

VAYU

II/2013

Aerospace & Defence Review



**Building National Air Power
Lessons from the LCA
Aero India 2013 - a review**

**'Iron Fist 2013' : before,
during and after
Rudra for the Army**

AgustaWestland



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during and after
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HAL ALH Mk.IV Rudra at Aero India 2013,
Yelahanka (photo by Angad Singh)

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38 Innovative action – not platitudes

Air Marshal Brijesh Jayal, writing with the biennial Aero India Show as backdrop takes a snap shot view of how Indian Aeronautics, and more specifically, its Industry have evolved over the past 20 years. The defence procurement procedure itself has also evolved but while India possesses all the prerequisites for a sound aeronautics industry, its contribution to building national air power has not been in keeping with the potential for lack of a National Aeronautics Policy.



46 The continuing RSH saga

Angad Singh writes on the situation today, where it has taken the MoD a decade already to do nothing ! The initial RFP was issued 10 years ago and virtually the same helicopters have been evaluated time and again. With HAL's LUH still years away from IOC, the Army urgently requires new rotorcraft assets.



48 Once more with feeling: Aero India 2013

In this comprehensive coverage of the biennial event hosted at Air Force Station Yelahanka, the Vayu editorial team have reviewed highlights of the Show, with the large editorial team being virtually everywhere, from covering exhibitions at the various Halls to attending press conferences as also conducting exclusive interviews. Even as the

Vayu stand in Hall A was visited by the thousands, three Vayu Show Dailies were published and widely distributed during the Show – and to readers far beyond !



82 The LCA – still a pie in the sky

Perhaps the most enlightening event at Aero India 2013 actually took place at the International Conference in downtown Bangalore a day before the Show was inaugurated at Yelahanka. The theme was 'Challenges in Design to Deployment'. Vayu recorded first hand the candid address by Air Commodore K Muthana, Project Director at the NPTC on the 'Critical lessons from the D&D of LCA'. The conclusion was that primary problem with the LCA programme is 'management'!



86 'Iron Fist' 2013

Three years after the Vayu Shakti 2010 fire power demonstration at Pokhran, the Indian Air Force displayed its might under the new banner Iron Fist. Vayu editors were on hand to witness the 'shock and awe' and record events by camera for its vast readership. However, in an exclusive, Vayu's Simon Watson from the UK was permitted to visit some of the bases before, during and after the main event. These dramatic images are combined with the on-the-spot article from Pokhran, giving readers a most unusual opportunity to also 'have been there' !

Vayu also looks back at 'The Tilpat Years' at which range just 20 kilometers south of Delhi, the Indian Air Force carried out not only routine armament

practice but since 1953, treated some privileged citizens to fire power and aerobatic displays.



104 MiG-21 Pioneers at Lugovaya

Air Marshal Brijesh Jayal reminisces on MiG-21 conversion training at Lugovaya, in the then Soviet Union, during October 1962-February 1963.



108 From Fishbed to Bison

April 2013 marks 50th anniversary of the MiG-21 in service with the Indian Air Force, beginning with the MiG-21F-13 (Type 74 or Fishbed C) till the present MiG-21 Bison. 'Saga of the MiG-21bis' upgrade by Air Commodore Nayani Harish is published on the eve of that momentous anniversary.



Also :
New Rotary Wings for the Dutch, Hunt with the Hounds, Run with the Hares, Army Day 2013, 64th Republic Day, Rudra – the Destroyer

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Beyond the old formulae

The sorry tale of India's attempts at self-reliance in defence equipment continued at this year's Aero India show in Bangalore. Defence minister AK Antony mouthed platitudes about how indigenisation, including technology transfer, was uppermost on his mind. The State-owned Defence Research and Development Organisation (DRDO) handed over the Dhruv helicopter and displayed a new and improved Light Combat Aircraft. That the real story of homegrown defence development has not changed was underlined by the more candid statements of the Indian Air Force chief, Air Chief Marshal NAK Browne, who called for financial penalties against Indian defence equipment makers guilty of "poor performance" when it comes to producing good weaponry on time and within budget.

India's inability to manufacture any defence equipment was once an embarrassment. Today, it is a festering economic sore and a national security issue. In a recent report, the Stockholm International Peace Research Institute showed that between 2007 and 2011, India was the world's largest arms importer, spending \$12.7 billion on weapons. And this story will get worse. Even after announced austerity measures, IHS Jane's Defence Budgets has projected that India will be spending over \$65 billion on weapons by 2020. Inevitably, given our inability to even produce 'Made in India' army boots and pistols, let alone submarines and fighters, much of this will be spent overseas.

Mr Antony has attacked the performance of the State-owned enterprises and he repeatedly called for indigenisation. In Bangalore, he insisted that technology transfer would be a prerequisite for all future contracts. This is the easy response to demands for indigenisation. The DRDO and State-owned firms regularly receive infusions of technology but are incapable of converting this knowhow into an innovation cycle. The technology is usually out of date and repeated transfers have to be arranged every few years at the cost of several billion dollars per dose. A much more strategic plan to develop indigenous defence capacity is needed. The monopoly of the State-owned defence enterprises must be broken. The Indian private sector has to be brought into this industry on a war-footing. This will not be easy: Mr Antony's minions are the greatest acolytes of the DRDO and its sister organisations. There must be a recognition that India needs a far more flexible defence offsets programme. India has a small private defence manufacturing base that cannot be scaled up overnight. The offset funds should be used to pay for technical education and infrastructure. So far, there is little evidence that the defence ministry has thought much beyond the normal platitudes and the traditional formulae.

From : Hindustan Times

Make it Here

Between 1999 and 2009, India spent a massive \$50 billion on importing weapons, earning the dubious distinction of being the world's largest arms importer. Estimates are that in the subsequent decade, this figure will double to \$100 billion. This is a drain on the exchequer that India can ill-afford. The only solution is to build up a strong domestic industry specialising

in defence hardware and software. There are several reasons why this must be done. First, imported weapons systems widen the balance of payments deficit. Second, imported arms can be a potential security risk. During the 1982 Falklands war, the Argentine military disabled two British warships with Exocet missiles supplied by the French. Then-British prime minister Margaret Thatcher was so upset by this that she threatened to nuke the Falklands unless the French handed over the missiles codes to the British. The request was granted, enabling British forces to foil further attacks and win the war. In the years since then, weapons have got ever more reliant on IT and software. What prevents India's weapons suppliers from handing over the codes of weapons used by us, to potential enemies?

Third, we need to remember that China, which has a much larger military than India, is not just a major manufacturer of defence systems, it is now emerging as an exporter too. There is no reason why our domestic defence manufacturing should not at least match up to Chinese levels. The offset policy, in which 30% and more of the value of all large import orders have to be spent by the supplier in one of a number of specified ways that include local investment, technology transfer and procurement, is a means of building up strong indigenous capacity in the defence sector. And finally, the private sector must play a vital role in this project, both to lower costs and improve efficiency in defence production, and to boost the technological base of Indian industry in general.

From : The Economic Times

Probe, don't scrap

Investigations into the allegations of corruption in the AgustaWestland VVIP helicopter deal must unearth the money trails and lead to punishment of the guilty. But the government's initiation of cancellation proceedings on the deal is a move that is as misguided as it is predictable. It threatens to bring on needless costs for the system. And in as much as it virtually amounts to an admission of guilt, it would even appear to be bad political strategy for the UPA. Yet it falls into a pattern that is particularly of the UPA's making, consisting of a frequent and almost instinctive recourse to blunt instruments like bans, blacklists and the pre-emptive freeze. As long as the choppers satisfy the technical criteria, there should be no reason why the AgustaWestland deal itself should not stand. There are compelling reasons, on the other hand, for the machine to be separated from the bribe. The process, which ended with the Rs 3,546 crore deal being finalised in 2010, had begun more than a decade ago. Its cancellation now would mean going back to the drawing board, tendering, testing and selecting a vendor. It would take several more years for the deal to pass through the various portals of the bureaucracy. This Sisyphean cycle is emblematic of the problem that afflicts defence procurement in the country, often with sobering consequences for national security and military preparedness.

Last year, six defence firms, including Israel Military Industries, Germany's Rheinmetall and Russia's Corporation Defence, were blacklisted for 10 years. In effect, this has contributed to slowing and stalling the army's search for modern

SAAB

artillery. Cancelling, banning and blacklisting indiscriminately, instead of applying more specific penalties and correctives in cases of proven wrongdoing, could also end up reducing the number of options in the market, increasing the chances of the MoD being left to deal with a single vendor.

Military modernisation is an urgent imperative, ill-served both by the cultivated opaqueness of the system as well as its knee-jerk response to the merest hint of scandal. What India needs is a calibrated and pragmatic approach. There are viable alternatives to blacklisting and cancellation. Fines can be imposed, and the guilty individuals punished. Integrity pacts allow the money paid to be recovered if the terms are violated by the vendor. The defence procurement system needs to be overhauled to increase transparency and draw sharper lines of accountability, while at the same time opening itself up further to participation by private players.

From : The Indian Express

Safety first, pride later

The road to security hell is paved with good political intentions. That is as succinct a description as possible of the decision, seemingly unilateral, by defence minister AK Antony to immediately seek a ban on the purchase of any more AgustaWestland VVIP helicopters following claims their purchase was tainted by bribery. Whether or not the purchase was marked by dirty deeds done rather expensively is a matter that will require some probe. So far, there is still not enough corroboration in India for the claims made by the helicopter-maker's overall Italian boss to make a sound legal judgement. What matters is that this should be set aside from the issue of the helicopters themselves and their importance to India's national security. An assessment, independent of the bribery issue, is needed as to whether the helicopters concerned are substandard and whether blacklisting Agusta-Westland is the proper punishment given India's security interests.

Mr Antony is reportedly concerned with maintaining his honest image — and that is understandable. Nonetheless, his portfolio is first and foremost about the defence of the country — the preservation of his image is a distant priority. Under him, the defence ministry has taken to blacklisting defence firms that are found guilty, even it seems those merely accused, of violating the integrity clauses of the purchase agreement. But the defence market is not like, say, the automobile market where there are many options with minimal differences among them. Many defence firms are monopoly makers for their products. Claims of bribery and worse are also easy because the market, by its very nature, is riddled with middlemen and secrecy.

As a consequence, India has banned so many makers of artillery in so many countries that the military now has a difficult time in finding any top-end guns. The Naresh Chandra Committee on defence preparedness pointed out that blacklisting was an over-the-top response and detrimental to the country's national security. It recommended that other penalties — fines and personnel expulsion — would make more sense.

A certain reality needs to be acknowledged here. India's two largest neighbours are countries with which it has waged

a number of wars. There is no evidence that either will not consider taking military action sometime in the future. This is why defence is such a large portion of the budget, despite so many pressing social problems at home. India must also import the bulk of its weapons because of its continuing failure to produce anything on the home front — even army boots are bought overseas. Mr Antony himself has acknowledged this deficit, though he has yet to come up with a solution. India thus cannot afford the extreme stance of banning arms companies whose catalogue may include vital defence equipment. Other punishments have been recommended and should be considered. National security must come before ministerial pride.

From : Hindustan Times

Towards stability

As the clock winds down to the planned withdrawal of AUS-led NATO troops from Afghanistan in 2014, the uncertainty about the country's fate is causing great concern among its neighbours. The agreement on beginning an official-level dialogue on Afghanistan between New Delhi and Beijing is welcome. At this critical juncture, it is only appropriate that the fear of an imploding, violence-torn Afghanistan turning into a net exporter of instability is putting strategic heads together in Delhi, Beijing and Moscow. Last month's trilateral dialogue in Moscow — between India, China and Russia, attended by National Security Advisor Shivshankar Menon — was their first, engendered by growing worries about the Taliban's return to a position of power in Afghanistan.

So far, India has had an institutionalised dialogue on Afghanistan only with the United States. But as the inevitable deadline approaches, it is Delhi's imperative to engage with Beijing to work out a system of watching, balancing and aiding to protect its economic, welfare and strategic interests in Afghanistan. While India fears a re-empowered Taliban controlled by the Pakistani military and intelligence machinery, Beijing has its own high investment and mining stakes in the country and would be keen to safeguard those. Although Beijing's traditional approach to Afghanistan has been via Pakistan's helping hands, it is invested in the country's stability in a way the Pakistan army is not. Therefore, China, unlike Pakistan, understands India's stabilising role in Afghanistan and has shown eagerness to expand its engagement with Delhi on this count.

Even as common security concerns add a new twist to the regional dynamic, India should approach the dialogue with no illusions about Pakistan's importance for China. A close ally of Beijing, Pakistan lends geography to the Chinese presence in Afghanistan. In fact, its role will only grow in post-withdrawal Afghanistan. But as China prepares for the potential fallout on its restive Xinjiang province of a re-Talibanised Afghanistan acting as a safe haven for Islamists, and Russia fears the impact on the Central Asian states, India has an opportunity to work with them to minimise instability.

From : The Indian Express

Boeing



‘CHOPPERGATE’

Air Marshal Brijesh Jayal looks at the deeper ramifications

A report by prosecutors filed in Italy in connection with the arrest of Finmeccanica CEO Giuseppe Orsi, has alleged that the then IAF Chief was instrumental in swinging the Indian VVIP helicopter deal and was paid ‘certain amount of money, not yet quantified’ through intermediaries. The report claimed that technical requirements were tweaked to enable the Italian helicopter to qualify and also named three of his relatives as intermediaries.

Not surprisingly this news spread like wild fire and the media (especially electronic), went wild. For a few days, image of the hapless erstwhile Chief accompanied every telecast on the subject. In the eyes of the nation, he was already damned. Like everything else in our volatile political climate, the debate soon took on political overtones and a partisan blame game began.

Without necessarily having to give the persona of the Chief a clean chit, the Ministry of Defence did not choose to assure the people unequivocally that our defence procurement systems are robust enough not to be influenced by any one

individual, irrespective of rank or status. The lone voice of sanity was that of Jaswant Singh when he counseled “we should not make wild allegations against a former air chief. It is not in the interest of both the Air Force and the country. The probe is on. Let’s wait”. Having been both a distinguished soldier as also the Defence and Foreign Minister, he understood more than any other the havoc such media hype was causing to the very fabric of our armed forces. Even this wise counsel was unfortunately drowned in political one-upmanship.

It is not this writer’s case to defend the erstwhile chief or his actions in the absence of full facts, which in any case are the subject of an investigation, but having served for nearly a decade in various capacities in the planning and procurement directorates of Air HQ, one can say with some confidence that one individual simply cannot subvert the procurement system. It can only happen when compromises are made at multiple levels, both military and civil, through patronage, persuasion or pelf or a combination of them all.

That there are to be no agents dealing in weapon systems has now been *mantra* of the Defence Ministry for decades, yet their existence must be the worst kept secret in Lutyens Delhi ! Recent reports have indicated that not only does this faceless tribe exist, but moves around in high circles and has access to Lutyen’s elite ‘bhawans’ and social circuits. The unspoken truth is that the system demonises them in public, but flirts with them in private. If the very apex levels of our national security and defence management are either unaware of their existence or unable to defang them, the question that naturally follows is whether national security itself is in secure hands ?

The primary charge leveled against the erstwhile air chief is that he conspired to reduce the Service’s Qualitative Requirements (SQRs) of operating altitude, enabling the Augusta Westland AW101 helicopter to enter the race from which it was otherwise excluded. The Defence Minister (and the recent MOD statement) on the other hand are on record to say that all laid down procurement procedures were “meticulously followed”.

Taking both these statements to be factually correct, two conclusions emerge. Firstly, that our defence procurement procedures are so devoid of checks and balances that one single individual within the system can distort it and secondly that the MOD has suddenly loosened its suffocating stranglehold on the armed forces' giving the chiefs adequate rope to swing a Rs 3760 crore deal ! As even a novice in this "arms business" in Delhi will tell you that both conclusions are patently false.

In midst of this gathering storm, the MOD has issued a press release giving out the sequence of events. It reveals that an acquisition process for VVIP helicopters commenced in March 2002 and culminated in the Eurocopter EC-225 being found suitable for acquisition after flight evaluation trials. In November 2003, the Principal Secretary (PS) to PM convened a meeting, voicing concern that the mandatory requirements stipulated by the IAF had resulted "in a single vendor situation". Ostensibly, to widen the choice of prospective vendors, those concerned decided to modify the "mandatory" altitude requirement to 4.5 km whilst leaving the 6 km altitude to be "desirable". It further added 1.8m cabin height as a "desirable" requirement.

The PS then followed this up in December 2003 with a letter to the Defence Secretary and the CAS voicing concern that neither the PMO nor the SPG had been consulted whilst formulating the SQRs and suggesting that "realistic mandatory" requirements be drawn up and the acquisition process be put on fast track. A strange suggestion considering that in the earlier meeting, such decision to change these requirements had already been taken!

In words of the MOD "in pursuance of the above directive, the ORs were deliberated at length between the IAF, NSA, SPG/PMO and MoD between March 2005 to September 2006 and the above indicated changes were incorporated". The devil however is in the detail as it is this deliberative process that was ultimately misused to "regularise" an "irregular" decision. It would be interesting to know as to how many within the system stood for professional integrity and probity and those that failed and their compulsions. Clearly one victim was the professionalism



that must form the bedrock of formulation of Services Qualitative Requirements.

The MOD statement fails to clarify that the professional expertise for aerial transportation of VIPs resides with the Air HQ Communication Squadron and they are part of the SQR process. It is also silent on whether the entire SQR process was revisited as per the procurement procedure or circumvented through this unconventional route.

Some interesting points emerge from this. The primary concern of the PS to PM was a single vendor situation. At the time, Defence Procurement Procedure (DPP) 2002 (version June 2003) was very much in existence although it was to come into force from 30 June 2003. Notwithstanding this, there did exist an earlier policy and the entire process was proceeding under authority of the Defence Acquisition Council chaired by the Defence Minister. The DPP recognises the reality of a single vendor situation arising even at the tender stage and leaves the authority to decide with the RM.

It was contrary to letter and spirit of the procurement procedure for the PMO to have interfered especially at the crucial decision-making stage. The MOD release glosses over this vital violation of procedure, which not only halted the induction process, which was nearing completion, but under the guise of single vendor and revision of SQRs, also paved the way for the Augusta Westland helicopter to join the race. The IAF Chief at the time of PMO's intervention was the predecessor to the CAS under fire, although the formal changes to SQR took place under the latter's watch.

Formulation of Services Qualitative Requirements is a highly professional and technical process. It involves a deep consultative process under the leadership of Air HQ and includes prospective users and concerned agencies, even outside of Air HQ. Once evolved, the SQRs are approved by the Staff Equipment Policy Committee. Changes, if any, can only be with approval of the RM.

In such a situation intervention by the PS to PM and silent acquiescence by the MOD and Air HQ speaks volumes of the arbitrariness of the way this procurement was handled. Had the PMO addressed its concerns to the RM as head of the Defence Acquisition Council (DAC) and let matters evolve till the proposal came to the Cabinet Committee on Security, it would have acted in keeping with the letter and spirit of the procurement procedure. Stooping to take on the role of changing the SQRs, it acted arbitrarily and in violation of the procedures. If IAF professionals then acted as mere doormats, this is, indeed, a sad reflection.

The MOD statement claims that "the procurement case was progressed in accordance with the established procurement procedure in a transparent manner with all stages of procurement being followed meticulously". On the contrary, agencies external to the defence procurement process interfered at two crucial junctures. Firstly to halt procurement of a selected helicopter in the final stages and then to meddle with SQRs to allow the Augusta Westland helicopter to enter the race. By remaining a mute spectator, the MOD and Air HQ became complicit. The rest is history and the chickens are now coming home to roost.

Since the CBI has initiated a preliminary enquiry and the Rajya Sabha debated the issue and set up a Joint Parliamentary Committee, the "choppergate typhoon" that hit New Delhi will soon pass, and be forgotten. If past performance is any indicator the end is predictable. A few reputations and careers of servicemen will be destroyed, the arms agents will move on to the next deal and the real perpetrators and beneficiaries will live to enrich themselves another day. All that the nation will be left with is that sanctity of Services Qualitative Requirements are open to abuse, and morale of the armed forces further eroded.

A hot summer ahead

2013 has dawned ominously portending dangerous trends with heightened security problems likely to face India in the coming year.

The twin blast terror strike, once again in Hyderabad, especially after the recent hangings of 26/11 terrorist Kasab and of Afzal Guru, mastermind of the 2001 attack on Indian Parliament respectively, were not entirely unexpected by Indian intelligence agencies and some alerts were in place on the ground. Yet, tragically, 17 innocent people lost their lives and over 120 injured in communally sensitive Hyderabad which appears to be growing into a favourite target for terrorists--- including some of the home-grown variety whose inspiration and all round material support unmistakably comes from across the western border. That the government and all its security and intelligence organs of the state will and must re-visit the nation's preparedness against the terror machine and perpetrators of such evil acts and take immediate prophylactic steps, is a critical national imperative.

Pakistan, in addition, in keeping with its historical predilection, continues to display its never changing mindset of creating tensions along the Line of Control in an effort to rekindle the waning militancy in Jammu and Kashmir in eager anticipation of 2014 which it surmises as the year of its reckoning.

That Pakistan eagerly awaits the final draw-down of US and western forces from Afghanistan by 2014 to re-establish its arc of influence (read: strategic depth) in that hapless and troubled land with its cadre of the faithful like the war lord Gulb-ud-din Hekmatyar, the Haqqani terror network, remnants of the Al Qaeda, and importantly the Afghani Taliban will perhaps be stating the obvious. Notwithstanding the façade of recent parleys between Afghan President Hamid Karzai and Pak President Asif Zardari

orchestrated by British Prime Minister David Cameron, to get the 'moderate' Taliban to talk to the Karzai government is nothing but an exercise in self-delusion. Pakistan hopes for, and with good reason, the Taliban to have a walk-over in Kabul as soon as US forces depart. Islamabad aims to then speedily fill the strategic vacuum in wake of the ill-timed and premature departure of the US and other International Security Assistance Forces (ISAF) from Afghanistan. Notwithstanding pious statements emanating from the senior US establishment regarding the efficacy of Karzai-led Afghan government to be adequately prepared to fill the void after the US forces depart is nothing short of pure chicanery.

The land of the Hindu Kush thus awaits the 'slaughter of the lambs' to be followed by medieval governance once again getting resurrected in Afghanistan. The Americans, battle weary and financially fatigued, refuse to flinch despite an ignominious exit they have planned for themselves built not on ground realities of Kabul's adverse security environment but a follow-up of electoral promises delivered during their presidential elections. Even the sole global super-power has its limitations.

Back home, overall last year, Jammu and Kashmir witnessed relative peace barring sporadic incidents of violence against a few democratically elected Sarpanches (village heads) by Pak inspired militants in the Valley. A record number of tourists, both Indian and foreign, visited the beautiful Vale, ushering in much financial relief to the hapless locals who had been fed up with the nefarious activities of Pak funded terrorists and separatists.

These terror outfits have, once again, have been encouraged by the otherwise legally implemented recent execution of the 2001 Parliament attack master-mind

Afzal Guru. Pakistan's sinister Inter Services Intelligence (ISI) perhaps smelled another opportunity to re-energise terror driven activities in Jammu and Kashmir and other parts of the Indian hinterland: the Hyderabad terror strike on 21 Feb 2013 was thus a part of Pakistan's evil strategy implemented by its local followers, the Indian Mujahideen (IMD).

Importantly, as the US and ISAF departs from Afghanistan, the ISI would already be planning to divert maximum resources from its terror machine in Afghanistan to Jammu and Kashmir, a development which the Indian security hierarchy will have to seriously factor in to thwart Pakistan's evil machinations in the Valley.

That post-Afzal Guru's execution, irresponsible utterances of local politicians in the Valley including from the ruling National Conference, Mehbooba Mufti's PDP and the separatist Hurriyat conglomerate, will now surely create more law and order problems for both the state government and the Centre in the days ahead should not be the least surprising. In addition, mainstream political parties at the Centre must not add fuel to the fire in their mindless endeavours to score political brownie points over each other. In matters of pure national interest, all parties must close ranks and stand unitedly to combat the common enemy with firmness and maturity.

In the run-up to 2014, Pakistan is all set to re-ignite the flames of instability wherever it can in India. Thus we have to be fully prepared with a range of options, including the military, employing all our genius and resources to meet the looming credible threat to our security forthwith as the summer months ahead promise to be hotter than in recent times.

Lt Gen Kamal Davar (retd)

HAL Rudra handed over to Indian Army



The first Advanced Light Helicopter Mk.IV *Rudra* was handed over by Dr RK Tyagi, Chairman, HAL to Lt Gen Narendra Singh, Deputy Chief of Army Staff (P & S), Indian Army during Aero India 2013 at Yelahanka on 8 February 2013 (*see report in this Issue*).



First test for 'Nirbhay'

The DRDO-developed long-range subsonic cruise missile *Nirbhay* ('Fearless') was test fired for the first time on 12 March 2013 from the Integrated Test Range at Chandipur in the Balasore district of Odisha. This maiden test flight was intended to impact on a static target situated 1000 km away in the Bay of Bengal. The missile was successfully launched at 11:50 hrs and switched to second stage propulsion (turbine engine), travelling through its envisaged path at a speed of Mach 0.7. Tracking the test flight necessitated a flight path close to the coast. However, some 17 minutes into the flight, after the missile had cruised around 250 km at an altitude of 4.5 km, it veered off course, forcing the



command centre to abort the test and destroy the missile to avoid risk of the missile causing collateral damage. It was later confirmed that the missile fell on land near the coast but no harm was caused.

Still, DRDO has claimed the test was a "partial success" as the missile was launched and switched to second stage propulsion as planned, before deviating from its intended path. According to a source, "the cruising phase was all right, and the way-pointing, navigation systems worked well during the first 20 minutes of the flight."

Avinash Chander, Chief Controller Missiles and Strategic Systems at DRDO said that all mission parameters until the course deviation were "as expected." All the aspects of the cruise vehicle were tested and verified. "That is a major achievement," Chander added. It will take some time to analyse the exact cause for failure. Subsequent tests will be conducted "soon" with the goal to begin production by the end of 2014.

Russian Air Force to exercise with IAF

The Russian Air Force will hold six joint exercises in 2013 with the air forces of Belarus (*Zapad-2013*), France, Mongolia (*Selenga-2013*), India (*Indra-2013*), the US and NATO (*Atlas Vision-2013*) and Brunei (*SMOA Plus*). Russia will also participate in NATO's exercise *Vigilance Sky-2013*.

According to a spokesman, the Russian Air Force in 2013 will undertake type-specific advanced training courses for tactical aircraft, advanced trainers, and helicopters that were evaluated during 2011 and implemented during 2012.

Separately, according to sources in New Delhi, Sukhoi Su-30s of the IAF's Nos. 2 and 102 Squadrons will participate at the forthcoming 'Red Flag' meet at Nellis Air Force base in Nevada, USA.

Induction of air-launched BrahMos

Induction of BrahMos supersonic cruise missiles into the Indian Air Force will be completed by the end of 2014, according to Dr. Sivathanu Pillai, Chief Executive Officer and Managing Director of BrahMos Aerospace Private Limited. Dr. Pillai also said that BrahMos would be upgraded to a hypersonic cruise missile with a speed of Mach 7 by 2017. "While Europe, the US, and China are in the process of developing such missiles, efforts are under way in India to make Mach 8 possible". The Indian Army is the only Service to have in its possession such a powerful cruise missile, he added.



20 HAL Cheetals for Indian Army

The Army has ordered 20 HAL-built Cheetal light helicopters at a cost of Rs. 418 crore. The helicopters are to be delivered over the next four years, according to a statement from HAL. The contract signed with the Ministry of Defence includes supply of associated equipment, training of pilots and technical crew.

While this is the first Cheetal contract for the Army, HAL has earlier supplied the Air Force with 10 Cheetals. Cheetal is the re-engined, fuel-efficient variant of the veteran Cheetah helicopter which HAL has been making for over 40 years and is powered by the Turbomeca TM 333-2M2 turboshaft engine.

Equipped with modern cockpit instruments, the Cheetal can fly for 640 km or 3.5 hours, can take higher payload of 90 kg to a height of 6 km. An important feature is the FADEC (full authority digital engine control) system for engine control; an electronic backup control box system automatically takes over engine control if the FADEC fails.

Mission to Mars

India is preparing to send a \$70 million space mission to Mars in 2013 to study the 'red planet's' atmosphere. The unmanned Mars orbiter mission, to be launched in October by the Indian Space Research Organisation, will undertake a 300-day journey to the planet to collect data on its climate and geology.

"The space programme epitomises India's scientific achievements and benefits the country in a number of areas," said President Pranab Mukherjee on 21 February 2013, adding that "Several space missions are planned for 2013, including India's first mission to Mars and the launch of its first navigational satellite".

The Mars mission will mark a significant step in India's space programme, which has already placed a probe on the moon and envisages its first manned mission in 2016. Four other countries have previously launched missions to Mars, including the United States, Russia, Japan and China.

Launch of ISRO's PSLV-C20

On 25 February 2013, India's Polar Satellite Launch Vehicle, in its twenty third flight (PSLV - C20), launched the Indo-French satellite SARAL along with six commercial payloads from Canada, Austria, Denmark and UK into a 785 km polar sun synchronous orbit inclined at an angle of 98.538 degrees to the equator. Launched from the First Launch Pad of the Satish Dhawan Space Centre SHAR (SDSC SHAR) at Sriharikota and having a lift-off mass of 407 kg, SARAL is the 56th satellite to be launched by PSLV. The six international payloads had a lift-off mass of 259.5 kg. PSLV - C20 is the ninth flight of PSLV in 'Core-Alone' configuration (without solid strap-on motors).



Rs. 763 Cr second interim dividend by HAL

Hindustan Aeronautics Ltd has paid Rs. 763.45 crores as second interim dividend at 634% on the paid-up share capital of Rs. 120.50 crores for FY 2012-13. The dividend cheque was presented to the Minister of State for Defence, Mr. Jitendra Singh by Dr. R.K. Tyagi, Chairman HAL in New Delhi. "Rs. 763.45 crores excludes the dividend tax", clarified Dr. Tyagi.



Dr. RK Tyagi, Chairman, HAL (second from left) handing over the second interim dividend cheque to the Minister of State for Defence, Jitendra Singh. RK Mathur, Secretary (Defence Production, extreme left) and Directors of HAL are in the photograph.

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RK Mathur, Secretary (Defence Production), KK Pant, JS (Aero), Mr. S.K. Jha, MD (HAL, Accessories Complex), P. Soundara Rajan, MD (HAL, Helicopter Complex), Dr. AK Mishra, Director (Finance, HAL) and S. Subrahmanyam, MD, (MiG Complex, HAL) were present on the occasion.

HAL had paid the first interim dividend of Rs.48.20 crores for FY 2012-13 on 7 December 2012. "HAL has set itself on the path of self reliance and to the greater national cause of indigenisation of air defence capabilities, the company has already drawn action plans to meet this objective", according to the spokesperson.

Indian Navy conducts TROPEX 2013

The Indian Navy's major annual exercise TROPEX (*Theatre level Readiness and Operational Exercise*), concluded on 1



March 2013 after over a month of manoeuvres at sea, weapon firings and tactical evaluation.

TROPEX is conducted in the Arabian Sea and aimed to assess the operational readiness of ships, submarines and aircraft from all Commands of the Navy, along with joint participation with units from the Army, Air Force and Coast Guard. Over 50 ships and submarines, including stealth frigates and nuclear-powered submarine INS *Chakra*, plus around 75 aircraft participated in the exercise. This year's iteration of TROPEX also included an amphibious exercise, involving about 2000 troops, tanks, amphibious vehicles and associated equipment.

Admiral DK Joshi, Chief of Naval Staff witnessed the proceedings "at close range." Diverse aspects of maritime operations were exercised at sea and bases ashore, with any issues identified "will be rectified and incorporated by the Navy into its Concept of Operations (CONOPS)".

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INS Saryu commissioned at Goa

Air Marshal PK Roy, C-in-C Andaman and Nicobar Command, commissioned INS *Saryu* into the Indian Navy at Goa on 21 January 2013, this being lead ship of the indigenous Naval Offshore Patrol Vessel (NOPV) Project to be inducted into the Indian Navy. Designed and built by Goa Shipyard Limited, the ship demonstrates the potential of the country's indigenous designing and ship building capabilities.

Induction of the INS *Saryu* is aimed at "meeting the increasing ocean surveillance and patrolling requirements of the Indian Navy, primary role of the ship being to undertake EEZ surveillance, anti-piracy patrols, fleet support operations, provide maritime security to off shore assets and carry out escort operations for high value assets." Capable of carrying an ALH helicopter onboard, the ship's weapon and sensor



outfit includes a SRGM 76.2 mm gun with an electro-optic fire control system, two 30mm guns as close in weapon systems, latest navigational and early warning radars, chaff launchers for self protection and an integrated ESM system to undertake all assigned missions.

The ship is propelled by two SEMT diesel engines, the largest engines of their type to be inducted in the Indian Navy, enabling the ship to achieve speeds in excess of 25 knots. A fully integrated LAN system onboard along with a CCTV management system ensures optimal utilisation of onboard equipment and better crew efficiency. The ship has a complement of 8 officers and 105 sailors, accommodated in ergonomic cabins, which provide improved crew comfort with enhanced space management.

Chief of Staff Japan Maritime Self Defence Force (JMSDF) in India

During his two-day visit to India from 25 February 2013, Admiral Katsutoshi Kawano, Chief of Staff, Japan Maritime Self Defence Force (JMSDF), called on Admiral DK Joshi, Chief of the Naval Staff, Indian Navy at Naval Headquarters, while discussing a wide range of subjects of mutual interest in the Maritime Domain. The Indian Navy and the JMSDF have been collaborating towards combating piracy off the Gulf of Aden. Admiral Katsutoshi Kawano also called on the Defence Minister AK Antony.



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LUTIONS



Admiral Katsutoshi Kawano also visited Western Naval Command Headquarters at Mumbai, where he interacted with Vice Admiral Shekhar Sinha, FOC-in-C Western Naval Command.

Successful underwater test launch of B-05 SLBM (K-15)

On 27 January 2013, the DRDO conducted the 11th successful underwater test firing of the K-15 medium range submarine-launched ballistic missile (SLBM) off the



coast of Visakhapatnam in the Bay of Bengal. The launch took place from a specially configured underwater pontoon as the launch platform. The K-15, officially designated B-05, with a range in excess of 700 km (the official range numbers are classified) is the submarine-launched version of the land-launched Shaurya missile that has so far been tested four times. The country's *Arihant*-class SSBNs will deploy 12 B-05s or four of the much longer-range K-4 missiles, which are still under development.

The missile launched from the pontoon was tested up to its maximum range and "met all mission objectives". Parameters of the vehicle were monitored by radar through its trajectory and terminal events took place "exactly as expected." This missile has been tested a number of times in the past 10 times from under water and three times from land. This particularly stringent test programme is intended to ensure that this vital leg of India's nuclear triad is as close to success as possible. The underwater component of the nuclear triad is widely viewed as the most survivable, and India's "no-first-use" policy on nuclear weapons makes operationalisation of this missile crucial.

Interestingly, the B-05 is not a 'pure' ballistic missile, as its trajectory is not a simple parabola, nor does it leave the atmosphere as typical ICBMs do. Instead, it is boosted to an altitude of about 40-50km, well within the upper limits of the atmosphere, before beginning its descent phase, which is fully guided all the way to impact, which makes it far more accurate than a conventional long-range ballistic missile. This test validates effectiveness of the missile system by itself. It is expected that the INS *Arihant* will enter service with the B-05 system "fully integrated."

INS Viraat gets 3 years extension

The Navy will be without an aircraft carrier at least till August 2013, by when the ageing INS *Viraat* is expected back in active service after a periodic refit lasting nearly 10 months. The carrier has done trials off Kochi following a Rs. 70-crore refit at the Cochin Shipyard Limited (CSL) during which its underwater surface was restored and hull painted. It headed for Mumbai in mid-March for further docking at the Naval Dockyard for repairs to its auxiliary equipment, propulsion, boilers and air conditioning which will take another five months for completion.



"The refit will see the ship through another three years, with sporadic maintenance," confirmed a Navy official. "However, one cannot predict how long it will last in service as it is linked to several other factors," he added. As for the long-delayed

acquisition of INS *Vikramaditya*, formerly *Admiral Gorshkov*, whose boilers “broke down” during pre-delivery trials in Russia in June 2012. Navy sources said the ship would be undocked for a fresh round of trials, including aviation trials, when sea ice melted “in preparation for its induction in the last quarter of 2013.”

“Indian Naval crew are being dispatched to Russia in batches. The carrier will undergo all trials, including deck-based operation of MiG-29K aircraft which will form its fleet, and high-speed trials before induction”.

In June 2013, the first indigenous aircraft carrier (IAC), under construction, will leave Cochin Shipyard’s building bay on completion of phase-I work, after a delay of over a year caused by non-delivery of critical equipment on time.

The shipyard was forced to carry out a low-key launch of the IAC in December 2011 to make way for commercial work after the gearboxes delivered to go into it were adjudged faulty. The platform, to be named INS *Vikrant* after the IN’s first carrier, was re-docked in February this year when equipment supply became steady. Contract negotiations for phase-II of carrier construction are under way. Concurrently, plans for indigenous construction of a second aircraft carrier, bigger at 60,000 tonnes are afoot with the Navy examining various options.

Of the remaining Sea Harrier VTOL fighters forming air complement of the carrier, the ship’s captain said that the aircraft, which had undergone limited upgrade a few years ago, was being “utilised optimally.”

Piaggio Aero contracts with Tata Technologies

On 8 February 2013, Tata Technologies gained a multi-year engineering services contract from Piaggio Aero Industries, of Italy. Tata Technologies will deliver a complete structural design and analysis solution for Piaggio Aero’s new Multirole Patrol Aircraft (MPA). Tata Technologies and its joint venture with Hindustan Aeronautics Ltd, Tata HAL Technologies Ltd., will deliver optimised structural design, engineering, manufacturing, and certification documents for the aircraft fuselage inclusive of the vertical fin in two separate phases. Piaggio Aero’s Multirole Patrol Aircraft (MPA) is based on the company’s P180 Avanti II multi-utility aircraft.

IndiGo gets Sharklet-equipped A320

At end-January 2013, IndiGo acquired its first A320 aircraft equipped with Sharklet fuel saving wing tip devices, becoming the first Indian carrier with the newly designed wing-tip devices. Sharklets are an option on new-build A320 Family aircraft, and standard on all members of the A320neo Family, offering the flexibility to A320 Family operators of either adding around 100 nautical miles more range or allowing increased payload capability of up to 450 kilograms. All future A320 aircraft to be delivered to IndiGo shall be fitted with the Sharklet wing tip devices.



IndiGo placed an order for 100 A320 aircraft in 2005 and became the first Indian airline to order the NEO with a contract for 150 A320neo and 30 A320s placed in 2011.

GoAir acquires A320 with Sharklets

GoAir has taken delivery of its first Sharklet-equipped A320 aircraft financed by ACG (Aviation Capital Group) under a sale and leaseback arrangement which will see the aircraft added to ACG’s growing portfolio of Airbus A320 family aircraft. The aircraft is part of an order placed by GoAir for 20 A320 neo in 2006. So far 13 aircraft have been delivered to GoAir making the first Sharklet equipped A320 the 14th to join the fleet.



Tata-HAL Technologies awarded design approval certificate

Tata HAL Technologies, the joint venture between Tata Technologies and Hindustan Aeronautics Limited (HAL) has been awarded the Design Approval certificate by the Centre for Military Airworthiness & Certification (CEMILAC), the airworthiness approval authority for military aircraft in India. “The certification showcases the solid foundation, systems and deep aerospace domain expertise at Tata HAL Technologies.”



Left to right: Dr Rajarajan S, Vice President- Delivery, Tata HAL Technologies Ltd., Lokesh Ranjan Srivastava, Chief Executive Officer, Tata HAL Technologies Ltd., Dr. K Tamilmani, Chief Executive (Airworthiness), CEMILAC, Dr. K Balakrishna, Senior Advisor, Tata HAL Technologies Ltd. and Sharad Moodi, Deputy Project Manager, Tata HAL Technologies Ltd.

EC135s for Indian operators

In February 2013, Eurocopter signed a sales contract for one EC135 to Ghodawat Industries, which will be delivered in May 2013 and replace the company's smaller Eurocopter EC120. Separately, Eurocopter provided a new EC135 to Mahindra & Mahindra for corporate transportation use. Mahindra's aerospace manufacturing arm, Mahindra Aerospace, is a partner of Eurocopter, both parties having forged a trade partnership focused on the manufacture of subassemblies, engineering and customisation of civil helicopters, as also the joint development of specific market segments in India.



"In 2012, the majority of new contracts signed with Indian customers were for the EC135," stated Eurocopter India CEO Xavier Hay. "The Ecureuil and Dauphin families have been leading the light-single and medium-class segments respectively in India. The EC135 has now made its mark to be the helicopter of choice for customers looking for light twin-engine rotorcraft products."

BEL MoU with Elbit

Bharat Electronics Ltd (BEL) have signed a Memorandum of Understanding (MoU) with Elbit Systems Electro-optics-Elop Ltd, Israel, for the joint development of



Compact Multi Purpose Advance Stabilisation System (CoMPASS) for naval applications. The CoMPASS is a day-and-night surveillance system that includes a colour TV daylight camera, 3rd generation 3-5 μm FLIR sensor, laser target designator and rangefinder (LTDRF) and automatic tracking capabilities, as well as command and control capabilities. It is



H N Ramakrishna, Director (Marketing), BEL and Adi Dar, Executive VP, of Elbit Systems Electro-optics-Elop Ltd., Israel, exchange documents after signing of the MoU.

distinguished by a wide variety of interfaces, enabling integration with various aircraft/helicopter systems, such as mission computer, fire control, radar, GPS, data downlink and helmet-mounted tracking systems. Its small dimensions, low weight, high level of stabilisation and coverage angles make it an optimal choice for long-range, day-and-night surveillance, target tracking, fire control applications and search and rescue. CoMPASS has been nominated for the 56 naval utility helicopter (NUH) programme of the Indian Navy.

Sagem Services India created

Sagem (Safran) has created Sagem Services India Private Ltd., a wholly-owned subsidiary that will be headquartered in New Delhi. Primarily focused on maintenance, Sagem Services India will provide customer support for all Sagem avionics, optronics and inertial navigation systems and equipment in service in India.

The creation of Sagem Services India marks a major step and Sagem's development and working with its customers, Sagem will enhance its role in the development of India's aerospace industry, and form new partnerships in all of its business sectors. Already a contributor to several major Indian civil and military aircraft programmes

Sagem makes the flight control system for the Dhruv ALH. In addition, it makes Sigma laser gyro navigation systems, hundreds of which have been acquired for the Hawk Jaguar, MiG-27, MiG-29K, Su-30 MKI and LCA Tejas. Sagem works closely with Indian industry to supply avionics and navigation systems for both new aircraft and modernisation programmes. Sagem's new subsidiary will draw on the resources of its parent company, Safran, which already has some 2,100 employees in India.

Eurocopter and AVIATORS in emergency medical services

Marking a key milestone in India's development of modern heliborne resources to support lifesaving missions, AVIATORS Pvt Ltd have signed a firm order for an initial batch of seven Eurocopter EC135 aircraft for helicopter emergency medical services (HEMS) operations. This was during the French President François Hollande's Indian visit on 14 February 2013. A second order is expected to be signed later this year and rapid growth is anticipated in the HEMS market with nearly 50 helicopters to be deployed throughout the country in coming years. With first deliveries planned for late 2013, AVIATORS is establishing itself as a pioneering HEMS operator in India. "As the EC135 is a global reference in helicopter emergency medical services, it is highly appropriate that AVIATORS will introduce such operations in India with these extremely capable helicopters," explained Norbert Ducrot, Eurocopter Senior Vice President for Asia Pacific.



Arun Sharma, Managing Director, Aviators with Norbert Ducrot, Eurocopter Senior Vice President for Asia Pacific.



EC135

Lifetime Achievement Award for CEO Avi-Oil JR Nanda

At a special function on the eve of Aero India 2013 in Bangalore, Dr VK Saraswat, Scientific Adviser to the Minister of Defence, honoured JR Nanda, Chief Executive Officer Avi-Oil, with the prestigious *Lifetime Achievement Award*.



JR Nanda's is a unique story of lifetime association with aviation and his passion for every facet of the Indian Air Force since its establishment in 1932. While the company he heads 'oils' the machines the IAF flies, he patiently and meticulously keeps adding to his enviable collection of IAF memorabilia : historical accounts, images, biographies of air warriors, especially those who founded the IAF and were part of it in nascent years, plus stamps, proving his impeccable credentials as a repository of memories of the air glorious past and an engaging raconteur of its present aspirations and achievements.

Besides, Mr Nanda frequently sponsors, supports and contributes material for books on the IAF, the most recent publication being 'The Indian Air Force at Eighty, 1932-2012', by Vijay Seth released by Air Chief Marshal NAK Browne, CAS, during Aero India. 2013.

Peter Gutsmedl is Cassidian's first Head of Asia-Pacific region

Cassidian has appointed Peter Gutsmedl as head of operations in Asia-Pacific and takes up this newly created role in addition to his position as CEO India . Gutsmedl's additional responsibility for the region reflects a realignment of Cassidian's business structure. "To better tap growth opportunities worldwide,



Cassidian has reorganised its newly integrated Sales and International Operations Division along the lines of three major regions: Asia-Pacific, Americas and Europe, Middle East & Africa (EMEA). As the in-charge of Asia Pacific, Gutmiedl supports the recently appointed Cassidian Chief Sales Officer Christian Scherer.”

On his new responsibility, Gutmiedl remarked, “I am looking forward to expanding Cassidian’s Indian operations into a springboard for strong and sustained growth in Asia Pacific. The capabilities at our Engineering Centre in Bengaluru allow Cassidian to customise products from our global portfolio according to local requirements. This gives Cassidian a competitive advantage in India which we can also leverage to target other Asian markets with similar requirements.”

HAL- Rolls Royce Production Facility Inaugurated

The International Aerospace Manufacturing Limited’s (IAMPL) production facility was formally inaugurated in Bangalore by Mr. K. Naresh Babu, Managing Director HAL (Bangalore Complex). Incorporated in July 2010, IAMPL is a 50:50 Joint Venture Company (JVC) of HAL and Rolls-Royce (UK). “The production facility incorporates the latest Rolls-Royce manufacturing techniques and will create job opportunities for highly skilled technicians and engineers in India”, said Mr. Naresh Babu. The facility will begin manufacturing production components later this year.



K. Naresh Babu, Managing Director, HAL (Bangalore Complex), inaugurating the HAL- Rolls Royce Production Facility, alongside Kishore Jayaraman, President, Rolls-Royce, India.

Commenting on the development, Dr. RK Tyagi, Chairman, HAL, pointed out that HAL and Rolls-Royce have been strategic partners for long. “This is a step towards indigenous production activities in the crucial aero-sector. The state-of-the-art facility in Bangalore will produce components for the technologically advanced Trent family of civil aero engines, as well as for a number of marine and energy gas turbines.”

At an investment of \$25 million (nearly Rs 135 crore) the Unit incorporates latest Rolls-Royce manufacturing techniques for making

130 different compressor parts. The facility will include latest machine tools, computerised maintenance management systems, metal spray booths and non-destructive testing lines. The newly-inaugurated facility will have about 100 employees.

HAL began producing the Orpheus engine under licence followed by maintenance of the Gnome engine and the 501 K industrial gas turbine. HAL is the production agency of Rolls-Royce’s Adour 804/811 engine for the Jaguar aircraft since 1981. HAL is now manufacturing the Adour Mk. 871 for Hawk Advanced Jet Trainers. “The JV is also committed towards developing a robust supply chain management system to ensure nurturing of small and medium enterprises and will have about 225 vendors initially”, according to a RR spokesman.

Tejas LSP-8 in maiden flight

The last Tejas LCA Limited Series Production (LSP) aircraft conducted its maiden flight at Bangalore on 31 March 2013. Dr RK Tyagi, Chairman HAL said the performance of the aircraft was “flawless.” The aircraft, bearing tail number KH2018, was flown by Air Cmde KA Muthana, who put it through its paces, covering supersonic flight as well as controlled flight at an angle of attack of 20 degrees, which is the current maximum limit.



The aircraft was built to ‘Initial Operation Clearance standard’ and underwent a series of rigorous checks by certifying and inspecting agencies two weeks prior to its flight, along with a few taxi checks to assess aircraft performance. The flight clearance for the aircraft was accorded on 31 March itself after ensuring that all systems were functioning satisfactorily on the ground. Typically, aircraft undergo high-speed taxi trials prior to first flight. However, with confidence gained by the flight crew and certifying agencies during the build and ground checks the decision was taken to proceed to first flight without going through a separate high-speed taxi trial.

Aircraft systems related to fuel, environment condition, electrical and avionics, which had undergone a series of modifications based on feedback from earlier prototype and LSP aircraft are reported to have “functioned well.”

BrahMos underwater test "successful"

The submarine-launched version of the BrahMos supersonic cruise missile was successfully test-fired on 20 March 2013 from a submerged platform in the Bay of Bengal off the coast of Visakhapatnam. The missile took off vertically from the submerged platform, took a turn towards the designated target over 290 km away, and impacted the target as expected, meeting all mission objectives. All the telemetry and tracking stations, including Indian naval ships positioned throughout the flight path, confirmed the accuracy of the mission.



This is the first time that any supersonic cruise missile has been launched vertically from a submerged platform, and this new variant of the BrahMos is intended to add more firepower to the Navy's underwater weapons delivery capabilities.

Dr A Sivathanu Pillai, CEO and MD BrahMos said the "missile is fully ready for fitment in P75(I) submarines of the Indian Navy in vertical launch configuration which will make the platform one of the most effective in the world."

Congratulating the team, Dr VK Saraswat, Scientific Advisor to the Defence Minister, and DG DRDO called the test "yet another landmark technological breakthrough" and a significant step towards boosting India's military strength. Defence Minister AK Antony congratulated the DRDO scientists and Russian specialists along with Indian Navy personnel associated with the project, stating that it was a "wonderful achievement and proud moment for India."

BAE Chairman flags off mobile hospital in Bengaluru

BAE Systems Chairman Dick Olver flagged off a mobile mini hospital 'Smile on Wheels' that will provide primary healthcare services to underserved communities in Bengaluru on 26 March 2013. The mini hospital is part of the company's 'Corporate Responsibility' programme in India through which it supports development programmes in the areas of primary education and healthcare in rural and urban communities across seven states of the country. For this, BAE Systems has partnered with Smile Foundation, a national level development organisation with an outreach of over 200,000 underprivileged children, women and youth across 25 Indian states. Mr. Olver led the BAE Systems Board's first visit to India, one of its five key markets. Accompanying the Board was Guy Griffiths, Group Managing Director – International, Dean McCumiskey, Managing Director and Chief Executive - India, and a number of senior company executives.



Dick Olver, Chairman, BAE Systems and Ian King, CEO, BAE Systems, flag-off the mobile hospital

Boeing and BEL expand partnership in India

Boeing and Bharat Electronics Limited (BEL) are expanding their partnership through a follow-on contract involving manufacture of subassemblies for the Boeing F/A-18E/F Super Hornet fighter. This contract adds to orders Boeing awarded BEL in 2011 for Super Hornet components. BEL also delivers components for the P-8I maritime reconnaissance aircraft. Through the new contract BEL will produce Super Hornet subassemblies including its Ground Power Panel, Helmet Vehicle Interface Stowage and Switch assembly and Cockpit Console Panels. For the F/A-18, BEL also produces a stowage panel for the Joint Helmet Mounted Cueing System connector cable and an avionics cooling system fan test switch panel with a Night Vision Imaging System-compatible floodlight assembly. For the P-8I it provides Identification Friend or Foe interrogators and Data Link II communications systems.

Third ASW corvette for Indian Navy launched

The third Anti-Submarine Warfare (ASW) corvette for the Indian Navy designed under Project-28 (P-28) by the Navy's Directorate of Naval Design, and built by Garden Reach Shipbuilders and Engineers Limited (GRSE), was launched in Kolkata, on 26 March 2013.



Named after an island (Kiltan) in the Lakshwadeep archipelago, the vessel was launched by Mrs. Chitra Joshi, wife of Navy Chief Adm DK Joshi from the GRSE mainyard in the presence of the CNS himself, and Chairman and Managing Director, GRSE, Rear Admiral (Retd) A K Verma and other officials from the Ministry of Defence, Armed Forces and West Bengal administration.

With nearly 90 per cent indigenous content aimed to be achieved in the manufacturing of the ship, the efforts made by Indian Navy and defence shipyards towards the national goal of indigenisation and self-reliance have been given a major impetus with this latest launch.

The first GRSE-built ASW corvette, INS *Kamorta*, is expected to be delivered this year. The remaining three ships, will be delivered by 2016 according to GRSE.

Kadet Defence Systems aerial targets to Indian Army

On 1 April 2013, Kadet Defence Systems successfully completed delivery of 70 JX2 aerial targets along with spares, ground support equipment and training aids.

The JX2 Aerial Target System is a versatile training aid for air defence gunnery and missile practice and has been supplied in the sleeve tow configuration pursuant to a contract entered into in May 2010 with the Ministry of Defence for 350 aerial targets, spares, ground support equipment and training services. The deliveries were preceded by extensive quality assurance tests, environmental trials as well as flight tests.



The JX Range of Aerial Targets comprises the propeller driven JX2 and the jet powered JX3. The systems can be configured to emulate various threat perceptions and can carry various payloads including IR flares, smoke generators, Luneburg lens, chaff and miss distance indicators. The aerial targets can also be retrofitted with tow systems to economise weapon training and development.

HAL eyes greater role in civil sector

HAL achieved a turnover of Rs 14,316 crore in the financial year 2012-13 (provisional figures), with the profit before tax for FY2012-13 period standing at Rs. 3,471 crore. The company has declared an interim dividend of Rs. 823 crore, 683% of equity base of Rs 120.50 crore for the financial year.

"We strive to live up to the expectations of our stakeholders", said Dr R K Tyagi, Chairman HAL, adding that the company's return on investment is comparable to some of the best companies anywhere.

Being a technology driven company HAL continued its focus on R&D, spending Rs.1749 crore (12% of turnover) towards technology development. The company filed a record 32 patents in 2012-13, and the year witnessed landmark events such as handing over of the first weaponised Advanced Light Helicopter (ALH) 'Rudra' to the Indian Army, export of Cheetah helicopters to Republic of Surinam and Do 228 light transport aircraft to the Seychelles. Additionally, first flight of the DARIN III Jaguar and LCA Naval prototypes took place in the last year, as well as the last of the limited series production (LSP) Tejas LCA.

Backed by extensive experience with military aviation and considerable infrastructure, HAL plans to foray into the civil aviation sector, which is forecast to have promising growth. Separate divisions are planned to handle the civil segment including suitable partnerships with private Indian industries and foreign operators.

Dassault

Eurojet EJ 200 offered for Indian programmes

The Eurojet EJ200 turbofan with its maximum thrust of 90kN (with reheat) is the powerplant for the Eurofighter Typhoon for which Eurojet was contracted in December 2006 to produce a total of 1,400 engines. The Eurojet consortium was formed in 1986 to co-ordinate and manage the project and has worked on this three-stage fan with a high pressure ratio, five-stage low-aspect-ratio high-pressure (HP) compressor with active tip-clearance control. Its combustor uses advanced cooling and thermal protection, and single-stage HP and low-pressure (LP) turbines with PM discs and low-density single crystal blades. The reheat system provides thrust augmentation and the variable area final nozzle is of a convergent-divergent design.



In 2009, Eurojet was invited to offer its EJ200 turbofan to power the Tejas LCA Mk.II in competition with General Electric's F414. Although after evaluation and acceptance of the technical offer provided by both Eurojet and GE Aviation, the commercial quotes were compared in detail and GE Aviation was declared as the lower bidder, the EJ200's thrust vectoring potential would make this an interesting option particularly for the LCA Navy variant.

The EJ200, which has potential for thrust augmentation by another 25%, has also been on offer for the Advanced Medium Combat Aircraft (AMCA) programme which is being progressed by the Aeronautical Development Agency (ADA) at Bangalore.

Raytheon systems for India

As the Indian Navy inducts the new generation P-8I Poseidon multi-mission maritime aircraft into its inventory Raytheon Missile Systems has developed an extended range wing kit for its torpedoes that can further enhance its capabilities. Raytheon's 'Fish Hawk' is a smart wing kit for MK54 Lightweight Torpedo (LWT) that is deployed by the P-8I. Fish Hawk enables operators to launch torpedoes at multiple targets from high altitude at stand-off range. "It is ideal for maritime patrols flying at a high altitude to avoid sub surface-to-air detection or firing, and eliminating the need to descend to lower altitude to launch a torpedo" and is also compatible with other platforms and torpedoes.

Raytheon has also begun the installation of 126 Munitions Control Units for the Indian Air Force's Jaguar aircraft. The MCU enables integration of modern weapons on legacy wing aircraft with minimal to no modifications to aircraft wiring and the flight or stores management software. The MCU's compact size enables it to be located in a weapons pylon or avionics bay of a legacy aircraft. From there, it interfaces between 'smart' weapons and the existing software of a legacy aircraft.



Munitions Control Units for the Indian Air Force's Jaguar aircraft.

Indian Air Force's first Boeing C-17 in flight tests

On 22 January 2013 Boeing delivered the first of 10 C-17 Globemaster III airlifters for the Indian Air Force. India's first C-17 will now enter a US Air Force flight test programme at Edwards Air Force Base in Palmdale, California and the company is on track to deliver four more C-17s to the IAF in 2013 and five in 2014.

The Indian Ministry of Defence signed an agreement with the US government on 15 June 2011 to acquire 10 C-17 airlifters, making India the largest C-17 customer outside the United States. The governments finalised the Foreign Military Sales contract for the airframe on 6 June 2012.

Boeing has delivered 250 C-17s worldwide, including 218 to the US Air Force Air Guard and Reserve units. A total of 32 C-17s have been delivered to Australia, Canada, Qatar, the United Arab



Emirates, the United Kingdom and the 12-member Strategic Airlift Capability initiative of NATO and Partnership for Peace nations.

Boeing will support the IAF's C-17 fleet through the Globemaster III Integrated Sustainment Programme (GISP) Performance-Based Logistics contract. The GISP "virtual fleet" arrangement ensures mission readiness by providing all C-17 customers access to an extensive support network for worldwide parts availability and economies of scale. This brings spares and support closer to the point of use and makes the C-17 more affordable to own and operate.

HAL LUH programme “progressing well”

In November 2012, HAL commissioned the structural coupling rig of the Light Utility Helicopter (LUH). The jig was designed at HAL and produced by Tata Automation Limited in Pune. It was built and validated using a CAMS (Computer Aided Measurement System) laser tracker to ensure all parts were machined and fitted correctly.

The LUH is to be assembled in modular manner with subassemblies being produced at separate locations and then assembled at a single site using the coupling jig. This is intended to reduce the cycle time for structural build-up considerably.

The first cockpit structure of the LUH ground test vehicle (LUH GTV) was built on 6 December 2012, and unveiled in the presence of P Soundara Rajan, MD Helicopter Complex, MS Srinath, ED Helicopter Complex, Dr M Vijayakumar, Officiating General Manager, RWRDC and other RWRDC officers. The frame is of



monocoque construction, made from carbon fabric produced at the Composite Manufacturing Division (CMD) at HAL Bangalore.

Shortly after the cockpit structure was completed, the first engine deck assembly was also unveiled, on 14 December 2012. The engine deck structure is the last of four structural modules, and work will now commence to couple all the modules on the recently-completed structural coupling rig, to produce the first complete LUH Ground Test Vehicle.

Cassidian presents first products designed in India

The Cassidian Engineering Centre in Bengaluru has “broken new ground in the company’s partnership with India”: its engineers have designed Cassidian’s first defence technologies ‘made in India’. This pioneering achievement marks a new milestone in Cassidian’s strategy to increase its industrial presence in the country. Indian engineers at the Centre have developed a High Accuracy Air Pressure Measurement System (HAAPMS) and a Structurally Integrated Antenna (SIA). HAAPMS is a critical on-board sensor providing pilots with highly accurate altitude readings. SIA is integrated into the structure of military aircraft, reducing drag and enhancing stealth.

Cassidian is marketing these products through its extensive global sales channels and also displayed them for the first time at Aero India 2013.

Congratulating the engineers on their achievement, Cassidian India CEO Dr. Peter Gutsmedl, said: “Our first two products ‘made in India’ for world-wide use demonstrate the innovative defence engineering capabilities we have established in Bengaluru. This centre supports our global technology initiatives and gives Cassidian a competitive advantage in India: It allows us to customise global products to local requirements, especially in areas such as UAVs, radar solutions and security systems.” The facility in Bengaluru is part of Cassidian’s global engineering organisation and conceived as a ‘centre of excellence’ and a single source supplier of certain technologies.

Inaugurated in 2011, the Cassidian Engineering Centre is the first defence oriented facility owned by a foreign company in India with around 60 Indian engineers employed there.



Selection of future targeting pods

The Government of India has issued an RFP for more than 100 advanced targeting pods for its strike fighters: two systems are under consideration: the French Damocles pod, offered by Thales of France, in co-operation with Bharat Electronics Ltd. (BEL) for this programme, and the Israeli Litening, the latest version of the targeting pod developed by Rafael. Rafael and Lockheed Martin often compete for targeting pod procurements worldwide as their products – Litening and Sniper – are similar in capabilities and performance. In India, however, the US company has remained out of the competition for unexplained reasons.

India is presently operating previous generation Litening pods and Rafael has sourced Indian subcontractors for subsystems and services. Both companies have passed the technical selection and are expected to demonstrate their pods in upcoming months. Selection of the Lowest Bidder (L1) will follow later in 2013.

While Thales is regarded by BEL as a “favourite supplier for the MMRCA and Mirage 2000 upgrades,” the advantages of commonality with existing and new targeting pods is obvious, even if it is not part of the parameters to be considered for selection. Thales recently announced an improvement of its Damocles pod.

According to Rafael, Litening pods deployed with the IAF could be upgraded to the same level as the new pods, bringing the total inventory of targeting pods to more than 200, all interchangeable between strike aircraft configured to carry targeting pods. These aircraft could also carry out recce missions, using the RecceLite pod that has recently become operational with the IAF.

Rockwell Collins teams with Tata Power Strategic Engineering Division

Rockwell Collins and Tata Power Strategic Engineering Division (Tata Power SED) have announced a teaming agreement as part of their pursuit of the Indian Air Force Software Defined Radio programme.

“Together, our companies provide the expertise to deliver the best-value software defined radio (SDR) solution for the Indian Air Force while offering an unmatched opportunity for technology transfer,” said Mr. Ram Prasad, managing director of Rockwell Collins India. “This announcement formalises what has been a long-standing and positive working relationship with Tata Power SED and will provide the Indian Air Force with advanced air and ground connectivity to meet their requirements. This relationship is very strategic in nature and would provide Indian defense with not only a local, within country, long-term support and maintenance provider, but also access to state-of-the-art technology.”

Under the terms of the agreement, Tata Power SED is the prime contractor and Rockwell Collins will provide technology for the team’s software defined radio offering. If selected, the team of Tata and Rockwell Collins plan to perform the majority of functions in India, providing faster delivery times, as well as more responsive in-country service and support for the customer.

IAI in MOU with BEL on LR-SAM

A memorandum of understanding (MOU) was signed on 5 December 2012 between Bharat Electronics Limited (BEL) and Israel Aerospace Industries Ltd. (IAI) for cooperation on the future LR-SAM ship-defence system projects. The signing ceremony was between IAI’s President & CEO, Joseph Weiss, BEL’s Director Marketing, HN Ramakrishna, Eli Alfassi, Corporate VP India Operations, and other representatives.

The MoU lays out the framework for BEL-IAI cooperation, under which BEL will function as the lead integrator and produce major sub-systems. IAI will continue to act as design authority and produce sub-systems as a main sub-contractor of BEL.



Joseph Weiss, President and CEO of IAI (right) with HN Ramakrishna, Director Marketing of BEL

Bell Helicopter signs MoU with Dynamatic

Bell Helicopter, a Textron Company, has signed a Memorandum of Understanding (MoU) with Bangalore-based Dynamatic Technologies for Dynamatic to act as a sub-contractor for Bell 407 airframe cabin assembly, and airframe components. The value of this MoU is approximately \$243 million over a ten-year period starting in 2013.



“Bell Helicopter is pleased to continue to invest in India,” said Rishi Malhotra, Bell Helicopter’s General Manager in India. “This is an important step forward in expanding our customer service, engineering and manufacturing capabilities in India. Bell Helicopter has had a presence in India for nearly 20 years.”

Dynamatic has already qualified itself as a supplier to Bell and has commenced trial production of airframe components and parts. Commercial production, scheduled to start shortly at the company’s aeronautic manufacturing facilities at Dynamatic Park Peenya, will be undertaken at Dynamatic Aerotropolis, Devanahalli, in the last quarter of 2013.

India represents a significant growth opportunity for both sales and manufacturing for Bell Helicopter and parent firm Textron.

QuEST Global Engineering appoints Ashok Baweja

QuEST Global Engineering, a leading ‘pure play’ engineering services provider with headquarters in Singapore, has announced the appointment of Mr. Ashok Baweja (former Chairman HAL). In his new role, Mr Baweja will be responsible for the newly formed QuEST Global Defence Engineering Services, which will function as an independent company. The new company will focus on expanding the Engineering Services business in Aerospace and Defence sectors from OEMs. Mr Baweja will work closely with the Chairman & CEO of QuEST Global, Mr. Ajit Prabhu and help position the new entity as the preferred partner for defence offset requirements. He will be based at Bangalore.



New AOP and DG (Inspection and Safety)

On 1 January 2013, Air Marshal P R Sharma took over as the Air Officer-in-charge Personnel (AOP) while Air Marshal PP Reddy, took over as the Director General (Inspection and Safety) at Air Headquarters.

Previously Commanding the Dundigal-based Air Force Academy, Air Marshal P R Sharma was commissioned into the fighter stream of the Indian Air Force on 14 December 1974. An alumnus of National Defence Academy, Defence Service Staff College, Wellington and Royal College of Defence Studies, London, he is a Qualified Flying Instructor and Test Pilot with over 3000 hours of flying. He has commanded a fighter air base, the Aircraft and System Testing Establishment (ASTE) in Bangalore besides holding various staff appointments at Air HQ, Strategic Forces Command and Integrated Defence Staff.

Air Marshal PP Reddy was commissioned as a Fighter Pilot in the Indian Air Force in June 1977, an alumnus of RIMC, NDA and DSSC. A Qualified Flying Instructor and test pilot, who has flown over 3600 hrs on various types of fighter as well as transport aircraft, including Su-30MKIs, Air Marshal Reddy has held various Command and Staff appointments including Chief Test Pilot at ASTE, Air Advisor at High Commission of India, London, Senior Officer in Charge- Administration (SOA), South Western Air Command and Senior Air Staff Officer (SASO), Training Command, Bangalore.



Air Marshal PR Sharma



Air Marshal PP Reddy

Air Marshal BS Dhanoa appointed SASO Eastern Air Command

Air Marshal BS Dhanoa YSM VM assumed office as Senior Air Staff Officer at Eastern Air Command Shillong, on 1 January 2013. An alumnus of the NDA and a graduate of the DSSC, the Air Marshal was commissioned in the Indian Air Force as a fighter pilot in June 1978. He has had various important command and staff appointments including commanding

officer of a fighter squadron, Chief Operations Officer and Station Commander of a Fighter Base. He was chief instructor (Air) at the Defence Services Staff College, Wellington. Prior to taking over the present assignment he was Assistant Chief of Air Staff at Air Headquarters New Delhi.



Air Vice Marshal Praveen Bhatt is SOA, EAC

Air Vice Marshal Praveen Bhatt VSM is Senior Officer in Charge Administration, Head Quarters, Eastern Air Command, Indian Air Force from January 2013.

Alumnus of the NDC and a graduate of the DSSC, Air Vice Marshal Bhatt was commissioned on 29 December 1982 as a fighter pilot. The Air Officer has held various command and staff appointments including command of a fighter squadron, Chief Operations Officer and base Commander of a Forward Base plus AOC of a premier fighter base. He has had the distinction of serving as Deputy Military Secretary to the President of India. Prior to his present appointment he was at the National Defence College, New Delhi. A fighter combat leader, he has flown various types of aircrafts in the inventory of IAF.



Lt Gen Ashok Singh takes over as GOC-in-C Southern Command

Lt General Ashok Singh took over as Army Commander South on 1 February 2013. He was commissioned into 7 Guards in December 1974 and is a second generation officer, a graduate of the DSSC, Long Defence Management College, Master of Management Studies and Diploma in Advance Software Technology. He commanded the 7 Guards later a Mountain Brigade and Rapids Division.

Lt General Ashok Singh served as Defence Advisor at the Indian High Commission in Islamabad from December 2006 to July 2009.



Vice Admiral Anurag G Thapliyal is new DG Indian Coast Guard

Vice Admiral Anurag G Thapliyal took over as the 20th Director General of Indian Coast Guard on 28 February 2013. Since commissioning in the Indian Navy on 1 July 1977, the Admiral has held a mix of operational and sea appointments. He is a 'Navigation and Aircraft Direction' specialist and various sea appointments include command of INS *Ajay*, *Khukri*, *Tabar* and *Mysore*. He has had the distinction of commissioning the INS *Cheetah*, as Navigating Officer, in Poland and the INS *Ajay* and *Tabar* as Commanding Officer, both in Russia. The Flag Officer has also been the Fleet Operations Officer, Eastern Fleet at Visakhapatnam.



He has held several challenging and prestigious appointments on shore which include the appointments of Chief Instructor ND School, Dy Director Naval Operations, Joint Director Naval Plans at the Integrated Headquarters of MoD and Director Maritime Warfare Centre Visakhapatnam. On promotion to Rear Admiral, he took over as Chief of Staff at Headquarters, Eastern Naval Command and later served as Assistant Chief of Naval Staff Information Warfare & Operations and Fleet Commander of the Eastern Fleet. While he was Commandant Indian Naval Academy Ezhimala, he was promoted to the rank of Vice Admiral.

Admiral Thapliyal is an alumnus of the Naval War College, USA and DSSC.

Air Marshal Daljit Singh is AOC-in-C South Western Air Command

Air Marshal Daljit Singh took over as AOC-in-C of South Western Air Command (SWAC) at Gandhi Nagar on 1 March 2013.

Air Marshal Daljit Singh was commissioned in fighter stream of the Indian Air Force in June 1976, is an alumnus of the NDA, and has flown over 3500 hours on various aircraft which include Gnats, Ajeets,



MiG-21s, Su-30MKIs and Mirage 2000s. He is a qualified flying instructor and a graduate of the DSSC.

Air Marshal Daljit Singh has held a variety of operational and staff appointments, including command of a frontline fighter squadron, Chief Operations Officer of an operational base and command of a premier fighter base. He was Director General Air (Operations) at Air HQ prior to assuming the post of AOC-in-C.

Air Marshal SB Deo takes over as DG Air (Ops)

On 1 March 2013, Air Marshal Shirish Baban Deo took over as Director General Air (Operations) at Air Headquarters, New Delhi. He was commissioned in the fighter stream on 15 June 1979 and has to his credit 4000 hours of operational and training flying, is a Fighter Combat Leader and an A2 Qualified Flying Instructor. He has been a Directing Staff at TACDE and an instructor at the Flying Instructors School, Air Force Station Tambaram. Prior to taking over as DG Air (Ops), he has held various staff appointments and worked in Ops / Plans Directorates at Air Headquarters.

Dr. K Tamilmani is Chief Controller (R&D) Aeronautics at DRDO

Dr. K Tamilmani, Distinguished Scientist and Chief Executive, Centre for Military Airworthiness and Certification (CEMILAC), one of the key establishments of Defence Research & Development Organisation (DRDO), has been appointed as the Chief Controller (R&D) Aeronautics. Graduate in Aeronautical Engineering from MIT, Chennai, Dr. Tamilmani did his post graduation in BITS, Ranchi, MA (Defence Studies) at Madras University, MBA (HRD) at IGNOU and has been conferred with the Doctoral Degree in 'Defence and Strategic Studies' by the University of Madras.

He served as the Director, Centre for Air Borne Systems (CABS) before being appointed as the Chief Executive (Airworthiness) at CEMILAC. He is also a Flight Test Instrumentation Engineer trained at EPNER, France.

Dr K Tamilmani is recipient of many awards and honours for his work including the 'DRDO outstanding contribution award' in recognition of rotodome modification and flight testing of HAL HS 748 aircraft. He also received the 'Prof VM Ghagte Award' for his contributions to the indigenous Airborne Early Warning (AEW) programme by the National Aeronautical Society of India (AeSI). He was also conferred with DRDO's prestigious 'Agni Award for Self Reliance-2008'. He has also received the DRDO's 'Technology Leadership Award -2011' from the Prime Minister of India, Dr Manmohan Singh.

“For Outstanding Leadership”

National Aeronautical Prize for P. Soundara Rajan, MD Helicopter Complex, HAL



Dr MM Pallam Raju, Minister of Human Resources Development presenting the AeSI award to Mr Soundara Rajan at Hyderabad, Dr VK Saraswat seen in the centre.

The Aeronautical Society of India (AeSI) has awarded the National Aeronautical Prize for 2012 to HAL's P Soundara Rajan, Managing Director (Helicopter Complex). Dr MM Pallam Raju, Minister of Human Resources Development presented the award at a function held during the 64th AGM of the Aeronautical Society at Hyderabad on 16 March.

The prize was instituted by the Aeronautics Research and Development Board in 1988 to recognise outstanding contributions in design/development of fundamental and applied work in the field of aeronautics. This award also marks the first time that a manufacturing engineer has been recognised for contributions to the aviation industry in the country. Mr Soundara Rajan is a past recipient of the National Award for Indigenisation, also presented by the AeSI.

P Soundara Rajan joined HAL as a management trainee in 1975 and has over 37 years of experience in the field of manufacture, repair and overhaul of aircraft, helicopters, aero engines and aero accessories. He initiated

several path breaking steps at HAL such as aligning the Quality systems to international AS 9100 & NADCAP standards, implementation of ERP systems, indigenisation of key systems and establishing long term business agreements with supply chain.

He established a major overhaul line for the Mirage 2000 and its systems,

the first of its kind outside France at the time. He was also responsible for establishing a world-class, state-of-the-art Centre of Excellence for Manufacture of Aerospace Composites. This Centre has subsequently expended into the Composite Manufacturing Division (CMD), of which he was the first General Manager.

Prior to his appointment as Director (Corporate Planning & Marketing) in August 2009, Mr Soundara Rajan was General Manager (Projects) at HAL Corporate Headquarters in Bangalore. He is presently Managing Director of Helicopter Complex, which position he has held since September 2010, where the entire gamut of Helicopter production – from design & development to manufacturing and maintenance, repair and overhaul – is under his stewardship. He has also held the additional charges of Director (Corporate Planning and Marketing) from September 2010 to August 2011 and Director (Design & Development) from October 2011 to January 2012.



Mr P Soundara Rajan, with Chairman HAL, Deputy Chief of Army Staff and ADG Army Aviation at the handing over ceremony of the first HAL Rudra (ALH-WSI) to the Army at Yelahanka on 8 February 2013.



Contingent of the Maratha Light Infantry.



General Bikram Singh, Chief of Army Staff, inspecting the parade.

Army Day 2013

In stark contrast to the rather modest celebrations marking the Indian Air Force's 80th anniversary on 8 October 2012, the Army put on quite an impressive show on 15 January this year, marking the day 65 years ago when General KM Cariappa (later Field Marshal) took over as the first Indian C-in-C of the Army. The traditional parade took place at the Delhi Cantonment parade ground, near Palam AFS, and along with an impressive parade of marching columns and equipment, included a spectacular assault demonstration for the attendees.

The three service chiefs were in attendance, with the Army Chief, General Bikram Singh presenting a number of awards for service and gallantry, in addition to reviewing the parade. After the Chief's address, a succinct speech paying tribute to the capability of the Army, the spirit of its personnel and homage to its martyrs and veterans, the parade was officially underway.

The marching contingents included the horse-mounted 61st Cavalry, one of the last horse-mounted regiments in the world, the Maratha Light Infantry, Dogra Regiment and



61st Cavalry mounted on horses.



The Punjab Regiment column.



Arjun main battle tanks.



BrahMos supersonic cruise missiles on transporters.



The Pinaka multi barrel rocket launcher.

Garhwal Rifles among others. Equipment on parade included Arjun main battle tanks, T-72 and T-90 tanks, BrahMos cruise missile transporter-erector-launchers (TELs), the Pinaka MBRL rocket artillery system, Chemical Biological Radiological Nuclear (CBRN) recce vehicles, and a Radio Trunking System Mk-II.

The Corps of Signals motorcycle rider display team, popularly known as the 'Dare Devils' then performed their typically breathtaking display, following which, the assault demonstration began with a starting series of explosions!

Featuring such excitement as low passes by HAL Lancer light attack helicopters simulating clearing of landing areas for helicopter-borne assault troops, the parade ground was briefly transformed into a mock battlefield, with thick smoke, rapid movement of vehicles and artillery and helicopter insertion of troops via HAL *Chetak* and HAL *Dhruv* helicopters. After the dust had settled and smoke had cleared, the Indian Army had "secured" the parade ground, and the battle was won !

Photos and text by Angad Singh





FH-77B 155mm howitzer.



Army HAL Lancer with gun pods and rocket launchers.



Army HAL Chetak lands in front of the audience.



Flying the flag!



Army HAL Dhruv ALH carrying out extraction of troops.

'Sare Jahan Se Acha'

Celebrating the 64th Republic Day

On 26 January 2013, Rajpath in the heart of New Delhi was once again witness to the nation's military prowess and air power as also the country's rich and diverse cultural heritage.

Amongst highlights of the 64th Republic Day parade was included the 5,000 km range Agni-V ballistic missile and Arjun main battle tank developed by the DRDO, an Armoured Amphibious Dozer (AAD) which is the indigenously developed versatile combat engineering vehicle with specific earth moving and amphibious capabilities in a variety of terrains, a tracked ambulance based on an APC platform, the BrahMos weapon system, the Pinaka Multi Barrel Rocket Launcher System, Chemical Biological Radiological Nuclear (CBRN) recce vehicle, and Radio Trunking System Mk-II (RTS Mk-II). The Army's mechanised columns were supported from the air by three Dhruv ALHs of the Army Aviation Corps (more on this in the Aero India 2013 section in this Issue). Clearly, the focus of the military section of the parade was to play up India's burgeoning domestic capability in defence production.

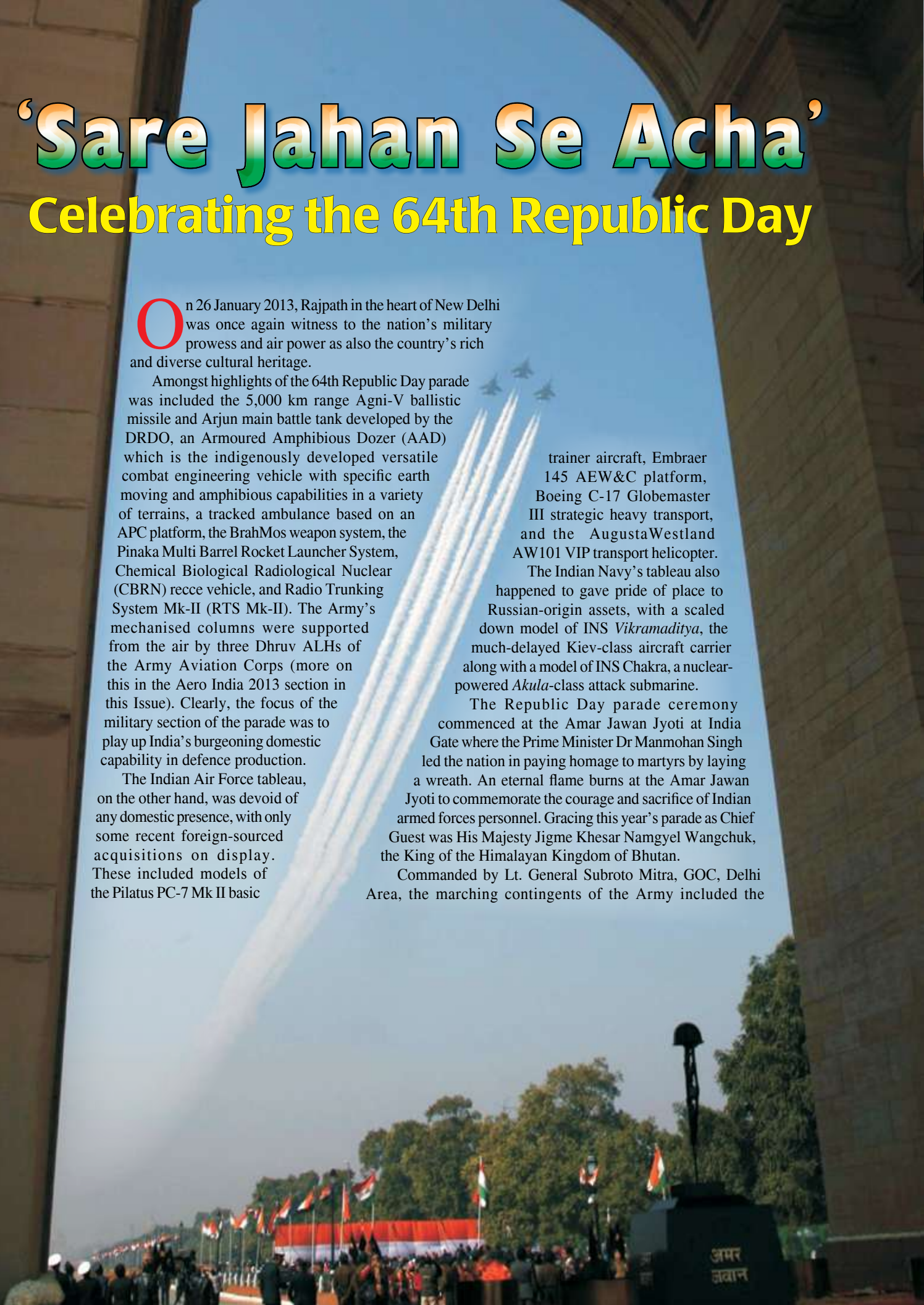
The Indian Air Force tableau, on the other hand, was devoid of any domestic presence, with only some recent foreign-sourced acquisitions on display. These included models of the Pilatus PC-7 Mk II basic

trainer aircraft, Embraer 145 AEW&C platform, Boeing C-17 Globemaster III strategic heavy transport, and the AugustaWestland AW101 VIP transport helicopter.

The Indian Navy's tableau also happened to gave pride of place to Russian-origin assets, with a scaled down model of INS *Vikramaditya*, the much-delayed Kiev-class aircraft carrier along with a model of INS *Chakra*, a nuclear-powered *Akula*-class attack submarine.

The Republic Day parade ceremony commenced at the Amar Jawan Jyoti at India Gate where the Prime Minister Dr Manmohan Singh led the nation in paying homage to martyrs by laying a wreath. An eternal flame burns at the Amar Jawan Jyoti to commemorate the courage and sacrifice of Indian armed forces personnel. Gracing this year's parade as Chief Guest was His Majesty Jigme Khesar Namgyel Wangchuk, the King of the Himalayan Kingdom of Bhutan.

Commanded by Lt. General Subroto Mitra, GOC, Delhi Area, the marching contingents of the Army included the





horse-mounted 61st Cavalry after whom marched columns of the Mechanized Infantry Regiment (not on IFVs), Maratha Light Infantry, Dogra Regiment, Garhwal Rifles, Ladakh Scouts, 58 Gorkha Training Centre, Army Ordnance Corps and Territorial Army (Punjab). The marching

contingents of the Navy comprising 144 men whilst a similar number comprised the Air Force contingent.

These were followed by contingents of the paramilitary and other auxiliary civil forces from the Border Security Force, Assam Rifles, Coast Guard,

Central Reserve Police Force, Indo-Tibetan Border Police, Central Industrial Security Force, Sashastra Seema Bal, Railway Protection Force, Delhi Police, National Cadet Corps and National Service Scheme and ex-servicemen marching proudly.

Tableaux from 19 states and Central Ministries and Departments represented the multi-faceted rich historical, architectural and cultural heritage of the country.

Grand finale of the parade, and always eagerly awaited, was the flypast by the IAF, with three Mi-35 helicopters in 'Vic' formation, followed by three C-130J Super Hercules aircraft in 'Vic' formation. Trailing the Hercules formation was a 'Big Boy' formation comprising an Il-78, flanked by two An-32s and two Dornier 228s. The fighters were next, five Jaguars followed by five MiG-29s, and then a trio of Su-30MKI in 'Trishul' formation over Rajpath, making a split manoeuvre as they climbed skywards over the crowds gathered below, making a trident in the sky.

Three days later and marking end of the Republic Day celebrations, massed bands from the Army, Navy and Air Force played various military tunes at the Beating Retreat at Vijay Chowk on 29 January 2013.

President Pranab Mukherjee, Vice President Mohammad Hamid Ansari and Prime Minister Dr Manmohan Singh along



with thousands of specially invited guests attended this beautiful ceremony. Lifting martial tunes and massed pipes and drum bands reverberated through the air, while the majestic Raisina Hill lit up the evening, bringing the curtains down on the 2013 Republic Day celebrations.





Innovative action –



Air Marshal Brijesh Jayal on self reliance in Indian Aeronautics

With the ninth edition of the biennial Aero India Show as backdrop, it is opportune to take a snapshot view of how Indian aeronautics and more specifically, its industry, have evolved over the years since Aero India made its debut in 1993 (as *Avia India* then), or 20 years back.

Systemic change commenced early in the year 2000, when as part of reforming the national security system, new defence procurement management systems and procedures came into being. A formal Defence Procurement Procedure (DPP) followed in 2002 with the avowed objectives of ensuring expeditious procurement of weapon systems to meet operational needs of the armed forces along with “transparency and probity” and keeping the interests of self-reliance in mind. Simultaneously, and

in a significant departure from the past, defence production was thrown open to the private sector with FDI up to 26 per cent being permitted.

In 2005, an offset clause amounting to 30 per cent of the indicative cost in the RFP for projects of Rs 300 crore and above was introduced with the



not platitudes



aim of developing the Indian defence industry alongside capital acquisitions. (Significantly, the RFP for the IAF's requirement of the MMRCAs increased

this offset obligation to 50 per cent). The private sector was clearly enthused by this policy initiative as reflected in an article that stated, "The CII has always strongly



recommended that direct offsets be implemented as a matter of national policy for defence procurement. The suggested aim of the Offset Policy should be to get state-of-the-art technologies for both public and private sectors to give major thrust to self-reliance and boost defence exports." Response from the international aeronautical industry was, however, muted. Clearly, for a high technology industry with high R&D investments, the low FDI limit came as a dampener.

In June 2005, the US India-Defence Framework Relationship opened a new chapter. In an age where some say that the arms race has been replaced by a technology one, access to the US for defence purchases and defence industrial partnership, a long cherished desire of the Indian Air Force, was expected to provide a significant boost to Indian aeronautics, both in technological and industrial terms. Unfortunately, thus far, apart from certain US procurements through the FMS there is no visible advantage for strengthening our aeronautics R&D or industry.

The Defence Procurement Procedure itself has evolved over the years, with the latest version currently being that of 2011. It was the release in 2011 of a Defence Production Policy by the Defence Minister that was expected to steer the defence and aeronautical industries on a path to international standards alongside ushering in of self-reliance. Amongst other things, the policy articulates, "In order to synergise and enhance national competence in providing state-of-the-art defence equipment/weapon systems/platforms within the price lines and time lines that are globally competitive, all viable approaches such as formation of consortia, joint ventures and public private partnerships *within the Government approved framework* will be undertaken. The Academia, Research and Development Institutions as well as technical and scientific organisations of repute will be involved in achieving this objective."

As intentions go, the above is unexceptionable except for the portion in italics of which there is more comment later on. Self-reliance in the field of defence production has been a much-heralded mantra for decades now and is not new. The problem is that we have no strategy or plan nor indeed an organisation to achieve this very challenging vision.



with achieving specific operational, technological and industrial goals. This single weakness could well become the Achilles' heel of an otherwise ambitious and potentially game-changing MMRCA programme in so far as it concerns the indigenous aeronautical industry and consequently, India's oft proclaimed objective of self-reliance.

Whilst the policy encompasses all possible approaches such as Joint Ventures (JV) and Public Private Partnerships (PPP), the dampener to any private enterprise will be the rider '*within the Government approved framework*'. Since the defence production sector has forever been zealously guarded preserve of the Department of Defence Production and its DPSUs, with the Services as captive and often hapless customers, the private sector will not find ready acceptance into this exclusive club. In addition, the private sector will be saddled with issues relating to other government departments such as licensing and many others. The policy is silent on how the Department of Defence

The new policy did nothing to bridge this gap. Instead, periodic issuance of procedure and policy appear now to have become an end in itself and are hailed as "progress". The following examples indicate that not much seems to have changed over the last decade and a half.

Along with the RFP for the MMRCA, no effort was made to prepare the Indian industry, neither public nor private, to absorb the 50 per cent offsets that were

required of the competing vendors. Nor was there any institutional framework for strategising and prioritising of technologies from contending parties that would best meet our strategic and technology needs and hence be given due weightage. These are very complex issues and cannot be achieved by the MOD and its defence acquisition systems as they exist today. These are best achieved through a mission-oriented management organisation tasked





Production proposes to be a welcoming facilitator in encouraging and promoting the private sector. Instead it, along with the DRDO, will have a say in approving any and all private sector proposals. Not only does this give them authority to veto, it would certainly amount to a conflict of interest as Defence PSUs could also be in direct competition.

For a programme like the MMRCA which has drawn wide interest from all leading international aerospace giants as also their governments, it was somewhat intriguing to learn that in the very final lap of this long drawn and competitively fought race, the French aerospace major Dassault, the winner, has now asked the government to clarify what role it

envisaged for HAL and had significantly requested the freedom to decide the proportion of work to be allocated to HAL versus Indian companies in the private sector. Considering that the RFP had designated HAL as the agency to handle the indigenous portion of this programme, the very fact that such question has been raised at this penultimate stage, reveals the





wide gap that exists between policies and procedures of MOD on the one hand and the absence of sound organisational and institutional framework on the ground to assist in their fruition, on the other.

It will be recalled that there was much consternation when the contents of a cable from the US Embassy in Delhi became public in which the then US Ambassador to India, after a visit to HAL in February 2010, had expressed doubts about HAL's capability to manufacture advanced fighters under the MMRCA programme. He reportedly also expressed surprise at the lack of automation and safety precautions at the HAL plant and had cautioned his government that despite the progress evident within the Indian defence industry, American firms need to approach partnerships carefully to understand the management and technological experience of Indian firms. Cost, schedule and quality will remain key challenges for any company engaging in joint production ventures.'

That the US Ambassador resigned as soon as the US competitors had lost out on the MMRCA race may have been co-incidental, but if he were to read the latest reports from India, he may well have the last laugh. Writing in the *Business Standard*, Ajai Shukla mentions the serious difficulties that HAL is facing in graduating to production standard Tejas (LCA) from the prototype and limited series production models. He quotes Director ADA who runs the Tejas

programme under DRDO in admitting that nobody realised that setting up production line was an advanced technology by itself and wryly added that "ADA and HAL have realised that creating a production line needs major effort...that realisation has come." According to this report, a proposal to hire a foreign consultant for setting up the Tejas LCA production line is under consideration. Is it possible that having "won" the MMRCA competition, Dassault is now faced with this dilemma?

The present state of affairs is best exemplified by what two national dailies had to state on eve of the Russian President's visit to India in December 2012. One mentioned that some Rs 25,000 crore worth of defence purchase deals were expected to be signed concluding, "This will reassert Russia's position as India's largest arms supplier despite Israel, France and the US now snapping at its heels..." Another in an item titled 'Russia Cloud on Defence Self Reliance', commented on the MOD having invited Indian private companies to participate in building a Future Infantry Combat Vehicle for the Indian Army two years ago. Many reputed Indian companies had tied up with foreign ones, and so responded but have continued to await a decision. Meanwhile, Russia now senses an opportunity and is urging India to settle for its latest variant of its troop carriers. What emerges is that foreign suppliers scarcely believe in our self-reliance *mantra* and the indigenous private industry that dares to venture into





of modern aircraft manufacturing that the American diplomat had earlier reflected upon !

With recent changes in policy, some of the larger industrial houses have tentatively moved into the land defence systems arena (also civil aeronautics), but none to one's knowledge into any significant military aeronautics business. To one's mind, such reason is not the lack of desire on their part, but lack of a clear strategy and plans on the part of the MOD as also the severe limitations of a 26 per cent FDI in a field where technology is the driver. Prospective partners would need greater incentive and control when sharing technology developed after significant investments in R&D. This is a pity, considering that there is now grudging recognition that private sector participation is pre-requisite for bringing the Indian aerospace industry to global standards.

During the last decade and a half, the IAF and to a degree, the other Services, have procured airborne platforms and associated systems from across the world.

Major procurements have been made from the US, Russia, UK, France, Italy, Israel, Brazil and lately, Switzerland. The relationship with Russia, a long time traditional supplier has graduated from a buyer-seller one to joint development with the fifth-generation fighter and the multi-role transport aircraft programmes on the anvil.

This approach may be good for diplomacy and international trade but throws up huge logistical, training and engineering challenges for the IAF, and is a poor substitute for sound operational logistics and resource management. In this context one wonders if the objective of the IAF in reducing multiplicity of types, as enunciated earlier, has undergone a conscious change ?

Since this approach is driven by user requirement *and the lowest cost*, it does not provide the impetus for making the Indian aeronautical industry strong and internationally competitive. As it is the industry is saddled with problems of multiple source acquisition with little





what economists call, ‘constrained maximisation’.”

Perhaps a hint of this is evident in the DPP 2011 wherein is stated “Service HQs while laying down the QRs for defence equipment / weapon systems / platforms to be developed / integrated / made will exercise due diligence at all times to keep in view feasibility and practicability of the QRs.”

The point that the DPP fails to address is how best this feasibility and practicability will be arrived at, unless there is an appropriate management structure in place! From all accounts, the realisation now setting in is that whilst India has invested heavily in the aeronautics industry, what remains lacking is the management ethos of the private sector and a national aeronautics policy and organisational framework that is so critical for a modern aerospace power. The IAF, which for long has suffered at the hands of the industry being run as a government department, must now feel somewhat vindicated at this belated realisation.

Recently, HAL’s bid to produce a basic turbo trainer for the IAF was reportedly rejected by the MOD because costs quoted were “double” those of similar aircraft available as import (*see article on this subject in this issue*). The Government has also decided to offload ten per cent of HAL’s equity in the market to garner resources for expansion and better management, although analysts and users say the plan does not go far enough and a complete restructuring is needed and merely selling a small stake in equity will not help it revamp itself. DRDO and its performance are also being viewed through a critical lens. These incremental steps could augur well for the future of Indian aeronautics.

A National Aeronautics Policy

While India possesses all the pre-requisites for a sound aeronautics industry, its contribution to building of the nation’s air power has not been in keeping with such potential. Lack of an integrated and mission oriented approach, a national aeronautics vision, the requisite organisational framework and supporting institutions are the primary causes. To overcome these, a blueprint is suggested :



The government should adopt a *National Aeronautics Policy* and put in place a dedicated *Department of Aeronautics* guided by an *Aeronautics Commission*, along with supporting institutional bodies, tasked with strategising and achieving the optimum blend of operational, scientific, technological and industrial goals in furtherance of this policy. A proposal to this effect was first mooted by the Aeronautical Society of India under the Presidentship of Dr Abdul Kalam in 1994 and later modified and submitted to the government in 2004. It draws on the successful model of the other two high technology areas of Atomic Energy and Space and is not new to Indian governance.

Aeronautics is a high technology, high risk and high cost regime where involvement of the Indian private sector has traditionally not been allowed. The time has now come for the Defence Ministry and the armed forces to take the private sector into their fold as partners along with generous financial and technical support to enable them to reach the take-off stage. Leaving them entirely to seek unequal partnerships and joint ventures may, in the long, run, be detrimental to all parties. This can only be achieved under the broader umbrella of an Aeronautics Commission and Department of Aeronautics.

It is time for research to be delinked from weapon system design and development, which must remain preserve of the industry. The ADA should either merge with HAL - or be privatized !

As technology advances, costs rise: even the Air Forces of developed countries are being confronted with major budget constraints. In this evolving scenario, international partnerships are becoming the norm. The limit of FDI in defence production must be raised to 74 per cent from the existing 26 per cent, if any meaningful participation by high technology partners is to be envisaged.

Funding of aeronautics R&D in both defence and private sector labs by the IAF and other aeronautical users including civil aviation must be generous. This too should be under aegis of the Aeronautics Commission. Industry should consider setting up a trade association of aeronautical industries to enable constructive and meaningful participation in promoting growth of the national aeronautical industry in harmony with all stakeholders.

The ad hoc approach to resource and technology strategy as well as management is clearly evident from the current state of affairs. One of the mission objectives of the proposed National Defence University is "to

educate national security leaders on all aspects of national security strategy, national military strategy, national resource strategy, national information strategy and national technology strategy through teaching and research." The nation continues to pay for delays in setting up of the National Defence University (see *Vayu I/2013*).

In an article titled 'Challenges facing the Indian Aerospace Industry' on the eve of Aero India 1998, (15 years back) whilst making the argument for restructuring of this strategic industry and evolving a unique structure of doing business suited to the Indian environment, this writer had concluded that "Aero India 1998 is an appropriate milestone for the beginning of this exciting journey such that when Aero India 2000 heralds the new millennium, Indian aerospace industry will be well on the path of reorganisation, reconstruction and a focused future. Only then can events such as Aero India become meaningful with trade promotional activities towards benefiting Indian aerospace. For the present, they mean little."

Fifteen wasted years later, one can only hope that the stirrings of change, slowly visible, herald a new beginning. The aeronautics community within the country has the potential; it cries out for bold leadership and paradigm change.



The continuing RSH saga

An end game?

The Eurocopter Fennec during trials at Leh

At Aero India 2013, before the AgustaWestland controversy had flared up and threatened to derail a number of defence acquisition programmes, the single most vital programme that observers expected a decision on was the requirement for 197 Reconnaissance and Surveillance Helicopters (RSH). After a decade of wrangling, one cancelled tender in 2007 and an unprecedented number of commercial bid extensions (four at last count) the programme is still hanging fire – and it is anybody’s guess as to what the outcome will be.

The initial RFP

Ten years ago, in 2003, the Government of India issued an RFP for 197 light helicopters suited for high-altitude operations. These rotorcraft were intended to replace the weary HAL Chetak (Aérospatiale Alouette III) and Cheetah

(Aérospatiale Lama) helicopters operated by the Army Aviation Corps and the Air Force. Bidders for this first tender included Eurocopter with the AS550 Fennec, Bell Helicopter with the 407, Russia’s Kamov with the Ka-226, and AgustaWestland with the AW119.

In the first tender, Eurocopter and Bell made it to the final round of field trials and in early 2007, it was reported that Eurocopter had been selected, which involved 67 helicopters bought directly from France with the remainder to be built under licence by HAL in India. However, in December 2007, the entire process was derailed owing to allegations that Eurocopter had been allowed to field “a civil version” of the Fennec in field trials. Plans were announced of the issue of a fresh tender “shortly,” and the new RFPs were duly sent out in July 2008.

The second tender was valued at around \$750 million, and envisaged

acquisition of the same number of helicopters, with 133 for the Army and 64 for the Air Force. The order size was reportedly influenced by HAL’s insistence that it would be able to deliver an indigenous Light Utility Helicopter (LUH) based on experience from the Dhruv ALH programme. Another change in the tender was the offset clause, this time set at a mammoth 50% instead of the usual 30%. In response to the revised RFP terms, Bell elected not to submit a bid citing “impossibly lofty offset obligations.” This left Eurocopter, still offering the AS550, Kamov, now with the re-engined Ka-226T, and AgustaWestland with their AW119SP.

Despite the new RFP being issued in mid-2008, there were no developments for another year, with no movement on the programme until the end of 2009. In early 2010, action began to be taken, with the first round of trials conducted

in February. In September that year, it was announced that AgustaWestland had not been invited to participate in the second and final phase of trials owing to the non-current production standard of the AW119SP's engine. The reason seemed curious, since the Ka-226T at the time also lacked certification for its then-new Turbomeca Arrius 2G1 engine. In any case, AgustaWestland's protests were either ignored or turned down, and the trials continued as planned, finally concluding in December 2010.

The year 2011 was similar to 2009 in that it saw almost zero progress made by

an exasperated letter to question the reason for delays, submitting that the technical evaluation process had "taken over 38 months" and had "not yet been concluded due to reasons which are unknown" (to the European firm). In December 2012, amid growing impatience on part of the armed forces as well as the bidders, the MoD issued the following statement:

"The Ministry has not deferred its decision of purchasing of 197 Light Utility Helicopters (LUHs) and the procurement case is under examination. The Defence Procurement Procedure lays down stringent guidelines to effect utmost

The RSH situation today

In essence, it has taken the MoD a decade to accomplish nothing. The RSH programme is exactly where it was in 2003 when the first tender was issued – there are no new helicopter types in service where they are desperately needed. From 2006 to date, 11 military light helicopters have crashed, resulting in 9 fatalities. HAL's LUH is at least four years away from IOC and HAL's ability to produce the aircraft quickly enough to re-equip the Army and Air Force remains questionable. The Army, which most urgently requires new rotorcraft assets to operate in the



The Kamov Ka-226T

the Indian side toward 'closing the case.' Reportedly, the trial results from 2010 were accepted by the MoD only in October 2011 and approved by the Technical Oversight Committee in January 2012. Indian bureaucracy was once again beginning to take its toll on defence acquisitions and the forces' preparedness. In fact, in February 2012, Eurocopter sent

probity and transparency in procurement transactions."

In plain language, the bureaucracy either could not move forward owing to conflicting intents, or was deliberately dragging its heels, possibly to allow HAL the opportunity to offer a home-grown solution and avoid foreign procurement entirely.

glacial heights of northern Kashmir and elsewhere on the northern front, has just ordered 20 HAL Cheetal helicopters as a stopgap, but the Cheetal, even if produced in large numbers, is far from meeting the requirement of the armed forces for light reconnaissance and surveillance helicopters.

Angad Singh

ONCE MORE - WITH FEELING !



 **AERO INDIA 2013** 

Vayu Aerospace Review at Aero India 2013

Although billed as the 9th such event to take place at Air Force Station Yelahanka (just off the NH-7 between Bangalore and Hyderabad and enroute to the new international airport at Devanahalli), this was actually *Vayu's* 10th such Show at the same venue. *Vayu Aerospace Review* has been intrinsic part of this major Indian aviation event since 1993 and Aero India 2013 therefore marked its tenth showing over the past two decades, every one of these being comprehensively 'covered' for the Journal's extensive readership in India and globally.

For contemporary *Vayu* readers, a brief recap on the 1993 event (Avia India '93) would be of perspective interest and so as to tick mark the manner in which aerospace matters in India have evolved. *Vayu Aerospace Review* has not only had considerable editorial presence at every such Yelahanka event but have published Show Dailies in every one of them, including at the latest edition, Aero India 2013.

Going back, to 1993, then *Vayu's* editor Air Marshal CV Gole, formerly Deputy Chief of Air Staff as also one

of the IAF's pioneer test pilots and one of the industry's most highly regarded professionals wrote thus :

Each new year, somehow, brings new hope and the country's aerospace

industry, as an entity, simply gut feels that this is going to be a good year. The last weeks of 1993 witnessed India's first international air show and exposition (covered and analysed extensively in



Rafale B at low level, engines aglow !

Avi Oil



Upbeat: Defence Minister AK Antony.

this issue) and the mood is upbeat as the economic indicators continue to swing positively. A good augury could be that the Rip Van Winkles in South Block have woken from a six-year slumber to initiate the very first moves on the IAF's Advanced Jet Trainer (AJT) requirement. Then corridor gossip has it that the country's brilliant, if mercurial, Finance Minister Wizard has at last, increased allocations for the much neglected defence sector in the forthcoming national budget. So some long-awaited moves could be taken in 1994, the IAF's priority needs, i.e. getting its MiG-21bis fleet upgrade, selecting an AJT and inducting some more force-multipliers into the inventory, essentially some 'smart' weaponry and electronic-warfare gizmiks. There is hope, but a great deal of work remains to be done and as spokesmedia for the Services and the Industry, we can only urge that decisions be taken expeditiously. No decision is far worse than a less-than-perfect one !

In the civil aviation sector, 1994 must witness some momentous and historic decisions. Firstly, the repealing (or at least much modifying of) the Air Corporations act of 1953. It has taken 40 years to do so but still, it is never too late to admit it : our pundits had got it wrong then. There will be some fly-by-nights who will vanish like shooting stars, still others will be sobered by reality (and lousy balance sheets) but enough will remain to emerge much as the phoenix, brighter and smarter for the experience. The country's air travelling public should never again have it so bad and Indian Airlines, too, will never be the same again (if it is to survive the century), Good luck !

What of the aerospace R&D sector? The moment of truth is nigh. The Light Combat Aircraft (LCA) prototype is to "roll-out" in mid-1995. The advanced Light Helicopter (ALH) must complete its test flying over the next 18 months. The Pilotless Target Aircraft (PTA) must go into service soon, the various missile programmes must mature in the year ahead. We are enthused to see the Prithvi SSBM rolling down Rajpath on Republic Day (emblazoned with "Izzat-o-Iqbal") and cheer the successful launch of the Akash SAM. Our spirits wane somewhat when the Agni refuses to leave the launch pad, but we must understand that

even after three decades of experience, the United States, France and Russia still have aborted launches.

The bottom line is : the people must be mature and understanding in their assessment of what the country's aerospace R & D is capable of achieving. Equally, those at the stewardship of R&D authority and responsibility, must be honest in their pronouncements. We cannot afford it otherwise at this stage. Not in 1994, nor ever.



Supportive: Civil Aviation Minister Ajit Singh.

Highlights of the Bangalore Air Show in 1993, as meticulously covered by Vayu included an exclusive interview with the legendary General Designer, Academician Rostislav A Belyakov, who quietly but confidently was promoting the MiG-21-93 (on which basis later evolved the MiG-21 Bison). The LCA was amongst other mockups at Yelahanka, the others being the HTT-35 BTA, Saras LTA and Akash SAM and readers can tick off which of these R&D programmes have progressed and in which manner by the time Aero India 2013 has come about, 20 years later.

It is certainly sobering to review status of those four Indian programmes, which were showcased in 1993 : the LCA, since christened as Tejas, has been flying since January 2001 and the various technology demonstrators, prototype



F-16CJ of the 14th FS "Samurais" in reheat.



DRDO-developed AEW&C system aboard the sleek Embraer 145 aircraft.



HAL Dhruvs of the Sarang display team stand out against a dark Bangalore sky.

vehicles and limited series production aircraft have made 2000 flights and the aircraft is inching towards initial operational clearance by late 2013, or some 30 years after the programme began. The patience of the country and its Air Force is wearing thin.

The HTT-35 turbo basic trainer project was unfortunately a non-starter and the repercussions are being felt today 20 years on. HAL has not progressed in the design & development of its new avatar, the HTT-40, with the intended customer (Indian Air Force) having virtually rejected the indigenous option, instead procuring the Swiss Pilatus PC-7 Mk.II (more on that later in this issue).

The Saras LTA which has been developed by CCADD (Centre for Civil Aircraft Design & Development) of the Council of Scientific and Industrial Research (CSIR) from 1991 has had two prototypes flying since May 2004 but suffered a major setback when the second prototype was lost in an air crash. Its future is still being debated.

The Akash surface-to-air missile programme was first launched in 1990 and after two decades of trials, the first systems were delivered to the customer (Indian Air Force) in March 2012, to complement the other air defence missile systems which will supplant obsolescent Soviet-origin SAMs.

Inaugurating Aero India 2013

However, back to the future, in this case Aero India 2013. As reported and recorded by the *Vayu* editorial team at Yelahanka (there were nine on the field including two from the UK and Israel), veterans at air shows could be forgiven for getting that *déjà vu* feeling - they had heard such pronouncements before! The only difference this time was that the inaugural platform was shared between the Defence and Civil Aviation Ministers who articulated on their vision for the future of aviation in India and the challenges ahead. Interestingly, it was also after several years that heads of the two ministries were together at an Air Show and appeared to agree on the need to move ahead jointly for such expositions.

Although the Civil Aviation Ministry has of late hosted its own show (*India Aviation* at Begumpet, Hyderabad, also covered extensively by *Vayu*) and there have been objections from the Civil Aviation Ministry as Aero India flying displays at Yelahanka create havoc with civil air traffic into nearby Devanahalli Airport, the fact that Defence Minister AK Antony announced holding of the next Aero India in 2015 (18-22 February) again at Yelahanka suggests that the two ministries have agreed to carry on regardless. *Vayu's* Show Daily for 7 February in fact headlined that as '*Back to one Air Show in India?*'. We shall soon see.

Defence Minister Mr AK Antony exulted in describing Aero India as "one of the best air shows in the realm," with the 2013 edition attracting ever-increasing participation, and that the few glitches "should be taken in stride". He hoped that even as the DRDO expands its working base, the public-private partnership model would be encouraged and HAL should strive to take full advantage of such emerging industrial capability.

Civil Aviation Minister Ajit Singh was near poetic in his opening remark that "for some, sky is the limit but for those who love aviation, the sky is home!" He shared some very encouraging statistics on the annual growth of civil aviation in India, the establishment of numerous greenfield airports and upgradation of others.

Karnataka Chief Minister Jagadish Shettar was rightly proud of the fact that the first Indian aviator was from Mysore (flying his own aircraft in 1911) and that India's aircraft industry was founded in Bangalore in 1940. Since then, Karnataka has consolidated as the aviation hub of the country and also attracting keen global attention. The 'Karnataka Aerospace Policy' document was released by AK Antony at the event.

The speeches were capped by the show-opening aerial displays, beginning with the IAF's newly-restored Tiger Moth biplane, followed



Su-30MKI retracting gear and banking left shortly after take-off.

by the Tejas light combat aircraft flown by Gp Capt Suneet Krishna who carried out a scintillating display. This was in fact the 2002nd flight of the LCA, Gp Capt Krishna having piloted the landmark 2000th flight a few days earlier. The Dassault Rafale, which has been selected as the IAF's MMRCAs, was airborne next and gave the audience a view of the shapes to come.

Although the F-16 was not chosen by the IAF, a pair of these spirited light fighters from the US Air Force 14th Fighter Squadron based in Misawa, Japan along with one KC-135 tanker from Kadena were in attendance at Yelahanka. The F-16 flight demonstration was awesome, as always! Other flying displays included those by the DRDO-Embraer AEW&C aircraft, ZM-1 Zephyr all-composite experimental aircraft, the *Flying Bulls* aerobatic team, the *Sarangs* with their brilliantly-painted Dhruv helicopters, prototype of HAL's Light Combat Helicopter and finally a thunderous display by an IAF Su-30MKI.



Indian Army Aviation put on a series of impressive demonstrations with their HAL Dhruvs.



The Russian Knights' Il-76 support aircraft moves into position at the static display area behind various parked fighters.



HAL Light Combat Helicopter taking off for a display flight



Not to be outdone, the Rafale display immediately after the Russian Knights was closer, faster and louder !



Rafale B taking off for an evening demonstration flight with an IAF officer in the rear seat



Watching the large Su-27s leap off the runway in pairs was quite a spectacle !



The C-17 display surprised many showgoers, as the aircraft is deceptively quiet and nimble to boot !



The Su-30MKI conducted displays at very low level, making them all the more impressive.



Tails of parked aircraft captured in the last rays of the setting sun.



Tight, well-controlled formations were the order of the day



While IAF Hawks did not conduct display flights, they did depart each evening for lengthy test or customer demonstration flights.



HAL-Dornier 228 MPA presented to Seychelles

At a special ceremony at Chakeri airfield in Kanpur on 31 January, Indian Defence Minister AK Antony presented an HAL-built Dornier 228 maritime patrol aircraft to the Minister of Foreign Affairs of Seychelles, Jean-Paul Adam. The Indian Ocean island nation had earlier signed an agreement with the Government of India for two HAL-Dornier 228s for delivery earlier than 2014 and this first aircraft has been delivered a year ahead. Earlier, HAL had delivered a Chetak helicopter

to the Seychelles and the Dornier 228 will be employed for maritime patrol and surveillance of its EEZ.

Mr D Balasubramanian, General Manager, HAL Transport Aircraft Division at Kanpur has stated that 117 Dornier 228s have been built by the Kanpur Division till now, mostly for the Indian Air Force, Navy, Coast Guard and other operators, with orders for another 30 Dornier 228s received for production in 2013-14. HAL's marketing efforts

have also resulted in firm interest from various countries including Vietnam, the Philippines, South Africa, Ecuador, Afghanistan and Thailand.

The Seychelles Defence Forces are organised into units with specific mandates and equipped accordingly. The Seychelles Air Force operates both fixed wing aircraft and helicopters for Maritime Reconnaissance, Medical Evacuation, Coastal Patrol, Island Services, VIP Transportation and Search & Rescue tasks.

HAL receives IOC for ALH 'Rudra'



HAL Rudra seen departing for one of many displays conducted during the show.

Hindustan Aeronautics Ltd has received the initial operation clearance (IOC) for its Advanced Light Helicopter Mk.IV-WSI named as the 'Rudra'. Dr K Tamilmani, CEO, centre for Military Airworthiness and Certification

(CEMILAC) presented the certificate to HAL at a function in Bangalore on 2 February.

Speaking on the occasion, Dr Tamilmani stressed that potential for helicopters remains "massive" in India

and the country has the ability to meet technical challenges on this front.

Mr P Soundara Rajan, MD of HAL's Helicopter Complex, stated that integration of multiple weapons systems simultaneously is a complicated task.

"In this particular case it involved four major groups of systems and weapons, involving eight countries; Israel, France, Belgium, South Africa, Germany, Italy, USA and India. Nearly 23 km of cables had to be laid and hundreds of hours of flight and ground tests were carried out.

The Indian Army has already received considerable numbers of the HAL ALH, most of this being Mk.III's which are formed into a number of utility helicopter squadrons, deployed in various operational areas in northern and eastern India, including at very high altitude bases in Ladakh. The Rudra will endow major strike power to formations on the western borders.

Shape of wings to come



AMCA mock up at the HAL pavilion



MiG-35 model in front of PAK-FA poster at the RAC MiG stand.



Perspective Multirole Fighter (PMF, also called FGFA) model at the HAL pavilion

In pride of place at the entrance of HAL's dominant presence in Hall E was a model of the Sukhoi T-50 PAK-FA 5th generation fighter aircraft, now being referred to as the Perspective Multirole Fighter (PMF). Chairman HAL, Dr RK Tyagi, during his press conference on 7 February stated that the project definition phase (PDP) of this joint Indo-Russian programme would be completed by March 2013, after which detailed design work begins. Some 30 HAL engineers are currently positioned with their Russian counterparts, preparing drawings and translation of documentation to Western equivalents.

The first of three PMF prototypes allocated to India will be positioned at HAL Nasik in 2015, followed by the second in 2017, and third in 2018. These test development aircraft will be subject to flight evaluation and extensive trials by the IAF, followed by selection of systems, which are likely to differ from the Russian variant. Production of the PMF will be the responsibility of HAL's Nasik Division, which will manufacture the airframe, carry out final assembly and conduct flight-testing.

The definitive powerplant (as distinct from the current engines on the prototypes) will be produced at HAL Koraput. The first Indian-manufactured PMF will fly in 2022, with deliveries to the Indian Air Force to follow thereafter.

However, there is considerable debate on the practicability of near-simultaneous development of two fifth-generation fighters for the IAF, the PMF in a sense 'competing' with ADA's Advanced Medium Combat Aircraft (AMCA). Concerns range from duplication of effort to whether India has the resources (both monetary and technical) to carry both programmes through to fruition.



Model of the LCA Navy at HAL's pavilion.

Indigenous or imported? The BTA as case study.



The first PC-7 Mk II delivered to India, bearing serial P101, seen landing at Yelahanka on 5 February.

The Indian Air Force's first Pilatus PC-7 Mk II trainer flew into India on the eve of Aero India 2013. This aircraft (tail number P101), which has, somewhat unusually, retained Pilatus company house colours, was flown to AFS Yelahanka on the morning of 5 February. In the cockpit were Pilatus test pilot Stefan Greub, along with Sqn Ldr S Mitra of the IAF.

Delivery of the last batch of 75 PC-7s on order will be completed by end-2015. Reacting to reports that this batch will be followed either by orders for additional aircraft directly from Pilatus or that HAL will undertake licence production of the type in India, an IAF officer has said that there was no provision in the existing contract for the latter option.

This hints at a faceoff between the IAF whose requirement for basic training aircraft totals 181 units, and HAL which is currently engaged in designing its HTT-40 turboprop basic trainer against the Air Staff Requirement issued to it by the IAF. Chairman HAL has stated that design and development of the HTT-40 is proceeding and *Vayu* learns that metal cutting is to begin "shortly." Design engineers at HAL's ARDC are confident that the HTT-40 will not only meet the IAF's requirements fully, but also that the type would have considerable advantages over the Pilatus aircraft. Scoffing at "rumours" that the HTT-40 is more expensive than the PC-7 Mk II, a HAL executive said that while the Pilatus costs Rs 37 crore per unit, the HTT-40 would be for Rs 34.5 crore per unit, of which only the powerplant and ejection seats are imported at an FE of Rs 6 crore. Most importantly, while the Swiss government forbids employment of any



This HTT-40 mock up was unveiled at the HAL pavilion during Aero India.



HTT-40 cockpit mockup.



PC-7 Mk II (P101) seen secured at the static display area

armament on its aircraft, the indigenous equivalent will have six weapon stations underwing and a centreline station for a targeting/reconnaissance pod. The IAF could certainly employ the indigenous trainer for light attack and COIN tasks as a secondary role.

The Air Chief, however, has been vocal in his rejection of the HTT-40, saying that there was "no need for it." Further, he said "we have the Pilatus PC-7. It's a proven aircraft. The project HAL plans is from scratch. Our indications are that the costs will be too high. There is no need for all this."

Chairman HAL stated in his interview with *Vayu*, "most of the preliminary design, including configuration studies and sizing, cockpit layout and wind tunnel model testing have been completed... any cost comparison with other basic trainers



HAL designer in the HTT-40 cockpit mockup.



Rear view of P101 at the static display area.

should be on the basis of life cycle costs, ensuring maintenance support for the next 30 years, in which HAL will be competitive."

Aero India 2013 : The International Seminar



'Aerospace Products – Challenges In Design To Deployment'

The above theme chosen for this edition of Aero India 2013 was significant as it reflected the critical need in India for resolution of problems confronting many strategic national aerospace projects such as the LCA, IJT and Saras.

As has become the norm, an International Seminar preceded the Air Show at Yelahanka and this, organised by the Defence R & D Organisation (DRDO) was conducted between 4 and 6 February 2013 at the Nimhans Convention Centre in centre of Bangalore. The event has over the years, been much enhanced



Mr. Hakan Bushke, CEO of Saab with AVM Nambior.

President of the Royal Aeronautical Society and Mr GM Rao, President of the Aeronautical Society of India as guests of honour.

The recurring theme of any indigenous effort is capability compromise along with cost and time overruns. There was much to reflect on from the proceedings, with over 60



Air Chief Marshal NAK Browne giving the key note address.

both in terms of relevance and candid approach to the situation as impacts the Aerospace industry. The Organising Committee, chaired by Dr K Tamilmani, Chief Executive (Airworthiness) of CEMILAC had worked for nearly two years to bring the 'finest minds' in aviation together at the Seminar. A high-powered 'Apex Body' assisted the Committee to cast their net far and wide and to share their expertise.

The formal inauguration, by Defence Minister AK Antony in presence of Air Chief Marshal NAK Browne actually took place a day after the technical sessions had begun on 4 February, which were inaugurated by Dr VK Saraswat, SA to RM with Mr Phil Boyle,



Dr. Tamilmani, head of CEMILAC and Chairman of the Organising Committee.



Entrance to the Seminar.



Packed audience, listening to an exposition.



The Swedish industry at Bangalore were exemplified by presence of Hakan Bushke Saab's CEO and Head of Saab in India, Lars-Olof Lindgren.

papers were presented of which 27 were from leading aviation firms around the world, including Boeing, Saab, Cassidian, Embraer, Sukhoi, NPO Saturn, IAI and Pratt & Whitney.

Eminent Indian speakers were from DRDO, DPSUs, ISRO, CSIR and the Indian Armed Forces. These speakers had backgrounds as varied as R&D, manufacturing and maintenance, not the least frontline aviators themselves made the proceedings as holistic as possible.

The technical sessions included such topics as small-sized turbine engines for UAVs, Indian experiences in developing UAVs, high performance fly-by-wire control laws, erosion-resistant coatings, Swedish low-frequency airborne radar systems and the design and development challenges of various Indian aerospace programmes such as the LCA, ALH and AEW&C. Speakers at this session included industry representatives from India and abroad, as well as serving and retired officers of armed forces across the globe.

Other sessions largely featured speakers from the industry along with policymakers and bureaucrats, with topics ranging from aerospace development cycles, to procurement and training, along with discussions on commercial to military derivative applications, development of Indian aerospace capabilities and electronic warfare.

The Seminar was successful in attracting close to 900 delegates, which bodes well for the development of a significant knowledge base in



Dr. Shyam Chetty, Director NAL and Air Commodore Muthana.

aerospace and defence. The attendees had overwhelmingly positive reactions regarding the quality and relevance of the papers presented at the seminar, and following the event, the Seminar Committee has been flooded with positive feedback.



Rudra – the Destroyer

From Rigvedic times Rudra was the embodiment of a storm god and unpredictable danger. The Indian Army has bestowed this name on the HAL Advanced Light Helicopter Mark IV – Weapons Systems Integrated.

The HAL Rudra was one of the stars at Aero India 2013. An armed variant of the HAL Dhruv advanced light helicopter, the Rudra is equipped with a self-protection suite, advanced electro-optical sensors, a 20 mm chin-mounted autocannon, 70 mm rocket pods, anti-tank guided missiles and IR homing air-to-air missiles.

Development of an armed variant of the ALH was sanctioned in December 1998, some six years after the first flight of the TM333-powered Dhruv prototype. The ALH-WSI made its maiden flight in August 2007, equipped with the Shakti engine.

The ALH-WSI thereafter underwent lengthy integration trials for armament, electro-optical systems and other avionics. It successfully tested the turreted M621 autocannon, 70mm rockets and MBDA Mistral air-to-air missiles in 2011, and also validated its



(All photos by Angad Singh at Yelahanka)



P. Soundarajan, rightly regarded as 'father' of the programme with senior Army Aviation officers.

ability to operate at heights up to 6,000m while equipped with a full weapons load. With the indigenous Helina (Helicopter-launched Nag) anti-tank guided missile (ATGM) delayed, it is likely that the Rudra will enter service equipped either with the MBDA PARS 3 LR or Rafael Spike ER ATGMS.

On the avionics side, the Rudra incorporates the Integrated Defensive Aids Suite (IDAS-3) from Saab which is fully integrated into the glass cockpit. IDAS-3 protects the Rudra from a wide range of anti-aircraft threats. Active self-protection includes an IR jammer and chaff and flare dispensers. Additionally,





At the formal handing over of first Rudra to the Indian Army.

the nose features the Elbit Compass stabilised multi-sensor pod, which incorporates daylight and thermal cameras and three different lasers: a rangefinder, target designator and IR laser pointer. The sensor suite on board the Rudra can be used in both unarmed and armed roles that include reconnaissance, troop transport, anti-tank warfare and close air support.

By September 2012, ground tests for the production ALH Mk.IV (the fully armed and sensor-equipped Rudra) were completed. HAL was awarded a combined order of 76 Rudras for the Indian Army, the primary customer, and the Indian Air Force.

On 4 February 2013, the HAL Rudra achieved initial operational clearance (IOC) and the first two Rudras were handed over to the Army by HAL during Aero India 2013, with the *Vayu* team specially invited by Mr. Soundara Rajan, Managing Director, HAL Helicopter Complex.

The Indian Army intends to acquire at least 60 Rudras for its Aviation Corps, with plans to use them for tactical support in a wide range of theatres, a role made possible by the high performance and service ceiling of the type. The Indian Air Force has ordered 16 Rudras, with possible follow-on orders planned.

There reportedly are enquiries for the ALH Mk.IV Rudra from certain countries for employment by special forces and this type could well become HAL's export star.

Angad Singh



Indian Army, the customer.



HAL, the producer.



ALH Rudra of the Army's 251 Armed Helicopter Squadron, outside Hall 'E' at Yelahanka.

HAL at Aero India 2013



Dhruv ALH.

HAL's attributes in design, development and production were showcased through its various products and systems at Aero India 2013. While the Dhruv ALH, Light Combat Helicopter and Rudra (ALH Mk.IV-WSI) carried out flying displays, scale models of the Light Utility Helicopter, Hawk AJT, Tejas LCA, IJT and the Sukhoi Su-30MKI were also displayed.



HAL Chairman Dr. RK Tyagi

"For the first time, we presented glimpses of the perspective multirole fighter (PMF) also known as the Fifth Generation Fighter Aircraft (FGFA). This is under co-development with the Russians", stated Dr. RK Tyagi, Chairman, HAL.

In addition, the Pilotless Target Aircraft (Lakshya), the Shakti engine, state-of-the-art accessories and avionics from various Divisions of HAL were also put up on display.

The other main products in the HAL pavilion comprised a 3D presentation

of the HTT-40 basic training aircraft, Dornier 228 glass cockpit, scale models of aerospace structures of the GSLV MkII, GSLV Mk III and PSLV. The Rotary Wing corner was dominated

by simulation and visual displays, and various capabilities and competencies of Hindustan Aeronautics Ltd, beside holographic projections of the LCA, Hawk, LCH and LUH.

Beretta Defence Technologies: "the first line of defence"

Beretta Defence Technologies is basically an alliance of four leading companies: Beretta, Benelli, Sako and Steiner. These founding companies of Beretta Defence Technologies, globally well-known through decades of leadership, innovation and investment, have joined their respective knowledge to form a single source contact for their military and law enforcement product lines. These firms are owned by the Beretta Holding Group, which has amalgamated technical knowledge base to meet the operational needs of military and law enforcement personnel worldwide. Beretta Defence Technologies has grown from the stated needs of governments and agencies to cover a wide range of complicated scenarios and aims to provide its customers with a combination of services, weaponry and equipment, ranging from firearms, ammunition, optronics to tactical clothing, in order to match their operational needs. In addition to their individual core competence areas, all the companies have their own subsidiary networks and ties with allied product makers, so allying their specific expertise with a unified focus, each company is able to provide the best possible solution for any given situational demand.



"Beretta assault rifle ARX 160 and Beretta grenade launcher GLX 160"

VAYU

Interview with Niklas Nieminen, Head of Saab Marketing and Sales in India



VAYU: What are the various Saab collaborations with the Indian industry?

NN: We have a long relation with the Mahindra Group, Pipavav Defence and Offshore Engineering Company Limited, Ordnance Factory Board, FFV Services and Bharat Electronics. Of course we try to expand these further. Co-operation programmes are also underway with Hindustan Aeronautics Limited, Elcom, Wipro and Samtel. We have also recently tied up with the Piramal Group to explore opportunities on the LEDS programme in India.

Our strategic plans in India are fundamentally based on two premises : one, we see India as a 'home market' and, second, for all major future

programmes, we will partner an Indian company either through a teaming agreement or through a joint venture. We will share technology with these companies, localise production and offer this to both Indian and global customers.

Consequently, we are in constant dialogue with Indian companies, throughout the year.

VAYU: What are the key challenges for Saab in India?

NN: The core challenge has many facets; firstly we have to gain an even better understanding in interpreting of the Defence Procurement Policy and how the revised version will be used in practice, especially related to offsets. Secondly, we need to keep improving

our ongoing partnerships and also identify additional partners in order to improve our competitiveness to win contracts, but also to execute the projects in these contracts. Thirdly, we also have to educate our Saab colleagues outside India on how business is done here and what impact it creates on product and service road maps.

VAYU: How do Saab products meet India's defence requirements? Are there areas where Saab needs to look at Indian opportunities any differently?

NN: The global trend of buying existing equipment from off-the-shelf is also very relevant in India i.e. we need to have suitable products which meet customer needs which are not over-engineered, thereby causing out-of-range pricing. This is also evidently the case in India that government agencies want to develop many products themselves with the support of external partners; sometimes in terms of knowledge and sometimes in terms of knowledge and partial funding of the R&D project. A fairly large portion of our product portfolio can be utilised for the Indian market.

Northrop Grumman's Global ISR Capabilities

Northrop Grumman Corporation highlighted its range of capabilities in intelligence, surveillance and reconnaissance (ISR) including airborne early warning and control systems for maritime reconnaissance and unmanned aerial vehicles, at Aero India 2013.

"ISR capability is critical to effective homeland security and our leadership in multiple-domain ISR strongly positions Northrop Grumman to help create solutions for India's defence modernisation," said Mary Petryszyn, vice president, International, Northrop Grumman Aerospace Systems. "We are excited to offer our core capabilities to advancing Indian naval, military and homeland security priorities."

The company's airborne surveillance capabilities were highlighted with the MQ-4C Triton unmanned aircraft and the

lighter-than-air Long Endurance Multi-Intelligence Vehicle (LEMV). Triton is a maritime version of the Global Hawk unmanned aircraft system. Developed for the US Navy, Triton can fly missions for 24 hours at altitudes more than 50,000ft. allowing the system to cover vast areas of ocean and coastal regions. The Navy developed its future concept for maritime

patrol using Triton in conjunction with the P-8 Poseidon, a manned surveillance platform that has also been purchased by the Indian Navy. Northrop Grumman produces the AN/ALQ-240(V)1 Electronic Support Measures system, the early warning self-protection system, and the embedded global positioning and inertial navigation system for the P-8A.



Cmde (retd) G. Sharma, Tom Trudell and Keirn C. Brown of Northrop Grumman.

Safran's long-standing presence in India

Safran is the leading supplier of jet engines, landing gear and carbon brakes for airlines operating in India and neighboring countries, and plays a full-fledged role in the development of air transport in the country. Today, Safran has nearly 600 employees in four facilities dedicated to products and services for fixed and rotary-wing aircraft:

Safran Engineering Services India (SESI) in Bengaluru provides end-to-end engineering services to global and local customers. It embodies Safran's proven expertise for the Light Combat Helicopter (LCH) and the Light Utility Helicopter (LUH) to be manufactured by HAL. In early 2012, India started exclusive negotiations to buy 126 Rafale fighters. Safran is one of the leading contributors to this aircraft, including the engine, landing gear, wiring, navigation system, etc.

Safran's presence in India started in the 1950s with the sale of equipment for aircrafts and helicopters. Since then it has quickly evolved to include partnerships with Indian industry, with on joint development, production and support for aircraft, helicopter and rocket



Jean-Paul Herteman, CEO Safran (photo: Stéphane de Bourgies Abaca press)

engines (including the Shakti engine for the Dhruv Helicopter), landing gear, navigation systems, and so on as well as associated support services. Safran is present in India through all product lines in its core markets of aerospace, defence and security and is involved

in out all activities, from R&D to production and support. In March 2012, Safran opened a corporate subsidiary in the country, Safran India Private Limited, to expand operations and strengthen relations with local partners. The Group now has more than 2,100 highly skilled employees in India, working at eight subsidiaries and joint ventures.

Safran has been a supplier to the Indian armed forces, providing engines and equipment for over 700 aircraft and helicopters, including the Jaguar, Mirage 2000, LCA, Su-30, Hawk, MiG-29K, Cheetah, Chetak, Dhruv, and others. Safran provides a wide range of avionics (inertial navigation systems, autopilots, etc.) and optronics systems for a number of combat platforms, including aircraft, submarines, artillery systems and tanks. Safran teamed up with HAL to develop the Shakti engine and autopilot for the Dhruv helicopter. Turbomeca is now finalising arrangements to provide powerplants providing state-of-the-art security solutions, especially for air travel, defence, law enforcement and commercial establishments.

Boeing: showcasing a range of advanced capabilities

Boeing showcased a broad range of aerospace capabilities at Yelahanka. Boeing's exhibit in Hall E featured commercial and defence products and services of interest to India, including a P-8 mobile console, a Maritime Surveillance Aircraft console and a Virtual Maintenance Training Demo. Product models include the Boeing 787 Dreamliner, 777-300ER (Extended Range) and 737 MAX commercial airplanes, as well as the C-17 Globemaster III strategic airlifter, P-8I maritime reconnaissance and anti-submarine warfare aircraft, AH-64D Apache attack helicopter, CH-47F Chinook heavy-lift transport

helicopter, and V-22 Osprey tiltrotor aircraft. Boeing subsidiary Insitu displayed full-scale models of the ScanEagle and Integrator unmanned aerial vehicles in the Boeing exhibit. A C-17 Globemaster III military transport from Hawaii was also on static display for visitors.

Boeing underscored the strength of its commitment to expand its partnerships in India to become the "aerospace company of choice in this important market." Company executives at Aero India 2013 in Bengaluru further emphasised that local presence, collaboration and integration are key to Boeing's success in India and that

the company is uniquely positioned to offer Indian customers the best in technology, capability and support. "We are investing in collaborations and partnerships with Indian industry and academia to jointly harness the full potential of India and Boeing," said Boeing India President Prat Kumar. "This winning relationship will provide a fantastic opportunity to build a strong future for India's aerospace industry. India is also an important customer, and we are here to remain responsive to our commercial and defence customers' requirements. We are definitely here for the long term !"



The MC-21 programme: from design to production

Irkut Corporation, manufacturers of Su-30MKI fighters, are also actively promoting the MC-21 narrow-body, new generation airliner. Oleg Demchenko, President of Irkut, observes that in the coming decade, “the MC-21 programme will contribute significantly to Irkut’s revenue, which currently exceeds \$1.6 billion annually.”

The MC-21 programme had been supported by the Government of Russia and its financing was included in the budget allocated for development of Aerospace Industries at the end of 2012. SberBank, a leading Russian financial institution, has provided Irkut with an investment credit of \$1 billion.

The MC-21 programme has progressed from the design stage to manufacture of the aircraft’s components and static strength tests, which are being undertaken by Yakovlev Engineering Centre, leading design unit of Irkut. In October 2012, the Irkutsk Aviation Plant commenced manufacturing of the first series of MC-21 bulk components, assembled as a fuselage section, which is now under testing. At end-December 2012, the Ulyanovsk-based ‘AviaStar-SP’ Aviation Plant completed assembly of the MC-21’s empennage, designed for rig tests, including 300 thousand cycles, with each cycle the equivalent of an actual flight.

New materials

Throughout 2012, main thrust of experimental activities have been tests of the MC-21 wing prototypes. It is for the first time that wings of a narrow-body aircraft are being constructed with composites, this being aimed at achieving a major breakthrough on the MC-21’s economic efficiency in comparison with existing narrow-body airliners. Owing to employment of composites, the MC-21’s design advantages will remain unchallenged even after embarking on re-engining programmes.

Composites not only decrease an airliner’s weight, but also improve its aerodynamics, mainly because of extended wingspan. Also, compared to existing narrow-body aircraft, the MC-21’s fuel consumption will be reduced by almost 25% and most of this is thanks to composites.

Tests of the composite components are being executed by TsAGI (Central Aerodynamics Institute). During first phase of

tests, the prototype of the wing caisson has undergone static tests on operational loads as well as frequency tests. Following that, the prototype was placed under extreme stress and destruction occurred within the expected range. Mr. Zichenkov, Deputy General Director, Head of Strength Complex opined that these tests had proved design methodology with infusion of technologies chosen for manufacturing of the MC-21’s composite parts.

The next phase of tests, completed end-2012, had tested resource indicators of the composite wing. After simulating 7000 sorties on the rigs, TsAGI scientists also identified the composites’ resistance to damage which is routine during operations. Simultaneously, manufacture of composite components for the MC-21 and some other programmes in order to establish self-sufficiency, has led to the creation of AeroComposit, a special entity of United Aviation Corporation (UAC).

International sub-contractors within the MC-21 programme include the Pratt & Whitney PurePower PW1400G engine for the MC-21 family of aircraft. The PW1400G air engine will lower the MC-21’s fuel consumption by 13% in comparison with existing types.

Zodiac Aerospace Group, a French enterprise, has been selected for the aircraft’s interiors and on-board systems. Taking advantage of a wider fuselage and innovations on interiors, Irkut will provide MC-21 passengers with comfort levels “that match long-range airliners.”

Mikhail Pogosyan, President of UAC, has suggested that some Indian aviation industries may join the MC-21 programme, it being projected that the growing Indian civil aviation market could well have around a hundred MC-21s. The MC-21’s order portfolio, including the 180-seat MC-21-200 and the 185-seat MC-21-300, now exceeds 250 aircraft, of which 185 are firm orders. Irkut believes that this volume is “encouraging” and market surveys conducted by experts from Irkut and Pratt & Whitney project that the MC-21’s orders will cross the 1,000 mark.

The MC-21’s maiden flight is envisaged for 2015, while first deliveries visualised for 2017.

Shinmaywa's plans

Aero India 2013 marked ShinMaywa's maiden participation at the event. The Japanese firm, with a stand at Hall G, showcased their US-2i amphibious aircraft as well as their innovative 'Paxway' passenger boarding bridges. Their aim at Aero India was to increase awareness about their high-technology products on offer to Indian customers.

The US-2 amphibian is a Government of Japan project and is manufactured by ShinMaywa Industries, Japan. The aircraft belongs to the 'US-family' of amphibious aircraft, which have been in service with the Japan Maritime Self Defence Force (JMSDF) since 1976. The US-2 is the newest variant and has been in active service with the JMSDF since 2007.



Cmdr Sujeet Samaddar, Director and CEO, ShinMaywa Industries India at their stand in Hall G.

Uniquely, the US-2, is the only aircraft in the world that operates in sea state 5 (rough conditions) on the high seas as well as on rivers and lakes. It can carry a sizeable payload of personnel (up to 30 fully-equipped troops) and stores (up to 3 tonnes). The US-2 couples extremely long range (approximately 4,700 km) with unparalleled STOL performance thanks to its unique 'Boundary Layer Control System' for lift augmentation. This system allows the aircraft to operate at very low speeds and significantly reduces the take-off and landing distances. It also adds an important safety margin for afloat operations during rough sea conditions. The US-2 is not just an effective oceanic search and rescue (SAR) platform but also may also be utilised in other roles such as island support operations, humanitarian assistance and disaster relief, EEZ surveillance and fleet support for Naval forces.

Being the only Japanese aerospace company participating in Aero India, ShinMaywa attracted a lot of attention from the media and general public as well as from senior officials of the Armed Forces and Ministry of Defence.

AVM (Retd) AJS Walia, EVP India & South Asia for Sikorsky on the company's presence at Aero India 2013



The helicopter has its origins in Igor Sikorsky's 1939 development of a rotor-powered vertical take-off aircraft. Igor Sikorsky founded Sikorsky Aero Engineering Corporation in 1923 in the USA, which became a subsidiary of United Aircraft in 1929. United Aircraft later evolved into United Technologies Corporation, which today is a US\$ 58 billion company.

Sikorsky's presence in India goes back to 1954 when the first helicopter inducted in independent India's Air Force was a Sikorsky. Sikorsky has now developed manufacturing facilities in India that constitute part of its global supply chain. Tata Advanced Systems Ltd (TASL) manufactures cabins for Sikorsky S-92 helicopters, which are shipped to the Sikorsky manufacturing facility in Pennsylvania, USA for final assembly. The first made-in-India cabin has been integrated with other components and the completed helicopter is already flying for a customer in Brazil.

Additionally, Sikorsky has a JV with Tata named 'Tara' to produce aerospace components. The venture manufactures over 4,000 components, which can be used for both fixed-winged and rotary-winged aircraft. Both TASL & Tara facilities started production within two years of the agreements with Sikorsky being signed. TASL is currently supplying around two airframes per month, though the intent is to scale up to three per month in 2013.

Sikorsky has also been keen on participating in the Indian defence procurement programme by manufacturing and supplying military range helicopters. Sikorsky's Vice President of Strategic Partnerships recently said, "The partnership with Tata will be extended to manufacturing and assembling Sikorsky military helicopters, besides making Sikorsky S-92 helicopter cabins. We have applied to the Indian government and are expecting the licence shortly."

The company would manufacture naval multi-role helicopters for the Indian Navy subject to grant of the licence. Sikorsky is also said to be considering development of India operations as a hub for manufacturing its helicopter range, including expanding its capacity to manufacture S-92 civilian helicopters.

Israel at Aero India 2013

Joseph Weiss, President and CEO of IAI at the Aero India opening ceremony



CEO of Israel Aerospace Industries, Joseph Weiss (third from left), with senior Ministry of Defence officials and the Defence Ministry Director General Udi Shani (fifth from left), at the IAI and Israeli booth in the Aero-India exhibition in Bangalore.

"As we stand here in the Israeli booth displaying the finest technologies and systems made by Israeli companies and Israel Aerospace Industries, we witness Israel's impressive performance and cannot help but feel pride," said Joseph Weiss, President and CEO of Israel Aerospace Industries, at the Aero India opening ceremony.

"All Israeli industries operating in the Indian defence market are in stiff competition with global and leading international powers. Despite competition, many Israeli systems operate in all arms of the Indian Army. These systems use leading technologies, allowing us to enter joint ventures with Indian arms and research institutes. The basis for this special relationship is the close professional and personal connection existing between leading Israel Ministry of Defence officials and top defence industries. I urge my colleagues in the Israeli industries to make every effort to promote cooperation. Yet when we do compete – I call for dignity and collegiality, I can assure you that we at IAI will do so," said Joseph Weiss.

RADA in successful testing of C-RAM radar

RADA Electronic Industries has successfully tested its advanced Multi-Mission Hemispheric Radar (MHR) with the RPS-40 Counter-Artillery, Rockets and Mortars (C-RAM) mission. The RPS-40 mission provides tactical accuracies of the Point of Origin (POO) and the Point of Impact (POI). During the testing which was performed and observed by representatives from the Israel Defence Forces (IDF) and the defence industry, multiple mortars and rockets were fired within the radar's area of coverage. The system detected the threats at a very early stage and provided exceptionally long alert times, while demonstrating no false alarms.



The RPS-40 detects, tracks, classifies and locates direct and elevated threats fired at stationary or mobile forces; threats include rockets, artillery, mortars, ATGMs, RPGs, and more. The system can be integrated with any protection and/or C4I system and can be installed at stationary bases and posts, or onboard fighting vehicles.



Alenia Aermacchi awarded contract from Elbit

Alenia Aermacchi, a Finmeccanica company, has been awarded a \$140 million contract from Elbit Systems for its share of logistics support (CLS) services for the 30 Alenia Aermacchi M-346I advanced trainer aircraft, ordered in July 2012 by the Israeli Ministry of Defence.

The CLS services, which include supply, maintenance and overhaul of spare parts for 30 Israeli M-346, will be performed jointly with Elbit Systems. The 30 aircraft ordered by Israeli Ministry of Defence will replace the A-4 Skyhawks in service today with the Israeli Air Force. Delivery of the first M-346 is expected in the middle of 2014. The M-346 is the “ideal platform for a latest-generation integrated training system. The versatility of the M-346 allows for its configuration as an affordable advanced combat aircraft”.

IAI's technologies displayed at the Show



EHUD Autonomous Air Combat Maneuvering Instrumentation (AACMI)

IAI presented its new and advanced concept for Air to Ground Persistent Surveillance at Aero India 2013. The advanced and comprehensive solution involved multiple aerial platforms, command and control centres and intelligence exploitation centres. IAI is exploring cooperation opportunities with leading naval helicopter manufacturers and users, for supplying its ‘Skimmer’- an integrated naval helicopter package. Developed by IAI’s LAHAV division, ‘Skimmer’ is designed to provide optimal solutions for naval helicopter future mission requirements. The package integrates advanced mission systems, sensors and avionics: radar, electronic warfare support measures (ESM), electro optic payloads, datalink, communication intelligence (COMINT), sonar, sonics, mission management and monitoring systems, anti ship missiles (ASM) as well

as other weapons. The “Skimmer” can be tailored to meet specific mission requirements for anti submarine warfare (ASW), anti surface warfare (ASuW), coastguard protection, special operations, amphibious assault and more.

IAI’s MLM division has expanded its ‘EHUD’ Autonomous Air Combat Maneuvering Instrumentation (AACMI) family to support Eastern fighter aircraft in addition to its Western fighter aircraft related advanced capabilities. MLM developed an AACMI pod in an R73 (Air-to-Air missile) enclosure, making its ‘EHUD’ the only AACMI pod in the market which can fit any R73 compatible aircraft.



Israel Air Force F-16 with EHUD

Elbit Systems military transport aircraft upgrades

Elbit Systems has earned international recognition in the aircraft upgrade market and maintained its leading position in the field. Using its expertise as an integrator and developer of cutting edge next generation electronics defence systems, Elbit Systems has expanded its line to encompass such features as data link systems, data fusion expert systems and 3-D digital maps. With across-the-board capabilities and technologies, Elbit Systems is a world leader in addressing entire platforms and upgrading existing aircraft with enhanced performance, extended life and next-generation capabilities. In the majority of the large-scale programmes it performs, Elbit Systems performs and manages multidisciplinary integration and lifecycle support. Additionally, it partners with local industries, leveraging capabilities and sharing know-how and expertise.

The company was recently awarded a contract by the Israel Ministry of Defence to upgrade the Israeli Air Force's C-130H (Hercules) transport aircraft. The modernisation project will extend the operational life of the aircraft and significantly improve its operational capability, particularly in precision flying, low-level night flight and operations in adverse weather. Modernisation will contribute to improved flight safety and reduce operating costs, by introducing cutting-edge digital systems to replace obsolete analog systems that have become unreliable and costly to maintain after four decades of intensive service.

In recent years, Elbit Systems has performed several upgrade projects for military transport aircraft, among them being:

- Upgrade of the Korean Air Forces' C-130, in which the Company installed various types of advanced electronic systems and also converted the existing analog cockpit into a 'Glass-Cockpit' using Elbit Systems' cutting-edge digital flight displays.
- Upgrade of the Romanian Air Forces' C-130 transport aircraft in which the Company installed various types of advanced electronic systems, including those produced by Elbit Systems EW and Sigint-Elisra. The project is executed in cooperation with local companies in Romania, lead by the Romanian Aeronautical Industry.
- The Brazilian Air Forces' C-95 freighter-wayfarer aircraft has also been upgraded by Elbit Systems' Brazilian subsidiary Aeroeletrônica (AEL). The programme includes integration of advanced avionics such as digital maps, displays, advanced communication and navigation systems and additional advanced systems, aimed at improving the aircraft's performance and the pilot's survivability. These new, cutting edge avionics systems meet the high standards of newly manufactured aircraft, specifically in flight safety and mission performance in harsh weather conditions.

Additional achievements in the military transport aircraft field

Elbit Systems have announced a collaboration with Northrop Grumman for the development of Terrain Following and Terrain Avoidance (TF/TA) System to improve tactical low-level flight safety for military transport aircraft. This innovative system will enable pilots to fly and manoeuvre more safely in Terrain Following/Terrain Avoidance (TF/TA) flight mode under all weather conditions, day and night.

Under the collaborative development, Elbit Systems' TF/TA head-up display (TA/TF HUD) application is coupled with Northrop Grumman's AN/APN-241 Terrain Following Radar for an avionics upgrade for existing or new C-130 Hercules transport aircraft. The TF/TA HUD demonstrator is expected to fly within the upcoming year on an international customer's C-130 transport aircraft. The TF/TA system relies on a Digital Terrain Elevation Database and the Terrain Following Radar as an active sensor, driven and controlled by Elbit Systems' Smart Displays. Implemented as part of a 'Glass Cockpit' concept, the system is positioned as a competitive and attractive enhancement for C-130 modernisation and upgrading. The system evolved in Elbit Systems' Futures Lab, the company's innovation centre tasked with rapid prototyping and proof of concept evolving aerospace systems. The TF/TA system has already been selected for integration into an ongoing C-130 upgrade programme. Northrop Grumman's AN/APN-241 radar has been selected as the standard radar for the Lockheed Martin C-130J Super Hercules and Alenia C-27J transport aircraft. Additionally, the AN/APN-241 radar has been integrated and installed on the CASA C-295 transport aircraft.



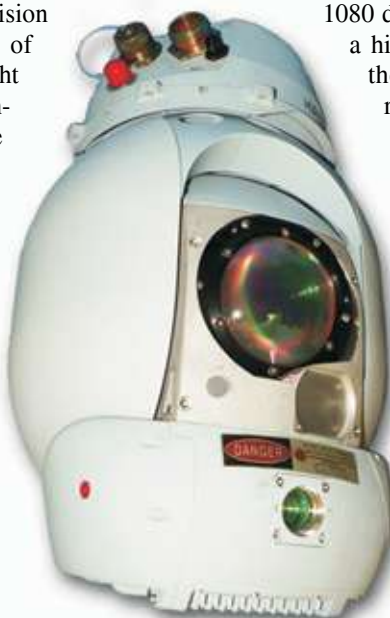
The TA/TF HUD

IAI Tamam's new line of high-definition optronic stabilised payloads

Israel Aerospace Industries' Tamam Division (IAI/Tamam) has launched a new line of True High Definition (HD) Day and Night Stabilised Optronic Payloads. These new high-resolution sensors make Tamam's systems the solution for wide area scanning and persistent awareness missions as well as for long-range surveillance and targeting applications. The new systems also include advanced video image processing and compression features that enable the FHDTV to be adapted to any downlink system.

Shaul Shahar, IAI/Tamam's General Manager said: "We are very proud of these new advanced payloads which combine the legacy of Tamam's field-proven payloads with HD technology and state-of-the-art image processing. These HD payloads are a remarkable achievement by our engineering and technical staff and will provide our customers with significant performance improvements while maintaining the original compact packaging."

The new range includes the MOSP3000-HD (a 31 kg, one-LRU multi-sensor highly-stabilised EO/IR payload equipped with a Full High Definition 1920 x 1080 detector for the colour day camera (FHDTV), a High Definition 1280 x 1024 detector for the thermal camera with a x30 optical zoom and an option for laser designation, laser rangefinder and laser pointer), the POP300D-HD (a 20 kg, one-LRU multi-sensor stabilised EO/IR payload equipped with a Full High Definition 1920 x



POP300D-HD

1080 detector for the colour day camera (FHDTV), a high Definition 1280 x 1024 detector for the thermal camera and laser designation, laser rangefinder and laser pointer) and the MiniPOP-HD which is a 6.5-9 kg (configuration dependent) compact, one-LRU multi-sensor stabilised EO/IR payload equipped with a Full High Definition 1920 x 1080 detector for the color day camera (FHDTV), a 640 x 480 thermal camera, and an option for laser rangefinder, laser pointer and laser designator.

IAI and Spacecom in Amos-6 Satellite agreement

In late 2012, Joseph Weiss, Israel Aerospace Industries (IAI) President and CEO, and David Pollak, Spacecom CEO, signed an agreement worth some \$195 million for the design, production, preparation for launch and operation of the Amos-6 satellite. Amos-6 is intended to significantly expand the variety of communication services provided by Spacecom to the international market from the orbit slot 4° West, and to replace the Amos-2 satellite, which is expected to end its service during 2016. Amos 6 will operate in parallel to the Amos-3 satellite. IAI is now in the process of producing two communication satellites in parallel: Amos-4, which will be launched in 2013 and the Amos-6.



Joseph Weiss, President and CEO of IAI (left) and David Pollak, CEO of Spacecom (right) signing the Amos-6 satellite agreement

VAYU**Interview with****Yedidiah 'Didi' Yaari,
President and CEO
Rafael Advanced
Defence Systems**

VAYU: What are the main drivers that make RAFAEL competitive in the Indian market. Do you plan to address opportunities beyond the military markets?

Yaari: Rafael's systems are Discriminate, Precise and Proportionate, which in turn makes them Economic, Efficient and Effective. Such is, for example, our 'Spike' missile family, which consists of precise tactical missiles. Rafael Advanced Defense Systems, with its proven building blocks, is one of the few worldwide vendors that can provide an end-to-end solution for today's challenges in critical asset protection and security well into the future, with its vast experience and based on extensive knowledge gained over the last 65 years. Strategic assets such as oil and gas pipeline and rigs, power stations, ports, and harbors, are vulnerable to terrorist and criminal threats. Such infrastructures have a high economic and political value, and the low probability of detection of threats, due to relative anonymity and the sensitive geographical location of these plus infrastructure environments, makes them an attractive target.

The potential immediate and long-term economic, environmental and political consequences that can emerge from an attack on such infrastructure, and the potentially high cost in human lives, requires governments to forge an holistic approach, which will address the complexities of such challenges. Rafael Advanced Defence Systems, as a designer and developer of multi-

disciplinary, field-proven 'system-of-systems', is well-versed in complex large-scale integration and development of solutions for critical asset protection programs, both for Israel and for various countries around the world.

VAYU: Are there specific technologies offered or implemented in India, that could provide exceptional capability to the Indian forces?

Yaari: The Indian Navy and Indian Coast Guard have shown great interest in the Typhoon Mk 30 and the Mini-Typhoon remotely operated, stabilised weapon systems for installation on several classes of ships and boats. Several navies worldwide including the Israeli Navy, the US Navy and several other Navies have procured the Typhoon system. The Typhoon system also incorporates our Toplite Electro-Optical Stabilised System. Another system addressing the maritime domain is the Protector Unmanned Surface Vehicle (USV) system, with the Force Protection/Anti Terror mission module it is also of special interest to the Indian Navy and Indian Coast Guard.

One of Rafael's core elements in the field of Network Centric Warfare (NCW) is its IMILITE command, control, communication, computers and intelligence (C4I) system, which keeps all security elements, from military personnel on the ground to Unmanned Airborne Vehicles (UAVs) in the air, connected, informed and synchronized in real-time. Rafael's solution supports connectivity with customer-defined sensors.

Rafael is one of the leading air-to-air and missile defence system houses in the world. Rafael's combat-proven aerial missiles include the Python-5 and Derby missiles, considered today the most advanced air-to-air missiles. Rafael's air-defense systems include SPYDER, a ground air-defense system, based on the Python and Derby interceptors to defend against aerial threats.

VAYU: How can RAFAEL share its knowhow and technology with its Indian partners?

Yaari: There is a growing need to increase cooperation and partnership with global clients, while maintaining knowledge transfer and adaptation of existing solutions to the specific needs of the user, thereby providing the added value in a highly competitive environment. As such, one of Rafael's main strategic endeavors is to bolster its cooperation with the DRDO, as well as with other leading defence industries in India. Rafael has created partnerships with companies in Israel and with leading aerospace and defence companies overseas. Offset activities and industrial cooperation have been organised with over 20 countries worldwide. Over the last decade, international business activities have been steadily expanding across the globe, with Rafael acting as either prime contractor or subcontractor, capitalising on its strengths at both system and subsystem levels.

Tamir Eshel

Rafael's SPIKE family of multi-purpose, tactical missiles

The SPIKE Family consists of missiles suited for land, air and naval platforms, multiple ranges and a variety of targets. The missiles in this family have sophisticated electro-optic CCD and IIR sensors for day/night all-weather operation, with a tandem warhead. The missile's lofted trajectories enable the warhead to strike targets at most vulnerable locations with pinpoint precision. The SPIKE Family members have a low life-cycle cost due to their high reliability, the operational and logistic support and production commonality between members.

SPIKE NLOS is an electro-optically guided multipurpose missile for ranges of up to 25 km with pinpoint accuracy and midcourse navigation. The weapon system can be launched from land, air and naval platforms. Spike NLOS provides the gunner with unique ability to attack targets at stand-off ranges with no line of sight. The Spike NLOS weapon system can be operated in either direct attack or mid-course navigation based on target coordinates only. These modes allow defeating long-range hidden targets with pinpoint precision, damage assessment

and obtaining real-time intelligence. The Spike NLOS electro-optical (EO) seeker incorporates a dual sensor capable of effectively engaging targets day and night and in adverse weather conditions.

Operational Flexibility

Spike NLOS can also be supplied with various warheads especially suited to urban and high intensity conflicts (heat, fragmentation, PBF, PBF/F). Spike NLOS can be used in a variety of battlefields as a solution for classic high intensity conflict (anti-armour), low intensity asymmetric conflict, and future stand-off battle scenarios (small group, remote/special operations). Sensors including C4I, UAV and others can be used to provide specific target coordinates. With high reliability and ease of use, SPIKE NLOS delivers maximum operational flexibility with minimal life-cycle cost.

The SPIKE-ER is an extended-range, multi-purpose anti-armour missile system designed for operation from various



platforms, including helicopters, fast boats and combat vehicles and can be mounted on a tripod for ground operations. SPIKE-ER is capable of destroying targets at a range of up to 8 kilometers and features day and night seeker, tandem warhead, and retains the dual operation modes of SPIKE- Fire and Forget, as well as Fire and Observe and Update.

SPIKE-MR and SPIKE-LR are lightweight, 4th generation, man-portable missile systems that share many of the same features that combine to meet the challenges presented by enemy forces. High hit probability against stationary and moving targets is provided by a state-of-the-art CCD / IIR seeker, for operation during the day, at night, and in adverse weather conditions, an advanced tracker and precision guidance system. Their lofted trajectories for top attack enable the warhead to strike the target at its most vulnerable location with pinpoint precision.

Elbit Systems EW and SIGINT – Elisra at Aero India

Elbit Systems EW and SIGINT - Elisra are the primary source of EW suites for the Israeli Air Force and for many other Air Forces with these EW systems installed in over 30 types of fixed and rotary-wing aircraft of both Western and Eastern origin. At Aero India, Elisra presented :

Unified Self Protection Suite for Helicopters & Transport Aircraft:

Elisra's first-of-its-kind unified suite for helicopters and transport aircraft includes comprehensive, advanced, passive and active EW capabilities. The lightweight, modular suite integrates and fully optimises, with total interoperability.

ALL-in-SMALL is an integrated EW Suite, offering for the first time the most advanced multi-spectral DAS and ESM capabilities packed into a single LRU,

delivering superior accuracy identification and location. Extremely compact in size and lightweight, the system's modular design and open architecture offer multiple interface possibilities.

Unified Self-Protection Suite for Fighter Aircraft includes the most advanced multi-spectral DAS and ESM capabilities in a single LRU, delivering the highest DF accuracy, identification, and location of received signals, very high probability of intercept (POI), and enabling swift response. The suite is operational and deployed onboard fighter aircraft in the Israeli Air Force and modern Air Forces around the globe.

Airborne COMINT/DF System - detects and intercepts voice and data radio emissions, determining their direction of arrival (DOA) and location.

COMJAM for Airborne Platforms is specially designed for installation

on-board mission aircraft. SKYJAM is a modular, flexible, future-ready configured system for UAS.

SIGINT Payloads for UAS include ELINT system (Emerald AES-210V) and COMINT systems (SkyFix), meeting the full range of SIGINT mission requirements.

SIGINT for Mission Aircraft combines advanced COMINT and ESM/ELINT systems into a unified system, presenting a new level of capabilities that provide a fast, complete and accurate intelligence picture for mission aircraft.

Data Links include advanced wireless communications systems for manned and unmanned aircraft, guided weapons, and space platforms - as well as unique SAR (Search and Rescue) systems for combat and non-combat applications.

"India a Strategic Growth Market for IAI"

With annual sales of over \$3.4 billion, and orders backlog exceeding \$9 billion, IAI is ranked among Israel's top five industries. As Israel's largest aerospace and defence exporter, and an important supplier for India's military services, IAI is involved in major programmes that implements most advanced technologies.

New opportunities and growing competition are driving IAI to expand its Indian operations over a wider spectrum, entering new fields where it was not present before. Carrying the company into the next decade, IAI's President and CEO Joseph Weiss defines several pillars for IAI's activities, including missiles, unmanned systems, special mission aircraft and network centric warfare – all considered to be IAI's primary growth engines.

Fuelling the anticipated growth IAI has recently raised about \$317 million in public offering of bonds issued in the Tel Aviv Stock Exchange. The amount issued is impressive, since it is the largest offering conducted during 2012 in the Israeli capital markets. It was also IAI's third and largest bond issuance. According to Weiss, it demonstrated the investor's confidence in the company and its ability to maintain its competitive advantage over the long term, despite the challenges.

"IAI is expanding its cooperation with local Indian companies, in the public and private sector alike," Joseph Weiss told the *Vayu*, "through this cooperation we seek to establish local production, service, and support for our products, as well as offering the necessary technology transfer and training for successful induction into service." According to Weiss, through this continuous process local partners have successfully established and sustained domestic operations, a process that has also contributed to increasing IAI's footprint in this important market.

To bring the corporate to focus on this strategic market IAI's board of directors nominated Eli Elfasi as VP for India. Before joining IAI Elfasi served as the Israeli Defence Attaché in New Delhi. He is expected to focus the company's

activities currently running in parallel lines, improving the synergy between the different divisions, plants and activities. The new function is expected to leverage new opportunities and better face growing competition.

In the missiles domain, IAI sees the air and missile defence as an important growth opportunity. IAI's leading edge in this area is the comprehensive network-centric integration of such systems, as reflected in the Barak 8 programme currently underway for Israeli and international customers.

particularly in Europe, where Heron TP is being considered for a number of strategic procurement programmes and endorsed by domestic industrial partners in each market. These include Germany, where Rheinmetall Airborne Systems promotes Heron TP; France, where France's largest aerospace company Dassault Aviation promotes the drone. The Heron TP is also being considered for a similar programme in Poland.

In the segment of special mission aircraft IAI's systems are already



IAI's President and CEO Joseph Weiss

In the UAS area IAI's Heron family of Medium Altitude Long Endurance (MALE) is already positioned as a world leading UAS in terms of number of operators and operational hours. Operating in Asia, Europe, North and Latin America and the Middle East, Herons are proving themselves on a daily basis as reliable, flexible and efficient combat-proven unmanned platforms, suitable for a wide range of missions. Of a particular value to India is the maritime surveillance version of the Heron UAS; its wide range of sensors has proved highly effective in supporting naval, maritime surveillance as well as homeland security missions.

IAI is optimistic about the prospects of Heron TP in international markets,

operational with a number of customers worldwide with maritime surveillance, intelligence gathering (SIGINT), and Aerial Early Warning (AEW).

Space is another growth area for IAI. The company currently has several satellite programmes underway, for communications and surveillance satellites. Of special importance for India is the Amos-4 satellite, built for Spacecom, which is scheduled for launch in June 2013 from Baikonur, Kazakhstan. Once positioned at 65°E it will cover Russia, India and the Middle East with multiple Ku and Ka transponders creating a powerful platform, enabling a wide range of cross-band, cross-beam connectivity options.

Tamir Eshel

Wide range of Controp observation solutions at Aero India

Controp, at Aero India (located in the Israel National Pavilion) displayed an array of observation systems, from short-range security solutions such as the DANIS system, with a range of about a kilometre, to long-range products like the MEOS, which is can scan between 7-20 km ranges.

The DANIS (Day and Night Integrated System) and DANIS 100 observation systems are short-range remote controlled two-axis pan-and-tilt day/night systems intended for round the clock perimeter security. The DANIS systems are effective for short-range surveillance applications up to 1000 metres, and can be customised to meet specific performance requirements.

They incorporate an uncooled IR camera with a continuous optical zoom lens, together with a colour CCD camera, which provides a wide field of view for overall observation together with continuous zoom capability for identification of objects. The system includes a built-in electronic stabilisation for FLIR and CCD.

The DANIS /DANIS 100 may be used as part of a comprehensive security system, integrated with the CEDAR (medium range) and SPIDER (long range) surveillance systems, or to any C4 system as an effective infrared security surveillance camera for due to the unique continuous zoom lens.

CEDAR, one of Controp's medium range systems, is a highly sophisticated electro-optical panoramic intruder detection system, which automatically detects motion in a wide panoramic view. CEDAR operates entirely passively, with no RF emissions.

The system incorporates a thermal imaging IR camera with a proprietary continuous zoom lens, as well as a high resolution colour zoom daylight camera. CEDAR has two modes of operation: a panoramic scan mode for intruder detection, and an observation mode with live video using thermal imaging or colour CCD camera for intruder recognition, identification and tracking. The scan sector can be selected in azimuth and elevation axes and range. The CEDAR system is operated and controlled by a personal computer integrated with a frame grabber and a joystick.

The final element, the long-range SPIDER is a wide area, passive, real time, electro-optical stabilised intruder detection system which automatically detects motion in a wide panoramic view in both day and night. The system can be installed on mobile platforms, portable masts, or fixed poles and towers.

The SPIDER system incorporates a thermal imaging IR camera with a 22.5x zoom lens, a CCD daylight TV camera, an Eyesafe laser rangefinder and a laser pointer for target marking. Similar to CEDAR, the SPIDER also has two operational modes.

The SPIDER System is operated and controlled by a dedicated Control and Display Unit (CDU) with proprietary software.



Elbit Systems to address Indian helicopter market

Elbit Systems promoted a range of helicopter-related products to tap growing opportunities in the Indian market, both for foreign built, locally made or upgraded platforms. Over the years Elbit Systems has established a number of partnerships in India, paving the way into many programmes.

"Advanced avionic systems, particularly those related to helicopter modernisation would fully comply for India's needs" explained Bezahel (Butzi) Machlis, until recently the General Manager of Elbit Systems' Land and C4I Division. Machlis said such systems could also include instrumented landing systems (for operating in brownout conditions), obstacle avoidance, sensor payloads, communications and networking, integrated cockpit and helmet displays, defensive aids and DIRCM, for which the company is actively promoting its new MUSIC system for military and civil applications. "The increase in India's helicopter and transport aircraft fleets, both of domestic and foreign designs, open significant opportunities for us, both for our partners and for us, as original system manufacturers (OEM). We expect our long-term cooperation with HAL, as well as other partnerships would fit well to this trend," Machlis added.

"Local cooperation is part of Elbit Systems 'DNA', and is also part of its activity in every strategic market, including India. "We already have an excellent cooperation with HAL, providing training and simulation systems, other partnerships are underway in other areas," Machlis told *Vayu*.

"Our portfolio is big and diversified and not necessarily suited for one partner that can cover all. We are evaluating different opportunities and structures of cooperation and partnerships," Machlis added, saying, "Gaining market position is what we look for. Seated close to your customer, your partner can better understand the requirements, be more flexible and responsive for evaluation and testing, or addressing specific issues," he explained. Elbit Systems has recently established a partnership with Bharat Forge, addressing the manufacturing, modernisation and support of artillery systems.

Machlis was recently nominated to become the President of Elbit Systems, beginning in the second quarter of 2013, succeeding Joseph (Yossi) Ackerman who has served in this position for the past 16 years.



Bezahel (Butzi) Machlis, until recently the General Manager of Elbit Systems Land and C4I Division

Tamir Eshel

Elbit Hermes 900 UAS in Maritime Configuration



Hermes 900 Maritime equipped with Maritime Patrol Radar (MPR) and EO & IR Payloads

For the first time globally, presented at Aero India 2013, was the combination of Elbit Hermes 900 UAS with MarInt - a maritime analytics system - as the search light for UAS operations. Maritime surveillance requirements demand specific capabilities and performance such as mission endurance, flight profiles, mission equipment and human factors. Until recently, such missions were performed exclusively by aircraft, some dedicated for the maritime surveillance mission, with others using existing transport planes modified for the mission. These missions typically demand coverage of very wide areas, monitoring extensive maritime traffic, as well as deployment in unexpected conditions, in response to emergencies or on search and rescue missions. Thus, the need for efficient development of a maritime situational picture is critical, enabling the deployment of the few available aerial assets to cover only those areas or targets of significance.

The introduction of unmanned aircraft platforms is changing this paradigm, removing the limitations that have restricted manned missions, while introducing new capabilities that significantly enhance operational flexibility and efficiency of maritime control. This capability is specifically important in recent years, as countries are required to cover growing maritime

areas claimed by the Economical Exclusion Zones (EEZ) that extend up to 200 nautical miles from the coastline or farthest islands. In the case of India, for example, such area covers a huge expanse of the Indian Ocean, bordering Indonesia in the east to Somalia in the west. A country cannot cover such vast space from its radar stations along the coast nor can it commit manned patrol flights to cover the entire area.

At Aero-India 2013, Elbit Systems showcased its newest and largest unmanned aircraft system (UAS), the Hermes 900, in a new configuration adapted for maritime mission, carrying payloads of up to 350 kg. In the maritime configuration the payload suite includes maritime surveillance radar, AIS, an electro-optical multi-sensor payload and electronic surveillance systems. It has endurance to cover vast ocean areas, with redundant line-of-sight and satellite communications links and radio relay, enabling the operator to 'talk through' to vessels at sea. The aerodynamic efficiency of the Hermes 900 enables frequent changes in flight profiles, enabling visual identification of vessels at sea in addition to the ISAR capability provided by the radar. Satellite communication enables mission areas at extended ranges as far as 1000 nautical miles from shore.

Rafael's Reccelite and Recce-U tactical airborne reconnaissance pods



Reccelite is a day/night electro-optical tactical reconnaissance pod for real-time imagery collection and data transfer. Self-contained and self-cooled, the multi-sensor system comprises an airborne payload, a wide digital data link and a ground exploitation station (GES). Reccelite is combat-proven and in operation worldwide. Among its features are a stabilised turret, day/night IR and visual channels (VIS and near IR) with simultaneous collection, image collection in all directions (horizon to horizon, forward-backward, side looking, vertical), multiple scan modes for optimal imagery in all terrains, pre-prepared mission profiles for high, medium, low altitudes, manual override for targets of opportunity, solid-state recorder on board and shares Litening targeting pod ILS infrastructure.

Recce-U is a real-time ISR system for UAVs. Based on the Reccelite system, Recce-U transforms the way persistent ISR and IED detection missions are carried out. Recce-U simultaneously collects high resolution infrared (IR) and visual digital images in an unlimited field of regard. A variety of scanning modes provide optimal photography of all terrains and combine accurate area coverage with high quality imagery.

The system enables automatic photography, according to either a pre-prepared mission plan or to an updated mission plan uplinked in real-time. Additionally, the operator can initiate manual scanning for targets of

opportunity. The system consists of an airborne payload with Reccelite infrastructure of a wideband digital data link, ground exploitation station (GES), LRU spares and maintenance labs.

Its operational flexibility includes day/night CCD and IR sensors with simultaneous collection, high resolution day and night imagery, persistent ISR scanning, IED detection capability, pre-prepared mission profiles, with manual override for targets of opportunity, multiple



scanning modes irrespective of UAV maneuvers: routine, strip, line search and real-time ISR based on advanced image processing capabilities.

IAI's helicopter embedded training system 'THRUST'

Israel Aerospace Industries' (IAI) Helicopter Rehearsal Autonomous Safety & Training System ('THRUST') participated in a large-scale exercise of joint forces which included hundreds of live forces including helicopters, air defence platforms, tanks, and land vehicles. Virtual armaments were used rather than live ammunition. During the exercise the forces used IAI's THRUST system to conduct in-depth debriefing of the battle's results. The attack helicopters and air defence units were equipped with IAI's THRUST and Air Defence Instrumented Training System (ADITS) - both part of IAI's EHUD family of embedded training systems. Connectivity to the land vehicles was achieved via an integral gateway. The airborne system is available in two configurations, both are now off-the-shelf products: THRUST airborne pod designed for attack helicopters, specifically Apache AH-64 (Hellfire), and the Internal case for utility or attack helicopters. The system also provides enhanced safety capabilities including air collision and obstacle avoidance and enhanced debriefing capabilities to allow reconstruction of all flight data and synchronisation of audio and video data.



Israel Aerospace Industries 'Skimmer' naval helicopter package

Israel Aerospace Industries (IAI) is exploring cooperation opportunities with leading naval helicopter manufacturers and users for supplying its 'Skimmer' integrated naval helicopter package. Designed to provide optimal solutions for naval helicopter future mission requirements, IAI's Skimmer package integrates advanced mission systems, sensors and avionics: Radar, Electronic Warfare Support Measures (ESM), Electro Optic Payloads, Datalink, Communication Intelligence (COMINT), Sonar, Sonics, Mission Management and Monitoring Systems, Anti Ship Missiles (ASM) as well as other Weapons. The package can be tailored to meet specific mission requirements for Anti Submarine Warfare (ASW), Anti Surface Warfare (ASuW), Coastguard Protection, Special Operations, Amphibious Assault, and others.



IAI draws upon its wide range of systems, broad helicopter engineering and system's integrator experience, to install and integrate the new systems being offered, on a wide range of platforms, including new or used helicopters. Helicopter pilots with specific experience performing naval helicopter missions were involved in the design and integration processes to ensure that the overall packages are fully customised to actual operational missions.

Controp's FOX family of unique thermal imaging cameras



Controp's FOX thermal imaging camera shows local AGC in hot spot fire area.

Controp has launched the FOX 1200mm and the FOX 1400mm thermal imaging (TI) cameras for very long operational ranges. These new products join the FOX Family of cooled thermal imaging cameras – ranging in size from 250mm focal length through 1400mm focal length – all of which are well known worldwide due to their unique continuous optical zoom lens as well as other unique features such as local AGC (Automatic Gain Control) and advanced image processing.

In addition, Controp provides uncooled thermal imaging cameras with unique continuous optical zoom lens and miniaturisation. In this range, Controp offers fixed field of view (FOV), dual FOV and/or continuous optical zoom FOV, with a variety of focal lengths such as 60mm, 120mm and 180mm.

Through an agreement with a major Indian PSU, Controp recently launched an extended I-Level Intermediate Maintenance Level (IML) Laboratory to ensure local maintenance and optimal operation of Controp equipment in India.

This new FOX-1400 TI camera has a 1400mm lens with x35 continuous optical zoom lens. This provides exceptionally long range target acquisition and observation, with “unmatched superiority in the world of night vision!” The new FOX 1400 has already been supplied as part of the Spider LR system to several customers as part of a long range observation system for coastal protection and surveillance.

The FOX family of thermal imaging cameras includes – FOX 250, FOX 450, FOX-600, FOX 720 and FOX-1400 - all including the continuous optical zoom lens which has a tremendous advantage

over the traditional thermal imagers with incremental zoom capabilities. The FOX continuous zoom feature provides a smooth transition between the various fields of view and ensures eye contact with the “target” through the entire zoom magnifications as well as during video tracking. The improved image processing algorithms, including a unique local automatic gain control (LAGC), enables a high quality image even when there is a “hot spot” in the picture (an explosion, fire, etc). Furthermore, the FOX cameras can be integrated with other systems through their standard communication protocol. The FOX thermal imaging camera is available with or without an enclosure, so that the camera can be used for higher assembly level systems, by installation in the customer's payload or operated as a stand-alone system.



Vayu's traditional pub evening before Aero India 2013

As has now become virtually traditional, the 'pub evening' hosted by *Vayu Aerospace Review* on eve of the Aero India Show, took place at the same venue on St Mark's Road in downtown Bangalore. And, as always, this was very well attended even though there were numerous other receptions and associated events taking place in the city at the same time.

'Hard Rock Café' reverberated with good cheer as professionals from international aerospace companies relaxed with their Indian counterparts even as they prepared for the hard week ahead at Yelahanka.



Vayu at Yelahanka



The *Vayu Aerospace & Defence Review* stand at Aero India 2013 in Hall 'A', was in great company, shoulder to shoulder so to speak with the 'big boys' from the industry. The *Vayu* stand was visited throughout the Show by thousands (sometimes it seemed almost impossible to wade through the visitors streaming through the Hall) and if sheer numbers are the criteria, *Vayu* had a greatly successful Show !

For those who did not come in, *Vayu* came out - in the shape of 'Show Dailies' which were published on the first three days of the event, (6, 7 and 8 February

2013) and distributed in the thousands to exhibiting companies and participating delegations, apart from the myriad of visitors at Yelahanka. Enthusiasm of the specially hired *Vayu* distribution team had to be seen to be believed.

At Aero India 2013, *Vayu* went 'mechanised', its fervent editors, contributors and fellow travelers being transported from Hall to Chalet to Static Display in their very visible buggy, flying the flag so to speak, so as to bring the Show 'LIVE' to its readers, at Yelahanka, the rest of India and the whole wide world !



IN and OUT of Hall A, at Aero India 2013



The LCA – still a pie in



Perhaps one of the most enlightening events of Aero India 2013 took place not at Yelahanka Air Station but at the Nimhans Convention Centre in downtown Bangalore. There, on 4 February, the entire day was absorbed by presentations of a number of technical papers by their respective authors. Covering a wide range of subjects, from fly-by-wire control laws to low-frequency radar, the Aero India Seminar organised by DRDO was an impressive three-day event.

After the usual welcoming speeches, lighting of lamps, singing of bhajans, came one of the most interesting papers to be presented during this technical session of the seminar entitled 'Challenges in Design to Deployment: Critical Lessons from the D&D of LCA' authored by Air Commodore KA Muthana, the Project Director (Flight Test) at ADA's National Flight Test Centre (NFTC). The Air



the sky?



Commodore shot straight from the hip, analysing the numerous challenges, shortcomings and failures in the LCA programme, in particular critically examining the management mis-steps so as to imbibe lessons for future aerospace programmes. The presentation was especially pertinent considering Defence Minister AK Antony's recent remarks urging vigorous indigenisation of Indian defence requirements.

Air Cmde Muthana's paper began by labelling the original Air Staff Requirement (ASR) for the LCA a "beautifully crafted" document which restricted itself to stating only performance requirements, an interesting fact given that such practices were only widely adopted in the West about a decade later! However, he lamented that the process of applying the ASR to actual design and development was "fatally flawed," with no comprehensive

process being following in making changes or seeking concessions from the IAF. This, he stated, has led to a number of significant challenges today, at a stage when the aircraft is (or should be) close to operational clearance. As a related point, he noted that higher management on the LCA programme was "severely deficient," with little inter-departmental oversight and cooperation. The speaker suggested that such strategic projects be headed by a single entity with powers to assign responsibility and demand accountability from all levels of management.

The challenges facing design and development outside of management issues were also highlighted, and the speaker stated that if two separate design houses (HAL and ADA) with different management styles and mandates were to work on a single design, "there would be a price to pay." And this price would not be

paid only during the pre-deployment stage of the LCA programme. With support, documentation, maintenance and upgrades to be conducted through the lifetime of the aircraft, the question as to who would ultimately be responsible for any or all of these remains poignantly unanswered.

In addition to the management and technical issues that have dogged the LCA programme, Air Cmde Muthana bemoaned the fact that no aviators were part of the design teams, leading to situations where scientists focused on getting indigenous technologies integrated at the expense of designing a maintainable and deployable platform, because no aviators were on hand to remind the largely civilian teams of the requirements of operating combat aircraft in actual service. To exacerbate this, the speaker emphasised that the Indian Air Force, the only comprehensive repository of aviation knowledge in the nation, was either not consulted or ignored during the critical part of the LCA programme. Only after the IAF placed an order (albeit reluctantly) for the LCA in 2006 did it get directly involved in the programme. At this late stage in the process, the Air Force flagged hundreds of issues that have certainly contributed to “betterment” of the aircraft, but also to inflating costs and delayed schedules.

Late entry of the IAF into the LCA programme also contributed to delays in the avionics package. With initial focus on getting the basic platform airborne, the pace of development in the fields of avionics and airborne systems far outstripped those of the indigenous

avionics development teams. There was no comprehensive software development for the entire aircraft, only system-specific development that catered to immediate testing and evaluation needs that failed to exploit the advanced nature of the LCA. Again, it was only after the IAF joined the process that things began to be rectified, albeit still with significant hurdles.

The expertise of Indian certification authorities has grown in sync with the LCA programme, given the large gap in indigenous aircraft development, production and certification between the HF-24 Marut and the Tejas LCA. Air Cmde Muthana insisted that comprehensive and detailed documentation of the military certification processes associated with this programme would be of immense benefit to future certification efforts of indigenous aerospace ventures, including those by the private sector.

In a similar vein, the development of support systems, flight manuals, maintenance guidelines and most importantly, simulators, is vital. However, the support systems for the LCA remain as lab prototypes, inherently unsuitable for deployment in the field. These need to be made to military specifications: light, rugged, ergonomic and easy to use by the average airman with limited technical expertise. Flight and maintenance manuals in a state that would be deliverable to an operator are non-existent and their generation from the vast amounts of developmental data are handicapped by the lack of a framework within which to produce them. On the other hand, the

design and production of simulators was dictated by the ASR but strangely this never took place. Funds were allocated and HAL given the responsibility to build, operate and maintain the simulators, but once again, without any direction or decision-making, the project has languished at the conceptual stage and the programme finds itself at a stage where the aircraft is approaching IOC without a type trainer or simulators for the pilots!





impacted the prototype evaluation part of the programme. Between the prototype and production stages, recommendations are made on changes necessary for production aircraft to be ready for deployment from an operational (read: maintenance, testing, usability) standpoint. This was entirely given the go-by, and the current run of LSP (Limited Series Production) aircraft are in effect hand-built test vehicles, with the actual standards of production still in flux!

Air Cmde Muthana concluded by stating that the primary problem with the LCA programme was **management**. Efficient and professional programme management would have avoided many, if not all of the mis-steps over the past thirty years. As it stands, two things are imperative – the customer (at this point essentially the IAF) must remain involved in the programme, and executive action must be taken on the key problems identified. The Tejas LCA can indeed prove to be more than a pie in the sky, but only if those at the helm act decisively – now!

But is anyone listening?

Angad Singh

Series production of the LCA and attendant challenges have also been managed rather indifferently. HAL remains unable to put together airframes with any level of quality control and design drawings are yet to be frozen into production drawings, meaning that even if the LCA were to clear all pre-induction formalities immediately, it would still be quite some time before the aircraft is produced in any significant numbers. This has also



With **VAYU**, Shaking an Iron Fist !



Before, during and after the fire power demonstration

The more things change, the more they remain the same. For those familiar with the last Indian Air Force fire power demonstration at the Pokhran ranges on 28 February 2010 (see *Vayu at Vayu Shakti 2010* in Issue II/2010), the IAF's operational fire power demonstration at the same venue three years later, only had minor differences, but included four new types of aircraft over those sandy wastes : the indigenous

Tejas light combat aircraft, Hawk Mk.132 advanced jet trainer, C-130J-30 Super Hercules and the Tiger Moth / Pilatus PC-7 duet.

The curtain raiser was the same : in 2010, a MiG-29 of No.28 Squadron ('First Supersonics') flashed past the grandstand as curtain raiser for the event with its shockwaves creating a supersonic bang and in 2013, a MiG-29 of No.28 Squadron ('First Supersonics') did exactly the same!

However, the subtle difference for those who knew, is that this elite squadron is marking its Golden Jubilee in April 2013.

In the order of pecking, however, the MiG-29 had been preceded by three Mi-8s 'trooping colours', which was followed by a MiG-27 of No.18 Squadron towing the 'Iron Fist' banner. The fly past phase was led by five MiG-21 variants, being the Types 77, 96, 75, 66 and 69, which once more was symbolic of the 50th



Mi-35 releasing salvo of 57mm rockets.



Su-30s dropping BETAB anti-runway bombs.

anniversary of the MiG-21 in IAF service (again, see related articles in this issue). On their heels were five Jaguars of No.16 Squadron, five MiG-27UPGs of No.10 Squadron and five MiG-29s of No.223 Squadron. The 'victory' formation of a MiG-21 bison leading a Jaguar and MiG-27UPG was followed by three Su-30s in vic formation before the helicopters came on : this obviously a HAL-benefit show, which consisted of single examples of the Chetak and Cheetah followed by the ALH and LCH. The latter (first prototype ZP4601) carried out a spirited aerobatic display, accentuated by smoke generated from a pod.

Even as a reccelite Jaguar banked past the grandstand (with the President, Prime Minister, Defence Minister and other VVIPs in attendance), the real fire power phase began with two Mirage 2000s of No.1 Squadron dropping 250 kg bombs, simultaneously ejecting anti-missile flares to ward off heat-seeking missiles. These were followed by two MiG-21 Bisons



HAL's Light Combat Helicopter in dramatic demonstration.



Led by MiG-21 Bison are Jaguar IS and MiG-27UPG.

MiG-29Ms and MiG-27bisons (of Nos.10, 108 and 4 Squadrons respectively) tore into their targets viciously with 30 mm cannon and S-24 rocket bombs while a Su-30 of No. 30 Squadron delivered the *coup de grace* by dropping 26 x 250 kg bombs. MiG-29s of No.28 Squadron led by their CO first escorted an Il-76 of No.44 Squadron making a heavy drop and then went on to combat mode, launching a R-73 close combat missile against simulated 'bandits'.

firing 57 mm RPs which straddled the designated target but the next-in-line Su-30 of No.31 Squadron, which was to launch a KAB (*Korrektiruyeskaya Aviatsionnaya Bomba*) 500 did not do so "for operational reasons". Not so the MiG-27UPG of No.29 Squadron which fired 40 x 80 RPs and pulverised its target. Three more Su-30s of No.31 Squadron appeared and dropped BETAB anti-runway bombs, followed by a single Jaguar of No.14 Squadron releasing a PB 500 hard-target penetration bomb. Another No.30 Squadron Sukhoi Su-30 was now to fire an LGB but again did not do so "for operational reasons". Two Jaguars of No.224 Squadron quickly devastated their target with eight 1000 lb bombs as did the Tejas LCA (KH 2015) firing an LGB, guided by the Litening pod. The same LCA then took on a simulated aerial threat by firing a R-73 all aspect close combat missile. Bravo !

For the first time in 'public', the Indian Air Force launched a number of its surface to air missiles at simulated targets, first two Igla (SA-16) shoulder-fired SAMs and later in the afternoon, two OSA AK-M (SA-8 B) and finally at night, two Pechoras (SA-3). Diwali never was like this !

Back to the dusk event : while two Mi-35s of No.104 HU set up a helicopter combat air patrol, a single Mi-17V5 of No.155 HU carried out a combat search and rescue mission, a simulated 'bouncer' in the shape of an Mi-25 being summarily shooed off. Later in the proceedings, two Mi-35s fired 40x80 mm RPs (see dramatic visual by *Vayu's* Angad Singh on the leadpage), and shortly thereafter a Mi-17 V5 rolled off a fast attack vehicle (FAV) from its ramp which was followed by two other Mi-17 V5s which hovered to allow slithering commandos execute their attack against an enemy radar station.



Jaguar dropping 1000 lb bombs.

A surprise inclusion was that of Hawk advanced jet trainers, employed in the close air support role dropping 250 kg high speed low drag bombs and firing 68 mm RPs. These were flown, according to the commentator, by recently commissioned flying officers which portends the employment of this AJT in the close air support role. Their big brothers, in shape of pairs of MiG-27s,

The Lockheed Martin C-130J-30 Super Hercules certainly made its mark at *Iron Fist 2013*, with two aircraft from No.77 Squadron disgorging paratroopers while another flew over the grandstand and then turned to make an assault landing on an improvised airstrip close to the audience, turn around, make a short take off and fly back over the audience, all in the space of a few minutes. Impressive !



OSA AK-M quick reaction surface-to-air missile launched from mobile carrier.

Then there were aerobatics at dusk: four Dhruv ALHs of the Sarang team made their presence felt over the Pokhran range before a low level aerobatic display by a lone Su-30 of No.20 Squadron. Meanwhile, an An-32 droned over at height to release members of the Akaash Ganga team from the Paratroop Training School. The dusk events were climaxed by Garud commandos, flown in by 2 Mi-17 V5s and demonstrating their special skills in clearing terrorists in an urban scenario, using both sniffer dogs and a remotely operated vehicle (ROV) to sanitise a booby trapped building.

After an interval when the IAF Symphony Orchestra Air Force entertained the exclusive audience, (Isn't She Lovely) began the night events which were literally designed for 'shock and awe'. Following a low level Mi-17 which fired a broadside of 128 x 57mm rockets against tactical targets was a high flying An-32 of No.12 Squadron ('Fighting Yaks') which dropped ten 1000 lb bombs in a carpet bombing demonstration. The fighters that followed included MiG-21bisons, MiG-27UPGs and Jaguars firing a variety of rockets with a Mirage 2000 launching a Paveway LGB, followed by a single Su-30 dropping 18 x 100kg bombs.



Formation of MiG-29s of No.223 Squadron.



Impact !



MiG-21 Bison firing 57mm rockets.

By now, the desert dust virtually masked the Mi-17 helicopters carrying out search light operations, before the finale, which was in shape of an IL-78, An-32 and ERJ-135 dispensing 100s of flares which climaxed the night events and *Iron Fist 2013* to a climatic end.

In his message, the CAS Air Chief Marshal NAK Browne had articulated that Exercise *Iron Fist 2013* was aimed at showcasing the operational strength of a transforming IAF and to assure the nation that the safety of its sovereign skies was in very capable hands. He explained

matrix, including our maintenance and administrative echelons, is an absolute must for orchestrating such a cohesive response. The conduct of this exercise spanning the day, dusk and night phase also demonstrated our renewed focus towards building up round the clock operational capability”.

According to Air Marshal AK Gogoi, then AOC-in-C South Western Air Command under whose overall control was conducted the Exercise, the IAF had demonstrated two of the cardinal principles of airpower viz. shock effect

more than our 24x7 air defence capability, glimpses of which were displayed by fighters, attack helicopters and an array of air-to-air and surface-to-air weapons”.

Some 230 aircraft and helicopters are deployed for *Iron Fist 2013* including UAVs, one of which was flown low and slow past the audience before the night descended. As per an official statement, “the exercise highlighted capability of the IAF to operate in a network centric environment around the clock, emphasising the lethality and precision of its air ground based weapon systems as well as its special forces”.



President Pranab Mukherjee with Prime Minister Manmohan Singh, Defence Minister AK Antony and CAS Air Chief Marshal NAK Browne at Iron Fist 2013.

that owing to setting constraints, the demonstration was obviously limited to a very small viewing area : in the real world of operations, the IAF’s actions would be conducted simultaneously at multiple levels. “The synergy required between the various components of our operational

and concentration of fire power, using both precision and other weaponry launched by various attack aircraft and helicopters against representative targets placed within the visual bubble. “Deterrence has always been at the forefront of our capability and nothing exemplifies this



The narrow fuselage of the ALH is seen to advantage.



Vice Admiral SPS Cheema (C-in-C Strategic Forces Command), Vice Admiral Shekar Sinha (FOC-in-C Western Naval Command) and Air Marshal RK Sharma (AOC-in-C Eastern Air Command).



Tejas LCA over Pokhran : note the single K-13 missile on launcher, the other having been launched earlier against simulated target.



C-130J Super Hercules disgorging paratroopers.



Air Marshals Arup Raha, Jasvinder Chauhan and PK Roy.



On concept of the special logo : which was conceived by the Wg Cdr Dinesh Vaswani : 'the Iron Fist with a long arm depicts lethal punch and long reach of the Indian Air Force. The Fist is poised and ready to make a point to emphasise Air Power capability. Iron Fist encompasses a laser guided bomb, displaying operational capability, technological advancement and lethal effect of the IAF. The Himalayan Eagle, is perched on top blending with the Iron Fist. The spread wings of the eagle portray the readiness for flight and incredible power. Behind the arm and eagle is a Tiger Moth biplane which is part of the vintage flight, with its long tri-colour trail leading to a Sukhoi Su-30MKI aircraft symbolising 80 years of the IAF. The logo is placed on a blue and yellow shield. The blue symbolizes the sky, while yellow depicts wisdom, clarity and glory of the IAF. The shape of the shield is that of 'Coat of Arms' awarded for continued excellence. The name 'Iron Fist 2013' is engraved on an antiquated banner at bottom of the shield'.



C-130J lands on an improvised airstrip in front of the audience ...



... turns around to take off ...



Leader of the Akash Ganga team flies the IAF ensign.



Launch of SA-3 Pechora.



Another shot of the OSA AK-M at launch.



Mi-17V5 in nocturnal mission.



... and flies over the grandstand !



An IAI Heron UAV makes a silent flyby towards the end of the dusk phase.



The IAF Symphony Orchestra entertaining the audience.

VAYU SELF AD

IRON FIST 2013:

Before, During and After



MiG-27UPG of No.10 Squadron carrying 80mm rocket pods taxiing for take-off ...



*... releasing rockets in salvo
over the Pokhran range ...*



... and recovering back at base.

Before the exercise... at the Air bases



MiG-27ML with banner which it towed to announce start of the Iron Fist 2013 exercise.



MiG-21bis in afterburner take off



Line up of Mirage 2000H from No.7 Squadron before take off.



Su-30MKI takes off with LGB attached to port wing pylon.



Thumbs up ! Pilot in MiG-21FL (Type 77) before participating with other MiG-21 variants in formation flypast over Pokhran.



Pair of Sukhoi Su-30MKIs of No.20 Squadron with weapons before take off.



Three MiG-21 Bisons of No.32 Squadron.



BAE Hawk Mk.132 of the Hawk Operational Training Squadron (HOTS).



Jaguar takes off with full weapons load ...



... and climbs out towards the Pokhran firing range.



MiG-21 Bison lined up for take off, with MiG-27UPG taxiing out.



Arming a MiG-21 Bison.



Tejas LCA (KH 107) with R-73 close combat missile on runway threshold.



Jaguar awaits loading of 1000lb iron bombs.



Tejas LCA with Litening pod and fuel droptank.

After the fire power demonstration



All photos by Simon Watson taken with special permission at Jodhpur, Uttarlai and Pokhran, before, during and after the fire power demonstration.



MiG-21 Bison awaits landing of Mirage 2000H.



Touch down !



Home is the airman ... MiG-27UPG comes back to base.



MiG-27ML, with its gawky landing gear explicitly seen, before touch down.



The Tilpat Years

B-24 Liberator of No.5 Squadron Indian Air Force which type dropped heavy bombs over the Tilpat range in 1954.

The first fire power demonstration conducted by the Indian Air Force was almost exactly nearly 60 years ago, on 21 July 1953 at the Tilpat range, located at 28°27'N 77°21'E, in Faridabad District, 14 miles south from Delhi. The area then consisted of some 500 acres of uninhabited wooded and scrub land and, considering its proximity to the capital city of India, was a rather 'bold' location for this purpose but the IAF continued to use the range till encroachments by ever expanding townships made it dangerous to continue. In fact, at one such Show, a stick of 1000 lb bombs dropped by a Canberra nearly overshot the designated target.

The last air power demonstration at the Tilpat firing range was on 18 March 1989 and after that, this event has been moved south to Pokhran in the Rajasthan desert, located at 26.92°N 71.92°E, where the endless desert wastes are used by the Indian Army and Air Force to fire at will (also not far from the site where the country's nuclear weapon tests have taken place).

However, six decades ago, at the very first fire power demonstration in

1953, the IAF's piston-engined Spitfires, Tempests and Liberators fired cannon, launched rockets and dropped bombs with aplomb. The big Show was a year later when the Indian Air Force marked its 'coming of age' on 1 April 1954 and the taking over of Air Marshal Subroto Mukerjee as first Indian C-in-C of the IAF. The climax was the fire power demonstration at Tilpat range. A large crowd of over 50,000 witnessed this and Prime Minister Jawahar Lal Nehru, who inaugurated the function, flew in by a Sikorsky S-55 helicopter, first to be acquired by the IAF. However, not all VVIPs made it their as many were stuck in the humungous traffic jams along the roads and remained stuck there till the evening.

The 1954 Show began with pyrotechnics (coloured flares) fired and over 100 aircraft taking part, the first being 21 Harvards (one for each year of the IAF), in a formation marking the letters 'IAF' in the sky. Thereafter came C-47 Dakotas, flying in formations of three to drop paratroopers. The fire power part had the IAF's newly acquired Dassault

Ouragans firing rockets, Vampires strafing with cannon and B-24 Liberators dropping heavy bombs.

21 years later, on 29 November 1975, the Indian Air Force once again carried out a fire power demonstration at Tilpat, when then Prime Minister Indira Gandhi also brought her grandson along (see photo from *Vayu's* archives). Air Chief Marshal OP Mehra was Chief and Air Marshal H Moolgavkar AOC-in-C Western Air Command. *Vayu* was present to file an on-the-spot report and the following excerpts are from *Vayu's* issue of December 1975.

As succinctly put by Air Marshal H Moolgavkar, AOC-in-C Western Air Command in his introduction speech, the Fire Power Demonstration was a relatively limited show, "for only the enemy had the monopoly of witnessing the real operations" !

Unlike previous occasions, the Demonstration on 29 November 1975 was marked by absence of the hundreds of thousands of enthused viewers, jamming the Delhi-Mathura approach roads to Tilpat and creating hazards of traffic and safety. The very exclusive and limited



Young Rahul Gandhi with then CAS Air Chief Marshal OP Mehra at the Tilpat fire power demonstration on 29 November 1975

into the ground, especially useful in penetrating deep into runway concrete. The next scenario called for HF-24 Maruts to destroy a bridge over a canal in order to curtail enemy buildup in a tactical situation. The Maruts fired T-10s with hollow charge 23 heads, their effective area of destruction being 350 sq. metres and the effect being equivalent to that of a 120mm calibre shell.

Four MiG-21Ms, armed with UV-16-57 rocket pods, came in next from a 027 attack direction, each firing 32 x 57mm rockets simultaneously at four Sherman tanks, two being destroyed with direct hits, other rockets ploughing into the rather slushy ground. Barely had the debris settled when another four Gnats came in at dive: angles of 25° to fire T-10 rockets, with hollow heads for wide fragmentation effect, against a road convoy. Some of the 'B' vehicles got direct hits and were flung off the road and although some others remained apparently intact to the

number of invitees had crossed the narrow Agra Canal bridge, without encountering any traffic whatsoever, and by 0900 hours after which the range became "live"; the Haryana Armed Police ensured that !

Alouette IIIs and Mi-8s, in a closely timed table, nimbly flew in the VVIPs onto the main helipad, the Prime Minister arriving in a Mi-8 at 0950 hours. At 10.00 hours, the AOC-in-C Western Air Command delivered his welcome address and some minutes later, the Show was on!

Appropriately, the first strike was a counter-air demonstration carried out by the light-weight Gnat, a flight of four attacking aircraft on the ground (an Ilyushin Il-14, minus engine and instrumentation, served as the live target); clusters of T-10 rockets were fired from about 1500ft, the Gnats pulling up sharply after the attack and the dust cleared to reveal the rear fuselage and tail of the Il-14 blasted away.

Two minutes later, a flight of four MiG-21Ms rolled in to attack the airfield complex from the 045° direction. Two S-24 rocket bombs were fired by each aircraft coming in at dive angles of 20°, this missile with 240 mm high segmentation warhead and a long flame-trail clobbering the hanger and ATC tower in a clap of thunder. The S-24 has a large explosive charge and the booster drives the warhead

Hunter dropping napalm at Tilpat





The President of India and other VIPs watching the Indian Air Force in action over Tilpat.

observers a mile away, all trucks were in fact peppered by shrapnel.

To allow the smoke and dust created by high impacting missiles to clear, a five minute solo low level aerobatic display was carried out by a MiG-21. Painted vivid red and black and piloted by a staff officer at WAC, the MiG-21 looped and rolled, carried out wing overs and four-point hesitation rolls, flew inverted and with the judicious use of afterburner, repositioned itself to remain always within sight. The MiG-21's small delta wings have little lift to offer at low speeds and only the power of the engine employed with fine knowledge of the handling characteristics could enable this primarily high altitude interceptor to be shown off as it was : a tribute to the aircraft no less than the skill of IAF pilots who first demonstrated its attributes to the world in December 1971.

The next action was a joint army-air force operation with a company of troops endeavouring to overcome a heavily defended river crossing. As per the Commentary. Four MiG-21s set up an orbit pattern over the VP to provide top cover to the vulnerable heliborne troops. A Forward Air Controller (FAC), stationed at brigade level, calls up the MiGs to silence enemy machine gun bunkers and the fighters tear in with the GSh 23 cannon blazing; almost immediately six troop carrying Mi-8s come in to disgorge 120 Para Commandos who lie flat as the

medium helicopters swing away from the area. A lone Mi-8 brings in a RCL-mounted jeep on sling, releases the anti-tank weapon and the Para Commandos regroup and leave the scene. In real action, of course, the Para Commandos would be more vigorous and the helicopter more brisk in lifting away. Two Mi-8s are called up by the FAC to silence enemy fire-vehicles and the helicopters fire 128 57mm rockets simultaneously to create a widespread linear area of effect.

An attack against a radar complex was next; four MiG-21Ms delivering steep diving attacks with 1000 lb bombs, dropping the ordnance from 3500 ft at 40° dive angles to avoid low-angle ground AA fire. Three minutes later, in excellent timing which was evident throughout the display, four Canberras made a level pass, dropping 32 x 1000 lb bombs in stream on a simulated factory complex. The bombs were delay action, burrowing 10-12 feet into the ground before exploding 0.8-1.0 seconds after impact to prevent shrapnel and concussion blast effects. The 'factory' was a 2-D plywood effort and a stick of bombs fell within 5 yards of the target, the bombers having to compensate for a 35-knot wind at their altitude. The Sukhoi Su-7BMK (S-22 in IAF service) was on next, a flight of four carrying out precision 57 mm rocket attacks against a fuel dump, located no more than 100 yards from a large Red Cross marked hospital. Following up were four Hunters (still looking resplendent

in grey-green camouflage) attacking a storage dump with their 30mm Aden cannon. Each aircraft fired a 2 second burst, meaning some 120-150 HE rounds, each weighing 9 oz. and being particularly suitable against soft skin targets, the last Hunter pulling up over the target at just 100 feet.

Three minutes later, another four Hunters were involved, this time carrying out napalm attack against a communication centre. The attacks were made at 500 mph on the level and the second section added their canisters to an already awesome conflagration. The last formal target was a storage dump, closest to the spectators, and napalm was again used as when close to friendly troops – this time the VIP guests! Four MiG-21s delivered the attack, the last section dropping their load from about 50 feet, the canisters skidding along the surface before the inflammable mixture enveloped the target in brilliant flame.

Two Su-7s were still overhead, flying armed-reconnaissance and looking for targets of opportunity. The VVIP was asked select a target : "the fuel dump" -and the aircraft were called up by the Chief of Air Staff. The Su-7s rolled in to fire 57mm rockets against some still standing fuel barrels, scoring direct hits with and most remaining barrels being knocked over by the kinetic energy of the rockets. Had it been a real fuel dump, this would hardly have remained a target !



Spectacular mixed-aircraft formations over Tilpat on 18 March 1989 : with Canberra leading are the MiG-25, MiG-29, and Ajeet, flanked by the Jaguar, MiG-23MF, MiG-21M, Hunter, MiG-23BN and Mirage 2000.

It was 1059 hours and the brief display was over, 49 minutes of air action with 58 aircraft involved, ranging from helicopter-gunships to supersonic strike fighters. In this compressed time-table and limited stage, aircraft could make no repeat passes, full lethal effect of some ordnance could naturally not be exploited and if after the smoke had cleared, half a gunny factory or some trucks remained visible, it hardly meant that the strikes had not been effective. Post-demonstration mortems confirmed that 90 per cent targets were destroyed or disabled. A high standard of co-ordination and marksmanship and atypical of the skill IAF pilots and their ground controllers possess : the men in the cockpits represented a cross-section from operational units, from Wing Commanders to Flying Officers and their professionalism showed up vividly even amongst the crescendo and thunder of attacking jets and impact of high explosive at Tilpat that morning. Curtain Call

The last Air Power Demonstration at the Tilpat firing range took place on 18 March 1989 with the President of India R Venkataraman as Guest of Honour. This took place after a 'gap' of seven years, the last being held in October 1982

during the Air Force Golden Jubilee. As recalled by Air Marshal Tirlochan Singh ('Tango') who was then SASO Western Air Command, during the 90 minutes of armament firing and flying display, the IAF had some 112 aircraft of all types take part.

Phase-I had begun with a low level photo run by a Jaguar which was followed by a supersonic run by a MiG-27, its sonic boom being a curtain raiser for the audience to prepare for the fantastic sight of a ten-aircraft formation flypast by virtually every combat type in the IAF's inventory. Thereafter, the Show took on an operational angle, a MiG-27ML formation escorted by MiG-23MFs being 'bounced' by two MiG-29s to display the intricacies of a low level strike and escort mission attacked by enemy interceptors. This Phase concluded with two Mirage 2000s "escorting" an HPT-32 basic trainer, vividly displaying the inherent low speed handling characteristics of the IAF's new generation digital delta fighter.

In Phase-II was demonstrated some of the armament used by the IAF, different weapons for different targets, ranging from 23mm cannon, 57mm rockets, S-24 rocket bombs, various retarders, cluster

bombs, the Beluga and finally napalm flaming jelly dropped by MiG-21s.

Phase-III concentrated on army support operations, special heliborne operations (SHBO) by Mi-17s followed by a Mi-26, the world's largest helicopter inducting an underslung BMP infantry combat vehicle. Thereafter, three Il-76s and 18 An-32s paradropped an entire battalion even as a pair of MiG-23MFs set up combat air patrol.

The audience were then treated to a spectacular low level aerobatic display by a MiG-29 before skydivers of the Akash Ganga team leapt out from a Mi-8, the morning being climaxed by the spectacular nine-Hunter formation aerobatic team ('Thunderbolts'). Nearly a quarter century later, in 2013, the audience certainly missed the awesome thrill of formation aerobatics by jets : the Hunters were to be supplanted by Kiran Mk.IIs of the 'Suryakiran' team but since its disbandment two years ago, the only display currently is by the 'Sarangs' flying Dhruv advanced light helicopters.

Hopefully, at the next such event, the IAF will have a new formation aerobatic team, *reportedly* flying Hawk advanced jet trainers.



MiG-21 pioneers at Lugovaya

Air Marshal Brijesh Jayal reminiscences on MiG-21 conversion training at Lugovaya, in the then Soviet Union, during October 1962-February 1963

It was in October 1962 that eight of us reported at Air Headquarters for the final set of briefings before setting off for the USSR. We were being sent to convert on the MiG-21 but the ‘mission’ was generally kept under wraps. There was informal talk that the Defence Minister Krishna Menon was keen that a MiG-21 formation take part at the Republic Day flypast 1963 and hence the great urgency. In the initial stages this is what our Soviet hosts in Lugovaya continued to emphasise, until the events of October 1962 and the frontier war with China in the north and east overtook all that !

Seniority wise, the group consisted of Wg. Cdr. Dilbagh Singh (Boss) Sqn Ldrs MSD Wollen (Mally) and SK Mehra (Polly) and Flight Lieuts AK Mukherjee (Mukho), HS Gill (Gilly), AK Sen (Laddoo), D Keelor (Denzil) and BD Jayal (Jay) (see in above photograph, kitted out in ‘space suits’, sans Denzil Keelor.)

As our Aeroflot Il-18 airliner taxied into the Tashkent dispersal area, curiosity

and excitement was apparent. For some it was the first trip overseas and, for all of us first time to the mighty Soviet Union! However, it did not take too long for us to get a taste of things to come. As the doors opened, in trooped a couple of well built nurses in uniform. They marched smartly along the aisle with stern faces, pushing a thermometer into each mouth as they progressed. Soon there was a cabin full of passengers with mouths shut and thermometers sticking out. Welcome to Soviet Union 1962 !

An Il-14 awaited us and within hours of having left Delhi, we landed at Lugovaya (in the Kazak SSR), which was to be our home for the next four months. The air base was primarily intended to train fighter pilots and engineers from “friendly countries”. Quite contrary to our own perception of a fighter base, Lugovaya was frugal in infrastructure. There were no large hangars nor buildings, just a tarmac and airstrips alongside single-storeyed barracks that were used for living, messing

etc. The ATC was a mobile traffic control tower. We were taken to our barrack, which had numerous but mostly large rooms with common bathrooms. The ‘Boss’ was accommodated in a small room whilst the remaining seven of us shared a dormitory. To those of us who had been to boarding schools, life indeed seemed to have come full circle.

At Lugovaya there also were pilots from three other nationalities training on the MiG-21 : from Syria, Iraq and Finland. Some of the Syrian and Iraqi pilots were old hands, having trained in Lugovaya earlier on MiG-15s and MiG-17s and some even boasted of girl friends in Frunze in the neighbouring Kyrgyz SSR where ground training courses were held ! In jest they would compare the luxurious state of accommodation now to earlier times when even toilets were far removed from living areas. It was evident that the Syrian and Iraqi officers were very familiar with the entire environment, having dealt with the Soviet Air Force for



Lugovaya airfield, circa 2013.

many years. The Finns, however, were very reserved and kept to themselves. All these nationalities were close to the end of their training and within a month of our arrival, had left.

Not long after we had arrived, the Finnish Colonel spoke with us of the great regard he had for Gp Capt Suranjan Das whom he had met when Das was part of the development team with the Folland Gnat and whose flying demonstrations during Farnborough shows were legendary. It needs recalling that the Finnish Air Force also operated the Gnat light fighter and hence there was some commonality between them and us. It was because of this 'bond' that he wanted to share his own perception of the training system in Lugovaya. The indirect message was that he was aware of the professional reputation of the Indian Air Force but since this was the first exposure of Soviet instructors to Indian fighter pilots, they were unlikely to be knowledgeable of this. At any rate their own approach to fighter flying was very conservative and they tended to 'molly coddle' to the extent of giving instructions over the R/T even on the aircraft's approach. Not only was this practice distracting especially in critical phases like approach and landing, but also since this was in Russian, it could

be both confusing and unsafe when handling emergent situations. In such an eventuality he advised us to turn a deaf ear and handle the situation as best as one could. Prophetic advice indeed as I was to experience not too long later !

Our interpreter was the jovial and pleasant Captain Maximov who stayed with us all the time and even interpreted for the technical instructors in class. It was not uncommon for him to be answering technical questions without even referring these to the instructor. When we asked, he merely laughed and said that he had attended these lectures so often that he knew the subject by heart !

The first six weeks or so were dedicated solely towards learning essential Russian language (since all radio communication during flying was to be in Russian) and systems of the MiG-21 in the classrooms that were well equipped. So serious were the Soviets about theory that they did not allow us to even look at a MiG-21 until we were ready for the flying stage ! I still recall our very first class, which was on the Russian language. We were seated in the classroom when the lady instructor walked in. She paused, gave us a hard look and then took us to task for not standing up when she entered. So not only were we to get used to dormitory

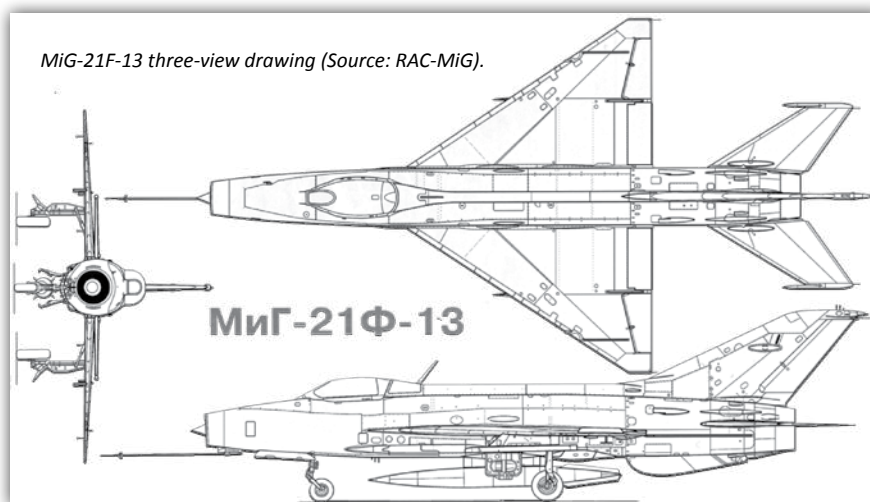
living, but now we had to behave like school kids in class ! A few days later when we shared this episode with our interpreter in a lighthearted manner, with a wink he confided that the lady in question was his wife ! All of us took it in good spirit and the matter was forgotten.

Even as we settled into the routine of shuttling between classes, the dining hall and the barrack, it would be an understatement to state that life was boring. There was no radio nor TV so we were cut off from the outside world. There were no newspapers nor any other literature in English, so there was nothing to read. And the village of Lugovaya was some 3-4 km away with nothing much there anyway except for a railway station. There was also no opportunity of any social contact, both because of the language barrier and the reserved nature of life in that period of Soviet history. Gilly was the only one who had some knowledge of Russian and he did manage occasional conversation with the old maid who was tasked to maintain the living quarters and the heating system. Since we Indians are fond of our morning cup of tea, the only luxury that was afforded to us was the facility to make our own tea in the morning. Denzil and I, being the junior most, naturally were appointed as tea bearers !

The pioneers suffered a setback when just before commencement of flying and on perusal of our medical records, the Soviet authorities informed the Boss that because of some earlier surgery that Denzil had had, he did not 'qualify' to fly fighters as per the Soviet Air Force rules. The logic that the IAF had no such embargo fell on deaf ears and we eventually had to bid farewell to Denzil. That left only seven of us and just one tea bearer !

Being cut off from the outside world, we were shocked when one day our liaison officer said, in passing, that he was sorry to see that our country was at war ! This was with reference to the Indo-China conflict, of which there had been no public inkling when we left New Delhi and came as quite a jolt. After some deft negotiations that the Boss had with the local authorities and no doubt, after due clearance from the authorities in Moscow, we were provided with a radio. For some inexplicable reason the only Indian radio station we could receive was AIR Jullundur on medium wave ! But at least this gave us a window to the outside world and especially as to what was happening in India with the crisis on the China border.

Working backwards from my Log Book, it must have been some time during the second week of December that we were finally taken to the Flight offices and had our first glimpse of the famous MiG-21 (Type 74). So thorough was their system of ground conversion that by now we knew how every system worked, only that we had not yet seen the whole aircraft ! The flight offices consisted of two small rooms, one which contained all the elaborate pressure flying kit and the other for no more than 6-8 people to mill around the Medical officer's table. All our flying was done in pressure suits so before one went in to change, the MO had to certify fitness. Once ready, it was best to hang around on the tarmac where most of the action was anyway. The met and air traffic briefings were all held on the tarmac with a soldier holding up charts as necessary. Flight debriefings and briefings for the ensuing day were held in the classrooms later in the evening. There were mornings when the Met officer declared outside temperatures to be below minus 20 degrees Celsius and credit must go to the wonderful Soviet era clothing that had been provided that the



cold did not bother us at all. An interesting practice was for each aircraft to be allotted to a specific three-man engineering crew of which the officer was leader. So it was he who saw one off and received one. We soon learned that any action on our part to be treating the aircraft harshly would draw very angry looks – so possessive were they of their aircraft. Poor landings were reacted by scorn as well.

It was on 18 December 1962 that I flew my first dual in a MiG-15 with Major Safonov and after a further seven duals, the last one as solo check with Lt Col Masky, the Commander. I went solo on the MiG-17F. Another three flights on this aircraft and a final dual check on the MiG-15 with Lt Col Masky and I finally flew the MiG-21 for the first time on 11 January 1963 in aircraft '98'. It must be mentioned that the two-seat MiG-21 trainer did not exist then and no amount of dual/solo flying on the MiG-15/17F could really prepare one to fly a MiG-21 with its delta planform and twin spool engine. Looking back, with the sort of flying experience that each of us had earlier, the dual MiG-15 and solo MiG-17 sorties helped in no manner at all to our graduating to solo on the MiG-21 except probably to give our Soviet instructors some confidence in us ! It was particularly frustrating when during MiG-15 duals the instructor would keep interfering with the controls. We soon found a way out - just pretend to be flying the aircraft, but actually let the instructor handle the controls from the rear seat !

An interesting experience is worth recalling. It had been drilled into us that

because of the MiG-21's high rate of descent on the final approach and slow response of the twin spool engine, one was committed to landing once the 100 metre threshold was crossed. Overshoots below 100m were not permitted for reasons of safety. On this particular day, as I crossed the 100m meter mark I saw a soldier suddenly dart across the undershoot area on foot. Instinctively I initiated a 'go around', as this was the only safe thing to do. As I pushed the throttle and began to nurse the aircraft to arrest the descent and begin a safe climb out, I could hear the Colonel on the RT from the beginning of the runway in a mobile ATC, shouting at me to throttle back and continue with the landing. With each passing moment his voice grew even more frantic. Fortunately the Finnish Colonel's words came to mind and I turned a deaf ear, although I needed all the concentration, being new to the aircraft. On landing, I was received at the dispersal by Capt Maximov and a few others with sombre faces and was told that I had disobeyed briefing and endangered safety. Obviously this was considered a serious matter by the base commander. My rejoinder that I had saved a soldier's life and perhaps an accident was received with a cold denial that a soldier could ever dare cross the runway as this was forbidden !

Fortunately, the debriefing sessions used to be held in the evenings. This gave us time to discuss the matter internally and it was felt by the 'Boss' and other seniors that the right decision had been taken by me for saving both the soldier and averting a possible accident. The 'Boss' decided that he would await the Soviet reaction during

debriefing and would respond accordingly. None of us was looking forward to an unnecessary confrontation and were very pleasantly surprised to see the Soviet side all smiles and congratulatory for what had happened. Surprisingly, they even accepted that a soldier had been crossing the undershoot area! This also busted the first of many myths as how the IAF would in later years operate the aircraft to its full operational potential.

It took all of us some time to get used to the aroma that pervaded the mess. One suspects this was originating from the kitchen where either the medium of cooking was lard or the meat itself, which was of horse ! There were no vegetarians amongst us and

and with severe boredom setting in, it was suggested that a few of us would walk to the railway station and pick up a few bottles of beer from the dining car of the train which transited the station. I think there were three of us who trudged all the way there on an evening when it all was snow bound, collected the beer and returned triumphant except that we were so exhausted that drinking beer was furthest from our minds by then !

I see from my logbook that there is a break of nearly three weeks from the time we finished our basic conversion (9 sorties) and commencement of flying again. Having completed the conversion we were looking forward to returning when the Air Attaché Air Commodore

The story would be incomplete if I didn't mention that our Deputy Air Attaché, Wg. Cdr. Menon, who was an engineer and monitoring our travaux, had felt sorry for us although there was nothing he could do from Moscow. To make up for this in his own humble way, he felt that we must at least get to spend a few days in Moscow rather than return to Delhi directly from Tashkent. With some deft planning with Air India, he fixed it such that we had to route via Moscow. Here he and his wife welcomed us with affection, opened their bar and laid out a sumptuous meal for us. So relieved were we all that late at night, when snow bound Moscow was asleep, we all 'bounced', unannounced on the Air Attache and Mrs.



Indian Air Force MiG-21F-13 BC816
28 Sqn 'First Supersonics', Chandigarh, 1963

whilst some resigned themselves to eating horsemeat, some others just could not. When later some of our engineering officers joined, there were some vegetarians amongst them. Since the concept of vegetarianism was not known to the Soviets, they were compelled to improvise as best as they could, no doubt washing this sin on their return home ! So particular were the Soviets that fighter pilots must have a stipulated diet that unknown to us, our appetites were being monitored by the servers and this was conveyed back to the Doctors on a regular basis. If on a flying day, one did not do justice to the huge breakfast, there was every likelihood that the doctor would check thoroughly before clearing one to fly. We also realised that casual visits by the doctor on most evenings before flying days were more than for casual banter. He wanted to ensure that we were not up to any tricks. Not that there was any possibility, considering that one could not get access on any liquor anyway !

I recall an incident when there was a long mysterious break in our flying

Lodi informed the 'Boss' that Air HQ wanted us to carry out some aspects of an operational syllabus. For three weeks the Soviets would say nothing and nor would the Air Attache (AA). At any rate contacting the AA was not easy as the Boss had to be taken to the nearby post office from where he would then book a call to Moscow and wait interminably for the call to materialise ! We never quite figured why we had been kept hanging around doing nothing for many weeks, but one learnt later from ministry sources that serious negotiations had preceded this additional bit of flying training, hence causing the delay.

After this frustrating break, we were taken through another series of duals and MiG-21 sorties to supposedly carry out formation and dummy air-to-air attacks. This part of the training was a complete waste of time as it was clear that the instructors themselves were not quite familiar with this part of operational training ! It was towards the end of February 1963 that we finally finished our flying training and were ready to leave for home.

Lodi and enjoyed their hospitality as well. Two wonderful days in Moscow and we returned home!

Professionally we came back with two clear lessons. The first, that the Soviet system of ground training was thorough and worth emulating and second that their approach to fighter training was very different from ours and we should not send any more fighter pilots for training to the USSR. Fortunately, both these lessons were accepted and the IAF is none the worse for them. Overall, one must be grateful to the Soviet Union for having built up and sustained a robust IAF by equipping it with advanced (for that time) fighter during a period of shortage of both resources and foreign exchange. But that is another story.

Editor's Note : Over the next two decades, Lugovaya continued to be frequented by IAF pilots training on new MiG-21 variants as also the MiG-23 swing wing tactical air support aircraft. The MiG-23BN was evaluated by then Wg Cdr Philip Rajkumar at Lugovaya in April-May 1979 and formally inducted into the IAF in January 1981.

From Fishbed to Bison



The first MiG-21 Bison prototype (C2777) before its maiden flight on 3 October 1998.

Saga of the MiG-21bis upgrade

April 2013 marks the 50th anniversary of the MiG-21 in service with the Indian Air Force, beginning with the MiG-21F-13 (Type 74 or Fishbed C as per the Soviet and NATO designations respectively) till the present MiG-21 Bison. This comprehensive article by Air Commodore (retd) Nayani Harish of the 'BUT' is published on the eve of that momentous anniversary.

The ubiquitous MiG-21 has the distinction of having ushered in the supersonic era into the Indian Air Force in 1963 and the fact that it still remains in front line service in 2013 is tribute to the type's resilience and versatility. Albeit designed from the outset as a high altitude supersonic interceptor, it has been extensively exploited in the IAF for roles as varied as air defence, ground attack, close air support, photo recce and lead-in fighter training. Since its inception, this relatively light fighter has seen the nation through two full scale wars and more recently, the Kargil operations.

With technology in the field of military aviation advancing at a scorching

pace, from the mid-1980s the IAF felt the need to refurbish its fleet of MiG-21s to keep these abreast of contemporary technology. However, owing to various reasons, this crucial requirement of the IAF was destined for fruition only in 1996 when the MiG-21bis Upgrade contract was signed with the Russians after protracted negotiations with them as well as the Israelis who were also keen on securing this contract. Accordingly, an expert IAF team was positioned in Russia to oversee the project and ensure timely completion. The team comprised Gp Capt (later Air Mshl) Anil 'Choppy' Chopra, late Gp Capt RM Sethi, Wg Cdr (now AVM) RK Dhir, late Wg Cdr Mokashi, Wg Cdr (now Gp Capt, retd)

RN Prasad, Sqn Ldr (now Wg Cdr, retd) Anil Arora and a support staff comprising Sgt Selvam, Sgt Kulhari and Cpl Ahmed. The contract also envisaged the "involvement of an IAF test pilot and FTE (Flight Test Engineer) during the flight test phase" and it was this clause that resulted in the author, along with Sqn Ldr (now Wg Cdr retd) VT 'Tango' Nathan being positioned in Russia in October 1998.

What follows is a narrative, at times anecdotal, of the trials and tribulations that we underwent in what undoubtedly was a unique and invaluable experience over a period of two years. Before I proceed any further, I would record invaluable contribution of Gp Capt (now Air Cmde,

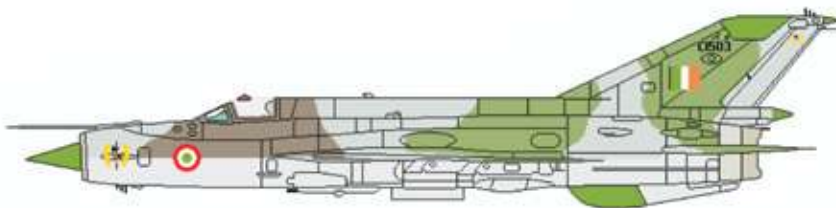
MiG-21 variants with the IAF 1963-2013



MiG-21F-13 (Type 74) of No.28 Squadron 'First Supersonics'



MiG-21FL (Type 77) of No.8 Squadron 'Eighth Pursuit'



MiG-21MF (Type 95) of No.7 Squadron 'Battle Axes'



MiG-21bis of No.26 Squadron 'Warriors'



MiG-21 Bison in current battle grey finish.

ret'd) Jose Mathappan, who, as DAU (Director, Aircraft Upgrade) virtually single-handedly oversaw, controlled and facilitated the programme from Air Headquarters, New Delhi like nobody else could have. The rapport that he established in the corridors of South Block and the alacrity with which he dealt with eagle eyed bureaucrats from the MoD are now legendary. Not once did I mind his 4 am (Moscow time) calls to check on nitty gritty details of the programme from the horse's mouth!

The Israeli Angle

In what turned out to be a serendipitous turn of events, about a month short of our departure for Russia, Israel Aircraft Industries (IAI) approached Air HQ with an offer of a "no cost no commitment" test flight of their MiG-21-2000 (not to be confused with the MiG-21 Lancer, which was an Elbit Systems' initiative). Air HQs decided that it would be appropriate for me and Tango to be deputed for the task, since it would enable us to draw meaningful comparisons between the Israeli and Russian upgrades. It was with a great deal of excitement that we landed at Ben Gurion International Airport on 20 September 1998 for, with the exception of the legendary Gp Capt Kapil Bhargava, this would be, to my knowledge, the only other time that an Indian test pilot would be undertaking test flight of a prototype in foreign airspace without the luxury of a 'dual check'.

What ensued was an eye-opening exposure to the professionalism and no-nonsense approach of the Israelis on all aspects of life. Under the tutelage of Ronen Shapira, the son of Israel's most famous fighter pilot, the legendary Danny Shapira, I was put through a grueling 4-day session of familiarisation by way of classroom lectures, demos and sessions on the integration rig and the cockpit. We were given the liberty of formulating our own test plan, which was agreed to with minor modifications. The plan was tailored to glean as much information as possible on the performance of the ELTA-EL/M-2032 radar that was installed and also on integration and MMI (Man-Machine Interface) aspects. The aircraft itself was a MiG-21bis, presumably from the Ethiopian Air Force, which had been upgraded by IAI. In addition

to its advanced multi-mode radar, it also featured an extensive cockpit upgrade with two colour MFDs (Multi-Function Displays), a HUD (Head-Up Display), a UFCP (Up-Front Control Panel), new throttle and stick top with a large number of HOTAS (Hands on Throttle and Stick) controls and a single-piece front windshield among other things. No weapons were as yet integrated. For the mission, I had a Kfir C7 fighter as safety chase and an IAI Astra executive jet as radar target. The former was considered necessary in view of the extremely restricted airspace and to “preclude getting shot down if I strayed out of Israeli airspace”!

In the event, it gave me a good opportunity to compare the performance of the Kfir with that of the MiG-21bis. The former’s poorer acceleration performance became apparent soon after take off when my chase began to lag behind and requested me to throttle back to catch up. Upon completion of the radar work, I planned a few manoeuvres to assess if the upgrade had any detrimental effects on performance of the bis. In a downward split-S (very commonly and incorrectly referred to as ‘half roll’ in the IAF), the Kfir was thrown way off and actually lost contact with me during the manoeuvre ! Sofar as the upgrade itself was concerned, IAI had certainly done a tremendous job and what impressed most were the ELTA 2032 radar with its SAR (Synthetic Aperture Radar) and TWS (Track While Scan) capabilities and the cockpit with its excellent MMI and HOTAS features. Little did we realise at that time that the very same radar would be inducted into the IAF and Indian Navy in prolific numbers within the very next decade. Following a detailed debrief of the mission in presence of the DA, Gp Capt (now Air Chief Marshal and CAS) ‘Charlie’ Browne, the Israelis admitted that they had lost out to the Russians insofar as the MiG-21 upgrade was concerned but were willing to offer a similar upgrade for our MiG-27 Upgrade programme, which was on the anvil at that point of time. And knowing the Israelis, we weren’t too surprised when they revealed that they were aware that Tango and I were headed for Russia shortly.

Russia, here we come

We had barely enough time to submit our report when it was time to depart for Russia. Since Tango and I were on ‘TD’ (Temporary Duty) and not on a posting, we were entitled to only 100 kg of unaccompanied luggage. With terrifying

for the *Bis Upgrade Team*) office housed within the erstwhile MAPO MiG complex. We were initially disappointed to learn that we would not be based at Moscow but at some obscure town called Nizhni Novgorod, about 400 km east of Moscow on the banks of the mighty Volga River.



Director General SOKOL after signing a protocol

reports of how unpalatable Russian food was, our luggage consisted almost entirely of spices, dals, *achaars* and other such items to sustain us for the envisaged period of 10 months. We reached Moscow on a dreary and cold autumn’s day and reported to Gp Capt Anil Chopra at the BUT (no pun intended but that was the acronym

It took us a while to even pronounce the name ! In retrospect, I would say that that was the best thing that happened to us from the professional as well as personal points of view. Insofar as the former was concerned, both our prototypes, C2777 and C2769 had been shipped to the NAZ Sokol Aircraft Building Plant there and



Gp Capt Anil Chopra with Chief Designer Dorboski at the Sokol plant Nizhny Novgorod.



IAF test pilots flank the Director General SOKOL plant

were undergoing extensive modification work and where all flight testing was to take place. Consequently, we were able to delve deep into various issues at the shop floor and briefing room levels and were literally eyes and the ears of the team leader stationed at Moscow. On the personal front, rather than living life on the fast lane in Moscow, we were exposed to

a very traditional and friendly atmosphere in what is probably one of Russia's most beautiful and historic cities. The cost of living was also considerably lower than at Moscow with the result that Tango and I got our families across at our own expense and managed to live a lavish life on the frugal TD allowance of \$ 33 that we were entitled to.

First Flight

As in most other prototype programmes, the Russians had conducted the actual first flight on 1 October 1998 sans any publicity and media, this being of course witnessed by Gp Capt Anil Chopra. The 'official' first flight was conducted amidst great fanfare on 3 October with the then ACAS (Plans) AVM Sehgal as the chief guest. As luck would have it, it was a dreary day with the visibility never in excess of 800 m and a cloud ceiling of barely 250 m. To make matters worse, the day also heralded first snowfall of the season and we were convinced that the Russians would call off the flight. MAPO MiG had assigned one of their best test pilots, Oleg Antonovich the task of executing the first flight as well as majority of other test flights on our two prototypes. He was as cool as a cucumber on that day and when asked if the flight would go through, he gave that typical Slavic shrug and said "if my Chief Designer tells me to fly, I fly"! The chief designer, Alexander Manucharov, took a call and decided to go ahead with a MiG-29UB chase from the NAZ Sokol plant. We lost sight of the formation soon after take off and to add to the excitement, the HAL INCOM-1210A R/T set on C2777



Witnessing the actual first flight of the first 'Bison'



Painting of the Bison's first flight, signed by those concerned !

failed ! But Oleg and the chase pilot displayed immense professionalism and also executed a low fly by for benefit of the press and landed in snowy conditions. Needless to say, copious quantities of Vodka were drunk that afternoon and that was something Tango and I more than got used to during our stint there, which got extended to all of two years.

Baptism by snow and ice

To state that upon arrival, we got a cold shoulder at Nizhni Novgorod would be an euphemism. It appears that the Russians suspected that we would poke our noses into everything to do with the programme (which, in the event, we did) and end up being sticks in the mud. Only after being shown the specific clause in the contract did NAZ Sokol most reluctantly accept our presence there. And since the contract made no mention of an interpreter or a vehicle for us, we were left to fend for ourselves. A retired Russian Air Force officer, Yuri Belyakov was put in charge and accompanied us wherever and

whenever we were at work. He turned out to be an excellent person and became our guide, friend and mentor. Going to work entailed trudging through the snow, at times with the mercury at an unbelievable -30°C ! The icicles on our moustaches told me why most men from cold countries are clean shaven! A pocket dictionary became indispensable and with Yuri's help, we rapidly picked up the language. In due course of time, with a great deal of pressure from Gp Capt Anil Chopra, the Russians relented and started giving us a vehicle (a sturdy Volga which I refer to as the 'Ambassador' of Russia) and an interpreter, although by then, we were fairly conversant with the language. But Russians being Russians, they adhered to the contract in letter and spirit. The formulation in the contract was "once the flight tests commence, one Indian test pilot and one test engineer would participate in the trials". Since nowhere was it mentioned that the Indian test pilot "would sit in the cockpit and fly the prototype aircraft", Tango and self were initially

only permitted to attend the briefing and debriefing sessions and to participate in test data analysis, lab tests, cockpit video analysis, ATPs (Acceptance Test Procedures) etc. So, much to my chagrin, I was effectively grounded and the prospect of not being able to fly what was our own Air Force's aircraft was galling indeed. But with a great deal of effort on the part of BUT and Air Headquarters, I was finally permitted to fly but not before almost 18 months had elapsed. More about that later.

Interesting Revelations

After a hibernation period of three weeks following the first flight, C2777 commenced flight testing in earnest. This example was earmarked for all flight tests to do with performance, handling qualities/stability and control etc, while C2769 which was still a few months away from first flight was earmarked for weapons, systems and radar testing. Almost as soon as flight testing got underway, the importance of having our own flight test team on the ground at NAZ

Sokol became clearly apparent. A few of the glitches that were pointed out and duly rectified are discussed as follows:

Velocity Vector

Till the advent of our programme with the Russians, it appears that they had had no experience in using a velocity vector/flight path vector on the HUD. Thanks to the HUD videos, we discovered that this symbol just wasn't behaving the way it should have. After some experimentation on the aircraft in the hangar, we realised that it was being generated purely from AOA (Angle of Attack) and sideslip vane data. While the former would have been acceptable to some extent, the latter wasn't by any stretch of imagination. When we quizzed the test pilot from NAZ Sokol on why he didn't think it right to bring this out in the debrief, we were surprised by his Slavic shrug and a "who looks at the HUD, anyway"? We prevailed upon the software development agency (GosNIIAS) and had this rectified by generating the symbol from x, y and z inertial velocities.

HUD Freeze

Yet another problem with the HUD, with dire flight safety implications was the problem of frequent and repetitive HUD

freezes. And just as surprisingly, it came to light only because of the video tape analyses by us, although it took a while to get to the bottom of the problem and institute the necessary software changes to the mission computer.

ADF Auto Selection

All Russian airfields are built to exact GOST Standards and the location of each and every nav aid etc is clearly specified. Hence, the NDB which also serves as the Outer Marker is placed on the final approach at the 4 km point. A logic was built in to the nav computer s/w to automatically switch the bearing pointer from waypoint (landing dumbbell) to ADF (Automatic Direction Finder) during the approach, which made perfect sense under the circumstances. But for IAF airfields where the NDB (Non-Directional Beacon) is far removed from the final approach track, this could spell disaster for a pilot under actual weather conditions.

Squinted Landing Lights.

From my very first night sortie in a MiG-21 till this discovery at NAZ Sokol, I had cursed Artem Mikoyan and Mikhail Guryevich for the landing and taxi light

alignment for which there seemed no plausible explanation. Which pilot would like to waste all that candle power illuminating the tarmac below and to the left whilst straining to pick out visual cues ahead during ground maneuvering and take off/landing? One IAF pundit did offer a half-baked explanation to the effect that the flare-out is judged by gazing at a point 30 deg to the left etc etc. Nothing could be further from the truth. The reason for this preposterous arrangement came to light over vodka with one of MAPO MiG's test pilots, although the same was in an anecdotal exchange of views. It emerged that the GOST standard for the landing lights was written in the WW II era for tail draggers with massive piston engines ahead of the cockpit. So, while on ground and during flare-out, the pilot couldn't see a *sasuski* (Russian for sausage) in front. It was hence decided that the landing and taxi lights would be skewed to the left to take some benefit from them. The GOST standard has not been re-written since, with the result that even the MiG-31, Su-27 etc are designed to the same specs! One should not be too surprised if even FGFA (Fifth Generation Fighter Aircraft) pilots in

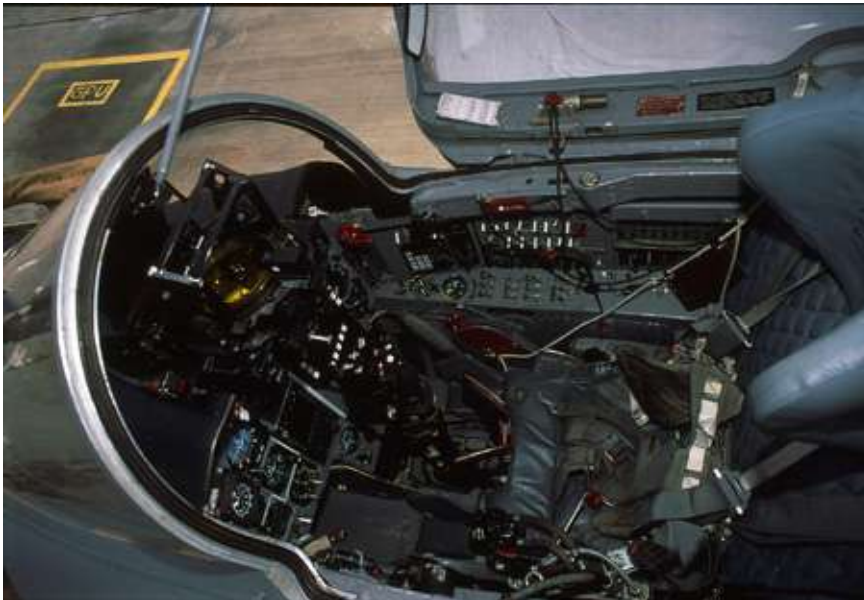


Roll out ceremony : Bison Chief Designer Manachurov, fourth from left.

the future are saddled with this ridiculous arrangement unless the IAF prevails upon the Russians to make necessary changes !

Aileron Fences

I am sure all MiG-21 pilots have wondered what purpose those little span-wise fences just ahead of the ailerons serve. It was clarified that during early flight testing, the aircraft exhibited divergent wing rocking at transonic speeds. This was attributed to asymmetric shock-wave formation ahead of the ailerons. By adding these tiny fences, the shock wave would occur symmetrically at lower speed and remain anchored there. The transonic wing rock problem was hence effectively taken care off.



Roll Rate Limit

This used to be a favourite AEB (Aircrew Examining Board) question and almost all pilots scored full marks on this one as I remember. But to think of it, a roll rate limit of 90 deg/sec for a fighter is like limiting its speed to 750 kmph! Indeed, those of us who have been through the TP course will vouch for the fact that the MiG-21 rolls at a head-jarring 330 deg/sec or more with max roll input. Then, whence this limit? While the Pilots' Notes lays down a blanket limit of 90 deg/sec, it was clarified that this applies only to high supersonic speeds and with cross control inputs – a sure recipe for inertia coupling. When asked why the Pilots' Notes were not being amended, you guessed right – the Slavic shrug once again !

True vs Indicated Angle of Attack

The relationship between the true and indicated AOA has been the object of much discussion and hypothesis at TACDE, AEB and every single MiG-21 squadron/training establishment. In order to display the true angle of attack on certain pages of the MFD, it had to be reduced from the AOA sensed by the vane, which in the event is far removed from the former due to airflow upwash ahead of the vane. The relationship follows a linear law (fortunately!) and is given by this simple equation:

$$\text{True AOA} = \text{Indicated AOA} - 1.21$$

“Technology” !

During the initial phases of radar flight testing, inexplicable false targets were encountered at close ranges. Analysis revealed that the sources of these false targets were those characteristic sets of alpha and beta vanes on the pitot probe. MiG-21 operators would recall that these are required by the gyro gun sight ONLY for air to air rocket firing. With the upgraded weapon aiming computer, the vanes were rendered redundant. It was hence decided that the vanes would be removed. A shop level technician promptly did away with them using a simple hacksaw and the false targets vanished, albeit detracting from the aesthetics of the MiG-21 with those prominent vanes blending so exquisitely with the sleek lines of the aircraft. A high level delegation from

HAL's Nasik Division visited NAZ Sokol a few days later. While inspecting the aircraft, when the missing vanes were noticed, the reason for their removal was explained to them. The then GM was very upset that this 'technology' had not been passed on to them!

Flight Testing – Russian Style

Asymmetric Stores

As mentioned earlier, C2777 was put through a gamut of tests for assessment of handling qualities, stability margins, etc. For determination of the limits for asymmetric carriage of weapons, a series of flight test points, culminating in wind-up turns till 28 deg AOA (Indicated), downward split-S manoeuvres and, finally, the approach and landing were carried out. In the event, the maximum asymmetry with which these test points could be conducted with an adequate margin of lateral and direction control was the 2 x RVV-AE configuration, whence the limit of 350 kg of lateral asymmetry for take off and landing. In the air, up to 500 kg on one side was assessed as the limit.

Longitudinal Stability Augmenter

It was determined through analysis that in certain stores configurations, the stability margin approached limiting values and some measures were required to offset the effects of the same. Consequently, the fuel feed sequence was altered to deplete IIIrd group fuel tanks first as opposed to the legacy MiG-21s in which the first group feeds first. In addition, MAPO MiG was of the view that installation of a LSA (Longitudinal Stability Augmenter) (Russian acronym 'APUS') was essential. To illustrate this requirement, the stabiliser deflection was plotted against AOA in wind-up turns at constant Mach with regions of instability showing up as a reduction/reversal in the slope of this plot. This, coupled with the test pilots qualitative remark that he felt the stick forces lightening, was deemed justification enough to incorporate the LSA.

Anti-Surge System

While the upgrade considerably enhanced the aircraft's weapon carrying capability, analysis indicated that firing of the R-73 missile from the inboard stations would disrupt the airflow to unacceptable levels and a minimum speed limit of 750 kmph was imposed for this condition. To overcome this problem, incorporation of

an Anti-Surge System was proposed, which initiated a fuel-dipper function along with certain other features. To prove the concept in flight, the Russians embarked on a novel campaign with many lessons for us. To begin with, Oleg Antonovich rehearsed the force landing pattern with a *simulated* flame out condition (throttle at idle and airbrake extended) many times over, till he could execute it to perfection. It emerged later that Oleg has the distinction of having executed actual dead-stick landings on the MiG-21, MiG-23 and MiG-29 (both engines shut down!). The next step was to fire an R-73 at 450 kmph to check if it precipitated an engine surge, which, in this case did not, much to everyone's surprise. For the next firing, immediately after missile separation, Oleg applied rudder in the direction of the missile efflux thereby precipitating a surge and initiating operation of the anti-surge system. The system functioned as desired and prevented the engine from flaming out, although Oleg was fully prepared for the worst case scenario, remaining within gliding distance from the airfield.

Radar and Weapons Flight Testing

Bulk of the flight testing effort was eventually devoted to flight testing of the fledgling Kopyo multi-mode radar and weapons flight testing. The latter was conducted from the Akhtubinsk air base close to the Caspian Sea. Akhtubinsk is the Russian equivalent of the USAF's Edwards Air Force Base and all military flight testing is done there. The town was strictly out

of bounds for foreigners but Tango and I had the privilege of being the first ever foreigners to have set foot there. Obtaining the necessary clearances was not easy, as one would imagine and it was only our team leader's persistence that paid off. The range itself is located in Kazakhstan, which of course, was part of the erstwhile Soviet Union. Any description of the nature of these tests is beyond the purview of this article for obvious reasons. However, it was interesting to note that the Russians did not have any state of the art equipment or miss distance indicators for weapon scores. On the contrary, the range was so expansive that each air to ground weapon pass was on a separate target and the weapon impact point with respect to the 'pin' would physically be measured with a tape on ground. A very cumbersome process indeed ! What is worth mentioning is that the initial air-to-ground weapon scores were disappointing. The Russians attributed this to the inaccuracy of the baro-inertial altitude derived by the Totem-221G INGPS (Inertial Navigation Global Positioning System) and put the blame squarely on Thales. The latter retorted by saying that there was no contractual obligation on their part to provide an accurate baro-inertial altitude. It turned out that they were



MiG-21 Bison over Hindan: Photograph by Angad Singh.



correct! It was then left to BUT and Air HQ to prevail upon the Russians that the radar should be the primary ranging sensor and not the baro-inertial altitude.

All air-to-air weapons were tested against the La-7 target drone. This was nothing but a simple straight winged airframe with a life-expired R-25 engine and 500 litres of ATF. Once launched from a rail, it was radio controlled and programmed to fly at 800 kmph TAS (True Air Speed) and was not recoverable. In the event that any of them went astray, two Russian Air Force 'killer' Su-27s were airborne to bring them down. The fact that the killers were never put to use was evidence enough that all our air-to-air weapons had performed satisfactorily.

Airborne at last

As flight testing progressed at the hands of test pilots from MAPO MiG and NAZ Sokol, negotiations between the Indian and Russian sides assumed frenetic proportions and reached the level of the respective Ministries of Defence to permit the author to fly our two prototypes in Russia. Fortunately for me, the Indian side managed to prevail and permission was finally granted for me to commence flying, albeit by way of a supplement to the contract. The earlier Russian stand that I would not be able to carry out 'radio exchange' in Russian language no longer held water for both Tango and I had acquired more than just a working level of expertise in the language. However, since I was grounded for more than a

year, it was agreed that I would undergo a refresher of sorts to get me back to speed. This I secretly resented, for I thought it cast aspersions on my professional capabilities. However, the experience gained during this 'training' process proved invaluable and exposed me to many facets of the MiG-21 that one could never have hoped to in the IAF.

My de-facto instructor was the CTP (Chief Test Pilot) of NAZ Sokol, the quiet and unassuming Alexandr Kononov. A highly experienced test pilot, he would have been a Guinness record holder if it wasn't for the iron curtain of the Soviet era. He holds the unique distinction of having ejected from a MiG-25 *at an altitude of 21 km and a speed of Mach 2.3!* Unfortunately, details of this episode



remained classified. Post perestroika, when Guinness approached the Russian authorities, they were denied access to his SARPP (Flight Data Recorder) data with the result that he never made it to the record book. He drew up a training syllabus for me comprising some ground classes, followed by a dual and two solos on the Aero L-29 Delfin and three duals on a MiG-21UM (Type-69) and two solos on a legacy MiG-21bis.

The flying on the L-29 was interesting because it gave me an opportunity to compare it with the Iskra, on which I had earned my A2 instructional rating. I was aware that the Iskra lost out to the L-29 in the competition for the erstwhile Warsaw Pact's basic jet trainer. In the event, I found the L-29 a lot more docile

and forgiving than the Iskra, although I would choose the latter any day for various reasons. And with the L-29, I also got to operate one of the world's last few centrifugal compressor engines.

Coming to the dual sorties on the MiG-21UM, well, that was something unforgettable. All takeoffs were with minimum afterburner. While the various aerobatic manoeuvres, circuits and landings and so on were fairly standard, I got the unique opportunity of carrying out intentional spinning and PFLs (Practice Force Landings) on a high performance supersonic fighter, something that would never ever have been possible back home in India despite the fact that the Pilots' Notes permits the MiG-21 to be spun intentionally. We usually carried out two

turn spins commencing from an altitude of 10 km. In fact, I should say 'height' because the Russian fly only on QFE ! In level decelerating flight, the entry to the spin entailed gradual application of the rudder in the intended direction till it hit the stop and progressively pulling the stick fully back. The MiG-21's resistance to spinning was clearly apparent. The entry, when it happened was characterised by a sharp rolling motion with hardly any yaw. After the first turn, the roll rate increased with an oscillatory yawing and pitching motion setting in and very noticeable rudder blow back. The recovery entailed centralising the rudder pedals and moving the stick to the neutral position, upon which the aircraft recovered predictably and repeatably. The typical height loss in a two turn spin varied from 4 to 5 km.

The PFLs were just as exciting. A dead engine condition was simulated by throttling back to idle and extending the airbrakes. A constant gliding speed of 450 kmph was maintained. The pattern called for the aircraft to arrive over the outer marker at a height of 5 km and aligned with the runway. A gliding 360° turn was then commenced with 45° bank to once again rollout on the final approach track at a height of 2.2 to 2.5 km. Thereafter the approach could be flown almost mechanically – unbelievable but true ! All that needed to be done was to initially aim for a point 900 m short of the threshold maintaining 450 kmph IAS and a scorching sink rate of 50 to 60 m/s. At a height of 250 m, the sink rate had to be reduced to 10 m/s which automatically altered the flight path to take the aircraft to the threshold. Although we went around from flare-out height, it was only a matter of holding the attitude till the aircraft touched down, if required. I got an idea of how scary this looked to an observer on the ground when Gp Capt Anil Chopra, who was in the ATC during my first two solos remarked "B....., you scared the s... out of me during that approach"!

I was 'cleared' to fly solo on our prototypes after much deliberation on the issue of insurance – mine as well as third party. To say that this was the high point of my stint in Russia would be a gross understatement. I finally ended up flying

22 sorties on C2777 and C2769, in which process, a few more design issues came to light and were duly rectified. I was naturally keen to check out effectiveness of the much touted LSA and must say that I was immediately disappointed somewhat. Not surprising, considering that the LSA has an authority of just + 1.5 deg of authority over the horizontal stabiliser. To begin with, in what was considered the most unstable configuration (4 x RVV-AE missiles), I found that the instability levels were comparable to that of the MiG-21 bis in the 2x490 litre drop tanks + 2xUB32 Rocket Pods configuration. All MiG-21 pilots will vouch for the fact that even with two UB16 and two tanks, the control stick is almost fully forward during the base leg turn. For comparison, I requested the Russians to provide me with a plot of Stabiliser Deflection vs AOA for the legacy MiG-21 in the drop tank + rocket pod configuration. Strangely enough, they never obliged!

While my flying training was in progress, the Yakovlev design bureau flew in their Yak-130 prototype to NAZ Sokol since the plant was earmarked as the series production facility for the type. With some degree of persuasion,

I was granted a sortie with the legendary Roman Taskaev, one of Russia's finest test pilots. The sortie left me with a lasting impression that Russian aero dynamists and control engineers are probably the best in the world. The handling qualities of the Yak-130 in all flight phases could only be classified as superlative and what impressed most was its ability to fly at 42° AOA in a fully trimmed condition.

On returning to India, my fervent efforts to have spinning and PFL on the MiG-21 included in the training syllabus, at least for test pilots and specifically for test pilots deputed to NFTC (National Flight Test Centre) met with nonchalance and/or resistance till I ultimately gave it up as a bad joke. It is indeed unfortunate that this unique experience and expertise that would have benefited the IAF and the flight testing community immensely has faded away and will never see the light of day again with me having hung up the blue uniform.

The Final Days

The flight test programme was initially planned for completion in 10 months' time. In the event, it finally got extended to all of two years, even at the end



125 MiG-21bis were upgraded to the 'Bison' standard and serve with six squadrons of the IAF today, all in overall matt grey finish, sans squadron markings.



All the good men with the two MiG-21 Bison prototypes in the Russian snow.

of which period, some tasks were as yet incomplete. Air HQ decided to withdraw the IAF team and continue the balance of flight tests in India. So both our aircraft went back to the shop for disassembly and crating, but not before a final photo session. The picture is a panoramic shot of both our prototypes, resplendent in their flashy tri-colour scheme with most of the team members from the Indian and Russian sides in the foreground in typical Russian winter conditions.

Meanwhile, the inevitable break-up parties commenced amidst a great deal of bonhomie with copious quantities of vodka being consumed. On Christmas eve of 2000, our motherly Il-76 arrived and parked for two days whilst both our aircraft and associated ground equipment were loaded on. As soon as the Il-76 left in a great flurry of snow, Tango and I departed for Moscow and thence to India with lumps in our throats and only fond memories to remind us and our families of an unforgettable two years

amidst lifelong friends and thorough professionals.

Upon return to India, Tango and I were posted to the ASTE to continue with flight testing on the two prototypes ex-Ozar. And as expected, Wg Cdr Dhir was designated as the CO of No.3 Squadron AF, the first unit to induct the MiG-21 Bison, as the type came to be known in the IAF. In a prophetic, turn of events, No. 3 Squadron was handed over to the author by Wg Cdr Dhir to complete the induction process and streamline various operational and maintenance issues. The IAF was quick to capitalise on the type's excellent operational capability and our pilots were able to adapt to what was virtually a new machine without major problems. The acid test for the Bison was during *Exercise Cope India* 2004 when this diminutive little fighter gave a good account of itself against the USAF's mighty F-15 Eagle. What is ironic is that the IAF's oldest and most venerable fighter has had the distinction of ushering in the following technologies/systems for the first time :

- ✦ Ring Laser Gyro based Inertial Navigation with GPS Hybridisation.
- ✦ Multi-Mode Radar
- ✦ Active Homing BVR Missiles
- ✦ A fully integrated EW (Electronic Warfare) suite
- ✦ Cockpit Video Recorder (albeit analogue)
- ✦ Digital Flight Data Recorder with diagnostics
- ✦ PC based Mission Planning System
- ✦ TV Guided bombs.
- ✦ Various new HAL avionics systems

While the Bison is unlikely to remain in service beyond 2017, it is proving to be an excellent platform for our pilots to get acquainted with state of the art systems, multi-mode radar, BVR (Beyond Visual Range) missile tactics, modern electronic warfare and a host of other features available only on fighters more than two generations ahead.

The author was the project test pilot at the Sokol plant in Nizhny Novgorod where the MiG-21bis upgrade was done.

100th Typhoon for the Luftwaffe

On 28 February 2013, the Luftwaffe acquired their 100th Eurofighter Typhoon from Cassidian at the Military Air Systems Centre in Manching. This anniversary aircraft, with the identifier 31x00, flew to Fighter Bomber Wing 31 Boelke in Noervenich. The German Air Force received its first Eurofighter from Cassidian at the beginning of 2003. The combat aircraft was launched in Germany in 2004 and since then has flown more than 30,000 flight hours without accident. The Eurofighter is currently operational at Fighter Wing 73 'Steinhoff' in Laage, Fighter Wing 74 in Neuburg and Fighter Bomber Wing 31 in Noervenich.



With 719 aircraft under contract, 571 orders and 355 deliveries, the Eurofighter Typhoon is currently the largest military procurement programme in Europe and generates employment for more than 100,000 people at 400 companies. Eurofighter Jagdflugzeug GmbH manages the programme on behalf of the Eurofighter partner companies Alenia Aermacchi/Finmeccanica, BAE Systems and Cassidian in Germany and Spain.

Denmark reopens fighter aircraft procurement

Denmark's competition to replace its fleet of F-16 fighter aircraft has been re-launched on 13 March. The programme had been put on hold in 2010, following financial trouble for the European nation. Boeing, Eurofighter, Saab and the JSF Programme Office have received official notification that the procurement process is open again.



The previous competition saw the F-35 in the lead, with Denmark participating in the development of the aircraft as a Tier-3 partner. European consortium Eurofighter dropped out of the race in 2007 after stating that the procurement process favoured the JSF, but following this resumption of the competition, have welcomed the opportunity to supply their aircraft to the Danish government.



Saab is similarly upbeat. Lennart Sindahl, Head of business area Aeronautics said "We note a great interest for Gripen worldwide and we follow the decision that has just been announced in Denmark. Now we are looking forward to receiving more information about the process."



Both Saab and Eurofighter are buoyed by recent export successes (in Switzerland and Oman respectively), as is Boeing, although perhaps to a slightly lesser extent. Notwithstanding Denmark's involvement in the JSF programme from an industrial perspective, the fact that a partner nation might not select the F-35 as its combat mainstay will be cause for some concern.

Another A350 XWB takes shape in Toulouse

Manufacturing of the third A350 XWB is underway at Airbus' Toulouse, France final assembly line, as preparations continue for the next-generation jetliner's upcoming flight and certification campaign. Designated the MSN3, this aircraft will be deployed for a variety of A350 XWB testing, including performance at high and medium altitudes, in cold weather and hot temperatures and on long-range flights. Build-up activity for the no. 3 A350 XWB commenced during February on the final assembly line, where the aircraft's three fuselage sections were



transferred following their arrival in Toulouse aboard a Beluga transporter. It joins the MSN5000 aircraft at Toulouse, currently undergoing preparations for static testing in another hangar, and MSN1, which is completing indoor ground evaluations.

Initial assembly steps for MSN3 included installation of the jetliner's 50-metre-long electrical harness for flight test measurements, which along with a complement of electrical cabinets, forms an advanced "supercomputer" called METRO. This was followed by the fuselage sections' successful moulding at the final assembly line's Station 50.

Next Generation fighter Gripen E for Sweden

Saab has signed an agreement with the Swedish Defence Materiel Administration (FMV) for development and modification of Gripen E for Sweden during 2013-2026 and a possible order for new production of Gripen E from Switzerland. FMV has placed an initial development order of SEK 2.5 billion for operations during 2013-2014 and balance orders from Sweden are expected in 2013-2014. The total value of possible orders amounts to SEK 47.2 billion.

The agreement with FMV includes firstly, development of Gripen E in 2013-2014 and is worth SEK 2.5 billion. The remaining parts of the agreement include orders as follows: Remaining development work for Gripen E to Sweden of SEK 10.6 billion – expected in the first quarter 2013; modification of 60 Gripen C to Gripen E with first deliveries to Sweden in 2018 – expected in the fourth quarter 2013 at the latest and mission-specific equipment and support and maintenance for Gripen E to Sweden with initial deliveries in 2018 – expected in the fourth quarter 2014.

In Switzerland, a possible acquisition of 22 Gripen E is awaiting parliament's approval. The agreement therefore, includes provisions of delivery of 22 brand new Gripen E, and related equipment to Switzerland, if Switzerland decides to acquire Gripen E.

ATR 72-600s for Malaysia Airlines

ATR and the flag carrier Malaysia Airlines signed a purchase agreement for 20 firm ATR 72-600s, plus options for 16 additional aircraft. The deal is valued at over \$ 840 million, including options. The signature of this new contract follows a Memorandum of Understanding announced by the airline in



December 2012. With this agreement, Malaysia Airlines brings to 42, the total of firm ATR 72s purchased since the initial agreement in 2007. Malaysia Airlines currently has 22 ATR 72-500s, operated by booming business units Firefly (12) and MASwings (10).

CFM LEAP engines' record sales in 2012

2012 proved to be another outstanding year for CFM International (CFM) with the company logging orders for 898 commercial, military and spare CFM56 engines and firm orders and commitments for more than 1,100 LEAP engines for a combined value of \$23.5 billion at list price.

CFM has till date logged total orders and commitments for more than 4,500 LEAP engines while total CFM56 engine orders stand at nearly 29,300 engines. The company is also achieving historic production rates for the CFM56 product line as it produced nearly 1,420 CFM56 engines in 2012, compared to just over 1,300 in 2011 and 1,250 engines in 2010. CFM

has consistently built more than 1,000 engines per year since 2006. Current plans are to reach more than 1,700 engines per year by 2019 as CFM transitions from CFM56 to LEAP engine production.

Sikorsky Begins Delivering Record S-92 Helicopter Order

Sikorsky Global Helicopters (SGH) has delivered of the first of 16 completed S-92 helicopters that the Avincis Group will use to provide transportation for its customers' offshore oil and gas crews and for search and rescue. The aircraft order, which was announced in February 2012, is the largest single purchase of S-92 helicopters to date, known for their robust design, safety features and performance especially in harsh environments including the North Sea.

All 16 S-92 helicopters will feature equipment and systems necessary for operations in the North Sea region in accordance with the European Aviation Safety Agency's requirements. These include five flotation devices, two auto-deployable life rafts, satellite flight following communications, and a main rotor blade ice protection system. Currently, helicopter operators based in five North Sea region countries are flying 47 S-92 aircraft configured for offshore transport and search and rescue missions.

In-Service Support for French A400M fleet

OCCAR (*Organisation Conjointe de Coopération en matière d'Armement*), acting on behalf of France, and Airbus Military have signed the initial In-Service Support (ISS) contract providing an 18-month A400M support services package to the French Air Force. This is a key milestone in preparation for the delivery of the first A400M and includes a tailored service to meet the needs of the French Air Force building on the foundations laid by the A400M Launch Contract between OCCAR (acting on behalf of France, Turkey, the UK, Germany, Spain, Belgium and Luxemburg) and Airbus Military, which already foresees Integrated Logistic Support (ILS) services such as Technical Documentation, Aerospace Ground Equipment and the like. The ISS contract covers industrial on-base maintenance support, spares management, extended query answering service and more to allow for smooth flight operations at the A400M's initial operating base at Orleans.

First A330 MRTT for United Arab Emirates

Airbus Military has delivered the first of three new generation A330 MRTT multi-role tanker transport aircraft ordered by the United Arab Emirates (UAE). Converted from an Airbus A330 commercial passenger jet by Airbus Military at Getafe near Madrid, the aircraft will serve with the UAE Air Force and Air

Defence. The remaining two aircraft are at an advanced stage of conversion and will be delivered by mid-2013. Especially for its UAE service, the A330 MRTT has been equipped with two underwing refuelling pods, the fly-by-wire Airbus Military Aerial Refuelling Boom System (ARBS), and a Universal Aerial Refuelling Receptacle Slipway Installation (UARRSI) enabling it to be refuelled from another tanker. It is powered by two Rolls-Royce Trent 700 engines and has 256 passenger seats. The aircraft is capable of conducting refuelling operations with UAE Air Force and Air Defence fighters such as the Mirage 2000 and F-16.

Arrow 3 tested by Israeli MOD and US MDA

Israel's Missile Defence Organisation (IMDO) and the US Missile Defence Agency (MDA) completed a successful flight test of the Arrow 3 interceptor missile on 25 February 2013 at an Israeli test range over the Mediterranean Sea. The Arrow 3 interceptor was successfully launched and flew an exo-atmospheric trajectory through space, as per the test plan.

The Arrow 3 interceptor was designed to provide an additional level of defence against ballistic missiles, to add interception opportunities to the joint US-Israel Arrow Weapon System and to improve Israel's active defence architecture against missile threats.



First Sukhoi Superjet 100 for Indonesia's Sky Aviation

On 27 February 2013, the first Sky Aviation Sukhoi Superjet 100 arrived in Indonesia. The aircraft, carrying a Manufacture Serial Number 95022, is the first of twelve SSJ100 aircraft ordered by the Indonesian carrier. Built by Sukhoi Civil Aircraft Company (SCAC) in its Komsomolsk-on-Amur assembly line, the aircraft completed the interiors' installation and painting in Ulianovsk site and finally flew to Jakarta Halim Perdanakusuma International Airport.

In 2011 during the Moscow International Aviation and Space salon MAKS, "Sukhoi Civil Aircraft" (SCAC) and the Indonesian carrier Sky Aviation signed a \$ 380 million dollars contract for twelve SSJ100 with delivery scheduled in 2012 - 2015. The

configuration of the first three aircraft features 12 business and 75 economy seats while the rest according to the customer needs will be delivered in 8 business and 90 economy seats configuration.

SuperJet International, a joint venture between Alenia Aermacchi (a Finmeccanica Company) and Sukhoi Holding, also in charge of Customer Services and Training, has already completed the SSJ100 Type Rating training of Sky Aviation pilots, as well as cabin attendants and mechanics, along with on-site support in Jakarta.

Upgrade of Mission System Erieye for Brazil

Saab has received an order from the Brazilian Embraer Defence and Security on upgrade of the Erieye AEW&C Mission System, worth 380 MSEK. The contract is for the delivery of an upgrade of the existing Erieye AEW&C (Airborne Early Warning and Control) systems, as part of the modernisation programme



for the Embraer 145 AEW&C, named E-99 by the Brazilian Air Force. The E-99 is important within the Brazilian Air Force in the control of airspace and border surveillance and the upgrade will bring a substantial increased operational capability. The upgrade of the Erieye AEW&C Mission System will be delivered from 2014 until 2017.

AW169 for Australia

AgustaWestland has been contracted for a VIP-transport configured AW169 light intermediate helicopter for Australia. The contract was signed with an undisclosed customer during the opening day at the Avalon Airshow, on 26 February 2013. With this order, the total number of Australians who have selected the new generation AW169 twin engine helicopter to meet their VIP transport requirement, now touches four. This latest helicopter will perform its missions in New South Wales.

This order further re-iterates the success of this all new model in Australasia, where the type has already been chosen by various operators particularly for VIP/corporate and emergency medical service missions, and continues the growing success of the AW169 in the global market. A total of over 70 AW169s have already been purchased by more than 30 customers in over 10



countries worldwide to perform a range of roles. The programme development is on schedule with all four prototypes now in flight and certification is expected in 2014.

X2 Design for US Army

Sikorsky Aircraft and Boeing will submit a joint proposal to build a demonstrator aircraft based on Sikorsky's X2 Technology rotorcraft design for the Army's Joint Multi-Role (JMR) Technology Demonstrator (TD) Phase 1 programme, which supports the US Army's Future Vertical Lift (FVL) initiative to deliver the next generation of vertical lift utility and attack aircraft.



"The Sikorsky-Boeing proposal will demonstrate how the X2 Technology with counter-rotating co-axial main rotors and a pusher propeller, and advanced fly-by-wire system, will deliver efficient 230-knot cruise airspeed, improved hover efficiency and weight optimised design in an affordable package," said Samir Mehta, president of Sikorsky Military Systems. "By leveraging our proven design, we can offer the Army reduced risk, a 100-knot improvement in speed, a 60 percent improvement in combat radius and 50 percent better high-hot hover performance."

"The Sikorsky-Boeing team for JMR TD is truly a team of equals," said Leanne Caret, vice president and general manager of Boeing's Vertical Lift division. "Sikorsky will take the lead role

in this JMR TD Phase 1 proposal, and Boeing will take a lead role for Phase 2, for the mission systems demonstrator programme.

Proposals for JMR TD Phase 1 were submitted to the US Army Aviation Applied Technology Directorate on 6 March 2013. The Army is expected to announce its selection of one or more winning bids in late 2013. Demonstrator aircraft are expected to fly in 2017.

French Naval Shipyard to acquire EOMS-NG optronic systems

Sagem (Safran) has signed a new contract with French naval shipyard DCNS, main contractor, for EOMS-NG (*Electro-Optical Multifunction System – New Generation*) systems that will be installed in 2014 on four large French navy amphibious and projection vessels: three Mistral class BPC ships and the Siroco TCD 1. Each ship will be equipped with two EOMS-NG systems.

Developed and produced by Sagem, the EOMS-NG is a day-night, multifunction, gyrostabilised optronic system, with complete functionality over 360°, including infrared surveillance, identification, tracking, laser rangefinding and fire control. Controlled from two consoles operating in tandem from the ship's close air defence bridge, the EOMS-NG system will help assess the ship's immediate environment, control self-defence weapons and enhance the safety of helicopter operations. The concept based on high-rate panoramic shots gives it the observation capability equivalent to 100 fixed cameras.



Nexter's profitable development

In a meeting chaired by Nexter Systems' board of directors at Versailles in France on 27 February 2013, it was concluded that despite the uncertain economic climate, which, in Europe, is also characterised by restricted national budget policies, the Group met its objectives for 2012 in terms of orders, income and profitability.

The Nexter Group's signed orders total €862M, with exports accounting for 75% of this sum. This year, three major orders worth €535M were added. By including conditional work packages from commercial contractual commitments in progress, the Nexter Group's orders amount to €2.8B, the equivalent of three years' worth of business. The Group's consolidated revenue totals €742M, which is in line with the objectives the Group set for the 2012 financial year. For the seventh consecutive year, the Nexter Group has posted a consolidated operating margin that is 10% higher than the Group's revenue, evidence of a robust economic model.

30 Sikorsky helicopters for Milestone Aviation

Sikorsky Aircraft have entered into agreements to sell 23 S-92 helicopters and seven S-76D helicopters to Milestone Aviation Group, a global finance company that leases helicopters to high-quality helicopter operators. The agreements also include options to buy an additional 14 S-92s and ten S-76D helicopters. Sikorsky expects to begin delivering the S-92 and S-76D helicopters in early 2013 and up to 2017. Founded in 2010, Milestone has more than 79 helicopters leased, till date, valued at more than one billion dollars and including contracts with the four largest global helicopter operators, as well as small and mid-sized high-quality operators globally. Milestone has secured close-in delivery positions for various helicopter assets, providing its customers with the opportunity to bid on tenders immediately without the traditional constraints of Original Equipment Manufacturer production backlog.

Bell Helicopter and AMHG for 30 helicopters

Bell Helicopter announced an agreement for the sale of 30 Bell helicopters, including 24 Bell 407s and six Bell 206L-4s, to Air Medical Group Holdings (AMGH), one of the largest independent provider of helicopter emergency medical services (HEMS) in the world. Deliveries are scheduled to begin in 2013 until 2018. AMGH subsidiary Med-Trans, headquartered in Lewisville at Texas, is a leading national air medical provider focused on establishing partnerships with hospital systems, medical centers and EMS agencies through 20 programmes, representing 36 bases, across 15 states. Med-Trans operates over 40 helicopters, comprised predominantly of Bell 407s.

First production Airbus Military A400M in maiden flight

On 6 March 2013, the first production Airbus Military A400M new generation airlifter has made its maiden flight, marking a key milestone towards its delivery to the French Air Force. Experimental Test Pilot Hugues Van Der Stichel, who captained the flight, said after landing: "The performance of the aircraft



was as expected and we had a very smooth flight, confirming the great handling capabilities of the aircraft. The result of this first flight gives us full confidence for the on-time delivery to the French Air Force”.

EC225s for Milestone Aviation

Milestone Aviation Group has ordered for 14 additional Eurocopter EC225 twin-engine helicopters, which will join the 16 EC225s ordered in 2012, along with the company's initial EC175 booking, covering five of these next-generation aircraft. This new order for the two Eurocopter helicopter types brings Milestone's EC225 total order book value to more than €675 million (\$ 891 million) at list prices, while the list price valuation of its EC175 acquisition is approximately €70 million (\$ 92 million). Milestone's EC225s and EC175s will be configured to the requirements of its operating partners for use in duties such as crew change missions to offshore oil and gas platforms and search and rescue.

Bristow order six more AW139s

AgustaWestland has signed a contract with Bristow Group Inc. for six AW139 helicopters, plus a number of options for additional aircraft. This latest contract increases the number of AW139 delivered and on order by Bristow Group to 15. In 2011, Bristow Group had ordered six 8-tonne class AW189 helicopters. The AW139 is part of AgustaWestland's family of new generation helicopters that includes the AW169 and AW189 models. These helicopters possess the same high performance flight characteristics and safety features whilst sharing the same common cockpit concept and design philosophy. This approach will deliver real cost savings in areas such as training, maintenance and support for operators having two or three of the models in their fleets.

Saudi Medevac to be equipped with AW139s

AgustaWestland has signed a contract for a fleet of AW139 twin engine helicopters to equip the Saudi Aeromedical Evacuation Department of the Ministry of Defence of the Kingdom of Saudi Arabia. The helicopters will be configured

with a dedicated aeromedical interior to perform air ambulance operations, with deliveries starting in 2013 and being completed in early 2014. It is the first order for the AW139 to be placed by the Ministry of Defence of the Kingdom of Saudi Arabia, where it is already performing demanding missions with other prestigious operators.

31,000th M250 engine for Enstrom Helicopter

Rolls-Royce has delivered the 31,000th M250 engine to Enstrom Helicopter Corporation for installation in a 480B training helicopter destined for the Japan Ground Self Defence Force. The Rolls-Royce M250 engine line has amassed an impressive 223 million flight hours over the past 50 years of operation and has been continuously updated through a series of innovative design improvements during the lifetime of the programme. The M250 engine continues to be installed on new applications, including the latest variant, the M250-C47E, on the US Navy's Northrop Grumman MQ-8C Fire Scout.

Greg Fedele, Rolls-Royce, Senior Vice President, Helicopters, said, "The Rolls-Royce M250 engine line has compiled an unmatched record of success over the years. But we haven't just rested on those laurels. Rolls-Royce continues to roll out improvements that will reduce operational costs while delivering the outstanding power and performance customers expect from their engines. We are proud to hit this significant milestone and look forward to delivering thousands more."

TAI F-16s delivered

Turkish Aerospace Industries have delivered the last Lockheed Martin F-16 Fighting Falcons on order to the Turkish Air Force on 11 December 2012, when two F-16D Block 50+s were officially handed over at Ankara.



TAI began to build F-16s for the THK in 1987, initially for the original 'Peace Onyx' I programme and eventually manufactured 308 of the aircraft for both the Turkish and Egyptian Air Forces. The last batch for the THK comprised 14 F-16C Block 50+s and 16 F-16D Block 50+s ordered under Peace Onyx IV. "The project will continue with the modernisation by TAI of Turkish, Pakistan and Jordan F-16s."

Official J-10 specifications

During a presentation by AVIC, at Airshow China 2012, the company has published official specification of the J-10 fighter. These are: length 16.43m (53.9ft), wingspan 9.75m (31.9ft) and height 5.43m (17.8ft). Normal take-off weight (including internal fuel and two PL-12/SD-10 air-to-air missiles) is 12,400kg (27,337lb), and the maximum take-off weight is 18,600kg (41,005lb). Based on this information, the J-10 can carry up to 6,600kg (14,550lb) of external weapons and stores.



Maximum speed is Mach 1.8, a service ceiling of 17,000m (55,775ft) and a range of 1,650km (1,025 miles), giving an operational range, usually 40%, of 660km (410 miles). According to AVIC, take-off and landing runs are 400m (1,312 ft) and 650m (2,132ft) respectively. The People's Liberation Army Air Force currently has more than 200 J-10s in service. The single-seat J-10A and two-seat J-10S are both in production and a new J-10B version is in flight-test.

Chinese Su-35 interest

Reports from Russian press suggest that the Russian Government had agreed to supply China with 24 Su-35 fighters. Negotiations had been underway for many years



and centred on the number of aircraft to be supplied with the Russians wanting to sell at least 48 aircraft, whereas the Chinese were ready to buy just a few to acquire the new design, its new Irbis radar and AL-41F-1S engines. Meanwhile, the Russian company Saturn displayed the 14.5 tonne (31,968lb) AL-41F-1S engine used by the Su-35 fighter at Zhuhai in November 2012.

Enter the Dragon

The AVIC-owned China Aviation Industry General Aircraft (CAIGA) company displayed a mock-up of the front fuselage of the JL600 JiaoLong (or Dragon) large amphibian. The JL600 is designed for search and rescue 'and fire fighting', and has a 38.8m (127.3ft) wingspan, a length of 36.74m (120.5ft) and a 53.5 tonne/117,947lb take-off weight, including a 12 tonne (26,455lb) water payload. Powered by



Computer-generated rendering of the JL600

four turboprop engines, AVIC claims the amphibian can reach a top speed of 560km/h (302kt) and take off and land on waves up to 2m (6ft) high.

The JL600 aircraft was designed by AVIC's 605th Institute at Jinmen, where the first prototype is already under construction and due to make its maiden flight in 2014. The type should begin series production in 2016.

AVIC claims the market for the JL600 is 60 aircraft over 15 years in civil applications, but the Chinese Navy will certainly be interested in the type as a patrol, mine-laying and anti-submarine warfare aircraft. The Navy has operated four (of five built) 45-tonne/99,200lb ShuiHong SH-5 amphibians since 1986. The military version of the JL600 is designated as the SH-6.

Fourth Bombardier 415 for Morocco

The fourth Bombardier 415 water bomber for the Royal Moroccan Air Force is to be delivered in early 2013. Morocco has ordered five Bombardier 415s. A single aircraft was ordered in 2010 and delivered in February 2011. Bombardier announced a further contract for four B415s, plus training and spares, on 28 March 2011, from Morocco. The first of this order (the second for Morocco) was delivered in May 2011 and the last is due to be handed over in the first quarter of 2013.



Morocco's Bombardier 415s are based at 3eme Base Aérienne at Kenitra Air Base and are assigned to the Escadron de Transport. Prior to delivery, the RMAF used its Lockheed C-130H/KC-130H Hercules (operated by the same squadron) equipped with palletised fire-fighting retardant systems to combat fires. Morocco has occasionally loaned its fire-fighting resources to other neighbouring countries during emergency.

China's Y-20 heavy airlifter makes maiden flight

China's indigenous Xian Y-20 transport aircraft (first reported in *Vayu* 1/2013) made its first flight on 26 January 2013 from the People's Liberation Army Air Force (PLAAF)'s China Flight Test Establishment at Yanliang, in Sha'anxi province. The aircraft, numbered '20001' and escorted by a Shenyang J-15 fighter (a navalised Sukhoi Su-27), was reportedly airborne for over an hour. No details regarding the results of the test have been made public, but from incomplete video footage of the flight, it does not appear to have retracted the landing gear during the flight. Video footage of the landing, however, shows spoilers and engine thrust reversers working normally.

While the maiden flight occurring so soon after the rollout of the aircraft is encouraging for the Chinese aviation industry, the aircraft as it stands presently is not representative of an



operational production-ready airlifter. Crucially, the Soloviev D-30K engines are old and underpowered Soviet low-bypass turbofans, and it remains uncertain whether China will be able to source high-performance turbofans from foreign sources for this project. Domestic turbine engine development in China presently lags far behind airframe technology, with the country purchasing most of its military turbines from Russia.

(Photo from xinhuanet.com)

Bell Helicopter delivers 100th H-1 helicopter

Bell Helicopter, a Textron company, has delivered the 100th of a planned total of 349 H-1 helicopters during a ceremony at its Amarillo Assembly Center. The US Marine Corps H-1 helicopter programme is comprised of both the UH-1Y utility helicopter and the AH-1Z attack helicopter. John Garrison, president and CEO of Bell Helicopter said, "The UH-1A story began back in 1959 with the US Army and it progressed through various versions ending with the 'M-model.' The 'Huey', as it was affectionately known, also served as the foundation for the Cobra attack gun ship. These helicopters also have a long Marine Corps lineage going back to the original basic Huey helicopter, first deployed during the Vietnam War in 1963 as the UH-1E. Later the 'E-model' was upgraded to a twin engine 'N-model'. The Cobra attack helicopter traces its history back to 1968 and the AH-1G model."



Previous models achieved considerable international sales success and the current models are beginning to attract foreign interest as well. The AH-1Z is in competition to supply 36 new attack helicopters to South Korea with a decision sometime in 2013.

More GE F414 engines for USN



The US Navy has exercised a 2013 contract option for the procurement of 52 GE F414 engines in support of the Navy's planned procurement of F/A-18E/F Super Hornets and EA-18G Growlers. This contract option follows the Navy's decision to purchase 82 F414 engines earlier in 2012. Options for the Navy could increase the total buy to more than 200 engines through 2013. The contract, with all options, is valued at more than \$800 million.

The F414 engine powers the US Navy's F/A-18E/F Super Hornet and EA-18G Growler aircraft. More than 1,200 F414 engines totaling two million flight hours power more than 500 aircraft in the fleet. The F414 engine is rated at 22,000 pounds (98 kN) thrust and is in the 9:1 thrust-to-weight ratio class.

As a part of the US Navy Task Force Energy Initiative, GE continues to focus on F414 fuel burn reduction. These environmental programs build on 2010's "Green Hornet" first flight featuring an F414-powered Super Hornet with a 50-50 biofuel blend.

Javelin demonstrates extended range capability in recent tests

Raytheon and Lockheed Martin Javelin Joint Venture demonstrated the ability of the Javelin missile to engage targets beyond its current maximum range requirements during a series of tests at Eglin Air Force Base, Fla. During the US Army tests, the Javelin system acquired and engaged targets



up to 4,750 meters. "These tests prove that, under favorable conditions, Javelin can have reliable, solid performance as a close-combat weapon system well beyond the current maximum range requirement of 2,500 meters," said Duane Gooden, Javelin Joint Venture president and Raytheon Javelin programme director. "There were two direct hits on the threat representative target at the extended range."

Airbus Military delivers final A330 MRTT to RAAF

Airbus Military Vice President Derivative Programmes, Antonio Caramazana said: "It is an enormous pleasure to make this landmark delivery which confirms the reality of the A330 MRTT as the world's only certified and flying new generation tanker/transport. We greatly appreciate the cooperative role of the RAAF in bringing this aircraft from development into service and we look forward to the declaration of Initial Operating Capability (IOC) of the KC-30A in the very near future."



Air Commodore Gary Martin, RAAF Commander Air Lift Group said: "We are very pleased with the in-service testing of the KC-30A and we expect to declare IOC before the end of the year. RAAF F/A-18A and B aircraft now conduct routine refuelling missions with the KC-30A, and the pilots are happy with the KC-30A tanking experience. The KC-30A makes a tremendous contribution to Australia's need to move large numbers of personnel and cargo over long distances, both domestically and throughout the Asia Pacific region."

In RAAF service the A330 MRTT is equipped with two underwing refuelling pods, the fly-by-wire Airbus Military Aerial Refuelling Boom System (ARBS), and a Universal Aerial Refuelling Receptacle Slipway Installation (UARRSI) enabling it to be refuelled from another tanker. Powered by two General Electric CF6-80E engines, the aircraft equipped with a comprehensive defensive aids suite (DAS) and fitted with 270 passenger seats.

Turbomeca's Arriel 2E engine certified

The Turbomeca (Safran) Arriel 2E engine, has been certified by the European Aviation Safety Agency (EASA). The Arriel 2E, with a take-off power of 950 shp, will power the Eurocopter EC 145T2 helicopter. The first engines entry into service is scheduled end of 2013. This follows the certification of the Arriel 2D in May 2011, to power the EC130T2 and AS350B3e Eurocopter helicopters. The Arriel 2E benefits from new technology (new axial compressor, new blade material, etc) in a proven engine. This new engine offers better performances with lower specific fuel consumption, resulting to lower operating costs. Its modular design, combined with a higher TBO (Time Between Overhaul), up to 4,000 hours at entry into service, then up to the goal of 6,000 hours at maturity, allow a simplified maintenance at low cost.



The Arriel 2E engine is controlled by a new-generation dual-channel FADEC, a "benchmark for efficient power control", reducing pilot's workload and increasing safety. The new Engine Data Recorder further shifts the emphasis from traditional to preventive maintenance. These innovations also drastically reduce unscheduled removals and significantly improve helicopter availability.

Chinese and Russian contracts for 4 FFSs

CAE has sold four Level D full-flight simulators (FFS), two each to customers in China and Russia. The sales include the first two FFSs, associated training devices and the CAE Augmented Engineering Environment (AEE) for the new C919 aircraft being developed by Commercial Aircraft Corporation of China, Ltd. (COMAC). They also include two simulators, a Boeing 737NG and a Bombardier CRJ200, to Russian aviation equipment company NITA (New Information Technologies in Aviation). In addition, CAE sold simulator update services to various customers.

Russian Air Force augments its force of Yak-130 combat trainers

On the eve of Aero India 2013, Irkut confirmed delivery of fifteen Yak-130 combat trainers to the Russian Air Force with deliveries to be made under the contract for supplying 55 aircraft to the Russian MoD by 2015.



Current plans of the Russian AF envisage acquisition of at least ten additional Yak-130s up to 2020. The Russian MoD is also in the process of forming a new Group, which will fly Yak-130s. Replacement of L-39 combat trainers with Yak-130s was dictated by the necessity to retrain Russian pilots for operating new Su-30SM and Su-35 super-agile fighters, which are being inducted into the Russian AF. Requirements for the Yak-130 are also related to lead-in fighter training of pilots for the T-50 5th generation fighter, which is being jointly developed in collaboration with India. The Russian AF has L-39 trainers of the previous generation, but according to experts, this aircraft is obsolete and not suitable for pilot training on super-agile fighters because of its low engine thrust, limited manoeuvrability and out-dated avionics.

Irkut experts believe that the Yak-130, in contrast to trainers of previous generations, corresponds more closely to fighters of '4++' and '5th' generation in its flight performance. One of the major advantages of the Yak-130 is the reprogrammed fly-by-wire system. Despite the fact that the Yak-130's certification was completed only in 2009, the trainer is attracting much attention in the international market. In 2011, Irkut supplied fifteen Yak-130s to Algeria, and in December 2012, the Belorussian AF placed an order for four trainers while interest is being generated in a number of countries including Kazakhstan, Vietnam and the Philippines.

Irkut envisages a requirement of 450-500 Yak-130s, both to the Russian Air Force and the international market. Apart from its advanced jet combat training attributes, the Yak-130 carries a potent array of weapons, deploying a wide range of guided and un-guided weaponry with a total weight of 3 tonnes.

Dassault Rafale extends combat experience in 'Operation Serval'

Operation Serval is an ongoing French military operation in the African nation of Mali, aimed at stopping an aggressive Islamic militant rebellion that has sprung up in the north of the country. The operation has recently been stepped up, following a rebel push toward central Mali.



A quartet of Rafales seen at N'Djema following the strike on Gao (note empty bomb racks)

On 11 January 2013, French President François Hollande agreed to deploy French forces in aid of the Malian government, following a direct request for assistance. Initially the French Air Force deployed two Mirage F1CR reconnaissance aircraft and six Mirage 2000D fighter jets, which were already part of the French military's *Opération Épervier* in Chad. Additionally five KC-135 aerial refuelers, one C-130 Hercules and a Transall C-160 are also deployed.

On 13 January, four Dassault Rafale combat aircraft of 1/7 *Provence* Fighter Squadron entered the operation, flying from their base in Saint-Dizier, France to attack targets in the Malian



Rafale refuelling over Africa. MBDA MICA on wingtips, GBU-12 LGBs on bomb racks, and Thales Damocles pod on the starboard fuselage pylon.

city of Gao. The Rafale strike was used to bomb rebel positions in Gao, taking out a fuel depot and a customs house being used as headquarters by the Islamist rebels. The Rafales then proceeded to N'Djamena in Chad and are to remain based there for the duration of the conflict.

By 16 January, two Harfang UAVs from the 1/33 *Belfort* Reconnaissance Squadron were also based at N'Djamena.

The French Navy has also deployed five Breguet Atlantic long-range reconnaissance aircraft operating from Dakar in Senegal and transported two companies of the 92nd Infantry Regiment along with their equipment and military materiel on the *Mistral*-class amphibious assault ship *Dixmude* from Toulon to Abidjan in Cote d'Ivoire. The *D'Estienne d'Orves*-class corvette *Le Hénaff* escorted *Dixmude* on her journey.

As of 26 January 2013, the Malian government has regained control of the towns of Markala (on 19 January), Konna (on 18 January), Diabaly (on 21 January), and Hombori (on 25 January). On 26 January French forces captured the airport at Gao, following the Rafale airstrikes two weeks prior.

Airbus Military begins flight tests of C295 winglets

Airbus Military has begun flight-testing a modification to add winglets to the C295 medium transport and surveillance aircraft, one of a series of product developments underway on the market-leading type. The winglets, which are short extensions to the wingtips of the aircraft, have the potential to improve



performance in the take-off, climb and cruise phases of flight by increasing the lift-drag ratio. Possible in-service benefits include improved hot and high runway performance, increased range and endurance, and reduced operating costs. First flight of the wingletted aircraft took place with complete success at Airbus Military's Seville facility in Spain on 21 December 2012. Data from that flight is being analysed and will be added to data from future flights, providing the basis for a decision on whether or not to incorporate winglets into the C295 design.

The photograph shows the C295 during its first flight with winglets.

Record turnover and boost : Eurocopter

Eurocopter delivered another “very strong performance” in 2012, with an all-time record turnover of 6.3 billion euros. The company’s second high record in bookings value marks a return to pre-crisis levels. This places Eurocopter in a strong position to benefit from its broad helicopter portfolio evolution, along with the expansion in services and a growing global footprint.

A strong growth in services and the 475 rotorcraft delivered last year generated a new turnover high of 6.3 billion euros, or 15 percent more than in 2011, when the Group reached a previous record of 5.4 billion euros. With a cumulated average growth rate of nine percent since 2006, Eurocopter is delivering one of the most impressive success stories in the European industry. Milestones in 2012 included deliveries of the first enhanced AS350 B3e version and the initial latest-generation EC130 T2 helicopter—both members of Eurocopter’s popular Ecureuil family along with the 500th EC145 delivery. Eurocopter also provided the first A350 jetliner passenger door set, underscoring its innovative composite technology production capabilities.



Eurocopter's AS 550 Fennec light helicopter during high altitude trials in Leh.

Eurocopter’s consolidated order intake in 2012 totaled 469 net bookings, representing a value of 5.4 billion euros and marking the company’s third consecutive yearly increase since 2010. Sales were paced by the Ecureuil/Fennec/EC130 family with 249 bookings and the EC135/EC145 families with 144 bookings while the Super Puma family remained strong last year, backed by significant bookings from the oil and gas sector including a framework contract for 16 EC225s with the Milestone Aviation Group leasing company, and a first contract for the new AS332C1e placed by Starlite Aviation.

Eurojet EJ200s for Oman

Multinational consortium Eurojet Turbo GmbH ended 2012 on a high with the Sultanate of Oman’s order for 12 Eurofighter Typhoon combat aircraft (as part of a larger order that also includes 8 BAE Hawk trainers).

The Typhoon is a twin engined aircraft, and while the details of the deal have not been made public as yet, it is likely that the Sultanate would acquire a number of spare engines in addition to the 24 fitted to the ordered aircraft.



Since entry-into-service in 2004, more than 340 aircraft have been delivered to six nations, including export customers Austria and Saudi Arabia, with over 700 EJ200 engines supplied as well. There are now 20 Eurofighter Operating Units all over the world, and the EJ200 engine fleet has achieved over 160,000 flying hours.

Finmeccanica/ AgustaWestland in major contracts

AgustaWestland, a Finmeccanica company, has signed contracts with a total value of about Euro 435 million in the UK and Azerbaijan. In particular, AgustaWestland has signed a three year contract (from March 2013 to April 2016) with the United Kingdom Ministry of Defence, valued at approximately GBP 260 million (about Euro 320 million), for the provision of Sea King Integrated Operational Support (SKIOS) for the UK MoD’s fleet of Sea King helicopters operated by the Royal Navy and the Royal Air Force. This contract follows on previous contracts signed with the UK MoD to cover the period between 2005 and March 2013.



RAF Sea King

T-50 makes first long distance flight

UAC's prototype fifth-generation Sukhoi T-50 fighter carried out its first long-range flight which was carried out by fourth prototype aircraft (T-50-4, also called "54 Blue") during its transfer from the Sukhoi manufacturing plant in Komsomolsk-on-Amur in the far east to Zhukovsky, near Moscow.



As Russian Deputy Prime Minister Dmitry Rogozin said "this is a serious breakthrough! The aircraft flew 7,000 km, making two landings, in Abakan and Chelyabinsk, on the way to the Russian capital." T-50-4 joins three other T-50 prototypes at the Zhukovsky airfield prior to further flight tests, which are scheduled to start in March 2013. The fifth prototype aircraft is being built at the Komsomolsk-on-Amur factory in Siberia, and will also join the test fleet in 2013.

The T-50, known as project PAK-FA, first flew in January 2010 and was presented to the public at the Moscow Air Show in 2011. The Defence Ministry is planning to finish flight testing with eight prototypes by 2015, before moving into series production in 2016.

The first prototype of the FGFA is to be delivered to India in 2014.

First 150 JIM LR 2 for French Army

On 5 December 2012, Sagem (Safran) delivered the first 150 JIM LR 2 multifunction long-range infrared binoculars to the French Army, in line with the original delivery schedule. This delivery was part of the JIR TTA NG programme, covering a total of 1,175 multifunction binoculars. The programme contract was awarded by French defence procurement agency DGA to Sagem, as prime contractor, in December 2010. JIM LR 2 is a portable, compact unit, combining a number of advanced functions: day and night (thermal) vision, rangefinder, laser pointer, compass, GPS and data transmissions. It is fully compatible with Sagem's own FELIN integrated equipment system for dismounted soldiers.

JIM LR 2 offers several major improvements in relation to the initial JIM LR version with its enhanced detection performance, longer-range pointer for fire support, 30% longer run time and the ability to record images and videos integrated in the product. Coupled to a new remote control terminal, JIM LR



2 provides a full-fledged optronic system for area surveillance, intelligence and support, whether used by dismounted troops or from a vehicle.

Produced by Sagem in its Poitiers plant, JIM LR binoculars are used by several NATO countries, where they are deployed in infantry, artillery and intelligence units, special forces, support for frontline troops, and border and coastal patrol. A total of 5,000 JIM LR binoculars are now in service or under order worldwide, including 2,000 in France.

Nexter SPACIDO artillery rounds in final qualification phase

After successful test firings in 2011, the French *Direction Générale de l'Armement* (DGA) has notified Nexter of the SPACIDO system qualification contract. SPACIDO is a trajectory correction system for artillery shells after firing.

The system is independent of GPS and a completely standalone device that uses real shell velocities during the first minutes of flight using the radar already fitted on existing artillery. The trajectory is corrected by the in-flight extension of an air-brake integrated into a multi-function rocket.

SPACIDO increases firing precision by a factor of 5, and is compatible with all existing 155 mm and 105 mm artillery and ammunition. This reduces the amount of ammunition necessary to prosecute a threat, and at the same time reduces risks of collateral damage and improves efficiency.

It is planned to introduce the SPACIDO system into operational use in the French Armed Forces after qualification in 2014. Armed forces in other nations have already shown a keen interest in this unique artillery round.



Lockheed Martin's F-35 : programme achievements for 2012

The Lockheed Martin F-35 Lightning II programme completed 30 aircraft deliveries and achieved significant advances in flight test highlighting a year of continued progress for 2012.



The 30 F-35 deliveries in 2012 included 11 Conventional Takeoff and Landing (CTOLs), 18 Short Takeoff/Vertical Landing (STOVL) variants, and one Carrier Variant (CV). Two of the STOVLs were the programme's first two international aircraft, which were delivered to the United Kingdom. All but the carrier variant, known as CF-5, were production aircraft delivered to various bases for operational purposes. CF-5 was built for flight testing and delivered to the System Development and Demonstration (SDD) programme. The 30 aircraft delivered in 2012 more than doubles the 13 aircraft delivered in 2011.



The 2012 flight test plan called for 988 flights and 8,458 test points by 31 December 2012. For the year, the SDD programme flew 1,167 flights and tallied 9,319 test points. The F-35A Flight

Science test aircraft flew 291 flights and accomplished 2,573 test points. The F-35B Flight Science test aircraft accomplished 396 flights and 2,443 test points. The F-35C flew 239 flights and tallied 2,247 test points. The Mission Systems test aircraft accomplished 241 flights and 2,056 test points. The F-35B also executed 102 vertical landings.

The cumulative 2012 milestones were achieved through a combination of planned test flights and test points, along with test flights and test points added throughout the year. The flight test programme is now more than one third complete in aggregate with the Air Force's F-35A variant leading the way with 43 percent complete.

The F-35 Lightning II is a fifth Generation fighter, combining advanced stealth with fighter speed and agility, fully fused sensor information, network-enabled operations and advanced sustainment. Lockheed Martin is developing the F-35 with its principal industrial partners, Northrop Grumman and BAE Systems.

New success for the AASM

The *Armement Air-Sol Modulaire* (AASM, or modular air-to-surface armament) was conceived by Sagem as a modular stand-off weapon that could be used in a very wide range of scenarios against any type of targets. Also known as 'Hammer' (standing for Highly agile and manoeuvrable munition extended range), the AASM is a low-cost, all-weather, fire-and-forget weapon optimised for high-accuracy attacks at long ranges.



Rafale (in front) with AASM and Mirage 2000 during the Libya Operations

For long distance engagements, the AASM is equipped with a bolt-on tail unit / range extension kit which comprises a solid rocket motor and flip-out wings. Range exceeds 60 km for a high-altitude release, or 15 km for a low-level firing, allowing air-defence systems to be targeted in the Destruction of Enemy Air-Defences (DEAD) role while safely remaining out of reach.

A total of 3,000 AASMs (2,250 for the Air Force and 750 for the Navy) have been ordered by the French MoD in the 340 kg (748 lb) variant fitted with a Mk 82 / 500 lb class bomb body. Further batches, with Mk 83 (1,000 lb / 454 kg) and Mk 84 (2,000 lb / 908 kg) bodies, could be purchased at a later stage to progressively expand the range of missions performed with the AASM family.

Thales delivers first maritime surveillance aircraft

Thales has achieved delivery of the first of three maritime surveillance aircraft under the Meltem II programme for Turkey, to be operated by the Turkish Coast Guard from Izmir Air Base. Pierre Eric Pommellet, Senior Vice-President of Thales Group, officially handed over the aircraft at a ceremony held at the Turkish Aerospace Industry (TAI) facility in Ankara.



This marks the delivery of the first maritime surveillance aircraft equipped with the Thales AMASCOS mission system, which will provide the Turkish Coast Guard with an enhanced capability to better monitor the Turkish Exclusive Economic Zone and territorial waters. This maritime surveillance aircraft is designed to perform a broad spectrum of missions including surface surveillance and naval control, anti-drug and other types of smuggling operations, the prevention of illegal immigration and illicit fishing; maritime pollution surveillance, with the provision of enhanced evidence collection capabilities, essential to this kind of operation and search and rescue operations.

MiG Corporation's growing "international influence"

The MiG Corporation's growing "international influence" in the world of combat aviation is set "to revolutionise." According to the Centre of Analysis of World Arms Trade

(CAWAT), a Moscow-based independent think tank, MiG's share of the worldwide export of fighters during a period of 2012–2015 will rise by 11.3% in number and 7.7% in value. In comparison, the CAWAT quotes the same parameters of the period of 2008 – 2011 as 5.2% and 3.5% respectively. This significant increment in figures is because of exports of MiG fighters, including the MiG-29K/KUB ship-borne aircraft and MiG-29M/M2, their counterparts for land-based operation.



Russian Navy MiG-29K refueling a newly upgraded IAF MiG-29UPG.

By the end of December 2012, the Indian Navy had acquired the first four MiG-29K/KUBs of the new batch of 29 aircraft contracted for in March 2010. The previous deliveries of 16 MiG-29K/KUB were completed during 2009 – 2011, as per the 2004 contract. Final deliveries of the IAF's MiG-29UPG up-graded aircraft were made in December 2012. The balance up-gradation of MiG-29s will be implemented in India. In comparison with its predecessor, the MiG-29SMT, the MiG-29K/KUB features more advanced avionics, in particular its EW system. With avionics performances similar to the MiG-29K/KUB/M/M2 family, the UPG variant is similar to the original MiG-29 fighter in its aerodynamics, engines and aircraft systems.

This option opens 'a window of opportunities' for countries, which are looking for a cost-effective variant with improved efficiency. RAC-MiG states that initially, the MiG-29UPGs will be available not only under an up-gradation programme, but as new aircraft as well.

Meanwhile, RAC-MiG will move to manufacturing more cost-effective fighters of the "unified family", which, apart from the MiG-29K/KUB and MiG-29M/M2, includes the MiG-35 fighter as well. This aircraft is also included in the Russian Air Force's acquisition programme officially confirmed by Lieutenant General Victor Bondarev, recently appointed as commander-in-chief of the Russian AF. With a contract signed with the Russian MoD for 20 MiG-29K and four MiG-29KUB ship-borne fighters, RAC MiG has certainly increased its share of the Russian defence market.

Hunt with the Hounds, Run with the Hares



Su-35s for the PLAAF

Even as the Indian Air Force is to receive an additional 42 Sukhoi Su-30MKIs from Russia, the People's Liberation Army Air Force (PLAAF) of China is in agreement, again with Russia, for the supply of the latest Su-35 multirole combat aircraft. Vladimir Radyuhin, looks at the implications for India in his recent article on this development.

Russia is resuming the supply of advanced weapon platforms to China in a move that may have implications for India. At the end of 2012, (almost at the same time that Russian President Vladimir Putin was visiting New Delhi : Ed) the Russian Government concluded a framework agreement with China for the sale of four Amur-1650 diesel submarines. In January, it signed another inter-governmental agreement for the supply of Russia's latest Su-35 long-range fighter aircraft. This will be for the first time in a decade that Russia has delivered offensive weapons to China.

It will also mark the first time that Russia has supplied China with more powerful weapon platforms compared to Russian-built systems India has in its inventory, although in the past, the opposite was the case. As examples, the

Su-30MKKs Russia sold to China were "inferior" to the Su-30MKIs supplied to India at about the same time. The Chinese fighters had an earlier model radar and without the thrust vectoring engines of the Indian Su-30MKI version.

This time the situation looks reversed. The Amur-1650 submarine is far more silent and powerful than the Kilo-class submarines the Indian Navy has in its inventory. The IAF's Su-30MKI will be opposed by China's Su-35 which is powered by higher thrust engines and boasts a more sophisticated radar, avionics and weapons, according to a leading Russian military expert, Konstantin Makienko.

In a swipe against the IAF's MMRC decision, a Russian spokesperson said that China's acquisition of the Su-35 will also question the wisdom of India's plan to buy the French Rafale. "The sale of Su-

35s to China will shoot down the value of the Rafale for India," according to Mr. Makienko, who is deputy head of Russia's top defence think tank, Centre for Analysis of Strategies and Technologies.

"The Rafale will stand no chance against China's Su-35," the expert opined. "The Su-35's Irbis radar has more than twice the detection range of the Rafale's Thales RBE2, and will lock onto its target well before the Russian fighter becomes visible for a retaliatory strike. The 117S engines of the Su-35 are also far more powerful than the Rafale's Snecma M88."

The Russian Air Force is just beginning to take delivery of the new aircraft and China may become the first country to import this. The relatively small number of Su-35s China plans to buy (24) should not deceive anyone, Makienko added. China is obviously following the same pattern for the Su-27, initially ordering 24 planes and



ending up with more than 200 Su-27s and its licence-built version, the J-11.

The supply of more advanced weapon platforms to China than those available to India appears to contradict some basic geopolitical realities. India remains Russia's most trusted partner whose defence requirements have never been refused. By contrast, Russia has always been apprehensive of the Chinese dragon and suspicious of its intentions towards resource-rich and population-poor Siberia.

Calls for restraint

However, there is consensus in the Russian strategic community that Moscow should exercise maximum restraint in providing China with advanced military technologies. Experts were shocked to find out that Chinese engineers had mastered the production of 'clones' of most weapon systems that cash-strapped Russia had supplied to China in the 1990s and early 2000s. In industrial terms, this is straight forward 'reverse engineering' which the Chinese have mastered (*Ed : another example is the J-15 carrier borne fighter based on the Sukhoi Su-33*).

Russian arms sales to China have plummeted in recent years as China switched to domestic production, while Moscow became more cautious in offering Beijing cutting-edge technologies. Not only did China illegally copy Russian weapon systems, but it also began to export those undercutting Russian sales of higher-priced original platforms. Some experts even called for a complete halt to arms sales to China, arguing that demographic pressures and a growing need of resources may one day push China to turn Russian weapons against Russia. "We should stop selling them the rope to hang us with," warned Alexander Khramchikhin of the Institute for Political and Military Analysis.

However, the risks of selling advanced weapons to China took a back seat in Moscow's calculations after Vladimir Putin returned to the Kremlin for a third term a year ago. Last year, Russia's state arms exporter,

Rosoboronexport, signed contracts with China worth \$2.1-billion, the company's head Anatoly Isaikin stated recently. The renewal of sophisticated weapon supplies to China should be seen in the context of geopolitical games in the China-US-Russia triangle. "The balance of power between America and China will to a large extent depend on whether and on which side Russia will play," said Fyodor Lukyanov, foreign policy analyst.

Russia and China are revitalising defence ties at a time when their relations with the US have run into rough waters. Moscow is deeply disappointed with Mr. Obama's policy of "reset," which is seen in Moscow as a US instrument of winning unilateral concessions from Russia, while Beijing views Mr. Obama's strategic redeployment in the Asia-Pacific region as aimed at containing China.

Profit motives

Russian defence sales to China are clearly driven by profit motives as arms manufacturers seek to compensate for the recent loss of several lucrative contracts in India, where they face growing competition from the US, Europe and Israel. Also, Moscow seems to be less concerned today about the so-called "reverse engineering" of Russian weapons in China as the ability of the Chinese industry to copy critical technologies appears to have been overrated.

"China's programme of developing the J-11B family of aircraft based on the Su-27 platform has run into problems," said Vasily Kashin, an expert on China. "China's aircraft engines, which are essentially modified versions of Russian engines, are way too inferior to the originals and China continues to depend on the supply of Russian engines." In the past three-four years, China has bought

over 1,000 aircraft engines from Russia and is expected to place more orders in coming years.

"When and if China succeeds in copying Russia's new weapon platforms, the Russian industry will hopefully move ahead with new technologies," Mr. Kashin said.

India can also easily offset the advantage that new Russian arms supplies may give China, experts said. "To retain its edge in military aviation, India needs to speed up the development of a 5th-generation fighter plane with Russia and go for in-depth upgrade of its fleet of Su-30MKI fighters," Mr. Makienko suggested.

Trade dynamics

However, the resumption of massive Russian arms supplies to China could still be a cause for concern in India. Closer defence ties between Moscow and Beijing are an offshoot of strong dynamics of their overall relations. China is Russia's top commercial partner, with bilateral trade expected to touch \$90 billion this year and soar to \$200 billion by 2020. Mr. Putin has described China's rise as "a chance to catch the Chinese wind in the sails of our economy."

This contrasts with sluggish trade between India and Russia, which stood at \$11 billion last year; even the target of \$20 billion the two governments set for 2015 falls short on ambition. India risks being eclipsed by China on the Russian radar screens. As Russia's top business daily Kommersant noted recently, even today, Russian officials from top to bottom tend to look at India with "drowsy apathy," while Mr. Putin's visit to India last year was long on "meaningless protocol" and short on time and substance.



New Rotary Wings for the Dutch

During a ceremony on 8 October 2012, held at Gilze-Rijen Airbase, the 298th 'Grizzly' Squadron of the Royal Netherlands Air Force took delivery of the first two Chinook CH-47F(NL). The two new helicopters (D-892 and D-891) are first in the total of seven new Chinooks of the F version, and will bring the total of Chinooks (D and F version) to seventeen. All Chinooks come under command of the Defence

Helicopter Commando (DHC) stationed also at Gilze-Rijen.

Two of the newly delivered Chinooks will replace the ones during operations in Afghanistan (D-104 and D-105). Rest of the new fleet is to fulfill the demand for heavy transport helicopters, which engage in a new manner of war for making these helicopters more important in combat. Also, aid to civil powers, like fighting big forest fires takes up many flying hours.





With seventeen Chinooks in service, the Royal Netherlands Air Force will meet all planned requirements.

Six of the eleven Chinooks of the D models (D-661 until D-667) are modified Canadian Air Force examples, having flown some 10.000 – 15.000 flight hours, these helicopters having been extensively operated during exercises and 'live' missions. The other five D models (D-101 until D-106) are newly delivered examples from Boeing.

Evaluation of the CH-47F took place during 2003, but the contract was signed in 2006 at Soesterberg Airbase in the Netherlands and after some delays, the first F model Chinook was delivered to the RNAF. As Commander of the 298th Squadron stated, "We can now better fulfill the demand for transportation, for example the transportation of our Marines (Korps Mariniers) Commandos (Korps Commando Troepen) and Special Forces (Luchtmobiele Brigade), which are the main tasks of our squadron." Lieutenant Colonel Hermans continued "Having

more helicopters will make all our tasks more easy to realise".

Four Electro Optical Infrared (EOIR)/ Forward looking Infrared (FLIR) systems were ordered for the F version. "This FLIR or forward-looking infrared camera mounting in a bubble under the helicopter's chin enables the pilots to fly low level, at night and in marginal weather like heavy rain and snow" Major Schattorie stated.

Two of the new CH-47F will be stationed at Fort Wood, Texas in the United States where flying training of the Dutch pilots is being conducted.

Before being delivered to the 298th Squadron the CH-47Fs were stationed at Woensdrecht Airbase for adding details, including installing map holders and permanent Rainex on the windows.

Major Ton Schattorie and Captain Michel Dekker piloted the first two CH-47Fs into Dutch airspace. "We were trained on the F model and that now makes us the test pilots for this type" Major Schattorie said on arrival at Gilze-Rijen. "We are the only two pilots now in the Netherlands

that are qualified to fly this F version" he continues. The helicopters were shipped from Baltimore in the United States to Antwerp port in Belgium, from there they were transported by road to Woensdrecht.



CH-47F(NL) Specifications

- ◆ Full Glass Cockpit
- ◆ Block -6 Avionics Control & Management System
- ◆ Digital Automatic Flight Control System (AFCS)
- ◆ 714A engines with Engine Air Particle Separator (EAPS), which protects the engine from dust and sand erosion, snow, foreign objects and salt spray fouling and corrosion.
- ◆ Fast rope Installation
- ◆ Armament: 3x 7.62 mm (NATO Standard) and/or 3x .50 calibre modular guns.
- ◆ Electronic Warfare Aircraft Self Protection Equipment (CHASE); The Chinook will carry two CHASE pods installed on each side of the helicopter. Each pod contains three missile warning sensors and one laser turret. The pods are mounted directly on the helicopter main frame to minimise dynamic in-flight impact, which could otherwise cause optical sensor distortion. The six-sensor solution provides a 360 deg spherical coverage against missile attack as shown on the sketch to the left.
- ◆ Electro Optical Infrared (EOIR)/ Forward looking Infrared (FLIR) and Weather Radar.

Photos and text by Carlo and Paul Kievit/Bronco Aviation.



25 Years Back

“HAL must meet civil aircraft needs”

Defence Minister KC Pant has asked Hindustan Aeronautics Limited (HAL) to take advantage of the growing need for aircraft in the civilian sector. The Minister said that there existed a large market for aircraft in the defence and civilian sectors. Planning was needed to meet the demand, otherwise the opportunity would be lost. Advantages like economies of scale would follow. Mr Pant noted that the country had the infrastructure and the scientific and technological capability for developing an aircraft industry which could be second to none in the world. But the right investments had to be made at the right time. There was also need for some boldness to achieve more rapid advance.

Ag. Aviation transferred to Vayudoot

The Agriculture Aviation Wing of the Agriculture Ministry was formally taken over by *Vayudoot*, the third level airline on 18 January 1988 following its transfer to the Aviation Ministry as directed by the Union Cabinet. The Aviation Ministry has decided to entrust the running of this wing to the third level airline as it is the one “with maximum experience of running small aircraft and also has low overheads as the entire operation is managed on a shoe string budget”.

Limited Dassault role in LCA

Refuting criticism that the Indian agreement with France for development of the light combat aircraft (LCA) would lead to “the French running the Indian show”, the Scientific Adviser to the Defence Minister VS Arunachalam, explained the limited role being assigned to the French company Dassault. According to Dr Arunachalam, the French company has been retained to only provide technology, information, data and computer software for this project at the definition stage. Beyond that it would all be indigenous effort. The technologies themselves would be absorbed from laboratory to laboratory, not lab to factory. The emphasis, Dr Arunachalam said, was on technology absorption through such agencies as the Aeronautical Development Agency (ADA) at Bangalore and Hindustan Aeronautics (HAL).

Vayudoot expansion plans

As part of its country-wide expansion programme, *Vayudoot* proposes to purchase 24 aircraft with a seating capacity of 40

From Vayu Aerospace Review Issue II/1988

to 50, according to MD Harsh Vardhan. Of seven international companies which had made offers, four had been “shortlisted” by the technical evaluation committee since they were able to provide the requisite specifications of range and seats. A final decision on the type of aircraft to be bought would be taken by the airline’s economic evaluation committee within the next two months.

Indian Navy’s first N-Submarine

Prime Minister Rajiv Gandhi inducted the first Soviet SSN nuclear propelled submarine ‘INS *Chakra*’ into the Indian Navy at Visakhapatnam naval base on 3 February 1988. The Prime Minister said, “All modern naval powers have acquired or are trying to acquire nuclear-powered submarines. We will not be left behind.”

He stated that the INS *Chakra*, which is on four-year lease from the Soviet Navy, is “a good vessel, which meets our need for contemporary technology”.

First IAF Adour completes 1,000 flying hours

An Indian Air Force Adour Mk 804E turbofan engine powering the Jaguar strike fighter and manufactured by the Anglo-French Consortium Rolls-Royce/Turbomeca has achieved 1,000 hours of flying operations. In recognition of this event Rolls-Royce recently made presentations of commemorative plaques to the Indian Air Force and HAL.

HAL now manufactures Adour Mk 811 aero engines similar to mark 804E under an agreement with Rolls-Royce/Turbomeca.

Pakistan interest in Mirage IV ?

Reports indicate that Pakistan is seeking to acquire the Dassault Mirage IVA supersonic tactical bomber and ‘upto a dozen’ ex-Armee de l’ Air aircraft may be involved. The French Air Force have operated the Mirage IV with the Strategic Air Forces Command as part of their first-generation nuclear deterrent force since 1968, and three squadrons are currently operating the type at Orange, Istres and Cambrai. These are to be supplanted by the new Mirage 2000N.

Rafale is “go”

Ending a protracted period of relative uncertainty about France’s fighter procurement plans, French Prime Minister Jacques Chirac has reaffirmed the “necessity of respecting the calendar of the Rafale programme, which calls for the first prototype to fly in 1990 and service introduction in 1996.” Chirac also said that French naval aircraft units would be equipped in the future with French-designed aircraft, thus ending speculation that France might buy a small number of McDonnell Douglas F/A-18 Hornets for its aircraft carriers.

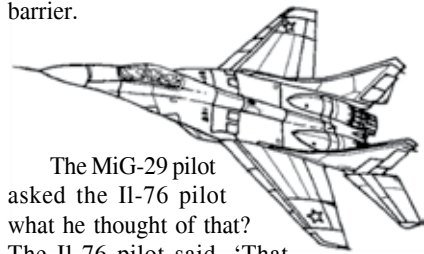
Recognise the shapes ?



A well known and respected white goods manufacturer expressed its joy in celebrating the nation's 64th Republic Day, issuing the above advertisement. The designers perhaps did not recognise the silhouettes but air enthusiasts did – the two aircraft depicted were the 'short listed' ones in the MMRC competition ! While the Rafale is climbing into the blue, the Typhoon appears to be doing a low level pass. Actually in the skies above Rajpath on 26 January, it was the Su-30MKI doing a Vertical Charlie, trailing white smoke, central band of the tricolour.

Twist to the Tale

An Il-76 was lumbering along when a cocky MiG-29 flashed by. The jet jockey decided to show off and told the transport pilot 'watch this!' and promptly went into a barrel roll followed by a steep climb. He then finished with a sonic boom as he broke the sound barrier.



The MiG-29 pilot asked the Il-76 pilot what he thought of that? The Il-76 pilot said, 'That was impressive, but watch this!' The Il-76 cruised along for about 5 minutes and then its pilot came back on and said: 'What did you think of that?' Puzzled, the MiG-29 pilot asked, 'What the heck did you do?' The Il-76 pilot chuckled. 'I stood up, stretched my legs, walked to the back, used the facilities, then got a cup of tea and a samosa.'

Moral of the Tale : when you are young and foolish, speed and flash may seem a good thing! But when you get older and smarter, comfort and dull is not such a bad thing!

This is what S.O.S is all about : 'Slower, Older and Smarter'.



(This item has been adapted from the original, substituting MiG-29 for F-16 and Il-76 for C-130 but its a small small world !).

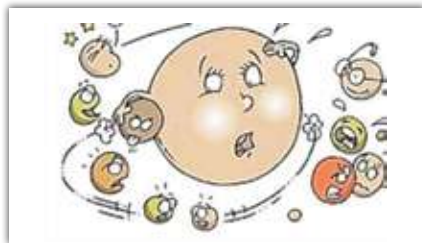
No laughing matter

Not that anyone is laughing but some Indian media and advertising agencies have picked on the AW101 case for smart spinoffs !



Fly me to the moon, moon, moon ...

In a new study, astronomers have come across several more moons that orbit Pluto than was earlier thought. In fact there may be ten or more moons, tiny and undiscovered



but moons nevertheless. This will make matters somewhat confusing for NASA's New Horizons mission, which is slated to take the first-ever up-close look at the Pluto system in July 2015.

Spaced out !

James Bond may have given it a go in 'Moonraker', but experiments on mating plants by the scientists at the Montreal University show that weightlessness affects the way cells are transported inside living things, causing 'traffic jams' on the vital highways that connect different processes. Although researchers have said that they could not draw any specific conclusions on the implications for animal and human sex in



space, it is obvious intercellular transport is important in a variety of human cells.

Watch that space !

Retired ? Want to ? Check list !

- Q How many days in a week?
- A 6 Saturdays, 1 Sunday
- Q When is a retiree's bedtime?
- A Three hours after he falls asleep on the couch.
- Q How many retirees to change a light bulb?
- A Only one, but it might take all day.
- Q What's the biggest gripe of retirees?
- A There is not enough time to get everything done.
- Q Why don't retirees mind being called Seniors?
- A The term comes with a 10% discount.
- Q Among retirees what is considered formal attire?
- A Tied shoes.
- Q Why do retirees count pennies?
- A They are the only ones who have the time.
- Q What is the common term for someone who enjoys work and refuses to retire?
- A NUTS!
- Q Why are retirees so slow to clean out the basement, attic or garage?
- A They know that as soon as they do, one of their adult kids will want to store stuff there.
- Q What do retirees call a long lunch?
- A Normal .
- Q: What is the best way to describe retirement?
- A: The never ending Coffee Break.
- Q: What's the biggest advantage of going back to school as a retiree?
- A If you cut classes, no one calls your parents.
- Q: Why does a retiree often say he doesn't miss work, but misses the people he used to work with?
- A: He is too polite to tell the whole truth.
And, my very favorite....
- Q: What do you do all week?
- A: Monday through Friday, NOTHING.....
Saturday & Sunday, I rest.

Courtesy : Iqbal Haider

Afterburner

Irkut

Shinmaywa