt a surge of interest in small, low-cost submarines. The corvette was specifically designed for operations in littoral waters and built with full knowledge of the threat spectrum she would face. Yet, she was blown in half by a torpedo she never saw coming. The force multiplier effect was clearly evident here.

"The *Cheonan* was designed to provide an economical asset for patrolling coastal waters, but the submarine used to sink her cost an order of magnitude less, and that submarine got away with her attack cold," said warships analyst Stuart Slade, author of the report. "It is quite clear which was the most cost-effective asset in this particular scenario."

It is likely that the sinking of the *Cheonan* will cause a surge in the market for small, coastal submarines. These low-cost, quick-to-build and economical-to-operate submarines offer small navies with the means to threaten those who intrude upon their territorial waters. Until recently, the capabilities of such submarines were neglected as attention focused on their ocean-going sisters. With the destruction of the *Cheonan*, this is likely to change. The question is whether the shipbuilding companies will be able to exploit this altered perception.

Western submarine builders have attempted to produce small coastal submarines but, with few exceptions, these have never enjoyed any significant success. Russian offerings of small derivatives of their Project 877 and 677 class diesel-electric boats have also met with scant success. The reason is that these boats have tried to package the capability of the larger submarines into a small hull. This is a technological challenge of daunting dimensions and, in solving it, the defining characteristic of the small coastal – its low cost – is lost.

"If the changed perception of the coastal submarine is to be exploited, the requirement is to build a low-cost submarine that makes no pretext of challenging its larger cousins in quality terms but instead requires a minimum investment in resources and personnel to operate," said Slade. He added that such submarines would exploit a gap in the market but require existing Western submarine teams to break decades of acquired design habits. If they do not do so, Slade said, the coastal submarine market will go to Chinese and possibly Russian producers.

India Aviation Airshow

Airbus Military

The Airbus Trade Media Briefing (TMB'11) was held at Airbus Military facilities in Getafe and Sevilla, Spain from 16-18 May. *Vayu's* Managing Editor reports on the visit:

We arrived at the San Pablo site at Sevilla where after a welcome speech, were briefed on the market for military and humanitarian transport aircraft with a A400M programme and flight test update. Later, after visiting the A400M Final Assembly Line (FAL), we walked through the CN235 and C295 lines. There were operator testimonials for the CN235/C295 with operators from the Portugese Air Force and Spanish armed forces giving a detailed in-depth account of the aircraft performances. At the Getafe (near Madrid) facilities, we were given a technology and innovations update as well as details on the A330 MRTT programme including support structure. Later, there were more testimonials on the Airbus L&M (Light and Medium) Division that included the C212, CN235 and C295. The tour was wrapped up by Domingo Urena, CEO Airbus Military who gave detailed briefings and updates as well as fielding questions from the gathering. It was a 'short but sweet" visit to "Sunny" Spain!

Airbus Military is arguably the only military and civic/humanitarian transport aircraft manufacturer to develop, produce, sell and provide all the services related to the support of 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 'Light & Medium' C295, CN235 and C212, Airbus Military is global leader in the market for military transport, tanker and surveillance aircraft able to perform the most varied types of missions. Altogether, Airbus Military has sold more than 1,000 aircraft to some 130 military, civilian and governmental customers. More than 800 of these aircraft have been delivered.

Headquartered in Madrid, the company's facilities are essentially based in Spain. Its main sites are Getafe, where the civil Airbus platforms are converted into Multi Role Tanker Transport (MRTT) aircraft, and Seville, where the San Pablo factory, south of the airport, hosts the A400M Final Assembly Line opened in 2007, as well as the complete production and final assembly of the C212, CN235 and C295.

Airbus Military was formally created in April 2009, following integration of the former Military Transport Aircraft Division (MTAD) and of Airbus Military Sociedad Limitada (AMSL) into Airbus. This integration allows for a single and streamlined organisation. Airbus Military, which has its own P&L accounting, now has more than 5,000 employéés.

The A400M was conceived from the outset to respond to the most varied needs that have emergéd over the past decades in terms of military transport for the Armed Forces. With the introduction of new, much larger and outsized equipment, and the growing use of military transport for humanitarian relief missions as well as for other "civic" missions to the benefit

in Sunny Spain

Two A400Ms fly in formation.

of society, the existing airlifters were not meeting the needs any longer, highlighting the requirement for a "truly versatile platform" able to perform both tactical and strategic missions in one single aircraft which could also be used as a tanker.

Already in the late 1980s, the European Armed Forces realised that, in view of their latest operational experience, they needed a different kind of airlifter to replace those which had been designed in the 1950s and 1960s. The aircraft then in service were either too small to carry the needed material to the site of action, be it for military or humanitarian and other 'civic' purposes (tactical transport missions), or they could transport these materials, but could not fly into the rough, soft, and short airstrips close to the theatre of action, having instead to land at airfields and leave their loads for onwards surface carriage across hazardous terrain. Nor could they do all the types of missions required and still provide, air-to-air refueling and paratrooping,. Furthermore, it was clear that the European Transall, which was conceived in the 1960s, would reach the end of its service life at the beginning of the 21st Century.

An initial call for tender was launched by the European Nations in 1998, to which the FLA grouping responded in 1999. After thorough examination of the various options which included other existing products and even co-operation with non-west-European manufacturers, the FLA proposal was selected by the Nations in July 2000. The initial commitment was for 288 aircraft from eight of the countries mentioned above.

In due course, France, Germany, Italy and the UK agreed to manage their joint defence equipment programmes by working together to better compete in the global marketplace, and to deliver collaborative projects more efficiently and economically. For this they created an *Organisation Conjointe de Coopération en matière d "Armement"* (joint cooperation organisation for armament), or OCCAR. This organisation obtained legal status in early 2001, and has six members, the four

An A400M lifts its nose wheel in the first ever takeoff in 2009.

C295 testing its chaff and flares.

Amendment negotiations with OCCAR concluded

EADS and Airbus have welcomed the conclusion of contract amendment negotiations with OCCAR and the seven A400M launch customer nations. The contract amendment was signed in Seville by Patrick Bellouard, Director of OCCAR – Executive Agency, and Airbus Military CEO Domingo Ureña, in the presence of Spanish Minister of Defence Carme Chacón. National armament directors and other representatives from customer nations also attended the ceremony. The Contract Amendment now implements the changes which were agreed in principle by the Participating Nations with EADS and Airbus Military in the Frame Agreement signed on 5 March 2010.

"This is a major milestone, and EADS is particularly proud to have the support of all governments involved in this cooperation programme that represents a strategic capacity for Europe and its defence, and for the new generation of military transport worldwide. The A400M is a fantastic new aircraft already flying with outstanding and unrivalled capabilities", said EADS CEO Louis Gallois. "From an industrial point of view, the programme is on track. This enabled us to agree, with full confidence on the industrial go-ahead of the programme," said Domingo Ureña, Airbus Military CEO. "We are also very satisfied with the progress of the Flight Test programme which confirms day by day the soundness of the aircraft. Also, all the pilots of the Air Forces who have already tried and flown the aircraft, expressed great satisfaction about its agility and capabilities. We are sure that, once it gets better known, many more Air Forces around the world will be keen to have it in their fleets".

CEO Airbus Military, Domingo Ureña, the Spanish Minister of Defence, Carme Chacón and Director of OCCAR, Patrick Bellouard, during the signature ceremony.

initial ones plus Belgium and Spain. On 21 December 2001 a preliminary contract was signed for a total of 197 A400Ms, as the aircraft was to be called from then on, by the European nations, but without Italy which had withdrawn from the launch-nations group. The German order for 73 aircraft was subject to hand-written budget approval, which was eventually obtained at the beginning of 2003, but for only 60. Meanwhile, Portugal had also withdrawn from the initial group.

The launch contract -for 180 aircraft- was signed with OCCAR, representing Belgium, France, Germany, Luxemburg,

Spain, Turkey, and the UK on 27 May 2003. This was to be followed by an order for four by Malaysia in December 2005. Because of the shift in the programme, announced in early 2009, this contract was eventually revised, leading to the signing, on 7 April 2011, of an amendment to the initial contract, which is now for 170 firm orders for the seven launch Nations, plus four for Malaysia.

The very close cooperation between the industry and the armed forces of the launch nations has enabled the A400M to be conceived to undertake the most varied requirements, including long range strategic missions, short field tactical operations in potentially hostile environments, and air-to-air refueling deployments. The end result is the A400M, a "highly versatile" airlifter, which is "absolutely unique" in meeting all of the airlifter needs in the 21st century, be they for strategic or tactical operations, and military, humanitarian or 'civic' transport missions to the benefit of society. The A400M took to the air for its first flight on 11 December 2009. By early April 2011 four A400Ms were satisfactorily flying, having achieved more than 1,400 test flying hours in over 440 flights, with the fifth due to fly in fall 2011.

The A330 that is MRTT is the "only modern Multi Role Tanker Transport Aircraft flying, and certified today", and has demonstrated its work during an extensive Flight Test campaign. Due to begin operations with the Royal Australian Air Force (RAAF) in 2011,

First A330 MRTT for UAE Air Force

The first Airbus Military A330 MRTT for the United Arab Emirates Air Force has successfully completed its maiden flight following conversion of the aircraft in Madrid. The crew reported that the aircraft, its systems and two Rolls-Royce Trent 700 engines "performed entirely satisfactorily" during the 2hr 55min flight on 9 April. As it features some different avionics, and is the first "receiver" to be powered by the Rolls-Royce Trent engine, the UAE A330 MRTT now enters the certification and qualification phase for these new elements. The first of three ordered by the UAE AF, will be transfered to Abu Dhabi around the end of the year for the final phase of flight-testing leading to delivery in the second quarter of 2012.

The first A330 MRTT for the UAE AF landing at Airbus Military´s Getafe base.

CN-235 MPA of the Spanish armed forces.

A RAAF A330 MRTT.

the A330 Multi Role Tanker Transport (MRTT) offers military strategic air transport as well as air-to-air refuelling capabilities. It is based on the latest medium to long range, twin-aisle, (and commercial) aircraft of the Airbus fly-by-wire family, the A330. More than 1,000 of these have been sold to some 80 customers and some 650 are operated all around the globe, ensuring easy support and many years of commercial life ahead.

The civil version from which the A330 MRTT is derived, the A330-200, already benefits from the "most up-to-date design and manufacturing techniques", and integrates the most advanced avionics as well as the proven fly-by-wire control systems which allow total flight envelope

RAF A330 FSTA refueling two Eurofighter Typhoons.

Chile takes delivery of first ASW C295

The Chilean Navy has taken delivery of the first Airbus Military C295 in the anti-submarine warfare (ASW) configuration. The aircraft is equipped with two underwing hard points to carry weapons or other stores and boasts a comprehensive suite of sensors including a search radar, digital avionics that are compatible with night-vision goggles (NVG), automatic identification system, acoustic system, and a magnetic anomaly detector. The data from all these sensors are processed by the Fully Integrated Tactical System (FITS).

This first C295 ASW is part of a three aircraft order placed by the Chilean Navy in October 2007. The first C295 MPA was delivered in December 2009 and the other two are both ASW versions with the second being delivered by mid-2011. The Chilean Army, Navy, and Air Force already operate one C295 MPA, three CN235s, and 13 C212s.

Prince of Wales visits the A400M in Seville

Prince of Wales in the A400M cockpit with Mr. Strongman (Airbus Chief Test Pilot Military) on his right.

The Prince of Wales, Richard Thompson (Head of Airbus Military UK) and Edward Strongman (Airbus Chief Test Pilot Military) in front of the aircraft.

Domingo Urena, CEO Airbus Military addresses the media at Getafe in Spain.

protection. Representing true state-of-the-art in its category, the A330-200 has a maximum range of 8,000 nm/ 14,800 km, with a maximum speed of Mach 0.86. It is the primary choice as a platform for a Multi Role Tanker Transport), offering the "best performance at the lowest investment and costs".

The A330-200 wing is large enough to hold all the fuel needed to make the A330 MRTT a high performing tanker

Group photo of visiting media and public relations firms at Airbus Military facilities in Getafe, Spain.

A400M completes low-speed take-off tests

The Airbus Military A400M has completed a challenging series of tests to determine the lowest speed at which it can take-off (known as minimum unstick speed or Vmu.) During the tests performed at Istres in France, the aircraft's nose was raised until a special 'bumper' fitted to the rear fuselage struck the ground at the maximum pitch-up angle of 13º. In the close-up photo sparks can be seen flying from the bumper as it drags on the runway.

First A330 MRTT for RAF displays its three-point refuelling capability

The first A330 MRTT Future Strategic Tanker Aircraft (FSTA) for the UK Royal Air Force is seen here with both its underwing pods and fuselage refuelling unit (FRU) deployed simultaneously. The photo was taken from a Spanish Air Force F-18 during a recent handling qualities flight as the FSTA nears civil and military certification. Two FSTAs are currently flying and the first is on schedule to transfer to the UK in the second quarter of the year to begin qualification flights with the specified receiver aircraft types, leading to first delivery towards the end of the year.

without requiring any additional fuel tanks and so avoiding any reduction in its ability to carry passengers or cargo. For air-to-air refuelling missions, the A330 MRTT is provided with the advanced Airbus Military Aerial Refuelling Boom System (ARBS), to refuel receptacle-equipped aircraft such as the F-16 Fighting Falcon, F-35A Lightning II, or even the A330 MRTT itself (when fitted with an UARRSI). The Airbus Military ARBS is the only new generation boom which allows the fastest fuel transfer, greatly reducing the refuelling operation time. Refuelling can be done at any altitude up to 35,000 ft while cruising at speeds between 180 kt and 300 kt. To refuel probe-equipped receivers such as the Typhoon or Tornado, the A330 MRTT is fitted with two Cobham 905E under-wing hose and drogue pods. Those AAR (Air to Air Refuelling) systems are controlled from an advanced Fuel Operator Console that is positioned in the cockpit and features an Enhanced Video monitoring System to perform day and night refuelling.

Able to refuel any receiver, the A330 MRTT can carry up to 111 tonnes/ 245,000 lb of fuel in its tanks. In a deployment mission, the A330 MRTT enables four Typhoons to fly 3,600 nm/ 5,794 km by refuelling them en-route, or, when carrying 20 tonnes / 44,800lb of payload, to deploy four fighters a distance of 2,800 nm / 4,500km.

The A330 MRTT can also be used on towline missions, whereby it can be on station at about 1,000 nm /1,600km from its base for some four hours 30 minutes, with the capability to provide 50 tonnes of fuel for needing receivers. Or it can provide 60 tonnes /2,170 pounds of fuel while remaining on station for five hours at 500 nm / 800 km from base.

The A330 MRTT is also designed to carry a payload of up to 45 tonnes/99,000 lb. Thanks to its optimised fuselage cross section, the cargo can conveniently be carried under-floor in any of the standard containers and pallets, ranging from the LD1 to LD3 and LD6, as well as the standard 88x108 inch 463-L NATO military pallets, which can be loaded onto the aircraft through a proven semi-automatic cargo loading system. Some of the cargo can also be carried as non-palletised 'bulk'. The main deck cargo

compartment can also be used for cargo, as required, when the aircraft is specified as a freighter. In this instance the main deck is fitted with a large upper deck cargo door and cargo loading devices in the main deck floor. This allows the A330 MRTT to carry up to 26 88x108 inch 463-L NATO military pallets. Furthermore, the aircraft can also be configured as a combi, to carry freight in the forward part of the main deck and passengers in the aft part.

The A330 MRTT can also be used for medical evacuation (MEDEVAC), as its cabin can easily be converted to accommodate up to 130 stretchers. Provided provisions are installed, the conversion to a medical evacuation aircraft can be done very swiftly.

It is offered with a customised suite of military avionics and a mission system integrated with civil avionics. A comprehensive survivability package including a Defensive Aid System, fuel tank inerting system and an armoured cockpit are all available. The A330 MRTT has been ordered by Australia, Saudi Arabia, the United Arab Emirates and United Kingdom, for a total of 28 aircraft.

Airbus Military also produces a comprehensive range of airlifters offering payloads from three to 45 tonnes. In the light and medium tactical segment it offers three models - the C212, CN235 and C295 – offering from three to nine tonnes of payload. For maritime and coastal patrol, the three members of the light and military family provide a flexible solution for all budgets and numerous tasks that has made them the "aircraft of choice" for armed forces and security agencies across the world. They are quickly convertible from one transport configuration to another, making them of "great value" to the many operators faced with a diverse range of civic tasks. In less than an hour the aircraft can be switched from carrying personnel to a medevac role, or to a cargo layout including aerial delivery equipment if required.

In the transport role the aircraft feature a rear ramp to allow easy loading and unloading, especially in ill-equipped operating locations, and a cargo compartment that is completely unobstructed and adaptable to operators´ needs. They have hardened cabin floors to cope with concentrated loads and STOL performance with robust landing gear designed to handle soft (CBR2) and unpaved terrain. For maritime patrol, anti-submarine warfare, and surveillance missions the aircraft have low-level flying characteristics with up to 3g manoeuvrability and, for the CN235 and C295 in particular, a cruise speed optimised for persistent surveillance and wide area coverage. In the search and rescue (SAR) role they benefit from wide field-of-view bubble windows and safe low-speed flying characteristics. All the aircraft have special anti-corrosion treatment for the maritime environment and the larger types have demonstrated remarkable growth capacity to cope with the installation of new equipment and tactical systems.

Thailand takes delivery of C212-400

The Ministry of Agriculture and Cooperatives (MoAC) of Thailand has taken delivery of the first of two C212-400 ordered from Airbus Military. The MoAC will receive the second aircraft by the turn of the 2011/2012. They are joining a fleet of 11 C212s the MoAC is already operating. Fitted with a specific kit, the main role of these aircraft is "rain-making" through cloud-seeding in the largely drought-affected country, as well as boosting water volume in dams. The C212 can also transport personnel, as well as bulky items thanks to the rear ramp. It has a 22 m3 cabin volume and is able to carry up to 2.8 tonnes of cargo. This more modern C212-400 version incorporates additional equipment such as a Flight Management System (FMS).

A330 MRTT for Royal Saudi Air Force in maiden flight

The first Airbus Military A330 MRTT for the Royal Saudi Air Force (RSAF) has successfully completed its maiden flight lasting 4hr 15min. The crew reported that the aircraft, its systems and two General Electric CF6 engines "performed satisfactorily." Following the 15 March flight the aircraft now enters the final certification and qualification phase for this version of the A330 MRTT leading to contractual delivery later this year. The second RSAF aircraft is already in conversion at the company's Getafe site and the third will begin the process in mid-year.

The spectrum of manufacturing

The A400M Final Assembly Line (FAL)

Aircraft sections being loaded into the Airbus Beluga

Final Assembly Line for light and medium aircraft.

at Getafe : some snapshots !

Checks on at the A330 MRTT line.

Wiring and other work at the FAL for light and medium aircraft

The Airbus Military plant at Getafe, Spain.

Work progressing at the A400M line.

Section pieces being loaded into the Beluga.

A330 MRTT conversion process.

Civil aviation times

Asian airlines boom as those in Europe stagnate

As per an ASSOCHAM-KPMG joint report on Indian civil aviation, India has registered the fastest growth in the civil aviation sector moving from current ninth position to third position in the global economy by 2010. Numbers of scheduled passenger airline operators have increased to 15 and the fleet size has increased to 430 in 2011. The airlines operated at a seat factor of 71.5% in 2010, the first time in a decade that seat factor crossed the 70% mark. In 2011, the average load factor increased to 77.6%.

Traffic is expected to grow at around 14% for the next five years before settling down at a level of 8% over the next ten years. Correspondingly, the number of seats per week available to Indian carriers from bilateral treaties has increased from 2.5 lakhs in 2004 to more than 7 lakhs in 2010. Perhaps the biggest challenge for Indian carriers is the cost of ATF, which forms nearly 40-50% of their total operating cost. ATF in India is one of the costliest in the world with high import duty, excise duty and sales tax. Thus, there is an urgent need for a special task force to be created by the government to identify ways in which ATF pricing can be brought down.

Moreover, the share of Indian carriers in the international traffic to and from India has increased from 30.5% in 2006 to 34.5% in 2010. The five-year restriction on Indian carriers to operate on international routes appears challenging when compared to lack of a reciprocal restriction on global carriers operating flights in India. Also, foreign airlines are restricted from taking an equity stake in Indian carriers, thus keeping out funds, technical know-how and global access.

Regulation of ticket prices is another area of concern where the MoCA and DGCA have often commented on excess prices during peak seasons. During lean periods, when airlines operate at say 50% or lower seat factor, there is no relief available. Hence a premium pricing at a time when demand is high should not attract adverse reaction from the government.

The government and industry also needs to consider the issue of slot trading. Whereas globally, trading of landing and parking slots are allowed ensuring better utilisation of slots and acting as a financing tool for airlines, in India this is not allowed. Additionally, given the high debt burden and financial risks the airline sector faces, the recent RBI permission for debt restructuring has come as a breath of fresh air.

Sri Lankan Airbus A340-300 at Singapore's Changi Airport.

Options also need to be explored to subsidise non-profitable routes to smaller cities through a joint effort between MoCA, state governments and the local industry. In conjunction with the no-frills airport model, this may bring in the next wave of expansion.

Simultaneously, in light of all-round growth in the aviation sextor, demand for pilots, cabin crew, operational staff, maintenance engineers, etc. is also increasing and capacity building is the need of the hour. In tandem, there is an urgent need to develop a robust R&D capacity in India whereby Indian corporates and academia must work on innovative solutions in the area of composites, avionics, fuel economy, air navigation, safety and environmentally sustainable technologies for the future.

Airlines in the Asia-Pacific region will grow strongly in the next few years even as air transport in Europe is likely to stagnate, according to the outgoing head of the International Air Transport Association (IATA) President Giovanni Bisignani. "Europe is by far the biggest problem for the sector." Bisignani blamed European governments for being more interested in raising taxes from the industry than in supporting growth and providing infrastructure, and also warned that the rising cost of fuel was a "disaster." The centre of gravity of air transportation is clearly shifting towards Asia not only because of the growth of its economy but also because governments there are careful to take measures to develop the sector. "When I see the situation in Europe, I am pessimistic. But I am very optimistic when I look at the trend in the Asia-Pacific region, and the involvement of states in creating favourable conditions to help the growth of traffic."

Giovanni Bisignani said that air transport in Europe was undermined by weak economic growth in the European area and also by the fact that air transportation was not unfortunately "not a priority for European governments." He said that during a crisis for the sector arising from volcanic ash spread from Iceland there had been "no consensus between governments." He observed: "Only taxes on companies and their passengers seem to interest them... and while there is a wave of taxes, there is no action on structural measures which, in terms of infrastructure, would enable companies to be competitive in a market environment."

He gave the example of a single European air space which had been promised since the 1990s but was "still a dream." By contrast, he forecast that the Asia-Pacific region would account for 30 percent of global traffic in three years' time from 26 percent now and that North America would account for 23 percent. He also held that a system for the exchange of carbon emissions quotas for the sector in 2012 would be difficult to set up because of opposition from the United States, Russia, Japan, China and Australia.

Air Asia A320.

Kingfisher Airlines ATR-72-500.

"We are ready to accept such a system on condition that it applies across the world under the aegis of the International Civil Aviation Organisation," he concluded.

While the performance of the global economy remains sluggish and the outlook remains uncertain, aviation security spending will demonstrate resilience, allowing for strong growth prospects during 2011 and beyond. According to the new market study, the global aviation security market will reach $20bn in 2011. North America will continue to lead investment and will remain a substantial part of the global aviation security market in 2011. The study expects the emerging Asia-Pacific market to become a significant aviation security market to watch. The study further identifies the Middle East as a key regional market owing to the robust growth path of its economy, which is stimulating domestic demand for civil aviation and encouraging greater levels of investment in infrastructure.

As the civil aviation security market adapts to different threats, the future of the industry will look very different, allowing for growth opportunities. In emerging and mature markets, upgrades and expansion of airports to accommodate soaring demand for air travel will provide new sources of demand growth for security systems. In Asia Pacific and the Middle East, ambitious construction plans for new international and domestic airports will provide a wealth of new opportunities for aviation security players.

Turboprops dominate

Turboprop sales have clearly dominated the regional market over recent years, with more than 75% of sales, underlining clear demand for cost-efficient regional aircraft. Also, the expected increase in fuel costs and new environmental constraints in the EU Emissions Trade Scheme (ETS) will put further pressure on airlines' costs over the coming years. ATR CEO Filippo Bagnato declared that "there is an estimated demand of almost 3,000 turboprop aircraft in the next 20 years, comprising 60% of growth and 40% of replacement needs. Our goal is to confirm our leading position in the turboprop market with over 50% of market share. In response to this increasing demand, we are ready to step up to a new level of growth from 2012 onwards, delivering 70 aircraft per year, and reaching a level of US$ 1.8 billion-turnover over the next few years."

He added: "There is strong commercial potential for ATR in regions such as South East Asia, India and Latin America, where ATR has been highly successful in recent years, and also in other emerging economies. Additionally, there is a strong replacement potential in mature markets. We are glad to offer a family of aircraft known for their lowest operating costs and lowest environmental impact".

European regional turboprop manufacturer ATR has booked orders for 80 new aircraft in 2010, with options for another 33. ATR generated a turnover of US $ 1.35 billion – almost three times the turnover achieved in 2005, and illustrates the first signs of recovery of the aviation

industry in 2010. They enable ATR to prepare itself to reach its next significant step of growth from 2012 onwards: yearly deliveries around 70 aircraft and turnover reaching US$ 1.8 billion.

ATR delivered 51 new aircraft in 2010. Cumulatively by 31 December 2010, ATR has delivered 915 aircraft (412 ATR 42s and 503 ATR 72s). In 2010 ATR generated a turnover of 1.35 US $ billion, which represents a substantial growth compared to turnover achieved in 2005 (around US$ 0.5 billion). ATR ended 2010 with a backlog of 159 aircraft, thus achieving a major increase from year-end 2009 (136 aircraft), and representing three years of production at the current delivery rate.

These comprise four ATR 42-500s, five ATR 42-600s, 43 ATR 72-500 and 107 ATR 72-600s. Asia-Pacific and Europe each represent 32% of the current backlog, followed by Latin America (18%), Africa-Middle East (12%) and North America (6%). As of today, ATR has a portfolio of 165 operators in 92 countries. ATR has added 46 new operators to its portfolio since 2005. In 2011 ATR will gain certification for both ATR -600 series models. Deliveries of the first ATR 72-600 will start by mid-2011, while deliveries of ATR 42-600s will start before the year end.

Jet Airways leads India with 26.1% market share

Jet Airways together with JetLite, have successfully retained their leadership position in the Indian aviation sector with a dominant market share of 26.1 %. The airline also posted its sixteenth consecutive month of double digit growth with robust international and domestic passenger traffic in February 2011. Jet Airways carried 381,000 international revenue paying passengers in the month of February 2011 with an overall seat factor of 81.1%. The airline also carried 824,000 domestic revenue paying passengers with a seat factor of 76.5%.

More importantly, Jet Airways has also registered the highest on time performance of 89.2% per cent by a scheduled airline, as per the statistics released by Director General of Civil Aviation. JetLite, the wholly owned subsidiary of Jet Airways India Ltd, carried over 377,000 revenue passengers in the month of February 2011 with a seat factor of 80.2%.

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 5.15 years, the airline has one of the youngest aircraft fleets in the world. Flights to 71 destinations span India and beyond, including New York (both JFK and Newark), Toronto, Brussels, London (Heathrow), Milan, Johannesburg, Hong Kong, Singapore, Kuala Lumpur, Colombo, Bangkok, Kathmandu, Dhaka, Kuwait, Bahrain, Muscat, Doha, Abu Dhabi, Dubai, Jeddah, Sharjah, Riyadh and Dammam.

Jet's Boeing 777-300 ER.

SEAPLANES AHOY!

Dornier CD-2 Seastar

VAYU exclusive on the 'Seaplanes in India' Seminar

Good Friday this year (22 April 2011) brought with it immeasureable goodness in a non-religious sense for civil aviation in India : it was on this day that Pawan Hans and the Directorate General of Civil Aviation held an unusual seminar, for the first time ever, 'Seaplanes in India'. This is a revolutionary theme and translation of the deliberations into concrete action in the future will certainly enrich take aviation in India into a new dimension.

There has been reckonable growth of civil aviation in the country with proliferation of private airlines, extension of flights to new foreign destinations, building of state-of-the-art infrastructure with new international and metro airports plus MRO facilities but little has been taken into account of the 5,500 km long coastline along the great Indian peninsula and the island clusters in the Bay of Bengal (Andaman & Nicobar Islands) and the southern Arabian Sea (Lakshadweep Islands) which offer great opportunities for air transportation and sustained tourism. A brilliant example is the Maldives, a small island nation in India's neighbourhood, which leads in seaplane taxi services generating great tourism.

Within the mainland too there are large waterbodies such as the Chilka Lake in Orissa, Nanak Sagar in Uttaranchal and the Wular Lake in Kashmir where amphibian aircraft can operate with minimum of infrastructure. Seaplanes offer the additional advantage of easier and effective succour in casualty evacuation and medical aid during calamities in inaccessible islands isolated from the mainland.

On 22 April at the Hotel Taj Mahal in New Delhi, while Dr Nasim Zaidi, Secretary Civil Aviation and EK Bharat Bhushan, Director General Civil Aviation, emphasised the need for introducing seaplane operations in India, for which dedicated divisions would be established, the event offered an excellent opportunity for leading manufacturers of amphibian aircraft and seaplanes to make personal presentations.

Mr Conrado Dornier, scion of the legendary Dornier family, pioneers of seaplanes, brought out some historic facts: Wolfgang von Gronau had visited India with his Dornier Wal flying boat in October 1932 in the course of his historic flight around the world, alighting on the Chilka Lake and at Karachi. Today's Dornier

Seastar is an all composite amphibious flying boat with twin inline Pratt & Whitney Canada turboprop engines. The Seastar is capable of operations from high seastates, has a 700 mile range and can accommodate 12 passengers. The menace of corrosion is obviated and since the Seastar can operate from high seastates, its versatility gives it more flying time.

Michael Moore of Viking Air, Canada, introduced the new Series 400 Twin Otter, a follow on to those built by the deHavilland Aircraft Company of Canada between 1965 and 1988. About 600 aircraft, out of 844 manufactured during this period, are still operational worldwide. Production of this aircraft was restarted in British Columbia in 2008 and deliveries have begun. Fredrik Groth, CEO of Maldivian Air Taxi spoke on their unique 17 year experience where this Danish-owned company has operated upto 50 Twin Otters on floats, flying some 400,000 passengers every year in VFR conditions, 'one every four minutes' !

Andrey Rudenko of Taganrog Aviation made a presentation on the Beriev Be-200 multi-purpose amphibian jet, which is 'blue water capable', combining maritime characteristics with flight capabilities of conventional aircraft and missions ranging from fire fighting, search and rescue, maritime patrol and environmental monitoring to medical evaluation and passenger and cargo transportation. This is the largest of amphibians and capable of operating from land airfields or water bodies. Since 2003, the Russian Ministry of Emergencies has employed the Be-200ChS amphibian in fire fighting missions in Italy and Portugal.

Dr. Nasim Zaidi, Secretary Civil Aviation with Mr. Conrado Dornier.

Emphasising importance of the role which must be played by MROs in the acquisition and operation of seaplanes in India, Ravi Menon of Airworks India Ltd, urged that the Government take active promotional steps and suggested that the government rationalise duties and taxes and establish quality training institutes.

Deliberations during the seminar and the presentations were a pointer on the distinct potential of seaplane operations and the economic and tourism advantages they would bring. In January 2011, Pawan Hans launched seaplane operations in the

The Beriev Be-200.

Maldivian Air Taxi sea port off Male airport, with Twin Otters at dock.

Andaman & Nicobar in collaboration with the Mumbai-based Mehair Airline. Operating presently from Port Blair to Havelock and Diglipur, other islands are to be connected through this 'Pilot Project'. The winsome Captain Wendy Reynolds of Mehair (Maritime Energy Heli Air Services) of Mumbai spoke on operating a Cessna Caravan 208A seaplane, which carries nine passengers and their baggage to destinations at 250 km distances.

The Government of India considers seaplane operations as "a key aviation activity" and has offered 100 percent foreign direct investment (FDI) in this sector. The Ministry of Civil Aviation and the DGCA now have the necessary regulatory framework in place to promote the operation of seaplanes. Maintenance infrastructure should be set up in the country with a number of third party maintenance organisations approved by the DGCA (and some by EASA and FAA) to international standards. There are aviation professionals and consultants available and aircraft manufacturers keen to facilitate India's venturing into seaplane operations along its vast coastline and offshore island territories.

JC Malik

Viking Air's new Series 400 Twin Otter.

Dornier Seastar

Airliners of the Future

–being shaped in Munich !

The RS 001: concept of the Royal Aeronautical Society.

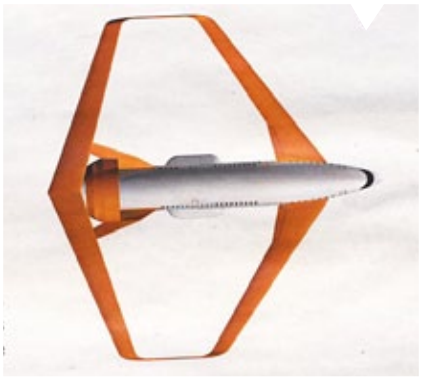
Andreas Sizmann's world is a crazy-looking jumble of numbers, formulas and vectors, a conglomerate of curves, equations and variables. This seeming wilderness of abstract knowledge hangs above his desk in the shape of a whiteboard covered with felt-tip scribbles. The word the physicist has coined to describe it is N-Tec, which stands for energy, technology and ecology. Its purpose? To investigate the future of commercial aviation.

Will aircraft in future be powered by electricity or by solar energy? Will they have their own batteries on board? How can energy from alternative sources be converted into propulsion? How can sustainability and availability be factored into the equation? And what's the best way to approach such complex subjects properly in the first place? The future of aviation depends on the answers to all of these questions. "We need to investigate a number of new technologies to decide what might be possible and what might make sense," explains Sizmann. He is Head of Future Technologies, Innovative Potential and Ecology of Aviation and one of 35 scientists working at Bauhaus Luftfahrt, a unique think tank in Munich, Germany. Airplane models and fuselage cross-sections line the corridor on the fourth floor. Its walls are hung with pictures of cockpits, charts and engine illustrations. No one wears coveralls, carries a screw-driver or uses an oil can. Bright minds and computers are creating the future of aviation here.

Bauhaus Luftfahrt regards itself as a "system house for the development of aviation." It is a non-profit organisation formed in 2005 by the European Aeronautic Defence and Space Company EADS, its subsidiaries Libherr-Aerospace and MTU Aero Engines and Bavaria's Ministry of Economic Affairs. Its mandate is to find solutions to the challenges that will face further advances in airborne mobility. "We want to help plan aviation developments through 2050," says Chief Technical Officer Professor Mirko Hornung. Not just technologies, aircraft and airports but also the social, economic and political aspects of air-traffic growth.

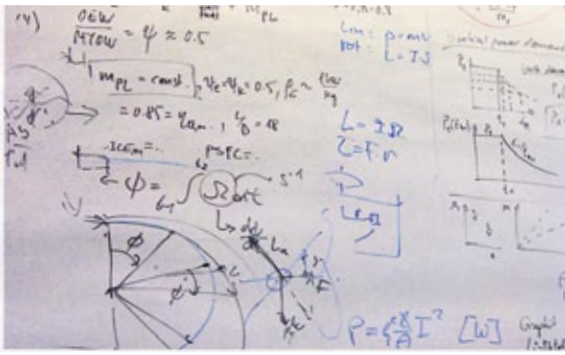
The scenario today: people are living longer and want to travel more comfortably. The rise of a global middle class means that more and more people will want to travel by air, especially in Asia. Aircraft capable of taking off and landing on short runways will be needed to enhance passenger handling capacity in the mega-cities of the future. Large, wide-body jets like the A380 will be used for medium hauls in countries like

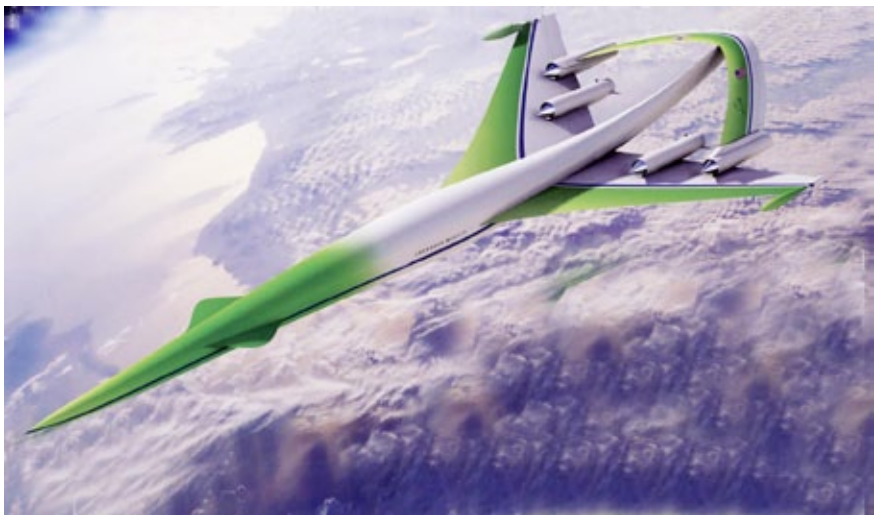
China and India, and aircraft carrying upwards of 1000 passengers will likely be the norm. "Finding practical solutions to all that means taking a look at aviation as a whole," explains Hornung. Experts from many fields work together at Bauhaus. And the goals they have set themselves are high: they want to improve fuel efficiency, for instance, by 1.5 percent a year and achieve absolutely clean, emission-free flight by 2050. Liquid gases, biofuels and synthetic fuels are high up on the list of possible alternatives to fossil fuels, but how suitable are they really? Are they a reliable source of energy and are they environmentally acceptable? Another Bauhaus aim is to make aircraft quieter. "We should be seeing some new developments pretty soon," says Askin Isikveren, an Australian who is researching visionary flight concepts like "morphing wings", aircraft wings that adapt to different flight situations by changing shape during flight. "The people in the window seats will be seeing some interesting things," Isikveren adds. He has a model of the Claire Liner on his desk – another promising concept, where tail assembly, elevators, winglets and main wings are united in a single "box wing" frame surrounding the fuselage. The drive unit is fully integrated into the body of the plane. Air intake comes from the slow-moving air near the fuselage called the boundary layer and the energy from the engines is transported to four covered rotors mounted on the tail. This makes for more efficient



propulsion. Not only would the Clair Liner cut fuel consumption by upto 20 percent, it would be quieter than the A380 and allow steeper, more efficient approaches.

But at Bauhaus, they're focusing on other things, too: knowledge management, safety, airport planning, climate change, materials technology. All of these fields will impact commercial aviation in the coming decades. Multi-level cabins in honeycomb configurations could be





just around the corner. Bees, pigs and rats could be deployed to sniff baggage samples at security checkpoints because they have a better sense of smell than an artificial sensor. And researchers are looking into vertical takeoff, three-surface aircraft and more comfortable and efficient seating layouts.

The task is Sisyphean, but it's the job of the 35 forward-looking Bauhaus scientists to recognise and work out solutions. Somewhere amid all those formulas and figures – the answers are there.

Marc Bielefeld
Lufthansa Magazine

Testing Times

Air Marshal Philip Rajkumar writes on the Jaguar Agave Darin Programme

IAF planners in the 1970s wanted the offensive air element of the force to include maritime strike capability to meet its commitments in this dimension. Initially this capability was provided by a flight of Canberra aircraft with No. 6 Squadron at Poona. When the Jaguar programme was started, British Aerospace was asked to develop a maritime strike version of the Jaguar exclusively for the IAF. This version was to have an air to sea radar fitted in the nose in place of the laser range finder and equipped with a suitable air-launched anti-ship missile.

The radar chosen by the IAF was the Agave developed by Thompson-CSF of France, optimised for air to sea search with other modes including air to ground ranging, mapping and weather detection. The radar was to be integrated with the British Sea Eagle anti- ship missile. The entire development work was done by BAe designers at Warton in the UK but flight testing and certification was to be done in India. One Jaguar maritime strike version (JM-251) was built at Warton and air transported in dismantled state to

Bangalore in a Shorts Belfast (4xRolls Royce Tyne turbo-props) heavy lift aircraft sometime in late 1985.

The aircraft was re-assembled and the Agave radar integrated under the supervision of Wg Cdr BR Madhav Rao at HAL's Jaguar production hangar. Madhav was a close friend of mine from our days together at No. 1 Squadron then equipped with MiG-21s (Type-77) at Adampur from 1966-70. To motivate the HAL workers Madhav used to use an IAF type of parade command *'Agave lagao! Tej Chal'*!

The aircraft was handed over to ASTE in February 1986. The strike version of the Jaguar was equipped with a pitot tube and a laser range finder and marked target seeker in its nose. In the maritime version with the radar installed in the nose, the air data system had to undergo major change with pitot probes on either side of the nose providing dynamic and static pressures as well as angle of attack information. Range for air to ground weapon delivery was to be provided by the radar.

JM-251 was equipped with a special pitot probe fitted at the right wing tip which had been calibrated at the BAe wind tunnel at Warton. Air data obtained from this probe was the 'truth' model and the side probes had to be calibrated against this yardstick The probe was used for production test flying at HAL, Bangalore and the aircraft was then handed over to ASTE for rest of the tests. The aircraft had the standard DARIN system fitted comprising the SAGEM Uliss-82 inertial platform, the Smiths Industries Head Up Display (HUD) and the Ferranti Combined Map and Electronic Display (COMED). The input output devices were the same as in the strike Jaguar cockpit. The Agave radar control panel was fitted on the left hand side panel behind the throttles. This was a very pilot friendly location, as in the air, the pilot had to move the left hand which was on the throttles only a few inches backward to operate the radar controls. The COMED acted as the radar display when the radar mode was selected.

An Agave radar integration rig supplied by Thompson-CSF was integrated with the DARIN system on the ground at the Inertial Integration Organisation's laboratory at HAL, Bangalore. Unfortunately this was only a static rig and it was not possible to play back a sortie on the ground for debrief purposes. After a software bug was discovered in the air, rectification could be checked out only in the static mode and dynamic mode investigation required another sortie to be flown. This procedure is somewhat archaic in these days of dynamic rigs where every thing can be checked out on the ground itself!

The aircraft had special instrumentation in the form of pressure tranducers to record pressures from the right wing tip probe and the side mounted probes. Information from the inertial platform pertaining to body rates and accelerations was also recorded on the MARS 2000 magnetic tape recorder. A HUD camera was fitted for post flight analysis of the symbology. A specially calibrated radio

altimeter was available to provide the datum at low altitudes.

The flight test programme was divided into four parts (i) calibration of the side mounted air data probes (ii) evaluation of handling qualities with the changed shape of the nose (iii) evaluation of radar performance in all its modes of operation (iv) integration tests of the Sea Eagle missile which comprised of carriage trials and one live firing in the integrated mode.

I was the project test pilot for these trials. John Sharrock, a BAe flight test engineer was deputed to ASTE for the side probe calibration phase of the trials.

John drew up the flight test schedule which mainly consisted of a range of wind up turns at various Mach numbers (0.5 to 0.95) at medium altitude. The test technique required the aircraft to be put into a spiral dive tightening the spiral to take the aircraft through the required range

At the handing over ceremoney of the first HAL-built Jaguar Maritime Strike Aircraft at Bangalore. Seen in the picture are Defence Minister KC Pant with Air Chief Marshal Denis La Fontaine, General K Sunderji, Air Marshal MSD Wollen and Wg Cdr IM Chopra.

of angle of attack (alpha) holding Mach number constant. At higher Mach numbers the dive became very steep indeed! The height lost in the dive could not exceed +/- 1000 feet of the designated height, usually 15000 feet above mean sea level (AMSL). After the sortie John would spend a day looking at the data and deciding which data had to be gathered afresh. At that time ASTE did not have state of the art computing facilities. Even the first PC had not made its appearance and John had to make do with the primitive, slow, mainframe computer that existed.

Two particular sorties stand out in my memory. The first was a maximum Mach number/maximum Knots Indicated Air Speed (KIAS) dive. I climbed to 40000

feet AMSL, reaching Srirangapatnam (Tipu Sultan's capital) just short of Mysore. I turned on to a north easterly heading towards Kolar which was the supersonic corridor, lit the burners and put the aircraft into a 60 degree dive (looks vertical from the cockpit!). The aircraft quickly went supersonic but thereafter the Mach meter refused to go past M=1.2. John wanted a data point at M=1.4 which was the cleared limit in the flight manual. I pulled out of the dive and climbed back to 40000 feet and tried again. Same result but this time I continued the dive in a series of stair steps to respect Mach number / IAS limits and finally ended up at 1500 feet over Kolar doing 700 KIAS. This was 50 KIAS above the flight manual limit but John had specifically asked for this data point. Before attempting this test point I found from Warton that this was the speed limit the aircraft had been cleared to during development testing. It was the maximum IAS I have ever touched in an aircraft. The dive which must have lasted all of three minutes was exhilarating to say the least!

The second sortie was to get data at an anchor point at 600 KIAS at 100 feet AMSL. John placed an aneroid barometer at his feet while standing on the taxi track near the airfield reference point. I came screaming over his head at 100 feet above ground level using the radio altimeter. The civilians at the civil terminal thought the airfield was under attack and I had some explaining to do after landing! After this sortie John went back to the UK to do the data reduction, arrive at the Pressure Error Correction (PEC) for the side probes, covert it into software and introduce the correction into the HUD computer. He came back in August 1986 and I flew two more confirmatory sorties to check out the PEC. Meanwhile the Chief Resident Enginer's Office said the PEC did not extend to the flight manual limit of M=1.4 and therefore they would not clear it for service use. I had to sit with them and explain why it was only of academic interest because the aircraft would never go past M=1.2 especially with drop tanks and ordnance. Finally the penny dropped and they cleared the aircraft.

The next phase was the evaluation of handling qualities with the changed shape of the nose. Another flight test engineer from BAe, Brian Beadle came to ASTE from Warton and drew up the flight test schedule. Again a series of wind up turns had to be performed through a range of alpha and Mach numbers. Designers had predicted a small change in the roll mode time constant (time taken to attain 2/3rd of the maximum roll rate attainable with full aileron deflection). In the Jaguar lateral control was achieved using three different control surfaces, ailerons, spoilers and differential movement of the slab elevator at low speed. For the pilot the use of these surfaces was not apparent as he only had to move the control column in the required direction of roll. Brian wanted data from a series of full aileron rolls through 120 degrees of bank at various Mach numbers without the slightest application of pitch control. This was tricky because normal piloting tendency was to have some backward pressure on the control column while rolling the aircraft. Several times Brian asked for a repeat of test points because

he had detected some elevator application during a roll. A sortie of only full aileron banks to either direction can literally get quite sickening after some time! I used to do a few aerobatics and then go back to data collection. After detailed data analysis Brian declared that there was no detectable change in handling qualities between the strike version and the maritime version. It was a lesson in thoroughness for me as BAe did a full test programme and flashed the green light only after analysis had showed no perceptible change. Since the change in nose shape was not very marked it could have been cleared with just a qualitative assessment - or so I thought!

The third phase was Agave radar assessment. Apart from the air - to - sea search and track function radar ranging had to be evaluated for weapon delivery. Analysis sorties were flown over Kolar using the photogrammetry markers set up for the DARIN programme. After analysing the data, IIO engineers cleared the radar ranging mode. To check out the radar for its main air to sea tracking mode I went to the west coast and over flew Mangalore harbour. I saw a big ship off loading cargo berthed there. I then flew down the coast at 500 feet over the sea to a distance of 100 nautical miles (nm) and turned on to the reciprocal heading. At the maximum range I got the first pick up of the ship in the harbour. Lock on was achieved at the specified range. The Agave radar was working as per specifications. However, I found a problem while looking at the radar display on the COMED. One had to fly head down at low level over the sea with the HUD and attitude indicator outside one's field of view. This was bad enough in daytime but at night it would be positively dangerous as spatial disorientation could easily set in. I discussed the problem with the IIO engineers and asked them to repeat the HUD attitude indicator at the bottom right hand corner of the COMED. This way the pilot could see his attitude even while concentrating on the radar display. This modification was implemented, flight tested and accepted by the CRE's office.

Photograph by Simon Watson with No.6 Squadron ('Dragons') at Pune.

The three phases of tests were completed by March 1987 leaving only the integration of the Sea Eagle missile with the Agave radar. For carriage trials a dummy missile was to have been procured from BAe. Air Commodore S Krishnaswamy (later CAS) who was the Director, Air Staff Requirements at Air Headquarters threw a fit when he saw the cost of the dummy missile. It was a cool 100000 pounds sterling (about 30 lakhs at that time). He asked HAL at Bangalore to fabricate a dummy missile at far lower cost but it took time. Carriage trials planned in late 1987 started only in mid 1989 when I was no longer at ASTE.

No.6 Maritime Strike Squadron worked up to full operational capability by 1988 but the Sea Eagle missile integration took longer than planned. In the interim period the Jaguars had air to ground capability similar to the strike version.

The Agave radar went out of service after about 20 years of operational use. The Maritime Jaguars are now equipped with a new generation radar and missile, with much improved capabilities.

Japan issues F-X fighter RFPs

Japan has formally launched its F-X fighter competition by sending request for proposals to three potential bidders. Boeing and Lockheed Martin have confirmed receiving Japan's RFP on behalf of the F/A-18E Super Hornet and F-35 Lightning II, respectively. A UK representative has picked up the RFP for a possible bid with the Eurofighter Typhoon.

Tokyo released the fighter RFP just a few weeks after the country was hit by an earthquake, tsunami and nuclear crisis. Japan has already started decommissioning its ageing McDonnell Douglas F-4 Phantoms, which it plans to replace with the F-X.

China in support of Pakistan...

Even as the United States has reiterated that it will continue to hunt down its enemies wherever they are and could repeat an Osama-like operation in Pakistan, China has asked the US to "respect Pakistan's sovereignty, understand its problems, address its concerns and acknowledge the sacrifices rendered by it in the war on terror". Chinese Premier Wen Jiabao was meeting with Pakistan's PM Yousuf Raza Gilani and reiterated that irrespective of changes that might take place, China and Pakistan would be "friends forever".

...with 50 more JF-17s

China's support to Pakistan was demonstrated in practical manner with an agreement for the "immediate provision" of 50 additional JF-17 Thunder fighters, even as talks have begun for more combat aircraft including the Chengdu J-20 stealth fighter in the future. The formal agreement for 50 JF-17 Thunders was signed on 20 May with first of this batch to be received "in weeks". China is believed to be "fully funding" the supply of these aircraft, which makes a total of 260 JF-17s ordered by the Pakistan Air Force.

Meanwhile, China will launch a satellite for Pakistan on the latter's forthcoming Independence Day, 14 August 2011, for relay of "multifarious data" to Pakistan.

Pakistan's tactical nuke capability grows

As per satellite imagery obtained by US sources, Pakistan's nuclear weapons programme is expanding at a rapid pace and its arsenal could well overtake that of France whose inventory ranks fourth in the world for nuclear weapons. Images show an "aggressively accelerating construction" at the Khushab nuclear site, 225 km south of Islamabad, which fourth operational reactor will greatly expand plutonium production for Pakistan's nuclear weapons programme, adding between 10 to 20 weapons a year to the 100 or so warheads in existence.

According to Daryl G Kimball of the Arms Control Association, "this is a destabilising and potentially dangerous development which suggests that Pakistan would seriously contemplate use of low yield fission devices on the battlefield in the event of an incursion by Indian forces."

New F-16s enter PAF service

The PAF has operationalised its new Lockheed Martin F-16C/D Block 52+ fighters, while its first two full-strength squadrons of Chengdu/Pakistan Aeronautical Complex JF-17 Thunders are also on the verge of becoming fully operational. The Pakistan Air Force inducted 17 F-16 Block 52+ fighters to re-equip No. 5 Squadron on 11 March.

The new batch of aircraft comprises 12 single-seat C-model versions and six two-seat F-16Ds and the PAF says it is in negotiations for additional Block 52+ aircraft, with its original deal having contained an option for another 18. The fighters are powered by Pratt & Whitney F100-229 engines and equipped with systems including Northrop Grumman's mechanically scanned APG-68 (V) 9 radar and ITT's ALQ-211 (V) 9 advanced integrated defensive electronic warfare suite.

A related weapons package includes Raytheon AIM-120C5 AMRAAM and AIM-9M-8/9 Sidewinder air-to-air missiles, plus Boeing joint direct attack munitions and Raytheon Paveway-series laser-guided bombs. A mid-life upgrade of 34 F-16A/B Block 15 aircraft is also due for completion next year, with the work to introduce modern sensors and weapons split between Pakistan and Turkey.

Meanwhile, the PAF's first full-strength squadron (No.26) of 18 JF-17s became operational during April, with a second Squadron (No.16) likely to follow within a further two months. The JF-17 Thunder will replace several types, including Chengdu F-7s, Dassault Mirage IIIs, Mirage 5s and Nanchang A-5s, the last of A-5s being phased out in May 2011.

Pakistan receives its third Il-78MP tanker

The third of three Ilyushin Il-78MP tankers ordered by the Pakistan Air Force from the Ukraine was delivered to the newly established No.10 Multirole Tanker Transport Squadron at Chaklala AB in February. The aircraft made its maiden flight following conversion as a tanker in December 2010. The first aircraft, R9-001, was delivered in April 2010 and the second, R10-002, in December 2010.

Israel to reinforce 'Iron Dome' shield

The Israeli government seeks emergency funding to procure additional 'Iron Dome' mobile air defence systems from Rafael, following the equipment's early success in shooting down rockets that were launched from the Gaza strip. One of the two newly installed 'Iron Dome' systems in use by Israeli air force achieved its first live intercept on 7 April 2011 when it destroyed a BM-21 Grad 122mm rocket near the city of Ashqelon.

Israel's government is expected to request that the USA approve an emergency procurement worth $ 250 million to allow it to order at least four more 'Iron Dome' systems. A total of 13 would be required to defend all "sensitive areas" in Israel against attacks using short-range rockets and artillery shells.

Each 'Iron Dome' system comprises a tracking radar, battle management and weapons control unit, missile firing unit and interceptors designed to engage threats launched from a distance of upto 70 km away.

Typhoon goes into attack

The Eurofighter Typhoon was deployed for its first offensive use on 12 April, when one of its aircraft dropped precision-guided bombs on two Libyan targets, south of the opposition-held town of Misrata. "The Typhoon successfully engaged two tanks with [Raytheon] Enhanced Paveway 11 precision guided bombs, while the Tornado hit another tank with a Paveway IV," the aircraft operating from their forward operating base at Gioia del Colle in Italy.

Hailing the action as "a significant milestone in the delivery of multi-role Typhoon", Air Chief Marshal Sir Stephen Dalton stated that the attacks were conducted "very successfully and very accurately". While the RAP's Eurofighters lack the ability to carry the wide range of weapons and sensors being employed by its Tornado GR4s over Libya and Afghanistan, the CAS said that this is "by design and by definition".

RAF Typhoons can only deploy 454kg (1,000lb) Paveway II-series weapons, but their capabilities are to be progressively enhanced, he says. "The bringing in of Paveway lV [MBDA's] Brimstone and Storm Shadow is all in the programme for the next three to four years."

German Herons complete 3,000 hours in Afghanistan

The Luftwaffe UAV reconnaissance squadron based at Mazar-e-Sharif in Afghanistan, has passed 3,000th flight hours with the Elbit Heron I, the unmanned system having taken over reconnaissance missions from Luftwaffe's Tornados in late 2010. The Heron I will be retained in service until the EADS/Northrop Grumman EuroHawk is delivered to Reconnaissance Wing 51 'Immelmann'.

Mi-17V5s handed over to Thai Army

Three Kazan Mi-17V5s delivered to Thailand have been handed over to the Royal Thai Army (RTA) in end-March. In an hour-long ceremony, the Russian helicopters were blessed by a Buddhist monk and then inspected by the RTA Commander-in-Chief, General Prayut Chan-O-Cha and Defence Minister General Prawit Wongsuwon. All three helicopters are to be part of the 11th Infantry Division at Bang Khen, Bangkok, where the ceremony took place and are operated by the General Support Aviation Battalion, known as 'Goliath'. Cost of the three Mi-17V5s, including training and spare parts is reportedly $29 million.

Additional F-16s for Indonesia

The US has offered Indonesia the provision of two squadrons of Lockheed Martin F-16 Fighting Falcons from surplus US Air Force stocks. Some 24 F-16A/Bs are involved, which will be upgraded with new avionics and systems as on the latest F-16C/D Block 50/52s. Indonesia is also planning to acquire six new-build F-16s in 2014.

Russian Air Force takes over aviation assets from AVMF and RVSN

Since 1 April 2011, a proportion of the aircraft fleet of the *Aviatsiya Voenno-Morskogo Flota* (Russian Naval Aviation or AVMF), have been transferred to *Voyenno-Vozdushnyye Sily* (VVS or the Russian Air Force) as per directives issued by the Russian Armed Forces General Staff. The aircraft types to be handed over to the VVS comprise Sukhoi Su-27 fighters of the Baltic fleet, Mikoyan MiG-31 long-range interceptors operated by the Pacific Fleet and Tupolev Tu-22M3 long-range missile-armed bombers. In addition, a number of Antonov An-12 and An-26 transports of the AVMF fleet will join the VVS.

Tupolev Tu-22N3.

Meanwhile, the aviation fleet of Russia's *Raketnye Voyska Stragicheskogo Naznacheniya* (RVSN or Strategic Missile Troops), comprising both fixed and rotary wing aircraft will also be incorporated into the *Voyenno-Vozdushnyye Sily's* (VVS or Russian Air Force) structure. The RVSN's fleet includes various Mil Mi-8 derivatives for transporting personnel and material, Mi-9 command posts and Antonov An-26 and An-72 transports.

Turkey orders 109 Sikorsky Black Hawks

The Turkish Defence Industry Executive Committee (DIEC) has selected Sikorsky for a contract involving 109 derivative Black Hawk helicopters for multi-mission use. Sikorsky will finalise contract details with the Undersecretariat for Defence Industry (known in Turkey as SSM) and Turkish Aerospace Industries (TAI). The aircraft will be assembled in Turkey by TAI as the prime contractor and will include components supplied by Sikorsky and other American and Turkish companies.

French Defence Expenditure Forecasts

A new study on the French defence expenditure, reviews and analyses for the period between 2004-2009 and forecasts for the period 2010-2015. Shows that French defence expenditure increased at a CAGR of 3.26% valued US$60.7 billion. The military modernisation plans outlined in the French white paper, coupled with perceived terrorist threats and active participation in United Nations peacekeeping missions, of which France is the second largest contributor among Security Council permanent members, has stimulated expenditure during the review period.

Such factors are expected to continue to fuel expenditure throughout the forecast period. As a result, and despite budget cuts during 2010-13 to reduce government fiscal deficit, the country's defence budget is expected to grow at a CAGR of 1.50% during the forecast period. The French defence budget, which stood at 2.3% of GDP in 2009, is expected to decline to 2.0% of GDP by 2015 due to budget reductions.

Capital expenditure allocation of the defence budget, which was at an average of 37% during 2004-08, increased to 41% in 2009 as a result of government modernisation plans. Capital expenditure allocation is expected to account for 39% of total defence budget in 2011, before stabilising at 42% during 2012-15. Common services such as health care and defence infrastructure facilities accounted for the highest budget allocation, with an average of 54% of total budget, excluding other expenses such as research and development and pensions. During the forecast period, the French Army, Navy and Air Force are expected to receive average allocations of 21%, 11% and 12% respectively.

UAE Air Force's first C-17

Boeing has delivered the first of six C-17 Globemaster III heavy airlifters to the United Arab Emirates (UAE) Air Force and Air Defence during a ceremony at the company's final assembly facility in Long Beach. The UAE will take delivery of three more C-17s in 2011 and two in 2012 as it modernises its airlift capabilities. As a member of the worldwide C-17 'virtual fleet,' the UAE's C-17s will be supported through Boeing's C-17 Globemaster III *Sustainment Partnership*, a proven multinational Performance-Based Logistics programme.

Russia's $705 billion military modernisation programme

The Russian government is intent on reviving the nation's arms industry while simultaneously modernising the armed forces. The Kremlin has revised its State Armaments Programme (SAP) and is now calling for RUB20 trillion ($704.9 billion) to be spent on the military's modernisation from 2011-2020. There are several key factors that will determine the extent to which the SAP can be implemented.

First, in order to meet the funding goal of RUB20 trillion, approximately 4.5 percent of the nation's GDP must be directed toward military funding. However, given Russia's current financial position, this may be a bit ambitious. According to *Forecast International,* the recent global economic crisis "exposed the structural faults of the Russian economy," and noted, "while equity markets have improved since mid-2009 and capital markets have re-opened, the repair of the financial system is far from complete." The government is now hoping that the economy will reach pre-crisis levels by the end of 2012, at which time GDP should be on par with the levels achieved in 2008. At the same time, the crisis has also exposed the financial weaknesses of the Russian aerospace and defence industry. Fortunately the government have leveraged this exposure to consolidate the defence sector under government control and will now use the industry's capabilities to complete the military's modernisation plan. However, the government must invest in research and development programmes for the defence sector in order to stave off the pending industrial decline.

Another key factor is the defence budget and the government has begun transitioning funding streams to support additional arms procurements through two major reform processes.

The first is a cost-saving reform which calls for the reduction of some 200,000 personnel by 2012. The second major reform is the adoption of a new budgetary framework. "The process is designed to modernise the Kremlin's fiscal practices and provide longer-term price and policy signals to the Russian defence industry."

In order for the SAP to be fully implemented, the government must continue to invest heavily in both the military and the nation's defence industry. Furthermore, because the SAP calls for 11 percent of existing military equipment to be upgraded and a full 70 percent to be replaced with modern weapons, the Russian defence industry needs to stay afloat and the economy must continue to rebound at a steady rate.

China and Pakistan Air-Exercises

The Air Forces of China and Pakistan have conducted the joint-air exercise *Shaheen-1,* which had the first ever deployment of the Chinese air force to Pakistan. "A contingent

of Chinese PLA air force comprising combat aircraft, pilots and technicians arrived at an operational base of the Pakistan Air Force. The exercise has been designed to share mutual experiences, hone professional skills, and accrue maximum benefits from the expertise of the two air forces," according to a spokesman, but did not disclose details about the types of aircraft involved, the missions performed, the location of the exercise, or the total number of personnel involved.

The exercise took place over two weeks in March 2011. From images released, it is seen that PAF F-16s (of No. 9 Squadron) and JF-17s (of No.26 Squadron) operated alongside J-10s of the PLAAF, probably at Sargodha in the Punjab.

AgustaWestland competes for US Air Force programmes

The US Air Force is moving forward with a competition for the Common Vertical Lift Support Platform and HH-60 recapitalisation programmes. The AW139M has been configured with the latest US military technology from suppliers across the United States, "ensuring that it is a cost effective, off the shelf option for the US Air Force". The AW139M includes a high-definition FLIR, self protection equipment including infrared detection and countermeasures, avionics, heavy duty landing gear, ballistic protection and other dedicated equipment, allowing all-weather operation at the US Air Force's northern-tier missile bases.

The HH-71, based on the AW101, offers a platform for critical combat search and rescue missions. "With extensive experience in Afghanistan and Iraq, the HH-71's size, low acoustic signature, long range all-weather capability and effectiveness in austere environments such as sand and snow enables the warfighter to complete challenging combat search and rescue missions with speed, range, security and safety". The HH-71 includes three engines providing aircrews the assurance that the mission can be safely completed, even under hostile or irregular warfare conditions.

A new C-130 'Shadow in the Sky'

The first MC-130J 'Combat Shadow II' for the USAF Special Operations Command has made its first flight at the Lockheed Martin facility in Marietta, with a series of flight tests prior to delivery to Cannon Air Force Base, N.M. The new aircraft is based on a KC-130J tanker baseline and will have the Enhanced Service Life Wing, Enhanced Cargo Handling System,

a Universal Aerial Refueling Receptacle Slipway Installation (boom refueling receptacle), more powerful electrical generators, an electro-optical/infrared sensor and a combat systems operator station on the flight deck.

Lockheed Martin is contracted to build 15 MC 130Js to begin replacing the current aging fleet.

E-2D Advanced Hawkeye Programme completes DAB Review

Following a successful Defence Acquisition Board review, funding for an additional 10 E-2D Advanced Hawkeye aircraft has been authorised, which comes just a short time after the Northrop Grumman Corporation built E-2D made its first carrier landing, aboard the USS *Harry S Truman*.

"This is a significant milestone for the E-2D Advanced Hawkeye programme," said Jim Culmo, vice president, airborne early warning and battle management command and control programmes, Northrop Grumman Aerospace Systems sector. The US Navy's programme is for a total of 75 aircraft, with deliveries through 2021. Northrop Grumman has delivered five E-2D aircraft to the Navy and production on the 10th aircraft recently began at Northrop Grumman's East Coast Manufacturing and Flight Test Centre.

Additional orders for DRAC Air Vehicles

Cassidian has been notified by the French defence procurement agency (DGA) of additional orders for DRAC air vehicles and systems for the French Army. The DRAC mini-UAV close-range reconnaissance system is intended to enhance the intelligence seeking and reconnaissance capabilities of front-line army units. The short-range DRAC UAV system has been developed for the French Army by Cassidian Air Systems, in partnership with SurveyCopter, as was the Tracker system from which it is derived.

Each DRAC system consists of two UAVs equipped with payloads, a compact ground station and an automatic tracking antenna, which can be packed into two personal rucksacks, thus allowing entirely autonomous missions. Tracker is one of the mini-UAV systems that offer the best performance available on the market.

EMS-Configured AW139s for Qatar

The Qatar Armed Forces have ordered three AW139 medium twin helicopters plus a comprehensive logistics support package. These will be operated by the Qatar Emiri Air Force to perform emergency medical service missions. This latest contract adds to the one for eighteen AW139s signed by Qatar in 2008, some already delivered to carry out a range of operations including utility, troop transport, search and rescue, border patrol, special forces operations, law enforcement and homeland security. The remainder are expected to be progressively delivered by early 2012.

ITT major milestone in Swedish coastal surveillance programme

ITT Corporation have successfully completed Production Acceptance Testing (PAT) for the first system of the Reliability and Modification (REMO) 870 Programme to modernise Sweden's coastal surveillance radar systems. In May 2008, ITT began a series of design upgrades based on ITT's new LCR-2020 radar and its integrated, turnkey coastal surveillance system, the SABER-2020. This successful PAT milestone marks the first of multiple production deliveries of the upgraded system.

Netherlands MPAS for NH90 NFHs

Royal Netherlands Navy (RNLN) has taken delivery of a Mission Planning & Analysis System (MPAS) for its fleet of NH90 NFH medium twin naval helicopters. The RNLN MPAS is based on the AgustaWestland-designed Skyflight Planning System, a multi-helicopter flight and mission planning solution that all variants of AgustaWestland's mission planning stations rely upon. Skyflight technology is currently being used for development of the UK Ministry of Defence's AW159 and Apache Mission Planning Systems and is also the core element for

the Flight Planning System of the AW101 VVIP helicopter and will be delivered to the Royal New Zealand Air Force in support of mission planning for their AW109 LUH helicopters.

Sweden negotiates for Black Hawks

Sweden's Defence Material Administration is in final negotiations to buy 15 Sikorsky UH-60 Black Hawk utility helicopters from the US government, with first deliveries expected in 2012. Defence minister Sten Tolgfors says pilot training should start in the USA "this summer", and that the entire fleet would be fully operational by 2017.

The Black Hawk acquisition will double Sweden's medium helicopter inventory, strengthening its ability to contribute to international operations. Its Defence Forces Helicopter Wing is likely to deploy the new aircraft to Afghanistan "from 2013", replacing deployed Eurocopter AS332 Cougars. Buying UH-60s has become necessary due to ongoing problems with the introduction of Sweden's NH Industries NH90 transports. An 18-unit order was signed in 2001, and the Air Force has so far received seven aircraft to support test activities.

Indonesia assessing C-27J Spartans

The Indonesian Air Force are to buy an unspecified number of Alenia Aeronautica C-27J Spartans to augment its transport fleet. Air Chief Marshal Imam Suffat has stated that the service will assess the C-27J based on its "operational requirements, technical specifications [and] logistics support".

Airbus Military's C-295 is also believed to be under consideration, with the type to be potentially licence-produced in Bandung by state-owned Indonesian Aerospace.

According to the Chief, "We also need a middle transport fleet…which could be met with the procurement of C-27J Spartans, A CN-235 has the capacity to transport about 3 tonnes, while a Spartan is able to carry up to 10 tonnes." Alenia is waiting for the air force to provide information on the number of aircraft needed and delivery schedule before it formally offers its aircraft.

The Company has also recently responded to an Indian RFI for 16 medium transport aircraft, while Taiwan has also expressed interest.

'Odyssey Dawn' against Libya

Twenty-five years after the inconclusive attempt to remove Col Muammar Gaddafi from power, the Western world have initiated military action over Libya. However, unlike long-range "El Dorado Canyon" strikes conducted in 1986 using General Dynamics F-111 bombers, this time the United States is at the head of a 13-nation coalition and in response to a UN security council resolution 1973, which calls for the use of "all necessary measures to protect civilians under threat of attack" in Libya. The first strikes were launched within 48 hours to neutralise Libyan air defence systems and command and control network, while also limiting movements of the Libyan air force by enforcing a no-fly zone. Opening salvoes involved the launch of more than 110 Tomahawk land attack missiles from US Navy frigates and submarines and by the Royal Navy.

Supporting this effort were three US Air Force Northrop Grumman B-2 stealth bombers, which conducted attacks against targets including hardened aircraft shelters at Ghardabiya air base. Royal Air Force Panavia Tornado GR4s released MBDA Storm Shadow cruise missiles against air defence targets. French Air Force Dassault Mirage 2000Ds and Rafales armed with Sagem AASM air-to-surface missiles, were among the first to target Libyan forces on the ground near the opposition stronghold of Benghazi, along with Boeing AV-8B Harrier IIs of the US Marine Corps. Italian air force Tornados electronic combat and reconnaissance aircraft and USAF Lockheed Martin F-16CJs, were armed with Raytheon AGM-88 high-speed anti-radiation missiles. The USN's Boeing EA-18G Growler electronic attack

Dassault Mirage 2000-9 of UAE Air Force.

aircraft also made their combat debut with five having been quickly moved to Aviano air base in Italy from their operational commitments in Iraq. During the first five days of the offensive the coalition flew 336 sorties, with US aircraft having performed 212 of these.

Operations expanded as other aircraft arrived in the region, including those from Belgium, Canada, Denmark, Norway, Qatar and Spain. The Netherlands deployed six F-16s and a McDonnell Douglas KDC-10, while the Swedish government deployed eight Saab JAS 39 Gripens. Also at Decimomannu were six F-16s and six Dassault Mirage 2000-9s of the UAE Air Force, which followed six Qatar Emiri Air Force Mirage 2000-5s, the first of which made their debut sortie in support of the Libyan campaign from Souda Bay, Crete.

The USAF is providing "80% of all air refueling, almost 75% of aerial surveillance hours and 100% of electronic warfare mission", said US Navy Vice Adm William Gortney, director of the joint Staff. US Air Force Fairchild A-10 ground-attack aircraft and Lockheed AC-130 gunships are in use against hostile forces and in striking ground infrastructure targets.

A-10 Thunderbolt II of USAF.

However, although Libyan fixed air defences were largely removed, potential threat posed by mobile SA-6 and SA-8 SAMs, man-portable SA-7s and thousands of anti-aircraft guns have remained.

BRICS Leaders oppose use of force in Libya

Brazil, Russia, India, China and South Africa (BRICS) regretted the use of force in the Arab world but refrained at the same time from explicitly calling for an end to the NATO-led air-strikes on Libya, an indication of lack of consensus on the issue. But they were concerned over the global uncertainty following developments in West Asia and North Africa and agreed to co-ordinate their viewpoints on all political issues. Expressing deep concern over the mass unrest in the Middle East, North Africa and West Africa, the BRICS leaders said in a joint statement that "the use of force should be avoided".

The situation in Libya and the UN-imposed no-fly zone that led to NATO air strikes in the North African country were among the issues deliberated upon by Indian Prime Minister Manmohan Singh, Presidents Hu Jintao of China, Dilma Rousseff of Brazil, Dmitry Medvedev of Russia and Jacob Zuma of South Africa. Calling for comprehensive UN reforms, China and Russia joined other BRICS members in supporting the aspirations of India, Brazil and South Africa for a permanent place on the Security Council.

ILFC orders 100 A320neo Family aircraft

ILFC has contracted the purchase of 100 A320neo Family aircraft with Pratt & Whitney engines for powering at least 60 of the aircraft. The A320neo is offered as an option for the A320 Family and incorporates new more efficient engines and large "Sharklet" wing tip devices, which together will deliver up to 15 percent in fuel savings, which will represent some 3,600 tonnes less CO2 per aircraft per year. In addition, the A320neo will provide a double-digit reduction in NOx emissions and reduced engine noise.

Sukhoi eyes F-X2 competition

Sukhoi is still working to compete in Brazil's F-X2 fighter contest, despite having been dropped from the air force's shortlist two years ago. Mikhail Bregman, first deputy general of Sukhoi for sales and marketing believes the Russian company's bid – based on the Su-35- is "better by far" compared with the F-X2 competitors, which now include the Boeing F/A-18E/F Super Hornet, Dassault Rafale and Saab Gripen. The aircraft also possesses some capabilities superior even to Sukhoi's PAK-FA design for a fifth-generation fighter, he claims.

Brazil has not officially reopened its 36-aircraft fighter competition to new types even as President Dilma Rousseff has launched a comprehensive review of the air force's two-year-old evaluation process for F-X2, which could delay a decision until 2012.

Bombardier CRJ900 NextGen Jets to Uruguay

Pluna Lineas Aereas Uruguayas SA has signed a follow-on order for three Bombardier CRJ900 NextGen regional jetliners, the airline currently operating 10 CRJ900 NextGen aircraft. The order increases firm orders for CRJ900 and CRJ900 NextGen airliners to 265 aircraft, with 244 of these delivered as of 31 January 2011.

UTair order 20 ATR 72-500s

The Russian carrier UTair have contracted purchase of 20 ATR 72-500s. With entry into service of these new aircraft, UTair will respond to the increasing market demand for regional connectivity in Russia and also in Ukraine, adding seat capacity on existing routes and developing new routes in both countries. UTair operates a fleet of 17 ATRs: 12 ATR 42-300s and 3 ATR 72-200s in Russia, plus 2 ATR 42-300s operated by its subsidiary UTair Ukraine. With the delivery of the new 20 ATR 72-500s, UTair will become the largest operator of ATR aircraft in Europe, with 37 ATRs.

More Saab 340s for Thailand

Regional airline *NOK Mini* in Thailand has leased two Saab 340Bplus from Saab Aircraft Leasing and started operations on 1 April 2011. Eight secondary cities in Thailand's northwest and northeast provinces will be serviced with daily flights from Don Muang airport in Bangkok. NOK Mini is a codeshare partner with NOK Air, a successful low-cost carrier famous for its colourful B737s based on local Thai birds. The NOK Mini 340s are painted in similar manner. The Royal Thai Air Force has ordered the special version Saab 340AEW alongside the Gripen C fighters.

Porter Airlines order more Bombardier Q400 NextGen turboprops

Porter Airlines of Toronto has placed a firm order for two Q400 NextGen turboprop airliners, the transaction involving conversion of two of the six options announced by Bombardier along with Porter's firm order for four Q400 NextGen aircraft on 6 August 2010.

Four Bombardier 415 Amphibian firefighting aircraft ordered

Bombardier Aerospace announced the sale of four Bombardier 415 amphibious aircraft to an undisclosed customer. This is the second order from this customer, who has previously ordered one Bombardier 415 aircraft. Based on the current list price, the contract for the four aircraft is valued at approximately $162 million and includes training and initial spares provisioning. Delivery of the aircraft will begin in the second quarter of 2011 and continue through to the first quarter of 2013.

Recent orders for the Bombardier 415 aircraft include those from the Canadian provinces of Newfoundland and Labrador and Manitoba, with four aircraft each.

The Bombardier 415 firefighter aircraft has a normal cruise speed of 333 km/h under certain conditions. In an average mission of six nautical miles (11 kilometres) distance from water to fire, it can complete nine drops within an hour and deliver 14,589 US gallons (55,233 litres) of fire suppressant.

MRJ assembly begun

Assembly of the Mitsubishi MRJ regional jet began on 5 April 2011, with riveting work at the Mitsubishi Heavy Industries, the work initiated around the emergency escape hatch for crew in the cockpit roof. The MRJ 90 regional airliner is set to make its first flight in the second quarter of 2012, with first delivery to launch customer All Nippon Airways in the first quarter of 2014. The MRJ 70 will have its first flight in 2013. MHI, which is responsible for manufacturing major parts of the jet including the fuselage, wings and empennage, will also manage the Pratt & Whitney PW1217G-powered MRJ's final assembly.

CAE's civil aviation training centre development and simulator contracts

CAE has signed contracts with airlines in Asia and North America for training centre development, the sale of two full-flight simulators (FFS) and CAE Simfinity training devices, with a combined value of approximately C$45 million at list and contract prices. China Southern Airlines and CAE are expanding their joint venture aviation training centre at Zhuhai in China to include two additional Level D FFSs purchased from CAE, a CAE 5000 Series for the Boeing 737NG and a CAE 3000 Series for the Sikorsky S-76C++ helicopter. This will mark the first CAE 3000 Series civil helicopter full-flight and mission simulator in Asia. With this contract CAE has had a sale of 29 civil full-flight simulators.

CAE has also signed a multi-year agreement with Virgin America to develop and support a new pilot training centre near the airline's home base in San Francisco. As part of this agreement, CAE will install an existing CAE-owned Airbus A320 Level D full-flight simulator (FFS), which will be updated to the latest Airbus configuration.

Rockwell Collins: enhancing air travel with next generation technologies

Rockwell Collins have revealed their next generation of in-flight entertainment and connectivity (IFEC) which includes the second generation dPAVES-HD single-aisle IFE system. This high definition (HD) capable system features an updated touch screen flight attendant entertainment control panel, USB ports for easier data on and offloading, and the newest version of Rockwell Collins' cutting edge Airshow 4200/D Moving Map system. The second generation dPAVES-HD, which now includes retractable 12" 16:9 LCD HD-ready displays, is offerable for line fit on the Boeing's 737 Sky Interior cabin option.

Recaro expands global network

Recaro Aircraft Seating is expanding its international presence, the aircraft seat developer and manufacturer setting up a new office in Beijing at the end of 2010 with a presence in Melbourne, Australia starting in April 2011, while Recaro has opened a purchasing office at Shanghai where the international supply chain is now supported by new Chinese suppliers.

In addition, Recaro also operates Service Centres in Hong Kong and Stockholm, while customers in Central Europe are serviced directly from the company headquarters in Schwaebisch Hall, Germany.

Recaro Aircraft Seating has also been successful with its Sourcing Centre in Shanghai, which was opened in 2010 with the aim to intensify the cooperation with Chinese suppliers and support the company's international supply chain.

Virgin Blue orders ATR 72s for Skywest

Australian regional carrier Virgin Blue has ordered 18 ATR 72 regional airliners, as a part of a wider strategic alliance signed between it and Skywest Airlines, which will operate the aircraft. Skywest serves domestic routes from its base in Western Australia and will provide technical and cabin crew for the turboprops along with sourcing a maintenance facility for the fleet. All the aircraft will be configured for 68 passengers and painted in Virgin Blue colours.

The first four aircraft will be delivered by mid-2011, with a second batch of four in 2012. Six will replace the existing fleet of Embraer 170s in Virgin Blue's regional network, with the others being used to expand the route structure.

Flights of the X-47B UCAS

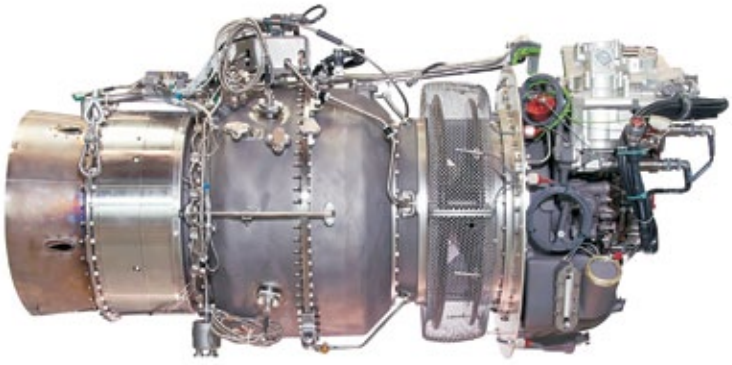
Less than a month after first flight of the US Navy's X-47B UCAS-Demonstration aircraft, flight test engineers from Northrop Grumman Corporation and the Navy have successfully completed the aircraft's second and third flights, conducted Edwards Air Force Base and mark the beginning of envelope expansion during which the test team will begin proving that the tailless aircraft can perform safely over a broad range of altitudes, air speeds and operating weights.

During the X-47B's 39-minute second flight on 1 March 2011, the aircraft flew to an altitude of 7,500 feet at speeds up to 200 knots. During its 41-minute third flight on 4 March 2011, the aircraft reached an altitude of 7,500 feet and a top speed of 180 knots.

Turbomeca Ardiden 3G engines on Ka-62

Russian Helicopters, JSC and French Turbomeca (Safran group), have signed contracts for the supply of at least 308 Turbomeca Ardiden 3G turbo shaft engines to be installed on the updated Ka-62 helicopter, which follows the 'protocol of intentions' contract signed on 21 February 2010.

Ardiden 3 line engines are designed for 6-8 tonne helicopters, whose modular design and dual channel FADEC make it "highly reliable and easy to use, with the benefit of an exceptionally low fuel consumption".



Russian Helicopters is expanding its range of light and medium multirole twinengine helicopters intended for multiple missions such as transport, EMS, aerial work and surveillance.

Sweeping review into cost of F-35

Understanding the drivers behind a projected $442 billion bill to operate and sustain the US-owned Lockheed Martin F-35 fleet will be the focus of a sweeping new review with the F-35 joint programme office to complete a detailed design review of the stealth fighter's logistics requirement, started Vice Adm David Venlet, F-35 programme executive officer.

A key target is reducing the $442 billion estimate at fiscal year 2002 inflation values, which was calculated by the US Naval Air Systems Command in late 2009. This estimated that the F-35 will cost $30,700 an hour to fly, or 40% more than the legacy Boeing F/A-18A-A and McDonnell Douglas AV-8B.

Meanwhile, Lockheed has delivered its initial proposal for the 35-aircraft fifth LRIP lot, starting a potentially months-long negotiating process. This comes as the programme's development contract is also being renegotiated, after running billions of dollars over cost.

No production in Saudi for Typhoons

BAE Systems have revealed major changes proposed to the Saudi *Al Salaam* programme to supply 72 Eurofighter Typhoons for the Royal Saudi Air Force. Details of the alterations to the contract have yet to be finalised by Saudi Arabia but are believed to have been caused by disagreements over the location of the production facilities and work share. As originally conceived, 48 Typhoons were to be assembled at a new facility in Saudi Arabia, but are now likely to be produced at the existing production line at Warton, in the UK and, instead, a maintenance and upgrade centre would be established in Saudi Arabia.

Second Sukhoi T-50 flown

Second prototype of the Sukhoi T-50 fifth generation fighter (T-50-2) made its maiden flight in March 2011 flown by Sergei Bogdan. Images of the aircraft reveal some differences between the two prototypes. T-50-2 has a pair of search and track devices, one in front and another behind the cockpit, part of its electro-optical suite. The rear segment of the canopy lacks the upper longitudinal metal frame visible on the first aircraft.

Mikhail Pogosyan, Chief of Sukhoi has announced that "during 2011, three test aircraft will join the test programme", so apart from the T-50-2, T-50-1 will be joined by -3 and -4. The two additional aircraft are due to be equipped with some of the mission systems planned for the production examples, including the basic variant of the Sh121 radar with the forward antenna, but not the side antennas. The comprehensive suite of avionics and all equipment will be fitted in T-50-5 and T-50-6, scheduled to join the test programme in 2012.

MBDA demonstrates VL MICA proficiency

On 13 April 2011, at the French DGA-Essais Missiles test centre in Biscarosse in South West France, a VL MICA missile launched from a ground based vertical launcher and controlled by a Tactical Operations Centre (TOC) developed by MBDA, intercepted a manoeuvring target flying at medium altitude and at a range greater than 15 km.

The objective of the test firing was to demonstrate the capabilities of the VL MICA system against precision weapons launched from a stand-off range. Organised by MBDA with the support of various DGA (*Direction Générale de l'Armement*) teams, the test was a follow on from the evaluations which have just been concluded by the French Air Force as part of their SALVE (*Sol-Air à Lancement VErtical*) technical demonstration programme.

The VL MICA was equipped with an active electromagnetic seeker produced by Thales. As in previous evaluations, this firing was carried out using a *Conteneur Lanceur Autonome* (Autonomous Launch Container) conforming to a standard series production model.

GE Aviation launches CF6 TRUEngine Programme

GE Aviation is launching the CF6 TRUEngine programme which expands the TRUEngine designation from CFM56 engines to GE's engines beginning with CF6. As part of the launch, GE has awarded TRUEngine designation to Nippon Cargo Airlines' (NCA) fleet of 43 CF6-80C2 engines that power its Boeing 747 fleet. To qualify for TRUEngine status, the engine configuration, overhaul practices, spare parts and repairs used to service an engine must be consistent with GE or CFM requirements. In addition, all maintenance must comply with GE- or CFM-issued engine manuals and other maintenance recommendations. The qualification data is obtained through a combination of fleet operations and maintenance records. The TRUEngine designation is available to the 4,000 CF6 engines in service if they meet the criteria.

Record number of Raytheon–evolved SeaSparrow Missiles

Raytheon Company's Missile Systems business delivered a record number of Evolved SeaSparrow Missiles in 2010, with 366 ESSMs in 2010 which were more than double of the previous year's total. With more than 200 at-sea firings, ESSM is a medium-range, all-weather, semi-active radar-guided missile used in surface-to-air and surface-to-surface roles by the US and currently deployed by more than 11 international operators. ESSM represents more than four decades of technology and design improvements by a 43-year international cooperative partnership composed of 12 nations, 10 of which employ ESSM. The programme continues to conduct studies to identify improvement opportunities required for ESSM to pace the threat with advanced capabilities.

IAI unveils new advanced Airborne INS/GPS Navigation System

Israel Aerospace Industries (IAI) Tamam Division (IAI/TAMAM) have unveiled its new advanced Airborne INS/GPS Navigation System TNL-16GI, based on Ring Laser Gyro technology. The TNL-16GI is a new member of TAMAM's TNL-16 Airborne Inertial Navigation Systems family, based on proven products and technology. The new TNL-16GI is intended for use in fighters, fixed wing aircraft, helicopters, Unmanned aerial vehicles (UAVs) and intelligence & targeting systems, where high accuracy navigation is needed.

TNL16-GI incorporates Tamam's advanced and highly accurate Ring Laser Gyroscopes and Accelerometers. An embedded GPS is integrated with the navigation algorithm, to provide precise navigation solution.

Eurofighter Typhoon adds more air-to-ground capabilities

The Eurofighter's air-to-ground capabilities were further improved when partners Cassidian Spain achieved the first EGBU-16 precision guided munition avionic release, which came immediately after the Paveway IV release carried out during February in the UK. These trials saw both bomb types being successfully released from Eurofighter aircraft and focused on the functional integration into the weapon system. The EGBU-16 is the selected dual mode precision guided munition for Germany, Spain and Italy whereas the Paveway IV precision guided bomb is the choice for the UK. Included in the broad-ranging Phase 1 Enhancement (P1E) programme, both weapons improve the all weather precision attack capability on the Typhoon.

The Typhoon has been autonomously air-to-ground capable since 2008 when the RAF successfully integrated the Paveway laser guided bombs with the Lightning III laser designation pod on to its Typhoon fleet. Demonstrating an unrivalled precision, a combination of weapons have been tested during several exercises both in the UK and abroad, confirming the built-in multi-role capability of the Typhoon.

Cobham systems for Eurofighter Tranche 3A

Cobham will provide Chaff and Flare Defensive Aids Systems for the Eurofighter Typhoon fighter Tranche 3A programme, under a contract worth Euro 21 million. Deliveries will begin in mid 2012 to sustain production until the end of 2014. The Eurofighter's Chaff and Flare Defensive Aids System comprises dispensers which release infrared flares to deflect heat seeking missiles and chaff to disrupt radar guided missiles. The Cobham-suppliedsystem is an aircraft baseline requirement, integral to the defensive capabilities of the Eurofighter.

Honeywell turboprop engine delivers 40 percent more power

The European Aviation Safety Agency has certified Honeywell's TPE331-12JR turboprop engine for the Cessna Caravan, enabling European operators to take advantage of the engine's improved power, lower cost, enhanced fuel efficiency, and low noise levels. Texas Turbine Conversions, a major Honeywell partner in this market have helped drive this important milestone. With the TPE331-12JR engine, operators experience up to 40-percent more power than the production engine. They also save as much as $40 per hour in operations costs due to longer maintenance intervals, fewer lifecycle-limited parts and better fuel efficiency when compared to the standard OEM engine. The engine also passes Germany's stringent maximum fly-over noise level of 78 dB(A).

Raytheon SLAMRAAM intercepts targets in test firings

Raytheon's SLAMRAAM (Surface Launched Advanced Medium Range Air-to-Air Missile) system successfully destroyed an unmanned aerial vehicle target and intercepted a cruise missile target at White Sands Missile Range, N.M. The limited user test-firing data will be used to validate key system capabilities and potential enhancements in addition to providing operational assessment.

The primary objective of this series of tests was to demonstrate soldiers' ability to operate the system in a tactical environment. In addition to manoeuvering and emplacing the system, the soldiers had to demonstrate the ability to properly operate the system to detect, identify, track, engage and destroy both types of threat. The US Department of Defence recently announced that SLAMRAAM would be funded through development and testing and will maintain an emergency operational capability.

SELEX Galileo takes a leading role on NATO AGS

The NATO Alliance Ground Surveillance (AGS) is the most ambitious transatlantic, co-operative NATO programme, which will provide a new Intelligence Surveillance-Reconnaissance (ISR) capability specially suited to modern operational scenarios. SELEX Galileo plays a leading role in the European part of the programme alongside EADS Cassidian.

SELEX Galileo is the programme's industrial lead in Italy and will also be responsible for cooperative activities with industrial partners from participating nations Romania and Bulgaria. The Company will take a leading role in the mission operation support and management as well as mission communications, the latter in collaboration with SELEX Communications, a fellow Finmeccanica company. SELEX Galileo's role as Italian industry lead is especially relevant as the AGS programme's main operating base will be sited at the NATO facility in Sigonella, Sicily.

Thales unveils Top Series NextGen System

Thales has unveiled the complete system architecture of the new Top Series system, whose advancements push the boundaries of previous IFEC systems with exceptional system performance, solid reliability and optimized flexible design.

The TopSeries Next Generation system, now called TopSeries AVANT, is a new Thales product and a revolutionary system that combines the strengths of earlier generation systems with advanced technologies such as high definition video, solid state hard drives, and faster processors to create a passenger experience that is "a genuine revelation". The new system is a seat-centric solution that underscores the importance of refining the passenger's environment making it more functional, comfortable and appealing to the eye. Recently, an undisclosed airline selected the TopSeries AVANT for installation on its future A350 XWB aircraft.

First production contract for Thales's LMM

Thales and the UK Ministry of Defence (MoD) will 're-role' previously contracted budgets to facilitate the full-scale development, series production and introduction of the Lightweight Multi-role Missile (LMM) into service for UK Armed Forces.

Specific activities covered under this contract amendment include the design, development and qualification of the laser beam rider version of LMM; production of an initial delivery quantity of 1,000 LMM; and precision-guidance system that will

deliver a highly accurate performance against static and mobile targets and with low-collateral damage.

The LMM will be integrated as the Future Anti-Surface Guided Weapon Light FASGW(L) missile on the new Wildcat Lynx helicopter platform under a parallel programme with the UK MoD, and will also have a ground-to-ground and air-launched role.

Comac steps up ARJ 21 flight testing programme

Comac is steadily ramping up flight testing for its ARJ21 regional jet programme as it closes in on a target to make first delivery by the close of 2011. Aircraft 101, one of four aircraft in the AR121 test fleet, completed static testing of the ARJ21 on 12 April 2011 after three and a half years. The completion of static testing is a vital step in ensuring that the ARJ21 receives certification from the Chinese authorities before its first delivery to launch operator Chengdu Airlines by the end of the year. "Completion of the static testing is extremely, significant. It is the first time that such testing is completed under the requirements of CCAR25 certification in China," said Comac's deputy general manager Luo Ronghuai.

Aircraft 104 has been undergoing icing tests and extensive flight trials in Uromqi since 27 March 2011. Earlier in April, aircraft 102 underwent engine tests in Gansu province.

RECARO

MBDA chooses Sagem's new Matis MP3 sight

The new Matis MP3 optronic aiming sight offered by Sagem has been chosen by missile manufacturer MBDA to modernise the French army's Mistral surface-to-air firing posts.

The contract covers the development and production of the sight and its new thermal imager for 186 launching stations, within a scope of a modernisation contract that French defence procurement agency DGA has awarded to MBDA, prime contractor for the Mistral missile. Sagem also supplies the infrared seeker for the Mistral surface-to-air missile.

First flight of the T-346A

The first Alenia Aermacchi M-346 aircraft for the Italian Air Force (ITAF) had a successful first flight on 31 March 2011. The ITAF has designated the aircraft as the T-346A.

Flown by Chief Test Pilot Quirino Bucci, the aircraft took off from Venegono, the home airfield of Alenia Aermacchi and lasted 40 minutes. The T-346A reached an altitude of 15,000 ft., covering the planned flight envelope in terms of speed, angle of attack and load factor. The flight also included manoeuvres to assess aeromechanical handling of the aircraft and systems

functionality. The ITAF T-346A is the first M-346 series production aircraft completed. The Alenia Aermacchi site in Venegono has highly-automated production line capable of delivering up to 48 aircraft per year.

The remaining aircraft for the Italian Air Force are already being built on this new assembly line, and production of the 12 aircraft ordered by the Singapore Air Force is also underway.

Saab airborne self-protection systems

Saab has received an order for airborne Electronic Warfare self-protection systems, worth Euro 28 million. Development and production of the self-protection systems (named IDAS, Integrated Defensive Aids Suite family) takes place at Saab in Centurion, South Africa and in Jarfalla, Sweden. Deliveries will be made 2012-2016. Saab's family of Integrated Defensive Aids Suite (IDAS) are suited to enhance the survivability of aircraft in sophisticated, diverse and dense threat environments, by providing a multi-sensor warning system i.e. radar, laser and missile approach (passive UV); integrated with the lightweight pyrotechnic dispensing system (BOP/L).

The system is installed on the Sukhoi Su-30MKM, C-130B, H and L100, Saab 2000, Eurocopter Super Puma, NH90, A109, A129, Agusta-Westland Super Lynx 300, Boeing CH-47 Chinook, Eurocopter Cougar, Denel Rooivalk, Denel Oryx and is ordered for HAL's Advanced Light Helicopter Dhruv.

Boeing Phantom Ray flies

Boeing's Phantom Ray unmanned airborne system (UAS) carried out its first flight on 27 April 2011 at NASA's Dryden Flight Research Centre at Edwards Air Force Base, California. The 17-minute flight followed a series of high-speed taxi tests in March that validated ground guidance, navigation and control and verified mission planning, pilot interface and operational procedures. Phantom Ray flew to 7,500 feet and reached a speed of 178 knots.

Successful firing test of AASM with laser terminal guidance

The French defence procurement agency DGA has performed a demonstration firing test of the AASM modular air-to-ground weapon against a land target moving at high speed. The test was carried out at the DGA's missile test range in Biscarosse by a production Rafale fighter deployed by the DGA's flight-test centre in Cazaux, the AASM fired from an extreme off-axis angle (90°) at a range exceeding 15 kilometers. The impact was at a very low angle, against a moving target represented by a laser spot generated by a ground illuminator mounted on a turret, to simulate a vehicle moving at a speed of 80 km/h.

Boeing JDAM contracts

Boeing has received contracts totaling $100 million for two types of Joint Direct Attack Munition (JDAM) kits. The US Air Force has awarded a $92 million contract for more than 4,000 Lot 15 JDAM kits on 14 March 2011, which follows an $88 million contract awarded in January 2011 for the first 3,500 tail kits in the same lot. JDAM is a low-cost guidance kit that converts existing unguided free-fall bombs into near precision-guided weapons. In addition to conventional JDAM and Laser JDAM applications, the JDAM Extended Range configuration is designed to increase the stand-off range to approximately 40 miles.

Sikorsky achieves 300 MH-60 Seahawk helicopter production milestone

Sikorsky have produced 100 MH-60R and 200 MH-60S Seahawk multi-mission helicopters for the US Navy, which Service has accumulated 370,000 flight hours on MH-60S aircraft since operations began in 2002, and more than 90,000 flight hours for the MH-60R helicopter since 2006. MH-60S aircraft performs roles previously carried out by CH-46D, UH-3H, HH-1N and HH-60H helicopters including transport of supplies and sailors between ships, search and rescue, protecting Navy ships with air-to-surface missiles, and as a future mission will hunt for mines at sea. The MH-60R aircraft, with radar, acoustic sonar, sophisticated communications links, torpedoes and missiles, combines the anti-surface and anti-submarine warfare roles performed by the SH-60B and SH-60F Seahawk helicopters.

SELEX Galileo contracts

SELEX Galileo has been awarded contracts worth more than Euro 36 million on integrated logistic support work relating to a number of programmes and systems. These include the Company's Grifo radar, the Eurofighter Typhoon, simulators and the Mirach aerial target drone. Of these contracts, 14.5 million Euros were awarded to SELEX Galileo to support two international air forces's Grifo radars. The Grifo is one of SELEX Galileo's most successful products, with more than 450 sold and a combined total of more than 100,000 hours in-flight. Other contracts awarded include those to provide logistic support services for the Mirach 100/5 aerial target drone. More than 600 Mirach systems have been supplied to date, and the system is currently being operated by several countries including UK, Italy, France and India.

Cassidian and TAI cooperate on the Talarion

A Memorandum of Understanding (MoU) has been signed between Cassidian on behalf of EADS Deutschland GmbH and Turkish Aerospace Industries, Inc. (TAI) to establish a close collaboration in the Talarion programme, which is the European programme for a next-generation Medium Altitude Long Endurance (MALE) advanced Unmanned Aerial System (UAS) to fulfill the requirements initially placed by France, Germany and Spain for future unmanned long endurance surveillance and reconnaissance missions. The novel aspect of this approach is a modular design and the integration of the UAV in a network-enabled operations scenario.

The prototype will be the first development standard following an interactive design approach. First flight of the prototype is scheduled for 2014.

Rockwell Collins systems for Turkey's Anka UAV

The Rockwell Collins' Athena inertial navigation system and global positioning system (INS/GPS) has been selected to provide guidance and navigation for the Anka Medium Altitude Long Endurance (MALE) UAV, developed by Turkish Aerospace Industries (TAI).

Under the contract, Rockwell Collins will provide TAI with its Athena 511 integrated INS/GPS and air data sensor suite system. The Athena 511 is a high precision, miniaturised solution, weighing six pounds and specifically designed for high-performance UAV applications. Unveiled at the Farnborough Air Show in July 2010, the Anka was developed for day and night real-time image intelligence for surveillance, reconnaissance, fixed/moving target detection, identification and tracking missions. The MALE UAV can reach 30,000 feet with endurance of 24 hours.

IRKUT Corporation: results and plans

JSC IRKUT Corporation published financial statements for 2010 and the first quarter of 2011 as part of its quarterly report. The company's revenue at the end of 2010 (compared with 2009) increased by 28% and amounted to approx $ 1672 million. Gross profit increased after the revenue and amounted to approx $ 644.6 million, which is 30% higher than 2009 results.

Classified as a highest-level system integrator, the Corporation is positioning itself in the various market niches including heavy fighters, jet trainers, light and medium class unmanned aerial systems and military freighters and amphibian aircraft.

Sukhoi Su-30MKI of the Indian Air Force.

The Corporation will continue delivery of the Su-30MKI/MKMs but aiming towards business development, the Corporation will extend its presence in the market of commercial aircraft components, as a subcontractor to foreign and domestic manufactures. The IRKUT Corporation now has a number of prominent design and manufacturing companies: Irkutsk Aviation Plant, Beriev Aircraft Company, Yakovlev Design Bureau, BETA AIR Company and others.

The IRKUT Corporation's main products remain the Su-30 family, the Corporation being a prime contractor in manufacturing Su-30MKI multi-role fighters for the Indian Air Force. Under a product diversification programme, the Corporation is also developing and manufacturing Be-200 multipurpose amphibians, Yak-130 combat training aircraft, unmanned aerial vehicles and components for Airbus passenger airliners. IRKUT has launched development of the MC-21 airliner.

Dassault introduces Falcon 2000S

Dassault has launched the Falcon 2000S, introducing this large cabin aircraft to the 'super mid-sized business jet market', offering category-leading payload, range, performance and efficiency. The 3,350 nm Falcon 2000S will feature inboard slats, high-Mach blended winglets, a new generation PW308C engine that produces fewer emissions, an entirely new BMW Group DesignworksUSA interior and redesigned cockpit aesthetics along with the next-generation EASy II flight deck. It is expected to be certified in the end of 2012 with deliveries beginning in early 2013.

With full fuel, the Falcon 2000S will have the largest payload in its class at 1,850 lbs; a range of 3,350 nm (standard aircraft), will climb directly to 41,000 feet in 19 minutes, reach a mid-cruise altitude of 45,000 feet and offer a certified ceiling of 47,000 feet.

TAP Portugal and CFM in million flight hour milestone

TAP Portugal and CFM International celebrated the achievement of the one million engine flight hour milestone by the airline's fleet of CFM56-5C engines. TAP took delivery of its first CFM56-5C-powered Airbus A340 in late 1994 and today operates a fleet of four of the long-range, four-engined aircraft. The airline also operates nearly 40 CFM56-5-powered single-aisle A320 family aircraft. TAP Portugal operates routes to more than 75 destinations in 34 countries throughout Europe, Africa, North America, and South America.

"Mind is the first defence"

Elettronica Celebrates 60 Years

Recalling six decades of its existence, Elettronica celebrates tradition and innovation, building upon an approach of flexibility and an indispensable philosophy to achieve excellence in the Defence Electronic sector. The Company's strength lies in maintaining a broad vision, encompassing the operational, technological and industrial spheres, optimising every step, from the identification of market requirements to the manufacture of leading edge products.

Going back to its roots, from the foundations in 1951, Elettronica established itself as a leader among Companies designing and manufacturing Electronic Defence Systems within a few years. Over the last 60 years their systems have equipped numerous air, naval and ground platforms of both national and international armed forces.

In 1951, the company initiated collaborations with the Italian Contraves Company and the Turin-based Sielte. The latter subsequently released part of its plant in Rome to this newly born industrial concern, in Via Tiburtina 650 where, on 15 May 1955, Elettronica transferred its head office. In a very short time the company was awarded several major contracts that enabled it to begin an important research and experimental phase which in turn enabled it to develop increasingly advanced equipment to meet new market needs. This period also witnessed collaboration with the Italian Armed Forces for the supply of underwater equipment (Sonar) to the Italian Navy, IFF/SIF systems to the Air Force and special transformers and modules for several on-board equipment of the F-104 and G.91 fighters. Radar jammers, produced under Italian MoD procurement, were also supplied to the Armed Forces of West Germany, France, Holland and South Africa.

In the late 1960s, Elettronica became a major industry leader in the European Defence market and became Elettronica S.p.A. (limited company). 24 June 1972 saw the grand opening of the current plant on the very same street where Elettronica S.p.A. still maintains its head office.

In the 1970s came important recognition in the international field, with the development and production of ECM self-protection systems for Italian and German Air Forces, with the development and production of Radar Warning Receiver (RWRs) and self-protection system for the Tornado MRCA.

The 1990s witnessed profound changes in industrial structure of the aviation sector, with numerous mergers between industrial groups and the formation of new business groups for international programmes.

Elettronica responded to these changes by participating in major European Consortia, including Eurodass, dedicated to the development of Defensive Aids Sub-System (DASS) of the Eurofighter

Typhoon and SIGEN, for the study and the subsequent development of a Defence System for the protection of *Horizon*-class frigates.

In 1996 the Company signed an agreement with the French company Thompson CSF, (today's Thales), with which it co-pursued contracts for the development and production of defence equipment for Mirage 2000-9 aircraft of the United Arab Emirates and other airborne platforms, as well as naval products..

The new Millennium saw the combination of both tradition and strengthening of its existing competitive position through the launch of new initiatives both at market/product and organisational levels. The new market approach was characterised by a new business model whose key points were international cooperation and the setting up of local activities in key countries.

Elettronica GmbH's activities in Germany were consolidated through its participation, as a German concern, in work-shares of European cooperation programmes and in product lines in the Ground Elint field. In 2003 Elettronica acquired a minority share in a small US company, LNX, managing supply-chain operations with US suppliers and a joint-project for advanced technological components. In recent years, we also participated in important Joint Ventures with two other companies, AEDS and ELTBAT, based in India and in the United Arab Emirates, respectively.

Electrical assembly laboratory in 1980.

The Products

The products manufactured by Elettronica can be divided into passive and active systems for air, naval and ground platforms, covering the radar, infrared and, in recent years, communication and cyber warfare fields as well.

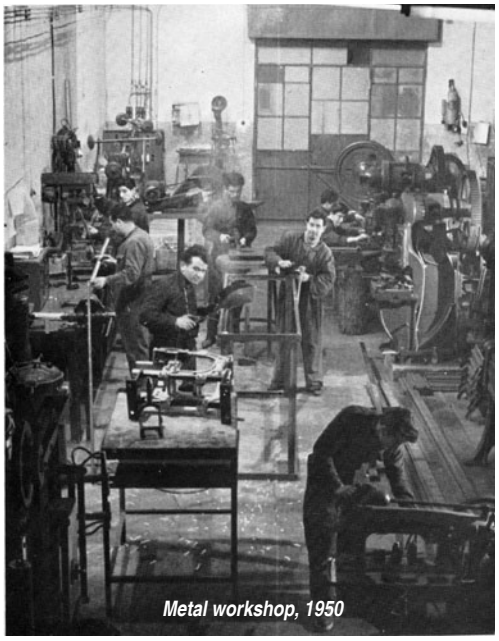
The Radar Band is the historical core business, the area where ELT prides itself on having extensive experience, which is recognised worldwide. These include ESM (Electronic Support Measures), ELINT (Electronic Intelligence), RWR (Radar Warning Receiver) and ECM (Electronic Countermeasures) system.

President and CEO Enzo Benigni.

The infrared field has been growing due to the proliferation of threats such as insidious MANPADS (Man Portable Air Defence Systems) missiles based on 'Passive IR Tracking Sensors', which have led Elettronica to develop an advanced IR Jammer that operates in the E/O spectrum: ELT/572, 'Directional IR Countermeasures' (DIRCM).

Elettronica has consolidated experience in the COMM/EW field. Since the 1980s, ELT has been a pioneer in producing 'Direction Finding Systems' based on interferometric technique. The COMINT (Communication Intelligence) equipment performs analyses of emissions of interest, revealing aspects to the finest detail. Moreover, the ability to produce ELINT and COMINT equipment enables Elettronica to offer Systems that incorporate both features, providing an increased coverage of the overall RF spectrum of the operational scenarios.

'Cyber Security' encompasses surveillance, analysis and continuous tracking of the Electronic Defence threat operating in the COMM/EW domain against distributed net-centric systems, for 'Homeland Security and Force Protection' applications of the military structures deployed in operational theatres. On the other hand, 'Cyber Attack' involves provision of countermeasure solutions aimed at deceiving the enemy's communication networks or reducing their effectiveness in coping with intrusion missions even at multiplatform levels.



Metal workshop, 1950

Working Philosophy

Elettronica's working philosophy focuses primarily on the customer: meeting their needs represents a distinctive feature of its work, because of the ability to interpret, in an interactive way, their most diverse requirements and to translate them into technical specifications in a totally self-sufficient process that covers applied technology, production and logistic aspects.

The Company provides customers with support and assistance during the entire product lifecycle, both to ensure optimum employment in terms of performance flexibility (Operational Support), and to maintain high operational availability (Logistic Support).

ELT provides a range of services and products (pre and post-mission) that enhance the equipment's functionality through several measures involving generating, upgrading, and management of the Electronic Defence Database, preparation of simulation modules for Electronic Defence equipment mission planning, briefing and debriefing of Electronic Defence missions, simulation using mathematical models for the evaluation of Electronic Countermeasures effectiveness as well as in training using simulation.

Elettronica also provides integrated logistic services in order to maintain product readiness, reduce the recovery time of functionalities and to prolong operational life. The logistic support is carried out in myriad ways through technical assistance for the recovery of product functionalities, retrofit to keep the equipment constantly updated, supply of diagnostic tools and preparation of manuals and refresher courses Elettronica's excellence in design, development and production of Electronic Defence systems enables it to cover all aspects of the defence sector, from individual stand-alone equipment, to integrated Systems and programmes like HODHOD and IMEWS, and is involved in several platforms of international importance, including the EH101, NH90, Eurofighter Typhoon, Tornado, C-27J, C-130J, Horizon, FREMM and Baynunah

proven by the development of various key items like advanced interception and countermeasures techniques, integrated and multifunctional electronic defence systems, electronic warfare management, electro-optic countermeasures systems, active phased array, digital receiver and waveform synthesiser (draws) and broad band digital receivers.

Human Resources

Most important for Elettronica is its human resources. "Mind is the first defence" is the motto chosen by Elettronica to give emphasis to its greatest asset: its staff. The collection of experiences, expertise and professionalism of its employees, has always been the key to success: a dedicated team of 750 people who work hard to come up with the most appropriate responses in a continuously changing market.

Clean Room, 1990.

Elettronica has always placed particular emphasis on 'innovation', both in terms of product architectures and enabling technologies. It adheres to this principle through the continuous evolution of its product architectures and related enabling technologies which allows them to achieve constant technical excellence, which is a key element to prevail in the area of Electronic Defence. It is this very process that has enabled the Company to become a market leader,

The Company's integrated management system and Human Resources development policy, centered on the model of distinctive skills and leadership, constitutes an essential tool for achieving and consolidating both competitiveness and business results, in order to maintain and increase the company's reservoir of knowledge, as well as to recognise individual and collective contributions, guaranteeing professional development within the organisation.

50 years of space flight

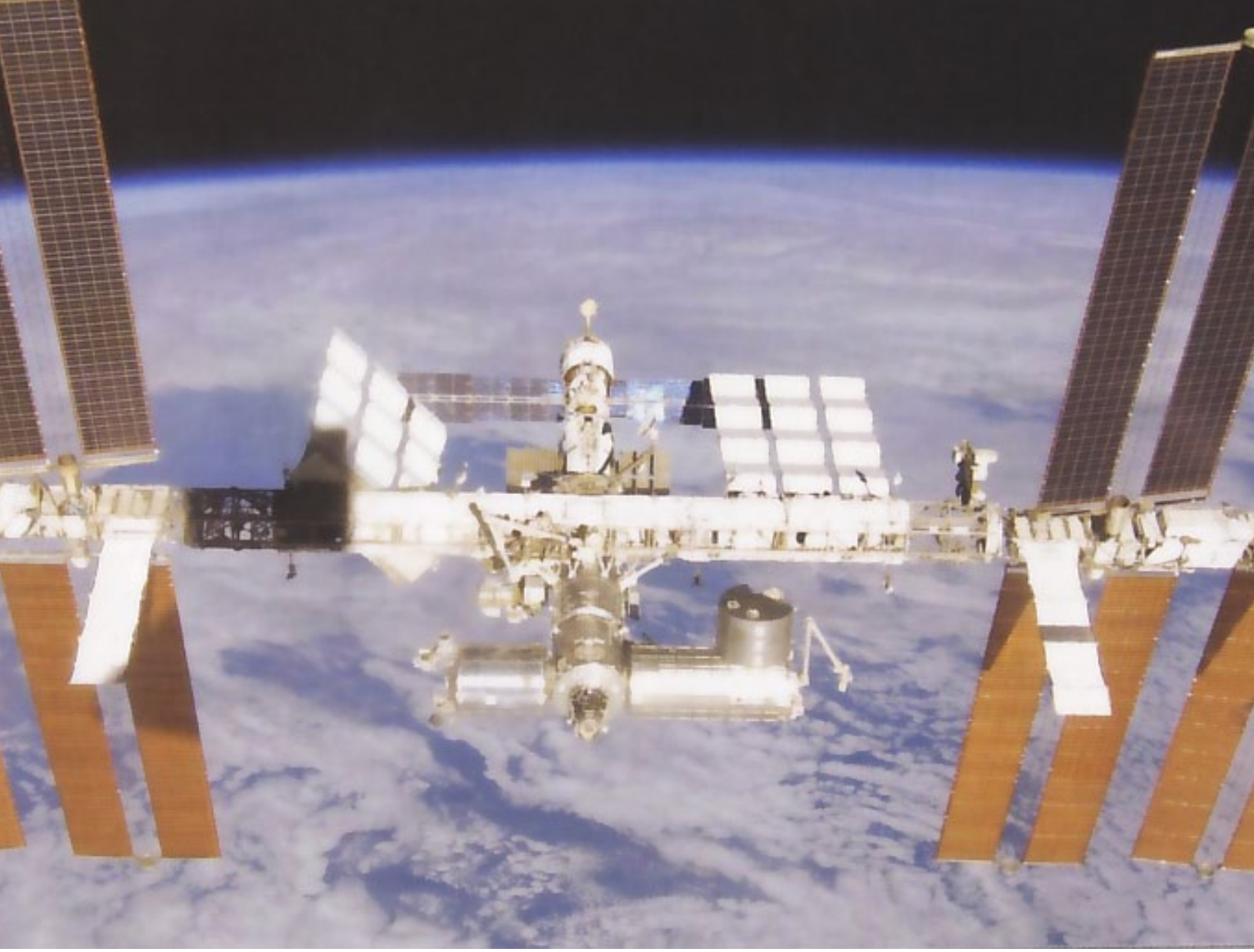
Half a century back, a small satellite which was the first to be built by human beings, was launched into near earth orbit and began to emit beeps, thus announcing that the Space Age had dawned. This was the Soviet Union's Sputnik 1, a 23-inch (58-centimeter) wide sphere that resembled a silver beach ball with antennas which, on 4 October 1957, was a small step for man but a gigantic one in the known universe.

Far larger and increasingly sophisticated satellites and space vehicles followed Sputnik, some with creatures aboard and others with scientific instruments, and so it was only a matter of time before humans catapulted themselves into that final frontier above the Earth.

However, it was the Soviet Union's successful launch of cosmonaut Yuri Gagarin on 12 April 1961, which precipitated the "space race" with the United States which other superpower of the time determined to send astronauts to the moon and back. On 20 July 1969, the first humans were on the moon, Apollo 11 astronauts Neil Armstrong and Buzz Aldrin. This was the beginning of a whole new epoch in human civilisation. But more Americans followed, including astronaut Edgar Mitchell who served as lunar module pilot during NASA's Apollo 14 mission, America's third manned moon landing, in 1971.

Sputnik's first flight and the advancements that led to Gagarin's launch and NASA's Apollo landings marked a pivotal point for human exploration.

Human space exploration was initially driven by political pride and technological prowess, not pure science and wonder. "What motivated us…to go to moon was the advancing nature of the Soviet Union with Sputnik," said former Apollo 11 astronaut Buzz Aldrin – the second man to walk on the lunar surface. The Cold War between the two superpowers was well underway by then but on 17 July 1975, two spacecraft from different nations, former rivals the Soviet Union and the U.S.A. linked in space for the first time during the Apollo-Soyuz mission. Three spaceflyers -- Russian cosmonauts Fyodor Yurchikhin, Oleg Kotov and U.S.



astronaut Clayton –stayed in orbit aboard the International Space Station, although none of them were even born the day Sputnik launched.

Since Yuri Gagarin's historic first flight, 462 men and women from many parts of the world have been launched into space and back but 21 tragically lost their lives aboard spacecraft on Earth or in flight.

NASA is once more reaching out to the moon, after retiring its three remaining space shuttles and reviving the capsule-based spacecraft concept from its Apollo era to ferry astronauts back to the lunar surface by 2020.

Apollo 12 lunar module pilot Alan Bean whom *Vayu* first had the privilege of meeting in Bombay in 1976 (see *Vayu III/1976*) has recently said "We had the potential, when we got back from the moon in the Apollo days, to start building the technology…to get on with it and go to Mars…I thought in my lifetime I might see people on Mars; certainly I would see them training and getting ready to go" but stressed that NASA will likely need more definite funding if it is to succeed in returning astronauts to the moon by 2020, let alone reaching out beyond lunar exploration.

Gagarin, a poster boy for Soviet space travel

The first cosmonaut Yuri Gagarin, a carpenter's son with a military bearing and an easy smile, was the ideal candidate for the Soviet authorities to send on the pioneering flight.

Today he remains one of the few idols of the Communist era whose popularity has not waned since the fall of the Soviet Union. In 2010, he topped a poll of the most iconic national figures of the 20th century, with his popularity highest among those aged 18-24.

Gagarin's peasant origins undoubtedly worked in his favour in the selection process for the first cosmonaut, between him and his closest rival, Gherman Titov,

Launch of Yuri Gagarin and Vostok 1 on 12 April 1961 opened the era of human spaceflight Cosmonaut Yuri Gagarin became the first human to journey into outer space by launching to orbit aboard Vostok 1.

who came from an educated family of teachers.

Yuri was born in 1934 to a couple who worked at a collective farm and had three other children. In 1941, the Nazis occupied their village close to Smolensk in western Russia, and he was unable to go to school until 1943.

Passionate about aeroplanes from childhood, Gagarin joined a flying club at the age of 20 and later trained as a fighter pilot at a military training school in the town of Orenburg in the Ural mountains. One day in 1959, the call went out for air force volunteers to train to fly a "new type of apparatus" and it turned out that Gagarin's small stature, around 1.60 metres (five foot three inches), was an advantage. The 20 volunteers began a year-long secret training in Moscow and the surrounding region. They were later whittled down to 12 and then to six, including Gagarin. In 1961, Gagarin was picked for the first manned mission to space, with the date fixed for April 12. At 27, he was already married to a nurse called Valentina, who was pregnant with their second daughter.

The mission was perilous for Gagarin. Out of 48 dogs sent into orbit, 20 had died. Nevertheless "everyone dreamed of being in his place". When he returned to Earth and worldwide acclaim, Gagarin carried out his role with grace, witnesses said, recalling his disarming simplicity. Three months after the flight, he dined with Queen Elizabeth II and was said to have admitted candidly that he did not know which fork to use.

Stamps published to commemorate 50th anniversary of Gagarin's mission.

In 1968, Gagarin was allowed to return to flying, initially with a co-pilot.On 27 March 1968, while flying a small training plane, he crashed north-east of Moscow in an accident whose reasons are still unclear. The file on the investigation remains a state secret.

Marina Lapenkova

Rollout and erection of Vostok 1

The Astronauts of planet Earth

Fifty years ago, the first human Yuri Gagarin went into space. Since then, 520 men and women from 38 countries have been launched into space. Some profiles:

Jim Lovell of United States. Flights in 1965, 1966, 1968 and 1970

James "Jim" Arthur Lovell, Jr., the veteran of Gemini 7, Gemini 12 and Apollo 8 is a former NASA astronaut and a retired captain in the United States Navy, most famous as the commander of the Apollo 13 mission, which suffered a critical failure en route to the Moon but was brought back safely to Earth by the efforts of the crew and mission control. Lovell was also the command module pilot of Apollo 8, the first Apollo mission to enter lunar orbit. Lovell is a recipient of the *Congressional Space Medal of Honour* and the *Presidential Medal of Freedom*. He is one of only 24 people to have flown to the Moon, the first of only three people to fly to the Moon twice, and the only one to do so without making a landing. Lovell was also the first American to fly in space four times.

Vladimir Remek of Czech Republic. Flight in 1978

Vladimir Remek is the first Czechoslovak in space who flew aboard Soyuz 28 from 2 March to 10 March 1978, for seven days, 22 hours, and 17 minutes. After the flight, on March 16, 1978, he and Aleksei Gubarev, the other member of the crew, were awarded the title *Hero of the Soviet Union*. The asteroid 2552 *Remek* is named after him.

Miroslaw Hermaszewski of Poland. Flight in 1978

Miroslaw Hermaszewski is a retired Polish Air Force officer. He became the first (and to this day remains the only) Pole in space when he flew aboard the Soyuz 30 spacecraft in 1978. Together with Pyotr Klimuk he spent almost eight days onboard the Salyut 6 space station (from 27 June 1978 to 5 July 1978). During their time in orbit, they carried out geo-science experiments and photographed the Earth. They landed 300 km west of Tselinograd. He was awarded with the *Hero of the Soviet Union* title for that flight.

Georgi Ivanov of Bulgaria. Flight in 1979

Georgi Ivanov along with Soviet cosmonaut Nikolai Rukavishnikov, was launched into space as part of the Soyuz 33 mission from Baikonur Cosmodrome on 10 April 1979. Though take-off was smooth, the mission was a disaster, with severe damage of the engine preventing docking in orbit to Salyut 6 orbital station as it was initially planned. A premature return to Earth became the only possible decision for Ivanov and Rukavishnikov. Due to some additional technical problems landing was difficult to endure-more than 9Gs. When Soyuz 33 finally landed, it was 320 km southeast of Dzhezkazgan. It completed 31 orbits, and was in space for 1 day, 23 hours and 1 minute. Ivanov was awarded the title *Hero of the Soviet Union* on 13 April 1979.

Pham Tuan of Vietnam. Flight in 1980

Pham Tuan is a retired Vietnam Air Force aviator credited with becoming the first Vietnamese fighter pilot to shoot down a B52 in air-to-air combat, a feat many US aviators still insist was impossible. Tuân received numerous high State distinctions for his service, including the *Ho Chi Minh Order*. He also was awarded the *Order of Lenin* and the rare honour of being one of the few foreigners to receive the title *Hero of the Soviet Union*.

Pham, along with Soviet cosmonaut Viktor Gorbatko, rocketed into the annals of history from Baikonur Cosmodrome on 23 July 1980, on board Soyuz 37 en route to the Salyut 6 station. During his time in orbit, Pham performed experiments on the melting of mineral samples in microgravity. He also carried out plant experiments on azolla and photographed Vietnam from orbit for mapping purposes. He was in space for 7 days, 20 hours and 42 minutes. He completed 142 orbits, and was returned to Earth on 31 July 1980.

Jugderdemidiin Gurragchaa of Mongolia. Flight in 1981

Jugderdemidiin Gurragchaa was the first Mongolian and the second Asian in space. He was Mongolia's defence minister from 2000 to 2004. He was selected as part of the eighth Intercosmos programme on 1 March 1978. Gürragchaa, along with Soviet cosmonaut Vladimir Dzhanibekov departed from Baikonur Cosmodrome on 22 March 1981 and docked with Salyut 6. While in orbit, Dzhanibekov and Gürragchaa carried out experiments on earth science. After 124 orbits and 7 days, 20 hours and 42 minutes in space, Gürragchaa and Dzhanibekov landed 170 km southeast of Dzhezkasgan.

Rodolfo Neri Vela of Mexico. Flight in 1985

Rodolfo Neri Vela is a Mexican scientist and astronaut, the first Mexican and the second Latin-American, to have travelled to space. He was a Payload Specialist aboard the STS-61-B Atlantis mission, from 26 November to 3 December 1985. STS-61B launched at night from Kennedy Space Center, Florida, and returned to land at Edwards Air Force Base, California. During the mission the crew deployed the MORELOS-B, AUSSATT II, and SATCOM K-2 communications satellites, conducted two six-hour spacewalks to demonstrate space station construction techniques with the EASE/ACCESS experiments, operated the Continuous Flow Electrophoresis (CRFES) experiment for McDonell Douglas and a Getaway Special (GAS) container for Telesat, Canada, conducted several Mexican Payload Specialists Experiments for the Mexican government, and tested the Orbiter Experiments Digital Autopilot (OEX DAP).

At mission conclusion, Neri had traveled 2.4 million miles (3.8 million km) in 108 Earth orbits, and logged over 165 hours in space.

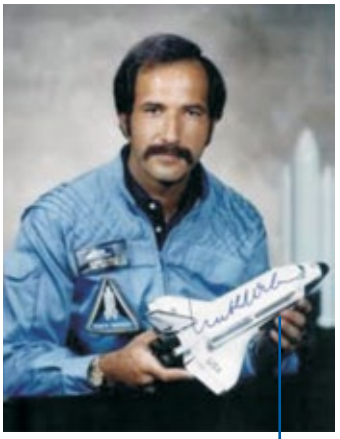
Rakesh Sharma of India. Flight in 1984

Rakesh Sharma is a former Indian Air Force test pilot, and Cosmonaut who flew in space aboard Soyuz T-11 as part of an Intercosmos Research Team. Sharma was the first Indian to travel in space. During the flight, Sharma conducted multi-spectral photography of northern India in anticipation of the construction of hydroelectric power stations in the Himalayas. In a famous conversation, he was asked by the then Prime Minister Indira Gandhi how India looked from space, to which he replied, "*Saare jahaan se achha Hindustan hamara,*" (our Hindustan, is the best of all).

He was conferred with the honour of *Hero of Soviet Union* upon his return from space. The Government of India conferred its highest gallantry award (during peace time), the *Ashoka Chakra* on him and the other two Russian members of his mission.

Sharma and his backup, Wing Commander Ravish Malhotra, also prepared an elaborate series of zero-gravity Yoga exercises which the former had practised aboard the Salyut 7. Retiring with the rank of Wing Commander, Rakesh Sharma joined Hindustan Aeronautics Limited (HAL) as a test pilot at its Nasik Division. He was later based at the National Flight Test Centre (NFTC) in Bangalore and worked on the indigenous Light Combat Aircraft programme, among others.

Wubbo Ockels of Netherlands. Flight in 1985



Wubbo Ockels is a Dutch physicist and a former ESA astronaut. Ockels flew as a payload specialist on the crew of STS-61A Challenger (30 October to 6 November 1985). STS-61A was the West German D-1 Spacelab mission. It was the first to carry eight crew members, (five Americans, two Germans and Ockels); the largest to fly in space and was also the first in which payload activities were controlled from outside the United States: from the DLR control centre in Germany. More than 75 scientific experiments were completed in the areas of physiological sciences, materials science, biology, and navigation. At mission conclusion Ockels had traveled 2.5 million miles in 110 Earth orbits, and logged over 168 hours in space.

A small planetoid, the 9496 Ockels, is named after Wubbo Ockels by the International Astronomical Union. The planetoid orbits the Sun between Mars and Jupiter.

Ockels is currently professor of *Aerospace for Sustainable Engineering and Technology* at the Delft University of Technology.

Muhammed Faris of Syria. Flight in 1987

Muhammed Faris, a Syrian military aviator, was the first Syrian and the second Arab in space. He was a pilot in the Syrian Air Force with the rank of a colonel and specialised in navigation when he was selected to participate in the Intercosmos spaceflight programme in 1985. He flew as Research Cosmonaut on Soyuz TM-3 to the Mir space station in July 1987, spending 7 days 23 hours and 5 minutes in space. He returned to Earth aboard Soyuz TM-2.

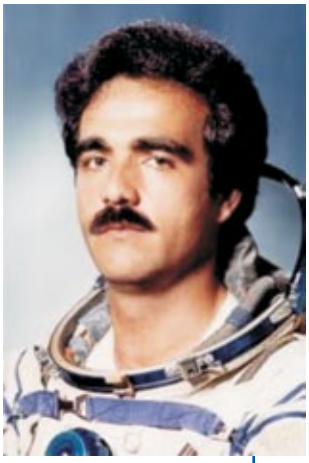
Muhammed Faris was awarded the title *Hero of the Soviet Union* on 30 July 1987. He was also awarded the *Order of Lenin*.

Sergei Krikalev of USSR/Russia. Flights in 1988, 1991, 1994, 1998, 2000 and 2005

As a prominent rocket scientist, Sergei Konstantinovich Krikalev has been veteran of six space flights and currently has spent more time in space than any other human being. He overtook Sergei Avdeyev's previous record for the career total time spent in space (747.59 days) during Expedition 11 to the International Space Station. Krikalev has logged a total 803 days and 9 hours and 39 minutes in space.

His missions include the Mir EO-4 (Soyuz TM-7), Mir LD-3 (Soyuz TM-12, Soyuz TM-13), STS-60, STS-88, Expedition 1 (Soyuz TM-31, STS-102) and Expedition 11 (Soyuz TMA-6). He was a member of the Russian and Soviet national aerobatic flying teams, and was Champion of Moscow in 1983 and Champion of the Soviet Union in 1986. For his space flight experience, he was awarded the title of Hero of the Soviet Union, the Order of Lenin, the French title of *Officier de la Légion d'Honneur*, and the new title of Hero of the Russian Federation. He also has been awarded the NASA Space Flight Medal (1994, 1998).

Currently, he has a desk job running the *Yuri Gagarin Cosmonaut Training Centre*, popularly known as 'Star City'.



Abdul Ahad Momand of Afghanistan. Flight in 1988

Abdul Ahad Momand is a former Afghan Air Force aviator who became the first Afghan in space when he spent nine days aboard the Mir space station in 1988 as a Intercosmos Research Cosmonaut. He belongs to the Mohmand tribe of the Pashtun ethnic group and was the fourth Muslim to reach space. Along with Commander Vladimir Lyakhov and Flight Engineer Valery Polyakov, Momand was part of the Soyuz TM-6 three-man crew, which launched at 04:23 GMT on 29 August 1988. Momand's inclusion in the mission was seen as a significant symbol during the Soviet occupation of Afghanistan. During his nine days stay on the Mir space station, Momand took photographs of his country and participated in astrophysical, medical and biological experiments.

Following the withdrawal of Soviet forces from Afghanistan, Momand fled to Germany in 1992 and applied for asylum, becoming a German citizen in 2003.

Toktar Aubakirov of Kazakhstan. Flight in 1991

Toktar Aubakirov is a retired Kazakhstani Air Force officer and was a parachutist and test pilot with the rank of Major General in the Kazakhstan Air Force before he was selected as a cosmonaut.

On 2 October 1991, he launched with Russian cosmonaut Alexander Volkov as flight commander, and the Austrian research cosmonaut Franz Viehböck in Soyuz TM-13 from the Baikonur Cosmodrome spaceport and spent over eight days in space. He was also the first Soviet citizen to go into space without being fully certified as a cosmonaut, as his flight was hurried forward (several commercial international cosmonauts were already booked, but the flight of a Kazakh cosmonaut was part of the Baikonur rental agreement between Kazakhstan and Russia). Among his scientific experiments was a test that led to a hardy new breed of Kazakh potato, named as the *Toktar* potato after him.

Helen Sharman of United Kingdom. Flight in 1991

Helen Sharman was the first Briton in space, visiting the Mir space station aboard Soyuz TM-12 in 1991 at the age of 27 years and 11 months. She was selected to travel in space on 25 November 1989, beating 13,000 applicants, after responding to a radio advertisement asking for applicants to be the first British astronaut. The programme was known as *Project Juno* and was a cooperative arrangement between the Soviet Union and a group of British companies.

The Soyuz TM-12 mission, which included Soviet cosmonauts Anatoly Artsebarsky and Sergei Krikalev, launched on 18 May 1991 and lasted eight days, most of that time spent at the Mir space station. Sharman's tasks included medical and agricultural tests, photographing the British Isles, and participating in an amateur radio hookup with British schoolchildren. She landed aboard Soyuz TM-11 on 26 May 1991, along with Viktor Afanasyev and Musa Manarov.

Dirk Frimout of Belgium. Flight in 1992

Dirk Dries David Damiaan, Viscount Frimout is an astrophysicist for the European Space Agency. He flew as a payload specialist on STS-45 Atlantis (24 March to 2 April 1992). STS-45 was launched from and returned to land at the Kennedy Space Centre, Florida. It was the first Spacelab mission dedicated to NASA's Mission to Planet Earth. During the nine-day flight, the crew aboard Atlantis operated the twelve experiments that constituted the ATLAS-1 (Atmospheric Laboratory for Applications and Science) cargo. ATLAS-1 obtained a vast array of detailed measurements of atmospheric chemical and physical properties, which contributed significantly to improving our understanding of our climate and atmosphere. In addition, this was the first time an artificial beam of electrons was used to stimulate a man-made auroral discharge. At mission conclusion, Frimout had traveled 3.2 million miles in 143 Earth orbits and logged over 214 hours in space.

Claude Nicollier of Switzerland. Flights in 1992, 1993, 1996 and 1999

Claude Nicollier is the first astronaut from Switzerland and has flown on four Space Shuttle missions, the first spaceflight (STS-46) being in 1992 and his final spaceflight (STS-103) in 1999. He took part in two servicing missions to the Hubble Space Telescope (called STS-61 and STS-103). During his final spaceflight he participated in a spacewalk, becoming the first European Space Agency astronaut to do so during a Space Shuttle mission. In 2000 he was assigned to the Astronaut Office Extravehicular Activity Branch, while maintaining a position as Lead ESA astronaut in Houston and he retired from ESA in April 2007.

Nicollier has spent over 1000 hours in space (42 days, 12 hours and 5 minutes), including one space walk lasting for 8 hours and 10 minutes. He served as mission specialist on four missions with four different space shuttles.

Chris Hadfield of Canada. Flights in 1995, 2001 and 2012

Chris Hadfield is a Canadian astronaut from the Canadian Space Agency (CSA) who was the first Canadian to walk in space. Hadfield has flown two space shuttle missions, STS-74 in 1995 and STS-100 in 2001. He has served as CAPCOM for both Space Shuttle and International Space Station (ISS) expeditions. He is currently training for a long duration stay onboard the ISS, which will include command of Expedition 35 in 2012–13. He will be the first Canadian to command the ISS.

Claudie Haigneré of France. Flights in 1996 and 2001

The elegant Claudie Haigneré is a French doctor, politician, and former astronaut with the *Centre National d'Études Spatiales* and the European Space Agency. Haigneré was a back-up crew member for the 1993 Mir *Altaïr* mission in which her future husband Jean-Pierre Haigneré participated. The asteroid 135268 Haigneré is named in their combined honour. Haigneré visited the Mir space station for 16 days in 1996, as part of the Russian-French *Cassiopée* mission. In 2001, Haigneré became the first European woman to visit the International Space Station, as part of the *Andromède* mission. She retired from ESA on 18 June 2002.

Following her career as a astronaut, Haigneré entered French politics. She became minister for European Affairs in Jean-Pierre Raffarin's government and minister delegate for research and new technologies.

Reinhold Ewald of Germany. Flight in 1997

In February 1997 Reinhold Ewald flew to the space station Mir with Soyuz TM-25, spending 18 days in space. He performed experiments in biomedical and material sciences, and carried out operational tests in preparation for the International Space Station.

Currently, Ewald is heading the Flight Operations Division within ESA's ISS Operations department at the Columbus Control Centre near Munich. In this role, he is directing a team of ESA Mission Directors managing the Columbus laboratory delivery flight in February 2008 and the Columbus science activities thereafter.

Ilan Ramon of Israel. Flight in 2003

Ilan Ramon was a fighter pilot in the Israeli Air Force, and later the first Israeli astronaut. Ramon was the space shuttle payload specialist of STS-107, the fatal mission of *Columbia*, where he and six other crew members were killed in the re-entry accident. Ilan Ramon is the only foreign recipient of the United States *Congressional Space Medal of Honour*.

Mark Shuttleworth of South Africa. Flight in 2002

Mark Shuttleworth is a South African entrepreneur, who gained worldwide fame on 25 April 2002 as the second self-funded space tourist. Flying through Space Adventures, he launched aboard the Russian Soyuz TM-34 mission as a spaceflight participant, paying approximately US$ 20 million for the voyage. Two days later, the Soyuz spacecraft arrived at the International Space Station, where he spent eight days participating in experiments related to AIDS and genome research. On 5 May 2002, he returned to Earth on Soyuz TM-33. In order to participate in the flight, Shuttleworth had to undergo one year of training and preparation, including seven months spent in Star City, Russia.

Marcos Pontes of Brazil. Flight in 2006

Marcos Pontes is one of the most experienced jet pilots in the Brazilian Air Force (FAB), where he holds the rank of Lieutenant-Colonel and has flown for more than 2000 hours in 25 different aircraft. On 30 March 2006 Pontes became the first Brazilian and the first native Portuguese-speaking person to go into space, where he stayed on the International Space Station for a week. During his trip, Pontes carried out eight experiments selected by the Brazilian Space Agency. He landed in Kazakhstan on 8 April 2006, with the crew of Expedition 12.

Following the Soyuz mission, Pontes returned to his technical duties for the International Space Station Programme at the Johnson Space Centre, working with FIESP/SENAI-SP for the development and fabrication of the Brazilian parts for the ISS. Pontes is on stand-by for training for future Brazilian space flights.

Anousheh Ansari of Iran. Flight in 2006

Anousheh Ansari is an engineer and the Iranian-American co-founder and chairman of Prodea Systems. On 18 September 2006, a few days after her 40th birthday, she became the first Iranian in space. Ansari

was the fourth overall self-funded space tourist and the first self-funded woman to fly to the International Space Station. Controversy arose when Nasa and Roscosmos refused to let her wear the Iranian flag on her spacesuit along with the US one. Finally, she wore the Iranian flag colours and kept the Iranian flag on her official flight patch.

Christer Fuglesang of Sweden. Flights in 2006 and 2009

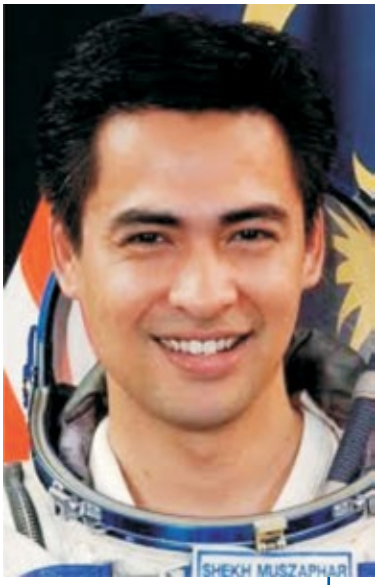
Christer Fuglesang is a Swedish physicist and an ESA astronaut. He was first launched aboard the STS-116 Space Shuttle mission on 10 December 2006 making him the first Swedish citizen in space. He has participated in two Space Shuttle missions and five spacewalks, and is the first person outside of the United States or Russian space programmes to participate in more than three spacewalks.

On 15 July 2008 Fuglesang was selected as a mission specialist of the STS-128 that launched on 28-29 August 2009. STS-128 (ISS assembly mission "17A") delivered equipment allowing the ISS crew to be expanded from three to six astronauts.

Yi So-yeon of South Korea. Flight in 2008

Yi So-yeon is a South Korean scientist and Ph.D. graduate of KAIST (Korea Advanced Institute of Science and Technology). On 8 April 2008, she became the first Korean and the second Asian woman to fly in space, after Chiaki Mukai. She became a sensation in South Korea when she was chosen out of 36,000 candidates to be the country's first citizen in space.

Yi was launched into space on board Soyuz TMA-12, with two Russian cosmonauts. During her mission, she carried out 18 science experiments including monitoring how zero gravity affected the behaviour of fruit flies, the growth of plants, operations of her heart and the shape of her face. Yi returned to Earth along with ISS crew members Peggy Whitson and Yuri Malenchenko aboard Soyuz TMA-11, on 19 April 2008 after spending 10 days and 21 hours in space.



Sheikh Muszaphar Shukor of Malaysia. Flight in 2007

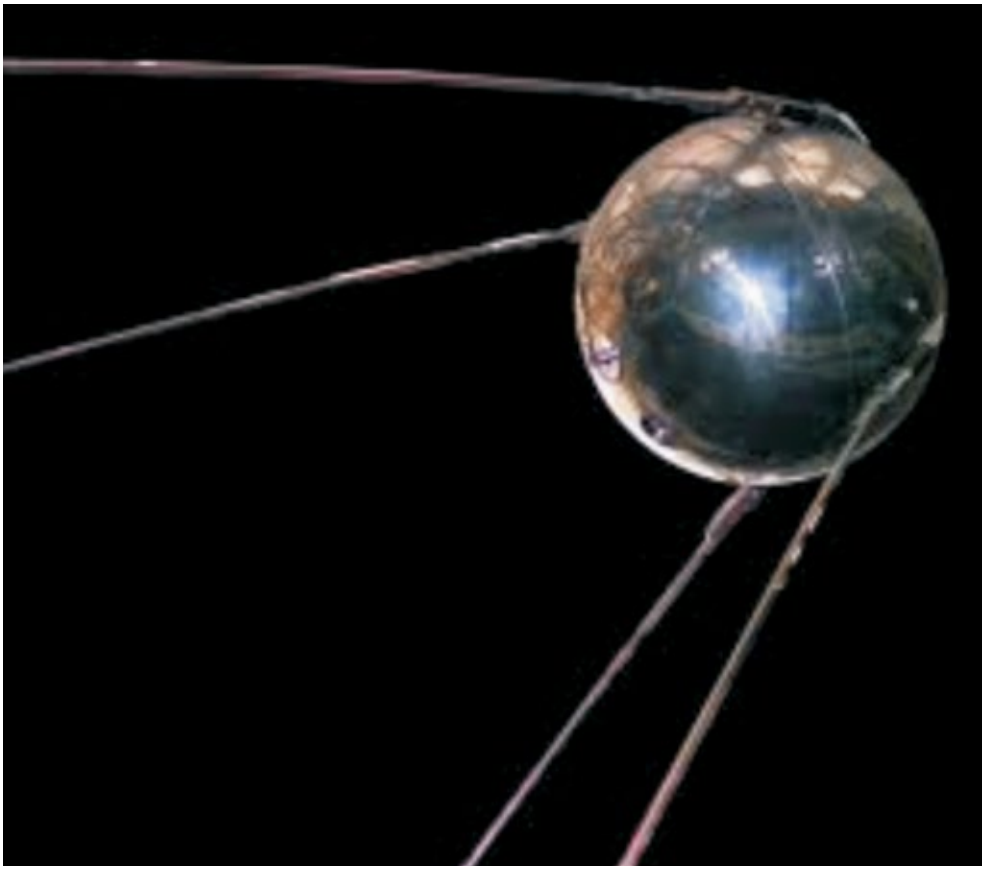
Sheikh Muszaphar Shukor is a Malaysian orthopaedic surgeon and was the first Malaysian to go into space. He was launched to the International Space Station aboard Soyuz TMA-11 with the Expedition 16 crew on 10 October 2007. Sheikh Muszaphar flew under an agreement with Russia through the Angkasawan programme. He performed experiments on board the International Space Station relating to the characteristics and growth of liver cancer and leukemia cells, the crystallisation of various proteins and microbes in space and returned to Earth on 21 October 2007, aboard Soyuz TMA-10 with the Expedition 15 crew members, Fyodor Yurchikhin and Oleg Kotov. During atmospheric re-entry, the spacecraft transitioned to a ballistic reentry, resulting in it landing west of Arkalyk, approximately 340 km northwest of the intended Kazakhstan landing site. The trajectory was reported by the crew as soon as they came out of the communications blackout caused by plasma surrounding the spacecraft.

Naoko Yamazaki of Japan. Flight in 2010

Yamazaki was selected as an astronaut candidate in February 1999 by the National Space Development Agency of Japan (NASDA, now JAXA), attended the ISS Astronaut Basic Training programme beginning in April 1999 and was certified as an astronaut in September 2001.

In November 2008, JAXA announced that Yamazaki would become the second Japanese woman to fly in space on STS-131, scheduled to launch in 2010. On 5 April 2010, Yamazaki entered space on the shuttle Discovery as part of mission STS-131. She returned to Earth on 20 April 2010 after spending 15 days, 2 hours and 47 minutes in space.

The Scientific Legacy of Sputnik



Five decades ago Sputnik Chief Designer Sergei Korolyov watched as a modified Russian missile launched into space from Kazakhstan's lonely steppes carrying a very special payload. Sputnik 1 ("traveling companion" in Russian) was about the size of a basketball and weighed about 180 pounds. It was equipped with two radio transmitters and four long antennas broadcasting a constant beep while circling the Earth for 21 days.

Sputnik's launch stunned the world and changed it too. It heralded a new "space age," created an identity crisis in the United States, led to the creation of NASA and began a flurried race between the world's two superpowers to place a human on the moon. Sputnik touched all walks of life. For politicians, its launch provided a new and powerful way to stir up patriotism. Winning the space race was not only a matter of national security, but of national pride.

For engineers, the space age represented a new set of daunting technological hurdles to be overcome. The engineers were the group tasked with inventing machines capable of escaping Earth's gravity and reaching the moon, as well as ways to keep humans alive in space and to communicate with them from the ground.

For the military minded, Sputnik represented an awesome and frightening new way of waging war. The same technology needed to loft a satellite into space could also be adapted to hurl a nuclear warhead at one's enemies from half a world away.

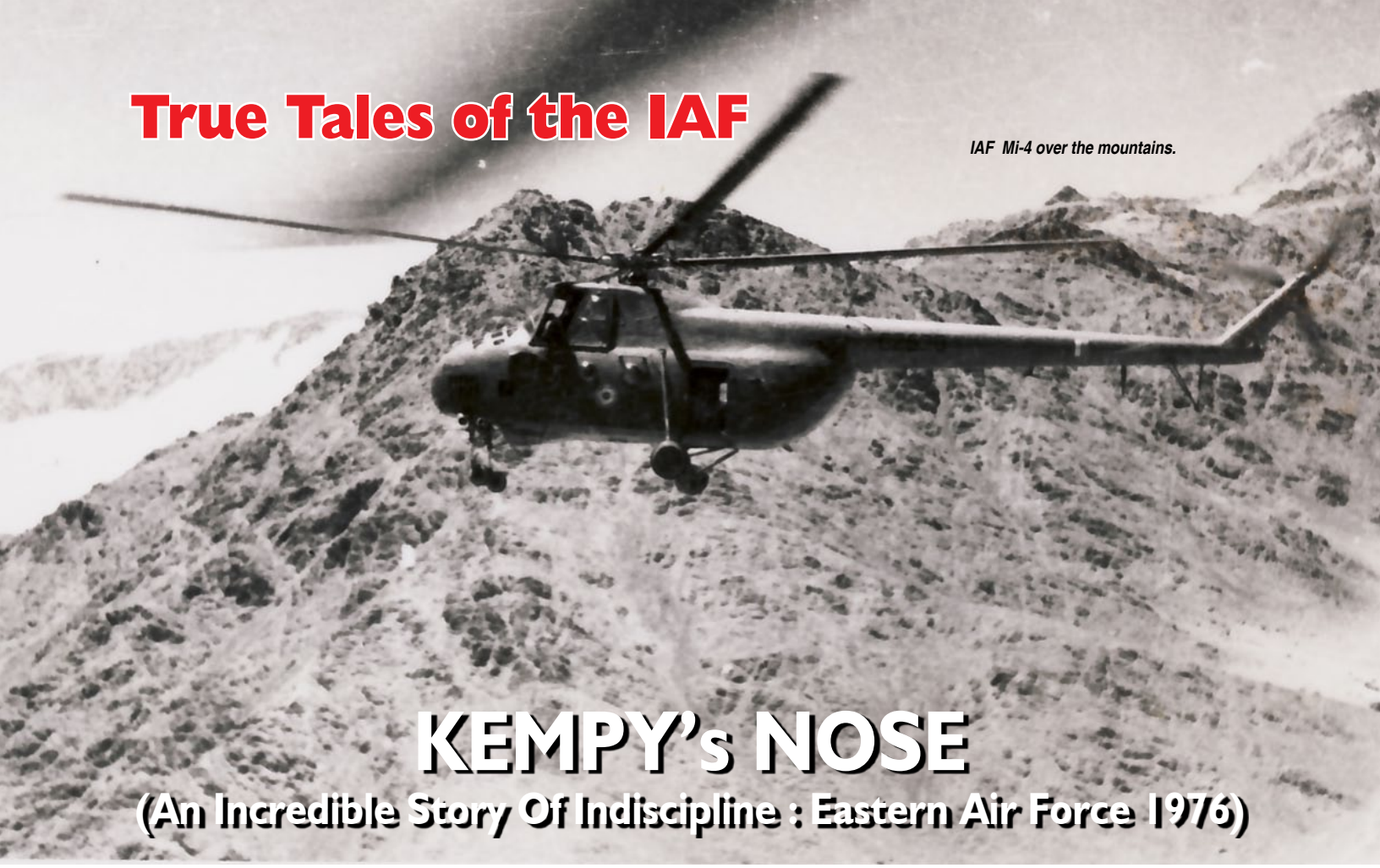
For environmentalists, the photographs of our planet in full that came out of the space age were a powerful propaganda tool. The "Blue Marble" image taken by the crew of Apollo 17 spoke volumes about Earth's fragility and the interconnectedness of life and humanity.

Scientists made their first major discovery of the space age a mere three months after Sputnik's launch. American scientist James Van Allen convinced engineers to strap a Geiger counter his team had designed to the first American satellite, Explorer 1, launched on 31 January 1958. The experiment confirmed the existence of Earth's magnetic field by detecting a doughnut-shaped region of high- energy particles encircling the planet. Scientists now know Earth has two such *Van Allen Belts* which can be hazardous to both satellites and astronauts.

Sputnik's launch led to an unprecedented push in the United States to educate the nation's youth in science and mathematics. In 1958, Congress passed the National Defence Education Act to provide scholarships for aspiring scientists, engineers and mathematicians. "Sputnik made everybody think about science and technology more seriously," said David Thompson, an astrophysicist at NASA Goddard Space Flight Centre.

The U.S. government's push for scientific education was made easier in many ways by Sputnik. The satellite was a technological marvel that inspired an entire generation of students and not just aspiring engineers. Some astronomers trace their interest in space to the Sputnik-era. "I was a kid and it sounded very exciting," said Mario Livio, a senior astronomer at the Space Science Telescope Institute in Maryland. "At the time, the first name that I remembered for this was an 'artificial moon.' That of course had its own feelings that went with it: "Humans have created their own artificial moon."

For many scientists, Sputnik's greatest legacy is the space observatories such as Hubble that it paved the way for. Others think Sputnik's contributions to science are more subtle. The space age also encouraged scientists in all disciplines to entertain new ideas and discover what the potential hazards as well as opportunities existed out there.



IAF Mi-4 over the mountains.

KEMPY's NOSE

(An Incredible Story Of Indiscipline : Eastern Air Force 1976)

The dark, ominous, thunderheads had been rising from the depths of Subansari valley all morning. The orographic winds pushed them up the slopes and the impetus helped it to climb higher and higher till the cataclysmic thermodynamics of thunder clouds unleashed enough energy to help them climb unrestricted to unimaginable height, hell bent on destruction around the Mechuka helipad. I was in the middle of it.

After waiting for several hours, I had got airborne from Dinjan in a Mi-4, on a bad weather day, to take the Army Commander on a recee of the Chinese border. The GOC-in-C had other preoccupations and hence I got airborne close to 1100 hrs, something which we had been told not to do, due to bad weather and turbulence inside the hills after 1200 hrs. The Eastern Air Force, those days, was a different sort of IAF, much like the CIA operations in Lagos, a decade earlier, except that we did neither gun running nor dope peddling like the CIA, we were very socially useful and productive fellows. Most of the guys in Chabua were either the ones who had failed the promotion exams, or were the guys on punishment posting. The guys that the IAF did not want to have around in any self respecting squadron. Chabua was therefore the best self respecting places to be. SOPs were made just for the pleasure of breaking the rule. Anyway, to continue my story: that day we went from place to place on whims of the Army Commander, who seemed to be enjoying himself at my expense. He kept dilly dallying at each whistle stop and as the day went by, we got hemmed in by the line squall while we were deep inside the hills.

Flying in bad weather was nothing new to me as in those years I was compulsively drawn to it, it was exhilarating, the most adventurous thing that I could do at the age of 26. As usual, I dumped collective, descended to the deck, with the Mi-4's wheels touching the Subansari River, more like driving a 'Jonga' than flying an airplane. I zig zagged along the river, acutely aware of a theorem propounded by my earlier Station Commander (Vir Narain). I whistled the morbid tune, taught to me by a navigator friend, it was called 'point of no return'. The Mi-4 was one hell of a helicopter to fly. In due course, we braved the weather and got out of the hills, to my recollection, around 1600 hrs or about 45 minutes before sunset.

That is when I heard James Palapura on the radio.

James was overhead Tezpur in a MiG-21 acting like an airborne FAC coordinating search and rescue over Dulanmukh range. I heard arguments, between a Caribou, Chetak and James. The sensible guys in the Caribou and Chetak were calling off the search and going home owing to impending bad weather and darkness. James was trying to order them back. I had no business to go anywhere other than directly east, back to Chabua, and get the Army Commander off my back. Yet, curiosity overwhelmed me.

"James Sir", I called on the radio. "Who punched out ?"

"Kempy", he said promptly and gave me a quick rundown.

It seemed Kempy (then Flt Lt Deviah, a course mate) had punched out from a Gnat earlier that morning over Dulanmukh after he got hit by ricochet and the engine flamed out. None saw him punch out, none noted where the aircraft went down. The place as you guys know is thick jungles, with crazy wild animals.

Just then my radio quit. That was not unusual. It was unusual if the radio ever worked in a Mi-4. We were quite used to flying the Mi-4 without radio, without navigational aids of any kind, without anything known or popular in aeronautics, all except a wing and a prayer.

I went into a tizzy, *hicum foocum*, sudden rush of muck to the brain. I was beset by a moral dilemma. Do I pretend not to have heard about Kempy ? Do I leave him there in the jungle and go home? Do I rationalise that I had no business to get involved ? Do I make excuses that I had the Army Commander on board ? Do I make an excuse that it was going to be sun set, that the weather was bad, that I was about 40 miles north and headed in the wrong direction ?

"God, I didn't even know if Kempy was dead or alive"..... I said in monologue. "Oh God, my CO will make mince meat out of me", I said to myself in self defence.

No .....in retrospect, I did not bring God in between and I did not consult with Him either. I went mind dead for about four minutes while I contemplated the odds. In the fifth minute, I turned around and went back to a clearing near Passighat which I had over flown about ten minutes earlier. I went and landed on a volley ball court next to some tents and without switching off, I ordered the Army Commander out. He was dumbfounded, initially loss of words. But when it came, he let it fly at me, alternating between request, order, court marshal, pleading and jostling. Actually he was a very fine man, a person I held in great awe. So I reasoned with him.

"Course mate down, Sir", I said in clipped military parlance. "He needs me", I told him with finality.

"You are the Tiger, the army is here, and they will take care of you", I think I told him. "Kempy is down there, I got to go before the other Tigers get to him".

I think the Army Commander made a request to take him along. I think I did not want to take him along lest I endanger his life. It is possible that I left him behind out of spite, for making me wait at all the places where we went and making me go through bad weather. I don't remember. It is quite possible. I was very young and impetuous.

Anyway I then headed full throttle for the Dulanmukh range. It was almost sunset by the time I reached there. I had to ask someone the general direction in which Kempy went down. I went and landed in front of the RSO's hut and a WO ran out. He quickly pointed out the general direction and I was off the ground in a jiffy.

The jungles reek a musty smell as the sun begins to set. I noticed it because I was at tree top height flying with both side doors wide open. There was total green cover, thick foliage. I looked for a fire, broken branches, silvery flash of the Gnat's fuselage or wings, a parachute, smoke, anything to indicate a crash site. There was nothing. I did not know where to go looking. I did mental DR, 1/60 rule, calisthenics to try and figure out where Kempy may have crashed. Over the whirring sound of the rotor, I had caught only snatches of what the WO had told me at the range.

He had said something about cross wind. Yes, he had said that Kempy had ejected on the cross wind. That meant close by. James in his zealous enthusiasm had misdirected the search and others had gone looking for Kempy far and wide and had missed him.

I flew over a large patch of open grassy space. I saw a large herd of frightened wild elephants scattering in all directions with their tails and trunks held high.

"Kempy, where are you ?" I shrieked over the noise of the wind and the Mi-4.

Suddenly I heard him. I swear I heard him! It seemed the Mi-4 knew where to go to find Kempy. I swear I never flew it. It was the hand of God that held the cyclic.

I overflew a hut in another patch of grass, and I thought I saw about 50 people milling about. The Mi-4 turned around on it's own and this time I could see clearly that there was some commotion on the ground. I closed the throttle, yanked the speed down and set down the helicopter in a small clearing with very tall trees all around. When I switched off, the helicopter started juddering and after the rotors stopped, I realised that I had hit a tree while landing. About 7 inches of all the tail rotor blades had been cleanly shorn off. I also discovered to my horror that the Russians had made the tail rotor with plywood. But at that time I was not too worried about the tail rotor. I ran forward to find Kempy.

Kempy was lying on a charpoy about 300 metres from where I had landed, where the villagers had brought him out from the jungle. He appeared to be semi-conscious, groaning with pain. He still had his helmet on, though the mask was dangling around his chest. His nose was completely smashed and his faced covered with blood. His nostrils were choked partially with dried mucus and blood, still oozing plasma. He was labouring for breath through his mouth, spasms raking his chest. I think he had been like that all day, while the search was on overhead, the villagers were frightened to touch him.

The sun by then had set or was about to set. I quickly got Kempy's helmet off, poured water on his face, cleaned his nose and mouth and made him drink some water. He seemed partially awake but he had no situational awareness or what happened to him. It also looked as if he had suffered a compression fracture of his spine. I knocked out the charpoy legs, loaded Kempy still on the charpoy into the Mi-4 and we went back to Chabua, unmindful of the missing portion of the tail rotor, the Mi-4 juddering and shaking all the way. 45 minutes later, when we landed, there was a big crowd on the tarmac, including the Station Commander and my CO, late Jayaraman. The docs took charge of Kempy and I think he was flown to Calcutta, never saw him afterwards, for a long time. The CO took me by the elbow and marched me to his jeep. Never said a word. He went straight to the bar, where Durga the ever smiling barman poured us both a large rum with water, the favourite drink in Chabua. There were many others too in the bar. Jayaraman, took a sip and I think he could not control himself any more.

"I don't know what to do with you", he said. "First you broke the 12 o'clock rule", he waved the glass in my face. My untouched glass still on the bar counter. True to Rimcolian tradition, I always took bull shit standing at attention. In RIMC, it was believed that attention was the only safe position to ward off predation.

"I can understand that you came out of the hills at 2 o'clock, I can forgive you if it went to 3 o'clock. But I cannot suffer in silence if you decided to clear the hills at sunset". His voice was quivering with emotion. There was pin drop silence in the bar. All drinks lay untouched on the bar counter. He took another sip.

Casualty evacuation by Mi-4 in NEFA.

"You got into bad weather". He paused. "No, not just bad weather, you f***ing had to go and penetrate a line squall and mapped the Sunasari river with your wheel to get out". I began to wonder where he had heard that one. Then I realised that the Army may still be searching for their Army Commander. "I can understand if you left behind an Army captain", he said very softly. He took another sip of rum and water.

"I can understand if you left behind a Colonel. I can forgive you even if had left behind the GOC 2 Div". He paused, seemingly at a loss of words. "F***ing shit bag, you went and left the Army Commander on a f***ing BSF picket and he is sitting on a charpoy right now". Jaya banged his glass on the bar counter, and lit a cigarette. Through a smoke ring, he kept staring at me.

"You went and chopped up your tail rotor, and had the audacity to fly it right back to Chabua", he said softly. I thought I could make out a note of admiration in his voice.

"Sir", I said pleasantly. "I shall go and pick up the Army Commander first thing tomorrow morning".

Jaya was my best friend, my guru, my only mentor, my only benefactor in all my years in uniform. "You will do nothing of the sort", he roared like a lion. "I shall pick up the Army Commander myself", he said. "You".....he paused for effect. "You are f***ing going on permanent detachment to Chakabama". He said with finality. Chakabama, a helipad in the middle of nowhere in Nagaland was the loneliest place those days, detachment in Chakabama was akin to solitary confinement.

"But for now, Barman....." he commanded, looking for Durga. "The drink will be on the house, put it all on Kartoos, he will pay for the drinks tonight".

He then raised his glass, like a formal dining in night, "For now, let us drink to Kempy's nose". "To Kempy's nose", we replied in unison, drowning the glass of large rum and water in one single bottoms up. That night, we did bottoms up again and again, each time toasting to Kempy's nose.

My bar book was closed that night, I had exceeded Rs 75, the bar book limit.

Considering that rum cost Rs 3.50 a bottle, and water cost nothing, we drank around 22 bottles of rum that night, all towards Kempy's nose. Assuming that there were around 28 of us that night at the bar, including the Gnat guys on detachment at Chabua, that was around 10 large pegs each, all for good cause, Kempy's nose. May be we all had one peg each and quite possible that Jagga Barar drank the extra 28 pegs. I think it was one of those nights when Jagga did not count the pegs using match sticks, lined up on the bar counter, one stick per peg. I think he lost count, like Count Brar, who never counted.

Next morning I was packed off to Chakabama in the dicky of a Mi-4, and I am told I kept saying "To Kempy's Nose" all the way from Chabua to Chakabama, rather silly of me. I stayed there for three whole months before Jaya relented and brought me back.

Kempy now has a wonderful nose. Makes him very handsome and dignified. Every bit like his illustrious martial predecessors from Coorg. I cannot take the credit, it was the Docs at Calcutta who made Kempy's nose look Coorg-like, handsome and accomplished. Me, I take the credit only for the incredible act of closing my bar book in one night, cheering for Kempy's nose!

Cyclic

25 Years back

From Vayu Aerospace Review Issue II/1986

Manufacturing Options on MiG-29

Contrary to earlier reports, India is keeping its option open on manufacturing the Soviet MiG-29, 50 of which are reportedly to be procured for the Indian Air Force directly as 'flyaway' aircraft.

The acquisition of the MiG-29, however, breaks the intervening, brief, period during which West European combat aircraft (Jaguars and Mirages) were acquired for the IAF. The MiG-29 became an object of Indian interest following the acquisition of F-16s by Pakistan and the Soviet fighter is considered superior to the F-16 in the air superiority role.

Meanwhile, the MiG-27M has been inducted into the Indian Air Force, the Soviet-origin fighter being manufactured by HAL at Nasik. The IAF has, since 1962, been operating almost every variant of the MiG-21, MiG-23, MiG-25 and MiG-27.

Last Batch of IAF Mirage 2000s

According to spokesman of Avions Marcel Dassault Breguet Aviation in Paris, the last batch of the Mirage 2000 fighters on order by the Indian Air Force was to have been delivered by the end of June 1986.

Mi-26s for IAF

The Indian Air Force is acquiring the heavy-lift helicopter Mi-26 from the Soviet Union. The Mi-26, code named *Halo* by NATO, is the heaviest and most powerful helicopter in the world. India is the first country outside the Warsaw-pact to have acquired the Mi-26 which became operational with the Soviet Air Force in late 1983.

In the freight hold of the Mi-26, at least 70 combat-equipped tropps or 40 casualty stretchers can be accommodated. As against this the Mi-17 helicopter, acquired by the IAF in 1984, can carry 24 troops or 12 stretchers or about 4 tonnes of freight.

Light Combat Aircraft Project

Addressing members of the consultative committee attached to the Defence Ministry, Prime Minister Rajiv Gandhi has defended the Light Combat Aircraft (LCA) and said that if India did not invest in the project now, it might not be possible to develop the multi-mission tactical fighter aircraft which would be required for the IAF from the mid-nineties. The Minister of State for Defence, Arun Singh, refuted allegations that the Air Force was not enthusiastic about the LCA project; the Air Force fully supported the LCA project as it was aware of the astronomical cost of importing aircraft as an alternative.

HAL Performance in 1985-86

Hindustan Aeronautics Limited have reported impressive performance for the year 1985-86: the value of production during the year was Rs 580 crores, sales reached Rs 620 crores and profit earned was Rs 53 crores.

Some highlights of HAL during 1985-86 are: delivery of the first MiG-27M aircraft to the IAF; delivery of the first Dornier 228-200 light transport aircraft to Vayudoot; construction of test bed for the Garrett TPE 331 engine that powers the Dornier aircraft; integration of new generation inertial navigation systems in the Jaguar aircraft; handling over to the Navy, in record time, of three *Chetak* helicopters for the Antarctica Expedition; commencement of the preliminary design phase of the Advanced Light Helicopter (ALH).

ALH Mock-up revealed

A full scale mock-up of the Advanced Light Helicopter (ALH), to be manufactured by HAL has been completed at Bangalore. HAL sources have said that ALH prototype fabrication would commence soon and would be test-flown in 1990. Completed production batches for the three defence services and civilian users would follow from the mid-nineties.

Govt admits grounding of MiG-21s

The Defence Ministry has for the first time officially acknowledged that it had grounded a variant of the MiG-21 for some time last year.

The Minister of State for Defence has said that Air Headquarters carried out special checks on one MiG-21 variant after overheating was noticed in some aircraft. The special check included both aircraft of Soviet and HAL manufacture.

INS *Virat (Hermes)* to be received in 1987

Admiral RH Tahiliani, Chief of the Naval Staff and Chairman, Chiefs of Staff Committee has said that the INS *Virat*, formerly HMS *Hermes*, which is being acquired from Britain for the Indian Navy, will be received sometime next year.

The CNS has stated that a plan was afoot to build larger-size vessels such as frigates at the Garden Reach Ship Building Yard. This would be in addition to the small size of ships like Seaward Defence Boats being built at the yard at present.

Replying to another question, he said "there was nothing special on the activities of foreign powers on the Indian Ocean. It has always been there. All commands of the Indian Navy, which were being strengthened progressively, were prepared to meet any challenge," he added.

US Helicopters for China

After sustained effort and intensive evaluation in different parts of the country, China has proved to be a massive potential market for helicopters, for both military and civil use. There are three possible markets in China, according to Sikorsky sources in Beijing.

The Civil Aviation Administration of China was responsible until recently for all civil airlift and air work in China. Provincial, regional or local governments now have some discretionary funds. The only sources of pilots are CAAC or the People's Liberation Army, so that those organisations' support will be needed for any proposed helicopter operation.

The PLA air force or army have used helicopters for transport and search and rescue, but have limited capability to maintain or diversify their use of helicopters. New Sikorsky S-76s have been operated the same way the PLA operated its old Soviet-made Mi-8s. The S-76 implied only a greater altitude capability to the Chinese.

New Trainers for Pakistan

Licence manufature at the Pakistan Aeronautical Complex, Kamra, will probably be a condition for any PAF purchase of a new training aircraft to replace the Cessna T-37s. A variety of aircraft are under consideration, such as the Pilatus PC-9, Embraer Tucano, MMB Fantrainer and SIAI-Marchetti S.211, but replacement of the PAC Mushshak (licence-built Saab MFI-17) in the grading and initial flying training roles roles seems unlikely. The type is still being produced at Kamra, where over 100 have now been assembled and a turbocharged engine and aerodynamic modifications have reportedly been introduced.

Saudi Arabian PC-9 Contract Signed

A contract has been signed between British Aerospace and Pilatus of Switzerland for the supply of 30 PC-9 aircraft as part of the large export deal between the Governments of UK and Saudi Arabia (for which BAe is the prime contractor). Signing the deal at a special ceremony at Warton, BAe's Dr Maurice Dixson said that the combination of PC-9 and Hawk is the best training package available for fast jet pilots. He added that the Saudi Arabian contract marked the first of a number of successful collaborations involving both aircraft. The contract will be handled from Brough, which is the Military Aircraft Division unit designated to develop business involving the PC-9, with all eight sites of the Division each playing an important role.

CFM Contracts with GPA and Piedmont

CFM International, a joint company of General Electric (US) and SNECMA (France), has received an order worth $575 million for CFM 563 high bypass turbofan engines to power a total of 81 Boeing 737-300 and 737-400 twinjets for GPA Group Ltd of Shannon, Ireland.

Earlier, CFM had received an order worth $ 150 million from Piedmont Airlines for CFM 56-3B-2 high bypass turbofan engines to power 25 of their latest Boeing 737-400 twinjets.

Show preview

A still from the last years event.

Indesec 2011

For the fourth time, New Delhi will host the international INDESEC 2011 exhibition which will take place from 20–22 June 2011 in Hall 11 at Pragati Maidan.

Supported by the Ministry of Home Affairs since 2009, INDESEC will maintain its focus on the Indian Government's urgent need to procure the most advanced technological solutions in order to meet their homeland/national security requirements. Senior visitors will include ministers and decision makers from the Ministry of Home Affairs, central police and paramilitary organisations, intelligence services, the Ministry of Defence, Coast Guard, individual state ministries and senior police representatives.

Tejinder Singh, Exhibition Director, INDESEC says, "We're delighted to open doors to INDESEC in Delhi. This international exhibition will attract thousands of visitors from across the country, and we want to ensure they receive a good welcome. We have worked hard to ensure that both exhibitors and visitors receive added value and can make the most of their time in Delhi"

Exhibitors and country pavilions at INDESEX will showcase products and solutions for cyber security, coastal security, airport security, border security, surveillance and infrastructure security. The profile of exhibitors include Tata Motors, Panasonic, Mistral Solutions, MKU, Streit Group, Lacroix Defence & Security, Ericsson, Getac Technology Corp, CAE, Saab Systems Grintek, and SIBAT, Camero Tech, Maresco Technologies & Temmek Optics Ltd from Israel, among others.

The Government of India has "fast-tracked" the acquisition of equipment and items necessary for a robust homeland security setup. It has sought offers from various companies and assurances from multiple countries to provide the much needed equipment and articles. These include bomb detection and disposal equipment, explosives detectors, deep search metal detectors, personal protection, riot protection equipment, disaster management equipment, sub-surface imaging systems, blast guard barrier systems, bomb resistant trash receptacles and bullet proof vehicles, and under-vehicle surveillance solutions, among others.

Also attending, speaking and discussing Homeland Security issues, at the INDESEC Conference, will be leading officials from MHA, MOD, Indian Coast Guard, Paramilitary Forces, State Home and Police departments, Armed Forces and security experts and industry. The key sessions include Critical Infrastructure Protection, Homeland Security and Offset Policy, Electronic & Digital Surveillances, Center & States Partnering for Homeland Security and Upgrading Technology for Border Management.

On the need for a platform such as INDESEC, Lt Gen R K Loomba, Director General, Military Intelligence, Army Headquarters says, "Terrorism in the present day is a worldwide phenomenon. It is in the interest of all security forces in the country to adapt quickly to the technically challenging scenarios. It is heartening to see INDESEC taking a quantum leap forward in this regard. I appreciate the efforts made by INDESEC for the educative technology on display"

INDESEC has also received the certified seal of endorsement from the United States Commercial Services and the United Kingdom Trade Investment bodies.

The US Commercial Service of the US Department of Commerce (DOC) has granted Trade Fair Certification to Oak Overseas Ltd to organise the official US Pavilion at INDESEC 2011 and has the support of the DOC's staff in both the United States and India.

The Israel Pavilion at INDESEC this year will showcase professional services companies operating throughout Israel and will give visitors an insight into the benefits and expertise located in the country. Israel has earned worldwide reputation for providing leading security solutions and partners with prime security integrators in the United States such as Lockheed Martin, Boeing, Northrop Grumman, SAIC, and others to protect airports, seaports, government offices, financial institutions, recreational centers, international events and more. Latest Israeli exhibitors to participate at INDESEC include SIBAT Israel MOD, Maresco Technologies & Temmek Optics Ltd, Cellebrite, Pineapp Network Security Solutions and Camero Tech, to name a few.

All kinds of cutting edge equipment will again be on display at this 4th edition of the event.

INDESEC

TALE SPIN

Bombs away !

The aerial might of the Western world has been unleashed on Col Muammar Gaddafi. If they were not at the receiving end, aviation aficionados in Tripoli would have been ecstatic at the amazing Air Show, which included B-2 stealth bombers, Rafales and Typhoons, F-16s, Mirage 2000s of various kinds, JAS 39 Gripens, A-10 Thunderbolts, Tornados … what an assortment ! (Have the Indian Air Force monitored their performance, considering that at least four of the types were on their M-MRCA list ?)

(all three cartoons from The Economist)

Bric-a-brac

So now it is plural, with South Africa joining Brazil, Russia, India and China, making it BRICS, the alternative set of global powers that met at the Chinese resort of Sanya on Hainan Island. Russian President Dmitry Medvedev joked that the acronym could well have been BRYuKI (in Russian, Yu refers to Yuzhnaya Africa, or South Africa, while the K refers to Kitai or China), the Russian word for 'trousers'. But no one was laughing since the BRICS members officially disapproved of the NATO bombing of Libya.

Cowboys and Indians a.k.a. al-Qaeda

Why would the first African-American President of the United States, as US commander-in-chief, think nothing of military forces applying the codename 'Geronimo' to Osama bin Laden during the assault against that long-sought enemy of the US ? Apparently, having an African-American President in the White House is not enough to overturn the more than 200-year American tradition of treating and thinking of 'Indians' as enemies of the US. For 'Indians' now read al-Qaeda.

(Thanks to Steven Newcomb in the 'Guardian').

Valid sporting activity

That golf is big in the military, almost becoming synonymous with having OLQs (officer-like qualities), can be gauged from the fact that over half of the around 180 golf courses in India are either owned or run by the armed forces. The Army Zone Golf, for instance, runs 97 golf courses. And the military is loath to part with this 'physical activity', even though there have been scathing reports of the CAG which year after year punches more holes into their golf courses than the 18 required (*reported by Rajat Pandit*).

Been to the Delhi Cantonment recently ?

'Pilots on strike, air traffic improves'

This actually was headline in a national newspaper during the recent Air India pilot's strike. The overworked air traffic controllers at Palam Airport felt 'relieved' after the airport had touched a new traffic record of over 1000 movements in a single day on 30 March. The sub-heading read 'Controllers Less Busy, Private Airlines to Record Better On-Time Performance'.

Thanks gentlemen !

No. 77 Squadron and 77CD …

A wag has cracked the 'mystery' on the Indian Air Force assigning the number '77' to the newly raised C-130J Super Hercules Squadron (ref. *Vayu Issue II/2011*). He was at Hindon that day where dozens of US Embassy cars were parked. '77' is the identification given to the US Embassy in New Delhi with each corps diplomatique car number plate thus marked. It was the day of the 'seventy sevens' and how appropriate that the IAF has followed suit !

Oops !

A*fterburner* had a red face on receiving the following mail from Joseph Antony, Chief Marketing Manager of HAL Corporate office when he referred to the 'Tale Spin' item in *Vayu II/2011* : *The 'ADGES, circa 1917' referred to as acoustic detection by the Germans in 1917-18, is actually a photograph of Emperor Hirohito inspecting Imperial Japanese Army acoustic locators (Tubas) sometime in the 1930s.*

Afterburner

Elettronica

Lockheed Martin