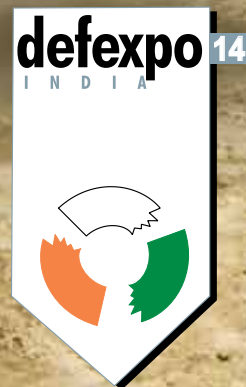


VAYU

I/2014

Aerospace & Defence Review



SPECIAL I S S U E

CFM



Depiction of IAI Ramta's new mine and IED detection system (courtesy IAI).

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VAYU

Aerospace & Defence Review

I/2014

33 Challenges : External and Internal

In an interview with General Bikram Singh, the COAS stresses the key thrust areas to enhance overall operational effectiveness of the Indian Army. The contemporary security environment is dynamic and poses challenges across the entire spectrum of conflict, ranking from "conventional threats, along our borders to sub-conventional threats, including its proxy war manifestations"

Army Aviation will play a major role in various scenarios, its assets up primarily directed towards and meant for "ground operations by using medium of the air."



warfare". Examined are various new programmes including the X-47B, nEUOn and Taranis from the West but also new UAV shapes from China, Russia and India.



106 Rafale : The Mission Possible

Air Marshal Anil Chopra, one of the first group of pilots converting on Mirage 2000s in France and thereafter continuing with his distinguished career, writes on the various attributes of the Dassault Rafale which omni-role fighter "would allow the IAF to dominate this skies and project power through air-sovereignty missions".



68 Maritime Security of India

Former CNS, Admiral Arun Prakash makes a presentation on future challenges and the crafting of a maritime security policy for India. His emphasis is that while to other countries, the Indian Ocean is only one of the oceanic areas, to India it is the "vital sea." Her future is dependent on the freedom of its waters. A strong and balanced navy is vital for India's march towards major power status.



44 Deterring the Dragon

Brigadier Gurmeet Kanwal, former Director CLAWS, looks at development of India's military capabilities as a hedge against the Chinese threat along the northern borders. Despite various attempts to improve relationships between the two Asian giants, there are areas of concern which could trigger off a future conflict. Raising of the Mountain Strike Corps is a pragmatic move which will help India upgrade its military strategy and provide genuine deterrence.



93 Bang ! on Target

In this part II of Vayu's visit to MBDA in Europe, Angad Singh covers munitions more relevant to the Army and Air Force, including third generation helicopter-fired precision missiles being evaluated by the Indian Army. Of immediate relevance is the ASRAAM proposal to equip the IAF's Jaguar fleet, while the unique Meteor BVRAAM represents future capabilities.



60 Army Aviation in Future Battle Space

In an exclusive interview with Lt Gen PR Kumar, Director General Army Aviation, Vayu posed pertinent questions on the AAC's plans for the next decades and records the Army's approach : the future battle space envisages integrated employment of all arms and

102 Year of the UCAV

As Unmanned Combat Aerial Vehicle (UCAV) prototypes take to the skies, Tim Robinson asks whether this is "the beginning of the next generation of air

110 Defexpo 2014 Special Section

This is the 8th land, naval and internal homeland security systems exhibition organised by India's Ministry of Defence at Pragati Maidan, in the heart of New Delhi, on 6-9 February 2014. An array of unique defence systems from leading companies of the world will be on exhibition and this special section reviews some of these.



Also :
INS Vikramaditya in home waters; LCA receives IOC-II; Pilatus Aircraft; Afghanistan : a grave unfolding crisis; Exercise INDRA-2013; Russian Navy Rising; Challenge of Offsets; Air Policing Macedonia.

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2014 rings in a cheer

The dawn of a New Year is a great time to take a fresh look at the world around us. It is when we look forward to the future, a time of hope, of breaking free from the past. The nation has got over a year that saw the corrosion of personal wealth of a majority of the population due to inflation and other economic factors; when mistreatment of women became a much-debated issue; when personal and institutional corruption became so high that there were mass protests against it. Now, as we look from the vantage point of a new beginning, we can take the luxury of looking at the future, unfogged, to a certain extent by the burden of the past. The time ahead is certain to throw up some interesting new situations that will pose fresh challenges.

The economy of the nation is likely to look up, in spite of a certain degree of uncertainty that comes in a year of the General Election. People have spoken in the recent Assembly elections, and political parties have been served notice that governments are expected to deliver. They must give action plans of what they want to do in the New Year. It is a shame that still many in our country go hungry even as grains rot in godowns. We need to take care of the basics. Food security has to be ensured; to secure our children's future, basic education needs major investment. The safety of women should be a matter of prime concern not only for the government, but also for each one of us. The nation is free, how come its women citizens do not feel that freedom?

We in India have the advantage of a multi-cultural and multi-ethnic heritage. As inheritors of a rich and proud civilisation, we must focus on what we can do for others, not on what others can do for us. Each of us can help India make its mark by contributing more as individuals. As we look at the New Year, we must learn to do more for each other. We should recognise the goodness in others, introspect and improve what we do not like. May the New Year bring in good tidings for all of us.

From *The Tribune*

Not fighting fit

The 1.1-million strong Army is still nowhere near fighting fit. The force may have inked contracts worth Rs 11,777 crore this fiscal but none of its critical modernization projects for howitzers, helicopters, anti-tank guided missiles (ATGMs), assault rifles or even night-vision devices are anywhere near closure.

Yes, matters have improved since March 2012 when the then Army chief General VK Singh complained to Prime Minister Manmohan Singh about "large-scale voids" in critical weaponry and ammunition. If 17 new contracts worth Rs 2,820 crore were signed for the Army in 2011-2012, the figure jumped to 29 contracts worth Rs 7,222 crore in 2012-2013. The tally stands at 17 contracts worth Rs 11,777 crore in the ongoing fiscal.

Army chief General Bikram Singh said another 23 contracts, worth around Rs 12,000 crore, were in the pipeline. "We are hopeful they will be inked before March 31. It's an upward trend, a healthy trend," he said. That is certainly the case. But most of the contracts inked this year are small-ticket ones, ranging from gunnery simulators and helicopter missile-warning systems to digital control harness and truck-mounted lifting devices.

The important ones approved are few and far between. These include the over Rs 2,000 crore deal for 15,000 3UBK Invar missiles for T-90S tanks and the Rs 1,200 crore one for two additional 'troops' of the Israeli Heron spy drones. The really critical projects are still stuck in the long-winded procurement process. Take the infantry, the largest arm with 355 battalions. Its desperate requirements for bullet-proof jackets, ballistic helmets, new-generation assault rifles with interchangeable barrels, close-quarter battle carbines, light machine guns and third-generation ATGMs have all been hanging fire for several years.

The force has not inducted a single modern 155mm howitzer since the infamous Bofors scandal of the 1980s. Different artillery projects worth Rs 30,000 crore for 145 ultra-light howitzers, 100 self-propelled tracked guns, 814 mounted gun systems and 1,580 towed guns, among others, are still to come through.

The Army Aviation Corps, which had chalked out big plans to induct attack helicopters and fixed-wing aircraft in the future, is yet to get replacements even for its ageing fleet of Cheetah and Chetak helicopters. The long-delayed Rs 3,000 crore project for acquiring 197 reconnaissance and surveillance helicopters from abroad has gone into a tailspin, with the CBI now probing the project as a fallout of the VVIP chopper case. Defence PSU Hindustan Aeronautics is also running way behind schedule to develop 187 similar light utility helicopters.

From *The Times of India*

Still thinking small

The grant of the initial operational clearance (IOC) to the Tejas Light Combat Aircraft (LCA) marks the 'release to service' of the indigenously developed fighter aircraft projected as the ideal replacement for the MiGs. But it would be premature to celebrate. An IOC does not certify actual combat readiness. The LCA has been three decades in the making and the Tejas requires a lot of work before the final operational clearance (FOC) : its weapons systems are nowhere near fully in place, and without the full integration of the combat suite, the LCA cannot be called combat ready. The challenge of developing the Mk-II version comes thereafter. Apart from weapons components, Hindustan Aeronautics Limited (HAL) will face the tough task of equipping Tejas with in-flight refuelling capability.

The LCA's protracted journey is a testament to the wrongheadedness of India's approach to arming the military. Nobody can question domestic production in principle, but it's an understatement to say that the DRDO's and ordnance PSUs' track records are poor. The lack of political will and ideas has

BAE SYSTEMS

confined defence production to the PSUs. And India's armed forces have paid the price. Meanwhile, the UPA's tendency has been to freeze serious projects and programmes at the whim of a scandal and blacklist all key foreign suppliers. While that hasn't precluded fresh procurement scandals, it has significantly compromised India's planned military modernisation and replenishment.

The DRDO's poor planning, over-optimistic timelines and lack of coordination with the armed forces are responsible for the cost and time overruns of major projects. Antony's faith in HAL and the LCA it has yet to fully develop is, therefore, questionable. As long as defence PSUs are not made to compete and collaborate with private manufacturers, India will persist in thinking small and missing the strategic perspective on armaments. Nor will it build the military-industrial complex befitting the world's fourth largest armed forces.

From *The Indian Express*

The Rising Sun

There is a strong case for saying that the expanding engagement with Japan is the most important bilateral relationship in India's global grab-bag. The potential is enormous. If Tokyo is able to accomplish its core objectives with regard to India, the result would be this country's economic transformation. The nub is whether India has the wherewithal to match the expectations of Japan and especially those of its prime minister, Shinzo Abe. Mr Abe's presence at the Republic Day parade this year will cause some angst in Beijing. However, the bedrock of the India-Japan relationship is economic. But it is an economic blueprint so large that it will have strategic consequences.

At the heart of it is Tokyo's interest in using the mammoth cross-border capital flows of its corporations and financial institutions to recreate the circumstances that led Japan to transform Southeast Asia and China into export-based, manufacturing dynamos. While there are many missing links in the Indian economy among the most important is its narrow manufacturing base. Among all emerging economies, India has the smallest manufacturing base as a percentage of GDP. This has plenty of fallout. As millions of Indians move from their ever-shrinking farms to the cities, they are not finding factory jobs to accommodate them. India must import billions in arms, electronic products and struggles to compete against 'made in Bangladesh' products because it lacks the world-class infrastructure to compete globally. The cost of this in terms of jobs, finance and keeping India mired in poverty is incalculable.

Which is why Japan is so important. Unlike most other governments who have focussed on selling one or two billion more widgets to India, Tokyo has sought to push India to the next quantum level economically. Unable to find the right infrastructure, for example, Japan has sought to make this infrastructure on behalf of India. The Delhi Metro was the first experiment. The massive Delhi-Mumbai Industrial Corridor is the centrepiece of Japan's vision. When completed it will catapult India into the top rungs of the international trading system. If thousands of Japanese firms move here afterwards, the days of India being a manufacturing wannabe will be over.

The Japanese themselves would profit from this. But there is no hiding the fact that, especially under Mr Abe, Tokyo has also come to see India in a strategic light. New Delhi should not shirk from embracing Japan. It is in India's interest to, one, have an ally committed to making India something greater than it is and, two, to have multiple centres of power in Asia.

From *Hindustan Times*

Morale mauling

There are more than sentimental reasons for military leaders to consistently emphasise the welfare of ex-servicemen. They are fully aware the morale of serving personnel is vitally dependent on their being confident that their families - and that includes all veterans - will be cared for should they be required to pay the ultimate price when serving the nation. Dissatisfied ex-servicemen militate against both quality recruitment and professionalism. It is in that context that the defence ministry would do well to clarify a recent directive to the armed services that they automatically appeal, to the apex court if necessary, against verdicts of courts and tribunals that have ruled in favour of claims for higher compensation from certain categories of veterans. There could well be valid technical reasons for the ministry taking such a stance, but a totally negative message is being conveyed. At one level, the ministry and its babus reinforce an impression that they have scant regard for the hardships endured by those who have spent the best part of their lives serving the Colours. At another level, the indication of appeals against awards of higher compensation points to the government being prepared to let veterans "bleed" from the considerable expenses incurred when dealing with matters in higher courts - the "establishment" does not suffer, its legal expenses are billed to the taxpayer.

What must never be overlooked is that veterans who seek relief from tribunals and courts do so only because the government's in-house redressal mechanisms do not deliver, it is common knowledge that soldiers are no "match" for babus when unravelling red tape is required. So complex and confusing are the regulations governing "compensation" etc that many a veteran breathes his last convinced that he did not get a fair deal. Serving personnel have lamented that with each Pay Commission their difficulties multiply - for veterans the situation is even more agonising. There is another Pay Commission in the offing, so the anxieties of ex-servicemen are on the rise: they fear they may no longer be around when all the anomalies in the award are resolved.

What the veterans need is a defence minister capable of independent thinking, applying a mind uncluttered by precedents and regulations. That kind of a bold minister is virtually impossible to find, but in his absence there is a danger of the frustrations of ex-servicemen being exploited for other political advantage. A message, right or wrong, that they might have to "fight" their cases all the way to the apex court could fuel the disaffection with the present dispensation. And this is an election year.

From *The Statesman*

Finmeccanica

AN IMMENSE OPPORTUNITY

The land of the historical Great Games and the 'graveyard of many empires', is according to many analysts, now inexorably heading for another Great Game, not between any imperial powers but two of Afghanistan's important neighbours, India and Pakistan. Post the ill-timed and premature, 2014 slated drawdown of all US and ISAF forces from this continuing fratricidal violence-afflicted country, both India and Pakistan naturally have their own, largely disparate, strategic interests. However, what is glaring is that Pakistan's myopic agendas in Afghanistan are hardly conducive to peace in the region for it is merely reducing Indo-Pak relations in Afghanistan unnecessarily to a zero-sum game, which need not be but instead transform into a win-win situation for both nations, in fact become a confidence building measure between them.

An analysis of Pakistan's strategy and multiple interests in Afghanistan, as followed by the former over some decades, largely stems from its stubborn adherence to the antiquated 'strategic depth' obsession, a desire to have a pliant regime in Kabul and keeping, unwisely, Indian influence totally out of the land of the Hindu Kush. Further, Pakistan seeks safe havens for its trained extremists, keeping the contentious Durand Line (never ever recognised by any Afghan regime) tranquil and there are endeavours to discourage the ever present latent Pashtun unity along the border regions with Afghanistan besides, also looking for Afghanistan to be its gateway to the energy rich Central Asian Republics (CARs). Importantly, Pakistan had made itself indispensable, at least logistically, to the US and NATO forces on the two critical supply routes to Afghanistan pass through Pakistan and has thus been getting its financial succour from the US thanks to the 'super power's' presence in Afghanistan since 2001. Pakistan, in alarmingly dire economic straits has, by conservative estimates, obtained a largesse of \$ 20 billion from the US over this period.

On the other hand India, apart from cementing its old civilisational and friendly links with Afghanistan, primarily seeks to ensuring Afghanistan not becoming a

major safe haven and training ground for anti-India terrorists, a natural fall-out with a radical regime in Kabul. Afghanistan also provides much needed access for both Indian imports and exports to the CARs. In seeking political and economic influence in Afghanistan, India has thus 'invested' over \$ 2 billion in various humanitarian developmental projects, while also providing military training to Afghanistan Security Forces. Overall, India desires Afghanistan, under a secular regime, becomes an important and independent partner in the regional security architecture of South Asia. There is a strong possibility that with the withdrawal of the US forces in 2014, Pakistan's ISI may already be working on contingency plans to divert then many out-of-work terrorists to up the ante in the Indian state of J&K and current indicators in the region all point to ISI's machinations in this nefarious game.

Meanwhile, Afghanistan, under outgoing President Hamid Karzai, although largely suspicious of Pakistan, has been navigating carefully with both "friendly India" and "brotherly Pakistan" perhaps not very successfully ! In October 2011, Afghanistan had concluded a Strategic Agreement and obtained additional financial aid and an increased Indian commitment to train its Army and the Police. However what is currently worrisome for Afghan security and stability is the yet unagreed-upon Bilateral Security Agreement between President Karzai and the US government which if not signed will, in the ultimate analysis, only assist radical forces like the Taliban and the Haqqani network in Afghanistan once the Americans depart. As current indications point Pakistan, would like its pliant 'strategic assets' comprising the conglomerate of fundamentalist elements to assume power in Kabul after the US departs.

Still, Pakistan must understand that a democratic and stable Afghanistan is equally important for both India and Pakistan and thus both nations must make a concerted effort to have a constructive and cooperative policy for it. Afghanistan is not considered by India as a region of competing national interests and its economic assistance to Afghanistan aims to contribute to the latter's

economic development which in turn supports its political stability and security. Pakistan must rid itself of a mere anti-India centric approach in Afghanistan. Pakistan's allegations that the existence of Indian consulates in Afghanistan are directed against Pakistan's interests are ill-founded and unsubstantiated misapprehensions.

Pakistan must comprehend, in its own interest, that the real threat to security and stability of Afghanistan and ultimately to itself comes from violent and extremist groups like the Afghan Taliban, elements of the Al Qaeda, the Haqqani network and the anti-Pakistan Tehreek-e-Taliban Pakistan (TTP), and the latter's linkages with the Afghan Taliban are only increasing by the day. After TTP supremo Hakimullah Mehsud's elimination by a US drone in North Waziristan, the TTP have vowed to take serious revenge which should send warning signals to Pakistani's government.

To both India and Pakistan, an objective analysis of the current dynamics and also in the foreseeable future of Afghanistan will clearly bring out the benefits which can accrue if relationships are based on a trilateral cooperative approach. A stable and peaceful Afghanistan, acting as a hub of trade and transit and as a corridor for both India and Pakistan to the energy rich CARs will be of immense economic benefit to the three nations. This shared interest thus calls for a serious Indo-Pak dialogue on Afghanistan to address any mutual apprehensions and develop a cooperative framework which contributes to the security and stability of a hapless Afghanistan and thus benefits both India and Pakistan. Indeed, this was a unanimous recommendation of the German think tank, the globally acclaimed FES sponsored Track 2 Dialogue between renowned Indian and Pakistani participants discussing vexed Indo-Pak issues. It was strongly felt that there was no requirement for differences on Afghanistan to be added to the already overflowing plate of growing Indo-Pak tensions ! On the other hand, a sincere, mutually accommodating Trilateral Dialogue could be in the interest of India, Pakistan, Afghanistan and South Asia as our entity.

Lt Gen (retd) Kamal Davar

Thales

INS Vikramaditya arrives in India



INS Vikramaditya and INS Viraat in the Arabian Sea

The Indian Navy's new acquisition, the aircraft carrier *INS Vikramaditya*, sailed into the Indian Ocean Region in early January 2014, a unique occasion for the Indian Navy as this was only the first time since 1992 that the Navy has operated two aircraft carriers together.

The 44,500-tonne carrier reached the end of its 8500 nautical mile voyage, without entering any other port enroute, arriving at INS *Kadamba* in Karwar on the night of 7 January 2014. *INS Vikramaditya*, under command of Captain (Commodore) Suraj Berry, had earlier been received at sea by a flotilla from the Indian Navy's Western Fleet, led by the fleet commander Rear Admiral Anil Chawla. The flotilla consisted of the aircraft carrier *INS Viraat*, two *Delhi*-class destroyers including *INS Mumbai*, three *Talwar*-class frigates *INS Teg*, *INS Talwar* and *INS Trikanth*, a *Godavari*-class frigate *INS Godavari*, plus a number of offshore patrol vessels including the *INS Subhadra*.

The *Vikramaditya*, which translates as 'Strong as the Sun', will now undergo a four-month integration phase with its air wing comprising MiG-29Ks and Kamov Ka-31 helicopters. The *Vikramaditya* is also to be equipped with Surface to Air Missiles and Close-In Weapon Systems in the coming months, and is expected to be fully operational by May, 2014.

XVII (Mountain Strike) Corps raised at Ranchi

On 1 January 2014, the Indian Army's new XVII (Mountain Strike) Corps was formally raised at its temporary headquarters in Ranchi, Jharkhand. Major General Raymond Joseph Noronha hoisted the new colours of the XVII Corps, which is to be operationalised at a reported cost of Rs. 64,000 crore over the next seven years and will eventually comprise some 80,000 troops to give the Indian Army an ability to launch counter-offensives into the Tibet Autonomous Region (TAR) in the event of hostilities with China.



FH-77 howitzer in the high Himalayas

The Army already has three Strike Corps: I Corps at Mathura, II Corps at Ambala and XXI Corps at Bhopal, but these are tasked for offensive capabilities towards the western land borders with Pakistan. XVII Corps will be the first Strike Corps tasked with operations along the high mountain borders with China-Tibet. Two Mountain Divisions, (including the 59th and 72nd) two Independent Infantry Brigades and two Armoured Brigades, two Para-Special Forces battalions, apart from integral units, will constitute the XVII Mountain Strike Corps whose designated headquarters will be Panagarh in West Bengal, to be established by 2015. Panagarh is also where the Indian Air Force plan to deploy its new squadron of C-130J Super Hercules recently ordered from the United States, these providing essential airlift support to the XVII Corps with their ability to operate from high altitude and austere airstrips.

Sikorsky

Six more C-130Js ordered for IAF

A second batch of six C-130J Super Hercules tactical transport aircraft have been ordered for the Indian Air Force, the 'letter of offer and acceptance' signed at New Delhi on 27 December 2013. The contract which is under the US Government foreign military sales (FMS) programme, stipulates delivery of the aircraft within three years. The new C-130Js will equip a second such squadron, the first being No.77 at Hindan, with the new formation to be based at Panagarh in West Bengal, also designated location for the Army's new XVII Mountain Strike Corps.

Panagarh airfield was constructed during World War II and used as a supply transport airfield from 1942-1945 by the United States Army Air Force's 10th Air Force and as a repair and maintenance depot for B-24 Liberator heavy bombers by the Air Technical Service Command.



IAF Super Hercules

First Rudra squadron formed

No.251 (Armed) Squadron of the Indian Army Aviation Corps was formally raised with the HAL Rudra (Advanced Light Helicopter Mark IV-Weapons Systems Integrated) in December 2013 and temporarily based at HAL Airport, Bangalore. Named Rudra by the Indian Army, this stands for the 'embodiment of a storm god and unpredictable danger'.

The HAL Rudra is equipped with a self-protection suite, advanced electro-optical sensors, a 20mm chin-mounted auto-cannon, 70mm 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 first flight of the TM 333 2B2 - powered ALH prototype. The ALH-WSI made its maiden flight in August 2007, and is equipped with the Shakti (Ardiden 1H1) engine (see *Vayu Issue III/2013*).



LCA scores 'bullseye'

Flying Tejas LSP-7 (KH2017), Gp Capt Suneet Krishna, test pilot with NFTC launched a R-73 infrared heat seeking close combat air missile against a towed target over the Arabian Sea range off Goa on 8 December 2013, scoring a 'bullseye'. This marked virtual culmination of LCA weapon trials before achievement of the initial operation clearance (IOC). Two LCAs had been detached to INS *Hansa* at Dabolim, Goa for these trials, which involved critical co-ordination with naval ships, with the Lakshya pilotless target aircraft, towing the heat-emitting target being launched from the frigate INS *Betwa*.



Dramatic photo of R-73 missile just after launch from Tejas LSP-7

According to the official statement, "a team from the National Flight Test Centre (NFTC), ADA, HAL, ADE (DRDO), CEMILAC, DGAQA and the Indian Navy worked in perfect unison to achieve this feat. PS Subramanyam, Programme Director LCA, Director ADA and Air Cmde KA Muthana, Project Director, Flight Test supervised operations from the National Flight Test Centre (NFTC). K Tamil Mani, S. DG (Aeronautical Systems) reviewed the flight trial".

Tejas LCA gets IOC (II)

On 20 December 2013, at a well-publicised ceremony in Bangalore, the Tejas Light Combat Aircraft was given its Initial Operational Clearance-II, which was marked by the Defence Minister AK Antony handing over 'Release to Service' Certificate to then Air Chief NAK Browne. In his address, the Defence Minister confessed that he had had his "share of anxieties regarding the future of LCA when he had taken over as the Defence Minister in 2006 but today, we are putting behind the moments of self-doubt,



Defence Minister AK Antony with Avinash Chander, his Scientific Advisor

Dassault



Tejas LCA (KH 2015) landing back at HAL airport Bangalore after demonstration

frustrations and setbacks which we as a nation have gone through in the last 30 years.”

In his address, Avinash Chander, Scientific Advisor to the Defence Minister stated that “those who perform will be asked to perform more. The Team Tejas will have to now sprint the last lap towards FOC. The FOC team will equip Tejas with in-flight refueling, Beyond Visual Range Missiles, new Close Combat Missiles, the GSh-23 gun, additional weapons and new drop tanks for supersonic flight. The teams are also working on a higher variant the Tejas Mk-2 with a higher thrust engine. Tejas Mk.2 will have improved performance and upgraded avionics.”

It will be recalled that the Tejas LCA had first received its ‘Certificate of Release to Service’ on 10 January 2011, the ceremony presided by Defence Minister AK Antony, Air Chief Marshal PV Naik and Dr VK Saraswat, SA to RM. That event is now recalled as IOC-1 (see *Vayu Issue II/2011*).

500 flights by Tejas in 2013

On 27 December 2013, eve of the new year, a Tejas LCA flew the 500th sortie by this type in a calendar year. The highest number of flight sorties attained earlier was less than 300. Congratulating the Tejas team, Avinash Chander, SA to RM lauded “the synergy of teamed efforts by ADA, DRDO, CEMILAC, HAL and IAF”.



The Tejas LCA has achieved several key milestones in 2013, with various aircraft detached to seven locations throughout India for various flight, systems and armament trials. These included trials for in-flight relight (shutting off and then reigniting the single engine), high energy brake testing, flight envelope expansion, R-73E missile firing with radar guidance, air to ground weapon tests, emergency jettisoning of entire stores, aircraft in wake tests, wet runway trials and demonstration of its ‘swing role’ capability during exercise ‘Iron Fist’ in February 2013 (see *Vayu Issue II/2013*).

General Bikram Singh appointed new COSC

General Bikram Singh, the COAS, took over as Chairman, Chiefs of Staff Committee (COSC) on 31 December 2013. According to analysts, General Bikram Singh’s main challenge would be “the successful induction and integration of the large number of weapon systems that India is either manufacturing or procuring at present”.



The three Chiefs as on 31 December 2013 morning

Air Chief Marshal Arup Raha is Chief of the Air Staff

Air Chief Marshal Arup Raha took over command of the Indian Air Force as the 24th Chief of the Air Staff on 31 December 2013. Commissioned into the Flying Branch in December 1974, (about the time the *Vayu* was launched) Air Chief Marshal Raha had graduated from the National Defence Academy (NDA), Poona with the President’s Gold Medal in 1973. An experienced Qualified Flying Instructor (QFI) holding ‘A2’ instructional category, Air Chief Marshal Raha, has served as Directing Staff at the Flying Instructors School (FIS), Tambaram as well as at the Tactics and Combat Development Establishment (TACDE) and has nearly 3,400 hours of flying experience, mainly on fighter aircraft.



An alumnus of the Defence Services Staff College (DSSC) and the National Defence College, New Delhi, he was an inspector in the Directorate of Air Staff Inspection at Air Headquarters and Staff Officer to the Chief of the Air Staff. He was deputed as the Military and Air Attache in the Embassy of India, Kiev, Ukraine from 1999 to 2001 and has held many operational assignments including command of No.47 Squadron with MiG-29s, and was AOC Advance Headquarters Western Command at Chandimandir. He later took over as Senior Air Staff Officer (SASO) at Headquarters

Alenia

Western Air Command and became Air Officer Commanding-in-Chief, Central Air Command before taking over Western Air Command, following which he became Vice Chief of the Air Staff (VCAS) on 1 July 2013.



In his first outstation visit after taking over as the new CAS, Air Chief Marshal Arup Raha visited Leh in the Ladakh sector, where he was briefed on the prevailing situation in the region by Lt Gen Rakesh Sharma, XIV Corps Commander and interacted with Army personnel to provide an impetus to jointness with the Army. Air Cmde R Isser, the AOC at Leh, updated the CAS on the progress of significant ongoing infrastructure projects in the Ladakh Sector, where the average temperatures in winter are -20°C.

New IAF chief's priority

Air Chief Marshal Arup Raha has the induction of new fighters, helicopters and mid-air refueling aircraft as his "priority". The new Chief will have to squarely face up to the reality of an ageing and depleting combat aircraft inventory, with some dozen squadrons of MiG-21s and MiG-27s earmarked for phaseout over the next three years, during his tenure. That the new Air Chief realises this fact, is evident by his statement that "accretion through new acquisitions, replacement of obsolete equipment and upgrade of vintage weapon platforms will bolster our capabilities."



MiG-27ML at Kalaikunda (photo: Angad Singh)

Lt Gen Dalbir Singh takes over as VCOAS

Lt Gen Dalbir Singh took over as Vice Chief of Army Staff on 31 December 2013 after handing over reins of Eastern Army Command to Lt Gen MMS Rai.

He was commissioned into the 4th Battalion 5 Gorkha Rifles (FF) in June 1974 and possesses tremendous operational experience which includes tenure as a Company Commander in 'Op Pawan' in Sri Lanka. He raised and commanded 33 RR (58 GR) in Nagaland from October 1994 to June 1997 as well as commanded 53 Infantry Brigade which was committed on Counter Insurgency Operations in the Kashmir Valley from July 2003 to March 2005. He was GOC 8th Mountain Division in J&K deployed on the LoC in High Altitude Area from October 2007 to December 2008. The General Officer then took over III Corps looking after the dual responsibility of CI Ops in the North Eastern States, as well as conventional operational tasks along the Indo-China border from March 2011 to June 2012. He was GOC-in-C Eastern Command till December 2013.

He has earlier held the key appointment of Inspector General SFF, Cabinet Secretariat from April 2009 to March 2011. Lt Gen Dalbir Singh is Colonel of the 5th Gorkha Rifles (Frontier Force).



Lt Gen Arun Kumar Sahni is GOC-in-C South Western Command

Lt Gen Arun Kumar Sahni has taken over as GOC-in-C South Western Command. An alumnus of the National Defence Academy and Indian Military Academy, he was commissioned into the Regiment of Artillery, being awarded 'Sword of Honour' for and the best all round Gentleman Cadet and the 'President's Gold Medal' for standing first in his course.

The General Officer has had an excellent professional career and has attended prestigious courses including 'Long Gunnery Staff Course', 'Defence Services Staff College', 'Higher Command' and 'National Defence College'. His career highlights include command of a Self Propelled Artillery Regiment in the desert sector, a Mountain Artillery Brigade employed in Counter Insurgency Operations in the North East, an Independent Infantry Brigade



MBDA

in Jammu & Kashmir and the famous 4th Infantry Division ('Red Eagles') as part of a Strike Corps. He later commanded III Corps in the North East, responsible for security along a large part of the northern borders with China, Myanmar in the east and Counter Terrorist Operations in four of the NE States.

Lt Gen MMS Rai is GOC-in-C Eastern Command

Lt Gen MMS Rai has assumed office as GOC-in-C Eastern Command. Commissioned into the Corps of Engineers on 15



December 1976, he has excelled in academics as well as in the sports arena, commanded an Armoured Engineer Regiment in the plains, a Mountain Brigade in the North East and a Rashtriya Rifles Force in Jammu and Kashmir. After commanding a Corps in Rajasthan, he was Chief of Staff of South Western Command. He is presently Colonel Commandant of the Bombay Engineering Group.

Air Marshal R K Sharma becomes Vice Chief of Air Staff



Air Marshal Ravi Kant Sharma took over as Vice Chief of the Air Staff (VCAS) on 1 December 2013. A Qualified Flying Instructor, he is an Experimental Test pilot who has flown around 3,300 hrs on several different types of aircraft including the LCA. In his operational career, he commanded No. 6 Maritime Strike Squadron ('Dragons') with Jaguars. He later commanded the Test Pilots School and Prototype Test Squadron at Aircraft System Testing Establishment (ASTE), Bangalore and has also functioned as the Project Director (Flight Test) of the ongoing LCA Project. He was Assistant Chief of the Integrated Defence Staff (Financial Planning) at HQ IDS, Assistant Chief of the Air Staff (Plans) at Air HQ, and Deputy Chief of the Air Staff (DCAS), before taking over as AOC-in-C Eastern Air Command at Shillong.

Air Marshal RK Jolly now AOC-in-C Eastern Air Command

On 1 January 2014, Air Marshal Rajesh Kumar Jolly took over as the new AOC-in-C, Eastern Air Command at Shillong. He was formerly AOC-in-C, Southern Air Command and has the distinction of heading two IAF operational commands consecutively.

He was commissioned in the fighter stream of the IAF on 11 July 1975, has flown various aircraft types, which include the Hunter, HF-24 Marut and all MiG-21 variants and has over 3800 hrs of flying. A qualified flying instructor, he has held many important field and staff appointments. He commanded a premier forward fighter airbase and was the Air Attaché at Embassy of India in Washington DC from 2005 to 2008.

HAL Dhruv ALH for the Maldives



An example of the HAL Dhruv advanced light helicopter was handed over to the Maldivian Defence Forces at a function organised by the Southern Naval Command at INS *Garuda*, Cochin on 14 December 2013. The Maldivian Defence and National Security Minister Mohamed Nazim accepted, what he called "precious gift from India" in presence of Vice Admiral Satish Soni, C-in-C Southern Naval Command and T. Suvarna Raju, Director (Design and Development), HAL.

Textron System



Suvarna Raju, Director (D&D) with the Maldivian Defence and National Security Minister Mohamed Nazim at ALH handing over ceremony at Kochi

A HAL technical support team will be positioned on Gan Island in the Maldives to provide maintenance and logistic support. HAL has so far exported the Dhruv ALH to Ecuador, Mauritius and Nepal.

INS Arihant on sea trials in early-2014

It is learnt that INS *Arihant*, the first indigenous nuclear submarine, will head to sea for extensive user trials in February-March 2014. During a Navy Day press conference, Chief of Naval Staff Adm DK Joshi stated that the *Arihant*'s reactor, which had gone 'critical' last August, is gradually being monitored to produce full power. Comprehensive and meticulous checking is required as the reactor power is slowly ramped up (5-10% at a time), and following the successful conclusion of this crucial activity, the submarine will be ready for user trials. The trials are expected to last a year, following which the Navy will be in a position to decide whether to operationalise the submarine or make further changes. The trials could include test firings of K-15 SLBMs.

Fast Patrol Vessels for ICG

Cochin Shipyard Limited (CSL) launched the fifth and sixth Fast Patrol Vessels (FPVs) being built for the Indian Coast Guard (ICG) on 29 November 2013 where present were senior officials of the Coast Guard and shipyard. The vessels were named *Achook* and *Agrim* at the ceremony.

20 FPVs have been contracted by CSL for the ICG, the contract signed in 2010 with the delivery of the last vessel scheduled for 2017. These vessels have a design speed of 33 knots, their primary role being fisheries protection and monitoring, patrol within the exclusive economic zone (EEZ) and coastal patrol, anti smuggling, search and rescue operations and anti piracy operations.

ICGS Rajdhwaj and Abheek commissioned



Indian Coast Guard Ship *Rajdhwaj* an Inshore Patrol Vessel (IPV), 8th in the series of eight IPVs, was commissioned on 11 December 2013 at Chennai by GK Vasan, Minister of Shipping in the presence of Vice Admiral Anurag G Thapliyal, DG Coast Guard and other dignitaries. The IPV is equipped with advanced and sophisticated navigational and communication sensors and equipment, is propelled to a maximum speed of 31.5 knots by three MTU 4000 series diesel engines of 2720 KW capacity each, coupled with three 71S2 Rolls Royce Kamewa Jets.

Shortly thereafter, the Indian Coast Guard Ship *Abheek*, second in the series of twenty fast patrol vessels (FPVs), was commissioned on 31 December 2013 at Kochi by Defence Minister AK Antony, in the presence of Vice Admiral Anurag G Thapliyal, Director General Coast Guard.

'Standard' presented to 89 Armoured Regiment

The Indian Army's 89 Armoured Regiment was presented its 'Standard' by the COAS General Bikram Singh at a ceremonial mounted parade at Namkum, Ranchi on 30 November 2013. This honour has been bestowed upon 89 Armoured Regiment "in due recognition of the dedicated and meritorious service rendered by the Regiment since its raising on 1 February 1980".

The ceremony involved both the marchpast and mounted columns where a phalanx of 25 T-72s moved on the parade ground even as military bands played martial music. The parade was commanded by Colonel Jagat Singh, Commandant 89 Armoured Regiment.



Cassidian

The Indian Future Main Battle Tank (FMBT)



Present day main battle tank of the Indian Army is the Russian-origin T-90, an example seen here at the Army Day parade on 15 January 2014

In an interview (*see this Issue*), General Bikram Singh the COAS has stated that the envisaged FMBT for the Indian Army will be “comparable to any other advanced armoured fighting vehicle (AFV) in the world and capable of operating in high intensity, high technology, network enabled digitised battlefield of the 21st century.” The ‘Qualitative Requirements’ are being presently deliberated upon and “we hope to achieve a major technological breakthrough with reference to the FMBT in the next two to three 5-year plan periods”.

DAC ‘clears’ Barak missile deal



The Defence Acquisitions Council (DAC), chaired by Defence Minister A K Antony, has finally cleared the procurement of 262 Barak-I air defence missiles from Israel for Rs. 880 crore. The deal was put on hold pending ‘investigations’ and has now been given the go-ahead. The Barak-I missile system is fitted on 14 frontline warships, including the aircraft carrier INS *Viraat*.

Private Sector in FICV project

The private sector is anticipating involvement in the Indian Army’s \$10-billion futuristic infantry combat vehicle (FICV) project, which had been in suspense since last 18 months. Amongst the companies are Tata, Mahindra, L&T and Ashok Leyland, all of whom have suitable credentials for the same and could possibly be joined by a consortium led by Bharat Forge and Punj Loyd. FICV is a project for the production of an armoured off-road vehicle with high manoeuvrability and strike power, but in mid-2012, the MoD instead decided to go for an upgraded version of the BMP-2 infantry fighting vehicle. However, there is now strong support for an indigenous FICV, with the Indian private sector having already invested substantially in the project.



BMP-2 of the 33rd Armoured Division at Army Day Parade

Irkut

GSLV-D5 with indigenous cryogenic engine



On 5 January 2014, the Indian Space Research Organisation marked a major success with the launch of its GSLV-D5, powered by an indigenous cryogenic engine which injected a telecommunication satellite, the GSAT-14 into orbit. With precision, the satellite reached its targeted perigee (nearest point from Earth) of 179 km and 36,000 km apogee (farthest point from Earth). As the GSLV-D5 mission director later observed, “behind the 1,000 wonderful seconds of GSLV-D5’s flight were more than a thousand days of dedication of our scientists.”

India’s quest to acquire cryogenic technology had faced not just technological challenges but was also mired in geopolitical sanctions. In fact, the USA had at one point tried to ‘scuttle’ India’s Geosynchronous Satellite Launch Vehicle project. A decade before that, in December 1982, India had formed a cryogenic study team to focus on the development of an engine which could generate a thrust of 10 tonnes.

Exercise ‘Shahbaaz Ajay’

Shahbaaz Ajay, mounted by the 36th Reorganised Army Plains Division (RAPID) was held in the western deserts of Rajasthan during December 2013. 36 RAPID, part of the Bhopal-based XXI Strike Corps, “validated new concepts and refined existing battle procedures as prevalent in the 21st century battlefield milieu”. 15,000 troops of the Division participated in the exercise which included more than 100 armoured fighting vehicles among the other advanced artillery and air defence equipment. “A high degree of integration was achieved with the Indian Air Force while undertaking specialised operations which included an airborne assault and special helicopter borne operations.”



Army Chief awarded ‘Legion of Merit’ in USA

General Bikram Singh, Chief of Army Staff, has received the Legion of Merit, a US military award that is given for “exceptionally meritorious conduct in the performance of outstanding services and achievements.” The award was given by US Army Chief General Raymond Odierno during the former’s visit to the USA in December 2013, to discuss India-USA military ties. A ‘full honour’ ceremony accompanied the award, with the 3rd Infantry Regiment of the US Army on parade in ceremonial attire. The Legion of Merit has earlier been bestowed on some Indian Service Chiefs, including Field Marshal KM Cariappa, General SM Srinagesh and Admiral JL Cursetji.



IAF considering private firms for maintenance work

The Indian Air Force are considering involvement of Indian private sector firms for maintenance of various Russian-origin aircraft, including An-32 medium tactical transport aircraft, amongst these being the Tata Group, Max Aerospace and Taneja Aviation.



Antonov An-32 of the IAF (photo: Angad Singh)

The IAF, which is faced with a number of problems relating to foreign OEMs, appears to have decided to energise more maintenance activities in-country and bolster domestic industry at the same time. RFIs for the maintenance agreements were circulated in late-2013 with seven companies reportedly responding to the same. Bids are now to be invited, with the IAF hopeful of signing a contract by March 2014. Initially, the IAF will assist the private companies in building their expertise, after which the companies will take over all the maintenance work.

US report: "India increasing nuclear arsenal"

The Institute for Science and International Security (ISIS), a US-based think tank, has reported that the Rare Materials Plant (RMP) Mysore could be producing highly-enriched uranium for military purposes, thus greatly bolstering India's ability to increase the size of its nuclear weapons stockpile or produce more powerful nuclear weapons. The report was based on the pace and scale of construction activities noted at the Mysore plant, believed to house a gas centrifuge enrichment facility. Nonetheless, intelligence sources in the US, both current and former, continue to view Pakistan as "a greater threat to nuclear non-proliferation, noting that neither Iran nor North Korea would be nuclear states today without Pakistani assistance".

Combined exercises between Indian and Japanese Coast Guard

A high level delegation led by Admiral Yuji Sato, Commandant of the Japan Coast Guard (JCG), made an official visit to India from 12-15 January 2014 for high level discussions including those



Indian Coast Guard FPV and Chetak helicopter

on combined exercises with the Indian Coast Guard (ICG). The visit was in pursuance of the Memorandum of Cooperation (MoC), signed between the two Coast Guards on 24 November 2006, which stipulates that heads of the two organisations meet every year to discuss maritime issues of mutual concern and formulate a cooperative approach to address these. The Memorandum of Cooperation between the two Coast Guards encompasses issues of maritime search and rescue, combating marine pollution, technical assistance for responding to natural disasters and exchange of information regarding crimes at sea, including smuggling and illicit trafficking. The Indian delegation in this interaction was headed by Vice Admiral Anurag G Thapliyal, Director General Indian Coast Guard.

Meanwhile, 'Sahayog- Kaijin 2014', 13th edition of the Indo-Japan Coast Guard joint exercise was held off the Kochi coast on 14 January 2014, as part of the continuing bilateral cooperation between the two countries. JCG (Japan Coast Guard Ship) *Mizuho* and its integral helicopter, Indian Coast Guard Ship (ICGS) *Samrat*, plus Chetak helicopter, Dornier 228 aircraft and ICGS C-404 took part in the exercise held about 20 nautical miles off Kochi. The exercises included cross deck landings, anti-piracy drills, search and rescue demonstration and a fire fighting demonstration.

Admiral Yuji Sato, Commandant of Japan Coast Guard and Vice Admiral Anurag G Thapliyal, Director General of Indian Coast Guard who were onboard Indian Coast Guard vessel *Samrat* witnessed the exercise along with Inspector General SPS Basra, Commander Coast Guard Region West and senior officials of Japan Coast Guard delegation.



DG Coast Guard Vice Admiral Anurag G Thapliyal with Admiral Yuji Sato, Commandant of the Japan Coast Guard

Air India to join Star Alliance

Air India's long-planned entry into Star Alliance, the world's largest global airline alliance, could finally take place in 2014. Star Alliance is a global union of 28 international carriers serving nearly 200 countries and, for Air India, this would mean an increase in passenger traffic as a result of increased cooperation with airlines across the world, while for Star Alliance it would be the end of a long process aimed at securing a foothold in the Indian air travel market, one that is comparatively small at present but has immense potential for future growth.

Air India was originally intended to become a member of Star Alliance in 2007, but owing to the company's continued operational



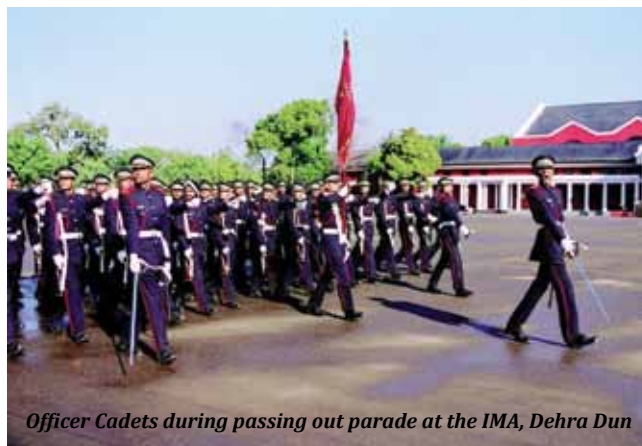
troubles, the integration was halted in 2011 on grounds that the carrier "had failed to meet the minimum joining requirements agreed upon in 2007". Following this, Star Alliance unsuccessfully attempted to bring in Jet Airways until that airline entered into a strategic partnership with Etihad, which is a member of the competing OneWorld alliance. Air India's concerted efforts at returning to profitability have apparently been noted, resulting in the renewed agreement to join Star Alliance. An AI statement said that the alliance would grant passengers "seamless transfers across the world, more frequent flier mileage points, code-sharing and a wider choice of flights."

India to strengthen links with Afghan military

The governments of India and Afghanistan will strengthen defence and security cooperation so as to increase capabilities of the Afghan military. In December 2013, Afghan President, Hamid Karzai said "we hope to have an army to defend Afghanistan through its own resources and citizens. To that objective, we are being helped by India."

India has already been training Afghan Army personnel, with a batch of cadets recently graduating from IMA, Dehra Dun in December 2013, capping off a total of 574 trained till now. That number is expected to increase to swell to over a thousand by the end of 2014. More recently, the Indian government has mooted plans to train Afghan troops in their own country and establish training facilities staffed by Indian instructors within Afghanistan.

In a significant move, the GOI will supply three HAL Dhruv helicopters to Afghanistan, with deliveries to take place between



Officer Cadets during passing out parade at the IMA, Dehra Dun

March and May 2014. Afghanistan had earlier submitted a "wish list" of defence equipment to India and the helicopters are anticipated to be the first of many transfers of equipment to the Afghan military. "Both sides hope that closer cooperation between the nations will yield strategic dividends once US-led ISAF forces withdraw from Afghanistan in 2014".

Amongst Afghanistan's list of requirements are artillery guns and medium battle tanks, as also Mi-17 helicopters. The difficulties envisaged in fulfilling the requirements is that India has "no excess military equipment" as also the "complex licensing and end use qualifications that guide India's virtual import dependant defence supplies."

Meanwhile, on a visit to Indian Military Academy on 14 December 2013, former Afghan Army General and now Provincial Governor from Ghazni, Lt Gen Musa Khan visited Dehra Dun to witness commissioning of his son Abdul from the IMA. General Musa Khan was amongst the Afghan cadets who were trained at the IMA in Dehra Dun during the 1970-1980s.

Agni-3 test launched

Strategic Forces Command (SFC) test-launched the long range Agni 3 missile, having a range of over 3000 kms, from Wheeler Island, off the Odisha coast on 23 December 2013. The trajectory of the trial was tracked by a battery of radars, telemetry observation stations, electro-optic instruments and naval ships from its launch till the missile hit the target area with "pin point accuracy".

The Agni 3 intermediate range ballistic missile is equipped with advanced high accuracy navigation systems and guided by an innovative guidance scheme. Quoting an SFC spokesman, "such successful training launches clearly indicate our operational readiness to meet any eventuality as also establishes the reliability of this deterrent component of India's strategic arsenal".



VVIP helicopter imbroglio

On New Year's day, the MoD terminated the existing contract with AgustaWestland to supply 12 VVIP helicopters to the Indian Air Force. According to reports, Defence Minister AK Antony met Prime Minister Dr Manmohan Singh before the official announcement was made. However, "no decision has been taken on blacklisting the firm and a call will be taken after the CBI finishes its probe."

SpiceJet deal with Tigerair

Two of Asia's leading low-cost airlines, India's SpiceJet and Singapore's Tigerair, have signed a three-year inter-line agreement to provide greater connectivity on flights operated by both the carriers. According to the agreement, customers travelling on SpiceJet's domestic network from 14 Indian cities will have seamless connection through on to Tigerair's Singapore-bound flights starting from 6 January 2014. The 14 cities are Ahmedabad, Bhopal, Chennai, Kolkata, Coimbatore, Delhi, Goa, Indore, Mangalore, Madurai, Pune, Bengaluru, Tirupati and Visakhapatnam.



GoAir improves market share

Mumbai-based low cost carrier, GoAir has improved its market share, going up to 8.8% in the second half of 2013 while IndiGo lost market share for the first time in the same period. Overall passenger traffic grew at a slower pace in November with an increase of only 2.3 per cent to 51.4 lakh passengers as against 50.2 lakh passengers in the same month last year. National carrier Air India regained the second spot with a 19.3 per cent share of



the market while SpiceJet fell to the third spot with 19 per cent. Jet Airways and JetLite combined had a market share of 24.1 per cent, but the two airlines file data separately. Stand-alone Jet Airways had 18.5 per cent while JetLite had 5.6 per cent market share.

Tata-SIA select Airbus A320s

Singapore Airlines (SIA) have selected the Airbus A320 for launch of its Indian venture with the Tata Group. Twenty A320s will be sourced from leasing companies rather than buying these directly from Airbus. "It's going to be an Airbus A320 fleet. The aircraft will be on lease," spokesman Sanjay Singh said in a statement. The Tata-SIA airline will start operations from July 2014, after regulatory approval in India. The Tata Group will hold a 51 per cent stake and Singapore Airlines Ltd 49 per cent in the new venture, which will have an initial combined investment of \$100 million from the two stakeholders. This marks the third foreign direct investment in the Indian civil airline sector since the government declared last year that international airlines could buy as much as 49 per cent of local carriers.



Creation of an SPV for IRTA

The Government of India has directed the creation of a Special Purpose Vehicle (SPV) charged with the responsibility of designing, developing and producing the Indian Regional Transport Aircraft (IRTA). Genesis of the SPV is linked to the NMCC



Artist's depiction of turboprop and turbofan airliners being considered for development by the SPV

(National Manufacturing Competitiveness Council) meeting headed by V Krishnamurthy held on 30 April 2013 on the issue of National Civil Aircraft Development. Subsequently, a meeting of the High Level Committee on Manufacturing (HLCM), was chaired by the Prime Minister on 9 July 2013 following which various key decisions were taken.

Essentially, the dedicated SPV will be created with NAL and HAL in partnership for design & development and production of the civil airliner, respectively, also seeking possible collaboration with both the public and private sector, beginning with identification of suitable power plants, detailed market analysis with selection thereafter of the aircraft configuration concerning its size, performance and future variants.

MEHAIR to expand

MEHAIR (Maritime Energy Heli Air Service Pvt Ltd), presently the lone seaplane operator in India, are to shortly launch services in Mumbai/Maharashtra. They are currently operating from Port Blair in the Andamans to nearby islands, particularly Havelock over the past three and a half years. The company was launched by three entrepreneurs and partners Siddharth Verma, SS Mann and CL Lakshmanan, who were recently awarded as the 'Innovative Start-up of the Year'.



Unit Citations on Army Day 2014

The Chief of Army Staff, General Bikram Singh, on occasion of the Army Day 2014, awarded Unit Citations to a total of 16



units during the parade ceremony held at the Delhi Cantonment parade ground. These units were the 262 Field Regiment, 39 (Independent) Reconnaissance & Observation Flight, 51st Engineer Regiment, 15th Battalion Maratha Light Infantry, 21st Battalion Rajputana Rifles, 5th Battalion Sikh Regiment, 18th Battalion Sikh Regiment, 6th Battalion Sikh Light Infantry, 12th Battalion Garhwal Rifles, 12th Battalion Kumaon Regiment, Garhwal Scouts, 21st Battalion (Guards) Rashtriya Rifles, 29th Battalion (Grenadiers) Rashtriya Rifles, 55th Battalion (Grenadiers) Rashtriya Rifles, Army Hospital (Research & Referral) and 5th Battalion Assam Rifles.

Army Day is celebrated every year on 15 January to commemorate the appointment of Lt Gen (later Field Marshal) K M Cariappa as the first Indian Commander-in-Chief of the Indian Army, succeeding Sir Francis Butcher, the last British Commander in 1949.

MiG-21FLs retired from IAF service

Vayu visited Air Force station Kalaikunda on occasion of phase out of the MiG-21FL (Type 77) on 11 December 2013. The MiG-21FL was inducted into the IAF in 1966, nearly fifty years ago and was the first supersonic fighter to be built in India, ushering in a new era of aviation technology and manufacturing. The Type-77 was in operational service when hostilities broke out in late 1971, and the aircraft has distinguished itself in both the air-to-air and air-to-ground roles. Over time, as newer combat platforms were inducted, the Type-77 formed the backbone of IAF combat flying training at the MiG Operational Flying Training Unit (MOFTU) at Tezpur and Operational Conversion Unit (OCU) based at Chabua, and later Kalaikunda. [see book 'First to the Last' published by the Society for Aerospace studies, released in April 2013]



MiG-21 FL (C1149) touches down for the 'last time' (photo: Angad Singh)

The phaseout ceremony involved a parade by the personnel of AFS Kalaikunda, as well as flypasts of MiG-21FLs from OCU and MiG-27MLs from No. 18 Squadron 'Flying Bullets,' the other squadron based at Kalaikunda. The last aircraft to land had tail number C1149 and was piloted by Wg Cdr M Kumaria, a flying instructor at OCU. Flight Lieutenant Nagarajan, the youngest OCU graduate, then handed over the Form-700 of one of the retiring MiG-21FLs to the Air Chief.

STOP PRESS:

Agni IV successfully launched

India's 4000 kms-range Nuclear Capable Ballistic Missile, the Agni IV was successfully launched on 20 January 2014 from Wheeler Island off the coast of Odisha, the third consecutive successful trial and the last one in the series of development launches. Propelled by composite solid fuel rocket motors, Agni-IV was launched from its road mobile launcher and continuously tracked by long range Radars and Electro-Optical Tracking systems (EOTS) located along the coast and parameters monitored through the flight. Two ships located near the target point tracked the vehicle and witnessed the final impact.

"The event is of greater significance since the system was tested in its deliverable configuration with the active participation of SFC personnel. The missile is now ready for induction and its serial production will now begin" stated Avinash Chander, SA to RM, Secretary Dept of Defence R&D and DG DRDO, who commanded the launch sequence. He congratulated all the team members from DRDO and SFC. "Today's launch takes India's level of deterrence and its preparedness and effectiveness to newer heights. Seen together with recent momentous events: the second launch of Agni 5, operational clearance of Tejas light combat aircraft, achieving the criticality of nuclear reactor of India's first nuclear

powered submarine INS *Arihant*, completion of development phase of underwater launched missile (B05 a.k.a. Sagarika) and development of Arjun Mk. II MBT, this also reflects the high maturity level of India's capabilities in design development and leading to production, contemporary weapons and platforms for strengthening its deterrence and defence capabilities", stated Mr Avinash Chander.

The Agni IV is equipped with state-of-the-art avionics, 5th generation on-board computer and distributed architecture, having the latest features to correct and guide itself for inflight disturbances, the most accurate Ring Laser Gyro based Inertial Navigation System (RINS) and supported by highly reliable redundant Micro Navigation System (MINGS), which ensured the vehicle reached the target within two digit accuracy. The re-entry heat shield withstood temperatures in the range of 400° centigrade and ensured that the avionics functioned normally with inside temperature remaining less than 50 degree centigrade.



Avinash Chander, SA to RM with senior DRDO Scientists and others at Wheeler's Island

Recognizing threats is our instinct



Systems



Munitions



Equipment

Being reactive is our strength

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

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INS Vikramaditya in home waters!



INS Vikramaditya with nine ships of the Western Fleet: INS Viraat, INS Delhi and Mumbai, INS Teg, Talwar and Trikand, INS Godavari, INS Subhadra and fleet tanker INS Deepak

The New Year brought with it a massive 'gift' for the Indian Navy in the shape of a 44,500 tonne aircraft carrier, the INS *Vikramaditya*. Escorted by units of the Western Naval fleet, including the venerable aircraft carrier INS *Viraat* and including the guided missile destroyers INS *Delhi* and INS *Mumbai*, guided missile frigates INS *Teg*, *Talwar* and *Trikand*, INS *Godavari*, INS *Subhadra*, and the fleet tanker INS *Deepak*, the Navy's newest warship entered the Indian Ocean Region (IOR) and proceeded to its home port, INS *Kadamba*, in Karwar (Karnataka) on 7 January 2014.

It is for the first time in two decades that the Indian Navy has two aircraft carriers in service, and this fact makes it the second such in the world (the US Navy of course are the giants with 10 super carriers in service while the French, Russian, Brazilian, Spanish, Italian, Thai and Chinese Navies have one each : the British Royal Navy still awaits its new aircraft carriers – see *Vayu* Issue VI/2013).



Line astern with INS Vikramaditya leading – showing her mammoth size in comparison to the trailing frigates



A Sea Harrier flies alongside INS Vikramaditya as she sails the blue waters of the Arabian Sea



Note HAL Chetak already embarked aboard INS Vikramaditya



Closer my Lord to Thee!



IOC-2 accorded to LCA but significant work remains

A Tejas armed with R-73 CCMs, LGBs and drop tanks seen at HAL Bangalore

On 20 December 2013, amidst the roar of jet engines and at the facility where it is built and tested, Defence Minister AK Antony handed the 'Release to Service' certificate of the HAL Tejas light combat aircraft (LCA) to Air Chief Marshal NAK Browne, Chief of Air Staff. The occasion marked the 'beginning of the end' of an arduous three-decade saga aimed at producing an indigenous fighter aircraft.

Initial Operational Clearance-II (IOC-2), thus named owing to an earlier 'partial' IOC being granted in January 2011, will begin the final phase of development on the programme, the 15-month journey to Full Operational Clearance (FOC).

The ceremony was attended by a number of heads of industry and technology, including Dr Avinash Chander, SA to the Defence Minister, GC Pati, Secretary Defence Production, Dr RK Tyagi, Chairman HAL, PS Subramanyam, Programme Director of ADA, Dr K Tamil Mani, DG-Aero and CE CEMILAC. Defence Minister AK Antony, MoS Defence Jitendra Singh and Air Force Chief NAK Browne were at the ceremony as well.

Antony appeared visibly happy and noted that the capabilities of the aircraft had been improved significantly over the

course of its development to the IOC-2 stage. "The improvements to the aircraft have enhanced the flight envelope and also weapon delivery capability. The performance at *Iron Fist*, Jaisalmer [see *Vayu II*/2013] and the recent missile firing at Goa are examples of such improvements. The reliability of the aircraft and serviceability has also been enhanced. The number of flights at 500 within this year provides an indication of this.

Operating from IAF bases namely, Jamnagar, Jaisalmer, Uttarlai, Gwalior, Goa, Leh, Pathankot demonstrate the aircraft's capability to operate from Air Force bases. There have also been occasions when the same aircraft has flown thrice on the same day, indicating the operational reliability of this home-bred fighter aircraft," he said. He also addressed the broader Indian defence industrial base when he called IOC-2 an "important milestone" in the long journey towards indigenisation through self-reliance, exhorting the public and private sectors to work in tandem to develop and produce world-class military systems for the nation.

Then Chief of Air Staff, Air Chief Marshal NAK Browne, said it was indeed "a proud day for the nation and particularly for the IAF; since the grant of IOC acknowledges the capabilities of this aircraft and paves the way for the induction

of LCA Mk.1 from into operational service." He praised the programme's safety record, noting that the progress of such a challenging experimental project without any accident or major incident was unprecedented in the history of aviation.

The LCA is designed to ultimately replace the MiG 21 fleet of IAF. The timing of IOC- II for LCA coincides with the iconic Mig 21 FL fighter flying into IAF's history just a week earlier. Dr Avinash Chander, DG DRDO and SA to the Defence Minister also spoke at the occasion, calling it "the culmination of the ceaseless efforts of the various programme stakeholders."

He elaborated on some of the "several hundred" design improvements that have been made leading up to IOC-2 that have rendered the aircraft more reliable and easily maintainable, and improved the performance in terms of flight envelope, weapon accuracy and enhancement of sensor functionality. He also stressed upon the pilot-vehicle interface (PVI), which the pilots themselves hail as one of the best.

Miles to go

Looking forward, Dr Chander said that "Team Tejas" would now have to "sprint the last lap towards FOC", which, he said, will

Eurojet



see Tejas equipped with in-flight refueling probes, beyond visual range (BVR) missiles, a new close-combat missile and Gryazev-Shipunov gun, additional weapons and new drop tanks for supersonic flight.”

He also briefly touched upon the future of the programme, the higher-performance Tejas Mk.2, which will feature a more powerful engine and further improved avionics.

He closed with congratulations to the teams at DRDO, ADA, HAL, CEMILAC, DGQA, IAF and various industry partners.

The Indian Air Force will begin receiving series production (SP) standard aircraft over the next few months, with an initial order of 40 Mk.1 aircraft. FOC for the type, confirming its readiness for all operational duties in IAF service, is anticipated 12-15 months from IOC-2, and involves a daunting array of tasks to be accomplished, especially given the timeframe involved. The list of key

activities to be undertaken before FOC is granted are as follows:

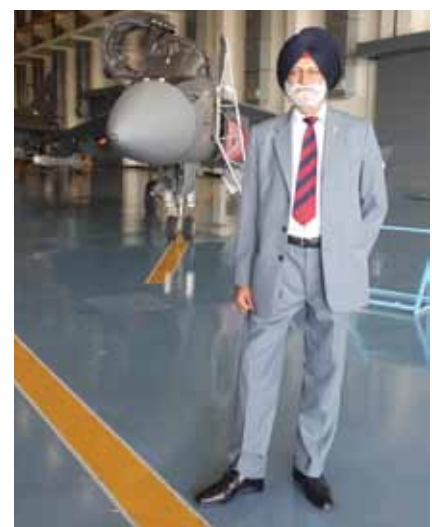
- ★ Expand flight envelope to -3.5 to 8G (presently -2 to 6G)
- ★ Clear 24° angle of attack (presently 22°)
- ★ Add in-flight refueling capability (retractable Cobham probe is already under testing)
- ★ Demonstration of BVRAAM (Rafael Derby)
- ★ Demonstration of new CCM (Rafael Python-5)
- ★ Integration of Gryazev-Shipunov GSh-23 23mm cannon
- ★ New supersonic drop tanks
- ★ New radome for improved radar performance
- ★ New brake cooling system
- ★ Additional weapons testing, including air-to-ground PGMs

After achievement of IOC-2, HAL will go ahead with series production of the Tejas. Production facilities for SP-standard aircraft have been set up at HAL and deliveries are expected to commence from mid 2014. HAL has established the structural assembly hangar and the assembly jigs have been calibrated with laser trackers to an accuracy of 80 microns (0.08 mm) to meet stringent quality standards. A state of the art CNC drilling machine has been installed to ensure repeatability and reduce cycle times.

“We have plans to initially produce eight aircraft per year. Further plans are afoot to enhance the production rate to 16 aircraft per year in consultation with IAF and MoD. HAL is fully geared up to meet the challenging production schedule and hopes to fulfil the requirements of customers in a time bound manner,” says Dr RK Tyagi, Chairman HAL.



Defence Minister AK Antony and Dr Avinash Chander during the IOC-2 ceremony



Pushpinder Singh of Vayu at the LCA hangar at HAL Bangalore

Challenges : External and Internal

Interview with General Bikram Singh, Chief of the Army Staff

On taking over as COAS, you had enunciated on your vision and focus areas. How far have you been able to achieve these?

On taking over command of the Indian Army, I had laid down certain key thrust areas based on my vision that seeks to enhance the overall operational effectiveness of our Army to ensure it remains a potent, responsive, accountable and relevant instrument of National Power. These form the basis of a holistic approach to building an Army that meets the aspirations of our Nation. My team has translated these thrust areas into an implementation plan with stipulated timelines.

Enhancing the operational readiness to enable effective fulfilment of our constitutional obligations remains the single most critical area of focus. The high levels of operational responsiveness have been on display both on the borders and in Internal Security commitments. In addition, our timely response to deal with disaster and emergency situations has helped save many precious lives of our people and their property. There is also an unwavering focus on capability development and



Army exercise underway involving HAL Dhruv ALH and T-90 MBT

the core values of integrity, loyalty, duty, respect, selfless service, courage and honour. These can never be compromised. It has also been my endeavour to bring in greater transparency and accountability in our policies and procedures. As the head of the Indian Army, it is my bounden responsibility to ensure the highest standards of motivation and morale of the troops, since it impacts every facet of our functioning. A review of the Human Resource Development policies has been undertaken to fulfil the aspirations of the officers and soldiers along with requirements of the organisation.

Conscious efforts to enhance the sense of pride and professionalism within the



Mix of MBTs on parade: the Army is seeking to acquire large numbers of new generation tanks in the next decade



FH-77 155mm howitzer in the mountains : artillery modernisation has been slow despite the Army's insistence that the requirement for large numbers of howitzers is urgent

out with the State governments to provide gainful employment to our veterans, *veer naris* and widows and strengthen their sense of belongingness to the larger fraternity of the Indian Army.

A dedicated mechanism in my secretariat has been closely monitoring these issues and ensuring that I am kept updated. In the organisational interest, for aspects that have long gestation periods, my effort is to set the process on track that will see the culmination in times to come.

It seems that the Indian Army is on the back foot in counter infiltration and Counter Terrorism operations, especially when it comes to Jammu & Kashmir and facing Pakistan-sponsored terrorists who seem to be able to get in almost at will. Your comments.

To state that the Indian Army is on the back foot in Counter Infiltration/ Counter Terrorism operations in Jammu and Kashmir will not only be factually incorrect but will also trivialise the immense selfless contributions of our brave soldiers in defeating the nefarious designs of the terrorists and other inimical forces.

The internal security situation in the hinterland, though marked by some incidents of violence in the recent past, is well under control and infiltration levels have been brought down. From 1,852 terrorists that infiltrated in 2001, the number in 2013 was 90, which is owing to the efficacy of the dynamic, multi tiered counter infiltration grid as also consistent and relentless operations by our Army along with the Police and the Central Armed Police Forces.

Army are being made with encouraging results. I have myself interacted extensively with commanders and soldiers across the Army to further enhance pride in our profession and revitalise the bond that exists between the officers and soldiers - this has always been the bedrock of Army's culture, ethos and discipline.

I must also mention here that in our efforts to prepare our scholar warriors for future challenges as leaders of character and competence, as also to build on the military strategic culture and awareness, revision of the curricula of various courses of instructions has been undertaken.

A number of schemes are underway and regular interaction it also being carried



Sikh Light Infantry troops on parade : India has the third largest standing army in the world, with over a million personnel

Sagem

What are the internal and external challenges before the Indian Army today and how well are we prepared to meet the emerging situation?

The contemporary security environment is dynamic and poses challenges across the

Our experience in Counter Insurgency/ Counter Terrorist operations has shown that such commitments impose great strain on resources and continue to suck 'boots on ground,' which invariably is at the expense of our conventional war fighting

potential. In a great democracy like ours, the Army must continue to be seen as a 'People's Army' and a resource essentially for the effective management of our borders against external threats and for furthering the National interests in consonance with our national strategy. Blunting this instrument of National power, through excessive application in Internal Security situations, would not only be detrimental to our stature as the People's Army but also to our capability development initiatives along the borders.

Keeping the Army trained and prepared for a conventional conflict scenario, which is its primary role, while many of our units are committed in Internal Security tasks on a day-to-day basis, is a major challenge that we face today. What needs to be kept in view is that despite our internal commitments, there are a large number of military formations and units which continue to be focussed on conventional operations. While there is no laid down right mix of Internal Security and conventional duties, we are prepared to face challenges across the entire spectrum of conflict, as they manifest. Our operation oriented training and responsive human resource management system ensures that the Army is adaptive and motivated to switch roles when so required.

When do you expect the new Mountain Strike Corps recently cleared by the government to become operational? What combat, combat support and logistics units will it have ?



Army troops are to progressively receive new equipment over the coming years, including a new standard-issue firearm, body armour and helmet

entire spectrum of conflict, ranging from 'Conventional Threats' along our borders to 'Sub-conventional Threats', including its proxy war manifestations. Towards that end, strengthening of our security apparatus, to combat multi-spectral threats, remains our priority. Accordingly, the Indian Army is constantly gearing up and training to counter multiple threats, ranging from a conventional conflict to tackling the ongoing proxy war and insurgencies.

What according to you is the right mix between internal security duties and conventional duties for the Army?

The Army should be employed primarily for the management of our borders and its employment in the Internal Security domain should be undertaken only as an instrument of last resort, when the security situation is beyond the control of the Police and Central Armed Police Forces.



The Pinaka MBRLS is an indigenous rocket artillery system in employment with Artillery Division and with increasing induction ahead.

Boeing



General Bikram Singh at an investiture ceremony

As part of the Indian Army's capability development, a Mountain Strike Corps (17 Corps), including two Infantry Divisions and associated combat support,

reconnaissance, surveillance and logistics components have been sanctioned by the Government in the 12th and 13th Plans.

The raising of units commenced on 1 December, 2013. The Corps Headquarters along with the Headquarters of one Infantry Division and two Infantry Brigades commenced raising on 1 January, 2014. These raisings will be accompanied by induction of combat and logistic capabilities as per a pragmatically evolved road-map and laid down timelines.

What is the Army's current perspective on Armed Forces Special Powers Act (AFSPA)?

The improvement in the overall situation in Jammu and Kashmir has been a result of the sustained operations undertaken by the Army along with the Police and Central Armed Police Forces. However, intelligence reports still allude to the presence of over 400 terrorists in the State, who are yet to be neutralised. In addition, the terrorist infrastructure across the Line of Control is intact and has the potential to vitiate the security environment in the State. Any let up at this stage, therefore, is likely to be exploited by the terrorists and other inimical elements to their advantage.

As earlier brought out by me on a number of occasions, the AFSPA is merely an enabling act that empowers troops to operate in an area declared disturbed and provides the requisite legal safeguards to carry out effective Counter Terrorist operations. Its withdrawal or even partial withdrawal at this juncture, is likely to prove detrimental to the ongoing Counter Terrorism campaign being conducted under aegis of the Unified Headquarters. It is also a strategic imperative that we wait and watch the developments in Afghanistan post draw down in 2014.

The Indian Army has a commendable Human Rights record and its actions are guided by the highest military ethos of upholding Human Rights and law of the land. Besides, a mechanism exists within the organisation to deal with Human Rights violations and in the past defaulters have been expeditiously dealt with as per the law.

What are the thrust areas of our modernisation effort in the future, say in the 12th and 13th Army Plans?

Our modernisation plan is aimed at capability building, based on state-of-the-art technology, to cover the entire spectrum of conflict envisaged in future. The projects aim at enhancing 'transparency' in the battlefield and augmenting the individual and collective 'operational capability' of our soldiers, units and formations to operate effectively in a complex battlefield milieu.

As the COAS, are you satisfied with the current holdings and the status of equipment and munitions for war?

Modernisation of the Indian Army is a continuous process that ensures the Army is fully capable of meeting any threat in the operational environment prevailing on our borders. Efforts are ongoing in conjunction with the Ministry of Defence, to enhance the capability of indigenous weapons and equipment. It would be reasonable to state that our soldier is optimally equipped for any operational contingency along our borders.

Ammunition management is a dynamic process wherein consumption and recoupment of deficiency is a function of production capacities of Ordnance Factories and availability ex- import. A comprehensive long term 'Ammunition Roll on Plan' for continued build up of ammunition reserves in a phased manner has already been approved.



The unique geography of the Indian subcontinent necessitates doctrine and tactics to match, such as the employment of airborne assets (this picture is of supplies being dropped to ISAF troops in Afghanistan).

Saab

Have the plans to make the Army's Special Forces and Infantry 'Ghatak' Platoons more potent and effective, been realised? What is the new equipment, if any, that has been inducted to ensure this?

Indian Army Special Forces have been raised, organised, equipped and trained for tactical, operational and strategic level special operations in support of the Indian Army's mandated roles in sub conventional and conventional operations. Indian Army Special Forces are highly professional forces

being developed in consonance with threat perception, our war fighting philosophy and the ongoing modernisation plan.

As regards the Ghatak Platoon of Infantry Battalions, a composite package of additional equipment and devices for special operations, referred to as 'Ghatak Brick', is also in the pipeline. This upgradation would facilitate the Ghatak Platoons to conduct their tasks with enhanced efficiency and comparative ease in conventional as well as sub-conventional operations.

What is the concept of our Future Main Battle Tank (FMBT)? What is the Army's broad time plan and vision for its development?

In congruence with the Long Term Integrated Perspective Plan and based on our operational doctrine, the Army is looking at developing a Future Main Battle Tank (FMBT) that would be comparable to any advanced Armoured Fighting Vehicle of modern armies the world over.

Conceptually, the FMBT is envisaged to be capable of operating in high intensity, high technology, network enabled digitised battlefield of the 21st century. The FMBT will be required to conduct sustained operations round the clock, in a dense anti-tank hybrid environment comprising missiles, aerial platforms and precision munitions, while catering for a 360 degree protection and at the same time being capable of delivering decisive and lethal response. The tank would be designed to have versatility in terms of tactical and strategic mobility, capability of employment over varied terrain as obtaining in our country and in line with our strategy and operational philosophies.

Currently, the 'Qualitative Requirements' are being deliberated upon. We hope to achieve a major technological breakthrough with reference to the FMBT in the next two to three 'Plan' periods. The endeavour would be towards indigenisation with key focus on self reliance.

Many feel that the 'quality' of officers enrolling in the armed forces has dropped. Would you agree?

We have a large pool of trained and dedicated youth from which to select our leadership material; hence we have the option to select the best without any degradation of quality. Also, the selection procedure adopted by the Service Selection Boards is a time tested one and only the cream from the applicants, based on existing vacancies, is selected. Their grooming and nurturing at the training establishments thereafter, makes them into well rounded leaders of character and desired competence. I, therefore, disagree with this perception, which is ill founded. As the COAS, I am very happy with the quality and standards of my officers, who always lead from the front and are the 'Best'. I am proud of them!

The Government has announced the 7th Pay Commission. We are given to



Taking the salute : General Bikram Singh (COAS) and Admiral DK Joshi (CNS) flank Prime Minister Dr Manmohan Singh.



Indian Army Special Forces on parade. (Photo: Angad Singh)



The T-90 is the Indian Army's lead MBT today (inset : Stuart light tank of the Indian Army in 1945)

understand that the Service Chiefs have turned down the offer of a separate pay commission for the armed forces which was made earlier. Have all the anomalies of the 6th Pay Commission been resolved? Will the Services be able to impress upon the government for fair representation on the 7th Pay Commission, something which has always been denied in the past?

The 7th Central Pay Commission (CPC) was announced on 25 September, 2013. While the announcements were made by the Hon'ble Finance Minister, there has been no mention of a Military Pay Commission; thus the question of turning down of a separate Pay Commission does not arise. The Services have taken a de-novo holistic view of the issue of a separate Pay Commission. The issue has been debated and deliberated at length at all levels of leadership and it is the considered opinion of the Services that the interests of the Defence Services would be best served by being part of Central Pay Commission with full representation from the three Services.

Not all the anomalies raised post 6th CPC have so far been resolved. Efforts are on to get

these resolved before the 7th CPC, so that the base for 7th CPC is devoid of anomalies. The matter of full representation in the 7th CPC has been taken up and the Services are optimistic of a favourable decision.

*(Courtesy : Sainik Samachar,
Directorate of Public Relations,
Ministry of Defence)*



General Bikram Singh pinning gallantry award at special ceremony.

Afghanistan : a grave unfolding crisis



The region of the historical Great Games, the land of the Hindu Kush, is on edge once again, with a grave crisis unfolding, portending a bleak future, importantly for Afghanistan's integrity itself. Continually reeling with political instability and senseless Taliban-perpetrated violence, notwithstanding more than a decade of a formidable US and International Security Forces' (ISAF) military presence in Afghanistan, the hapless fratricidal conflict-afflicted country faces stormy times with the impending, perhaps ill-timed, withdrawal of the US and the ISAF in 2014.

For years, the principal player in this region, the United States, essentially not having achieved its strategic objective of effectively 'cleansing' this region of the Al Qaida and other fundamentalist Islamic terror conglomerates, is looking eagerly to vacate Afghanistan, thus leaving behind a volatile restive nation to its fate. This does not, at all, speak highly of the world's sole super power, notwithstanding the military fatigue and financial burden the USA

has undergone in its 12 years of presence in this violent expanse. Nevertheless, the US can take comfort for what it achieved in the early part of the decade when it had ousted the fundamentalist Taliban regime from Kabul in 2001 and later eliminated Al Qaida supremo Osama bin Laden in 2011 who had clandestinely hidden in the garrison town of Abbottabad in Pakistan since 2005. That the US endeavoured, rather unsuccessfully, to usher in stable democracy and peace in Afghanistan before its proposed inglorious exit, will remain historically one of America's grave failures just as Vietnam was in the mid-sixties, and more recently, Iraq.

With the draw-down of the US troops and the ISAF in 2014 from Afghanistan, perhaps leaving a small 'training contingent' and some air effort, teams to operate US drones, a security detail and some logistics and maintenance detachments, the US forces will be in no position to provide any worthwhile security to the Karzai regime or any government civil or military installations. Thus



Both present leaders of India and Afghanistan will no longer be in office after 2014.

the situation will be ripe for the formidable Pakistani-supported Taliban, Pashtun warlords such as Gulbuddin Hekayatmar, the Haqqani network and remnants of Al Qaida foot soldiers to create mayhem not only in Kabul but especially the eastern and southern portions of Afghanistan to fill in the political and security vacuum respectively created by President Hamid Karzai's relinquishing his Presidential post and the US withdrawal. Thus, surmising that Pakistan and the Talibani cohorts are eagerly awaiting US forces' departure, will be an understatement !

Time is now running out for Afghanistan and India, as the leading South Asian power, has to take the initiative to stabilise this violent, albeit strategic, expanse.

It is indeed paradoxical that most nations that have a direct stake in Afghanistan's future have, by and large, conflicting objectives. The US now only wish for a near trouble-free exit with their heavy equipment and minimum of 'bodybags', the Russians looking for some enhanced military sales to some future dispensation in Kabul, the Chinese, in their unending quest for resources the world over, are currently eyeing the huge mineral deposits of Afghanistan, while the Iranians plan to restore their Shia influence in Afghanistan. Not surprisingly, the Pakistanis are unabashedly looking ahead to planting an absolutely pliant regime in Kabul which can acquiesce to Pakistan's eternal 'strategic depth' conundrum and also, importantly, keep India totally out of reckoning, even in development projects in impoverished Afghanistan. That Pakistan will leave no stone unturned to prevent India from even cementing its soft power forays in Afghanistan should be factored in not only by the Indian government but also by the large number of out-of-reality peaceniks in this nation.

India, which is respected by a majority of Afghans, in keeping with its inborn ancient pacifist and reactive inclinations, appears not showing any signs of a proactive approach in its future Kabul policy, post the US withdrawal in 2014. The prospective shape of Afghanistan, after 2014, is going to be a litmus test for India's foreign policy in the immediate future. Afghanistan as a nation is of much strategic significance for India. No personality in recent times has summed up Kabul's importance to India than the Afghan Ambassador in Delhi prior to his President, Hamid Karzai's visit to India in May 2013 stating unreservedly and reminding India that "it is critically important that the two countries..... deepen and talk more substantive issues beyond training and other soft issues." He further added rather succinctly that "... investment in the security and development in Afghanistan means the safety and security of India."

President Karzai during his May 2013 visit had brought a 'wish-list' for defence equipment to discuss with the Indian government. Nevertheless, it will be in India's interest that whatever it can do to reinforce Kabul's security must be done speedily and effectively within the frame-work of the India-Afghanistan Strategic Partnership Treaty 2011. Without dispatching any 'boots on the ground', India must sell/donate some lethal arms and equipment including helicopters, T-72 tanks, BMP infantry combat vehicles, heavy machine guns, 105mm light artillery, tactical bridging, mines and mine clearing equipment, heavy machine guns etc to bolster the much-needed combat capabilities of the Afghan National Security Forces (ANSF). In actual fact, it is the ANSF's capabilities that will become the centre of gravity for Afghanistan's survival.

As India continues with its humanitarian and economic uplift endeavours in Afghanistan, it also needs to beef up the security of its development and infrastructure projects by dispatching additional para-military units for guarding them as they are constantly under threat from Taliban attack.

In addition, though newly elected Pakistani PM Nawaz Sharif may not be able to immediately pursue a peaceful and reconciliatory policy towards Afghanistan and India owing to strong pressure from the Pakistan Army and the fundamentalist 'tanzims' in Pakistan, India should endeavour to balance both bilateral and trilateral relationships between these three nations which have a common stake in fostering peace and stability in the region.

Time is now running out for Afghanistan and India, as the leading South Asian power, has to take the initiative to stabilise this violent, albeit strategic, expanse. Afghanistan must not be allowed to be engulfed into a civil war, which some strategic analysts rightly fear. With President Karzai's cooperation and consent, India must vigorously keep open its communication channels with the Pashtuns of diverse hues and revive its old linkages with the erstwhile Northern Alliance, the Uzbeks and the Hazaras.

Notwithstanding Pakistan's likely machinations to establish a pro-Islamabad fundamentalist regime in Kabul, India must move with determination and alacrity on a multitude of fronts embracing the diplomatic, economic and military to help ensure a peaceful and smooth transition in Kabul, post Karzai's, and the US, departure from Afghanistan in 2014.

Lt Gen Kamal Davar (retd)
(The author was the first Chief of India's Defence Intelligence Agency)

DETECTING THE DRAGON

Brigadier (retd) Gurmeet Kanwal on developing India's military capabilities



Indian troops in the high mountain frontiers with China

China and India, both Asian giants and emerging world powers, have begun to exercise immense influence in international political and economic affairs. As China's GDP is much larger than that of India, it enjoys a correspondingly greater international clout - at present. Relations between India and China have been fairly stable at the strategic level with political and economic relations between India and China much better now than these have ever been since the 1962 border war between the two countries. Economic relations are much better too than in the past. Mutual economic dependence is growing rapidly every year, with bilateral trade increasing at a brisk pace. Even though it is skewed in China's favour, bilateral trade has crossed US\$ 60 billion and is expected to touch US\$ 100 billion soon. The two countries have been cooperating in international fora like WTO talks and climate change negotiations, and there has even been some cooperation in energy security.

Unfortunately, growth in the strategic and security relationship has not kept pace



Chinese troops patrolling near the LAC in the Himalayas.

with the political and economic relationship. Despite prolonged negotiations at the political level to resolve the long-standing territorial and boundary dispute between the two countries, there has been little

progress on this really sensitive issue. China has a clandestine nuclear warheads-ballistic missiles-military hardware technology transfer relationship with Pakistan that causes continued apprehension in India.



A convoy of PLA trucks on the Tibetan plateau. China has been proactive in the rapid development of military infrastructure in Tibet.

Also, in recent years, China appears to have raised the ante by way of its shrill political rhetoric, frequent transgressions across the Line of Actual Control (LAC) and unprecedented cyber attacks on Indian networks. This security situation has the potential to act as a spoiler in the larger relationship and will ultimately determine whether the two Asian giants will clash – or

Strategic Relationship: Competition or Cooperation?

On 11 April, 2005, China and India announced a new 'strategic and cooperative' partnership after a summit-level meeting between Prime Ministers Manmohan Singh and Wen Jiabao. International analysts were quick to pronounce that the

become a leading base for the manufacture of IT hardware. Synergising India's software capability and China's hardware strength will arguably produce an unbeatable combination.

The rapidly growing needs of both the countries for energy and their high dependence on oil and gas imports, is forcing both to secure oil equity abroad.



Indian Army FH-77 (Bofors) 155mm towed howitzer in Ladakh

cooperate – for mutual gains. Arguably, while the India-China relationship is relatively stable at the strategic level, China's political, diplomatic and military aggressiveness at the tactical level is acting as a dampener. China's assertive behaviour regarding India is in keeping with its recent aggressiveness in areas of the East China Sea and the South China Sea. While the probability of armed conflict is low, its possibility cannot be ruled out.

prospects of a more cooperative relationship between these two growing economies had significant global implications. A meaningful strategic partnership would lead to mutually beneficial synergies between Chinese and Indian economies. As India is rapidly emerging as a leader in software development, its knowledge-based industries are attracting the interest of major information technology (IT) enterprises from all over the world, while China has



An IAF C-130J Super Hercules landing at Daulat Beg Oldi, the world's highest military airstrip, in virtual shadow of the Karakoram pass leading to Xinjiang province of China.



Invaluable support was given by 155mm howitzers of the Indian Army during the Kargil conflict of 1999.



The Boeing Chinook, powered by twin Lycoming T-55 turboshafts, boasts an impressive airlift capability in the high mountains, as proved in Afghanistan.



The joint Sino-Pak fighter JF-17 is in series production at PAC Kamra and already equips a number of frontline squadrons of the PAF.

Chinese and Indian oil and gas companies have often been in competition with each other to invest in overseas fields and have driven up prices by outbidding each other. A strategy based on cooperation rather than competition will help both the countries to secure better terms and enable them to share their risks. They could follow a consortium or joint venture approach for bidding and invest in sharing infrastructure costs such as building joint



The Al Khalid Main Battle Tank, jointly developed by Pakistan and China, will remain the mainstay of the Pakistan Army well into the next decades.

pipelines. Thus far, however, cooperation in this field has been extremely limited.

China and India's coordinated approach in international negotiations is proving to be mutually beneficial to both. The two countries have been following a coordinated approach in the ongoing WTO negotiations and on environmental issues, which was particularly evident during the 2009 World Climate Summit at Copenhagen. When two countries that

represent more than a third of the global population speak in unison, the world has no option but to sit up and take note. China and India played a calming role in the 2008-09 global financial melt-down that has now begun to peter out. They are likely to work together towards the long-pending reform of the international financial architecture. As both the countries hold substantial foreign exchange reserves, they must increasingly play a greater role in decision-making in the existing Bretton Woods organisations.

Reform of the UN Security Council (UNSC) is yet another area for cooperation. Just as India had played a very positive role in China's initial membership of the UN and its subsequent inclusion in the UNSC, India expects China to support its aspiration for a seat in an expanded UNSC. This will quite naturally increase Asia's clout in world affairs. However, so far such explicit support has not been forthcoming. In Asia, China and India should work together for peace and stability and broader regional economic integration to make the 21st century truly Asia's century. Counter-terrorism is another area in which China and India can cooperate for mutual benefit as both countries are victims of Islamist fundamentalist terrorism emanating from across their borders. In this context, the *Hand-in-Hand* series of joint military exercises, conducted at Kunming in 2007, at Belgaum in 2008 and after a gap of five years again at Kunming in November 2013, were positive steps in the right direction. Both also need to work together to counter the menace of narcotics trafficking from the Golden Crescent on one side and the Golden Triangle on the other.

Areas of Concern

In the Indian perception, there are several major areas of concern that are limiting the growth of the bilateral relationship. The foremost among these is the "all-weather" friendship between China and Pakistan that is, in Chinese President Hu Jintao's words, "higher than the mountains and deeper than the oceans". The Indian government and most Indian analysts are convinced that China has given nuclear warhead designs, fissile material and missile technology as well as fully assembled, crated



'Hand in Hand' 2013, a joint Indo-Chinese military exercise, was conducted at Kunming in Yunnan province of southern China.

M-9 and M-11 missiles to Pakistan, all this widely reported in the international media. China and Pakistan also have a joint weapons and equipment development programme that includes Al Khalid tanks, F-22 frigates and JF-17 fighter aircraft. China's military aid has considerably strengthened Pakistan's war-waging potential and enabled it to launch and sustain a proxy war in Jammu & Kashmir and in other parts of India. By implication, therefore, this is also China's proxy war on India.

Other contentious issues include China's continuing opposition to India's nuclear weapons programme; its deep inroads into Myanmar and support to its military regime; its covert assistance to the now almost defunct LTTE (Liberation Tigers of Tamil Eelam) in Sri Lanka; its increasing activities in the Bay of Bengal; its attempts to isolate India in the ASEAN Regional Forum (ARF) while keeping India out of the Shanghai Cooperation Organisation and its relentless efforts to increase its influence in Nepal and Bangladesh. China's efforts to develop port facilities in Myanmar (Hangyi), Chittagong (Bangladesh), Sri Lanka (Hambantota), the Maldives and at Gwadar in Pakistan – Baluchistan are seen by many Indian analysts as forming part of a 'string of pearls' strategy to contain India and develop the capacity



Pakistan's tactical ballistic missile programmes have been assisted by the Chinese for the past several decades.

to dominate the northern Indian Ocean region from around 2015-20. Although at present the Indian Navy dominates the northern Indian Ocean, a maritime clash is possible in the future as the PLA Navy begins operating in the Indian Ocean – ostensibly to safeguard its sea lanes and protect its merchant marine traffic. Hence, China's moves are seen by Indian analysts as part of a carefully orchestrated plan aimed at the strategic encirclement of India in the long-term to counter-balance India's

growing power and influence in Asia, even as in the short term China engages India on the political and economic fronts.

China and India are both nuclear-armed states and it is in the interest of both to ensure that strategic stability is maintained and that the risk of accidental or unauthorised nuclear exchanges is obviated. This would be possible only if negotiators from both the sides get together to discuss nuclear confidence building measures (CBMs) and nuclear risk reduction measures

(NRRMs). However, China's insistence that it cannot discuss nuclear CBMs and NRRMs with India "as India is not a nuclear weapons state recognised by the NPT" is proving to be a stumbling block. China's official position is that India should cap, roll back and eliminate its nuclear weapons in terms of UNSC Resolution No 1172. That is unlikely to happen. India has been recognised as a responsible state with advanced nuclear technology and has been given a backdoor entry into the NPT through the NSG waiver and the IAEA safeguards agreement. India has also signed civil nuclear cooperation agreements with France, Russia and the United States. It would be in the interest of both India and China to discuss nuclear CBMs and NRRMs so as to enhance strategic stability in Southern Asia. It is also in China's interest to enter into a nuclear trade agreement with India as India is rapidly emerging as a large market for nuclear fuel and nuclear technology.

India realises that its growing external relations with new strategic partners are causing some concern in China. China has viewed with obvious suspicion India's willingness to join Australia, Japan and the US in a 'quadrilateral' engagement to promote shared common interests in South East Asia. China also wishes to reduce what it perceives as the steadily increasing "influence" of the USA over New Delhi. China is surely aware that the US is several years ahead of Beijing in recognising India's potential as a military and economic power, having greatly increased its cooperation with India in both spheres. China fears that the growing US-India strategic partnership is actually a "loose alliance" and that the two countries are "ganging up" against China. China should study India's track record whence it must be clear that India is unlikely to ever form a military alliance with the USA – unlike Pakistan, which is a Major Non-NATO Ally (MNNA) of the US and is also China's "all weather" friend ! India has always pursued an independent foreign policy and cherishes its strategic autonomy. It will be recalled that India steadfastly supported the Non-aligned Movement (NAM) for several decades during the Cold War and has never entered into a military alliance with any country. The USA is an Asian country in the strategic sense and it is necessary for India to maintain good relations with it. It is also India's largest



Google satellite map showing IAF Advanced Landing Grounds bordering the Aksai Chin in Ladakh.



In April 2013, PLA troops crossed 30kms into Indian territory, setting off a diplomatic tussle between the nations.



The monastery town of Tawang in the Kameng district of Arunachal Pradesh. China has claimed that the 'Tawang Tract' is part of Tibet as a former Dalai Lama was born there.



One of the world's most spectacular high altitude lakes, at 14270 ft above sea level, is the Pangong Tso in eastern Ladakh, which has seen intensified PLA patrolling since 2009.

trading partner and has a large Indian Diaspora. There are major convergences of interests between India and the US. Hence, India's newfound strategic relationship with the US need not come in the way of India-China relations, which have their own strategic imperatives for India.

In an article entitled *Warning to the Indian Government* (posted on the website of the China Institute of International Strategic Studies on 26 March 2008),

Zhan Lue, a Communist Party member, warned India not to "walk today along the old road of resisting China" as the People's Liberation Army is now well-entrenched in Tibet and will not repeat its mistake of withdrawing after a border war as it did in 1962. He extolled the virtues of the PLA's newly developed capabilities and went on to advise India "not to requite kindness with ingratitude." This surprisingly sharp attack in a scholarly journal did not appear

to be an isolated piece of writing. Another Chinese scholar advised his government to engage with India's neighbours so as to "break India into 26 parts". In the wake of the Tibetan unrest in India and across the world earlier during 2008, anti-India rhetoric in the Chinese media had been ratcheted up several notches. Analysts in India believe that such scurrilous writings could not have been published without the express sanction of the Chinese authorities as almost all Chinese media are state controlled. This type of rhetoric certainly sets back efforts at any reconciliation and mutual understanding.

In turn, it should be accepted that China is concerned about the situation that might develop when the Dalai Lama passes away. Despite all the raving and ranting against him, the Chinese government is acutely conscious of the fact that the present Dalai Lama's is a voice of moderation and accommodation. They know that there could be a major uprising in Tibet when he passes away as the Tibetan youth will no longer feel constrained to respect his cherished desire for peace and harmony and are likely to resort to violent attacks against the Han Chinese people and officials and state property.

Despite India's remarkable restraint over the past 50 years, the Chinese are not sure of how India will react to a post-Dalai Lama rebellion in Tibet. In fact, the Chinese have always harboured a fair deal of ill will against India for providing the Dalai Lama with a sanctuary – even though India has forbidden him from any anti-China political activities from Indian soil and the Dalai Lama has honoured the restraints imposed on him by his hosts. A senior Chinese interlocutor told this analyst at a bilateral think tanks' dialogue at Bangkok in October 2009 that relations between China and India would flourish very well if India was to hand over the Dalai Lama to China, even at this belated stage. The depth of Chinese resentment with India for providing shelter to the Dalai Lama can be gauged from this. Since such a course of action would be completely out of character with India's civilisational and spiritual values, handing over the Dalai Lama is simply out of the question. China would, therefore, do well to put this issue aside and move forward in developing its relationship with India.

A major area of concern to India is the rapid development of Chinese military



With the acquisition of 155 mm calibre howitzers still incomplete, the Bofors will remain the backbone of the artillery's long range arm.

infrastructure in Tibet. The Gormo-Lhasa railway line is now fully operational. The rail network is proposed to be extended towards Shigatse and then even into Nepal. China has recently developed a road network of 58,000 km and five new air bases in the territory. New military camps have come up close to the border with India. Telephone and radio communication infrastructure has been considerably improved. China

has been practicing the rapid induction of airborne divisions into Tibet. Some Indian analysts have estimated that China is now capable of inducing – and sustaining about 25 to 30 divisions in Tibet in a single campaign season. Short range ballistic missiles (SRBMs), some of them nuclear tipped, are also known to be deployed in Tibet. Surely, all these developments are not for sustaining Tibet's fledgling economy!



SMERCH heavy multiple rocket launcher system of the Indian Army



The Indian Army has a number of missile groups equipped with the Prithvi TBM.

The continuing improvement of military infrastructure in Tibet does not augur well for future peace and stability between the two nations in light of the unresolved territorial and boundary dispute.

Trigger for Future Conflict

Of all the areas of concern that have dampened relations between the two countries, it is the long-standing territorial and boundary dispute which is the most disconcerting. The genesis of the territorial dispute is well known and not repeated here. Since well before the 1962 border war, China has remained in occupation of large areas of Indian territory. In Aksai Chin in Ladakh, China is in physical possession of approximately 38,000 square kilometres of Indian territory since the mid-1950s when China surreptitiously built its alternative route from Tibet to Sinkiang through this part of Aksai Chin. In addition, in March 1963, Pakistan incredibly ceded 5,180 sq km of Indian (J&K) territory in the Shaksgam Valley of the Northern Areas of Pakistan Occupied Kashmir (north of the Siachen Glacier and west of the Karakoram Pass) to China under a boundary agreement that India does not recognise. Through this area, China built the Karakoram highway that now provides a strategic land link between Sinkiang, Tibet and Pakistan.

In India's north-east, China continues to stake claims to about 96,000 sq km of Indian territory that includes the entire Indian state of Arunachal Pradesh even though the territory has always been part of India in contemporary history. In terms of physical area, Arunachal Pradesh is over three times the size of Taiwan. Sun Yuxi, the then Chinese Ambassador in New Delhi, had in fact publicly reiterated China's claim just before President Hu Jintao's visit in November 2006. The ambassador thus single-handedly ensured that his President received a cold shoulder in Delhi and the visit turned out to be inconsequential. Since then, Chinese interlocutors have claimed several times that the 'Tawang Tract' is part of Tibet because one of the Dalai Lamas was born there. Chinese scholars visiting New Delhi always hint that the merger of the Tawang Tract with Tibet is non-negotiable. China's often stated official position on such issues is that the reunification of Chinese territories is a 'sacred duty'. The concern exhibited by the Chinese authorities for a



The newly raised Mountain Strike Corps must have requisite airlift capability, to provide for rapid induction of forces in the frontiers with China.

former Dalai Lama is curious as they lose no opportunity to revile the living Dalai Lama!

An inherently destabilising situation stems from the omission that the Line of Actual Control (LAC) between India and China (implying *de facto* control after the 1962 war), is yet to be physically demarcated on ground and delineated on military maps. The LAC is quite different from the disputed 4,056 km long boundary between India and Tibet. The un-delineated

LAC is a major destabilising factor as patrol face-offs are not uncommon and could even result in armed clashes between patrols. Incidents such as the Nathu La border clash of 1967 and the Wang Dung standoff of 1986 can well recur. Such incidents have the potential to escalate into another border conflict similar to the war of 1962.

Even after over 16 meetings of the Joint Working Group and the Experts Group, it has not been possible for the two countries



HAL light combat helicopter (LCH) at the 'Iron Fist' fire power demonstration in 2013. The LCH will have an important role with the Mountain Strike Corps.



An IAF Mil Mi-35 demonstrates its firepower at Exercise 'Iron Fist'.

to exchange maps showing the respective versions of the LAC claimed by the two armies in the contentious Western (Ladakh-Aksai Chin) and Eastern (Arunachal Pradesh) sectors. Discussion of the varying positions can begin only after marked maps are first exchanged. The only positive development has been that maps have been exchanged for the least contentious Central Sector, that is, the Uttarakhand and Himachal Pradesh borders with Tibet where no fighting had taken place in 1962. This clearly shows how intractable the challenge is.

Early in 2005, India and China had agreed to identify “guiding principles and parameters” for a political solution to the five-decade old border dispute. Many foreign policy analysts had then hailed this as a great leap forward but some years down the line, the two countries are still stuck with the principles and a solution is nowhere in sight. In fact, even the sanctity of the principles accepted by the two sides is in doubt as China has violated the agreed principle that “settled populations will not be disturbed” while arriving at an acceptable

solution by so vociferously laying its claim to Tawang. This is not the first time that India has signed a “feel-good” agreement with the Chinese. The Border Peace and Tranquility Agreement (BPTA) signed with the Chinese in 1993 and the agreement on Confidence Building Measures in the military field signed in 1996 were expected to reduce the operational commitments of the army from having to permanently man the difficult LAC with China. However, it has not been deemed possible to withdraw a single Indian soldier from the LAC so far.

In fact, despite the 1996 agreement on CBMs, several incidents of Chinese transgressions of the LAC at Asaphi La and elsewhere in Arunachal Pradesh and in Ladakh have been periodically reported in the Indian media and discussed in the Indian Parliament. Defence Minister A K Antony stated in the Rajya Sabha in mid-May 2012 that China had violated the LAC over 500 times since January 2010. India refers to such violations as “transgressions” and not “intrusions” as intrusions have a sense of permanence about them. The PLA Border Guards have even intruded across the Sikkim border with Tibet in Area ‘Finger’ but were pushed back. This is a settled portion of the border and is



The induction of C-130Js has dramatically enhanced the IAF's airlift capabilities in utilising the ALGs.



There are plans to induct Chinook heavy lift helicopters which will bolster the operations of the Mountain Strike Corps.

marked by recognisable landmarks. While no violent incident has taken place in the recent past, there have been occasions when Indian and Chinese patrols have met face-to-face in areas like the two 'fish-tail' shaped protrusions in the north-eastern corner of Arunachal Pradesh. Such meetings have an element of tension built into them and despite the best of military discipline the possibility of an armed clash can never be ruled out. An armed clash in which there are heavy casualties can lead to a larger border incident that may not remain localised.

The PLA has been flexing its muscles through an aggressive border management policy to stake claim to disputed areas in all the three sectors – western (Ladakh), middle (Uttarakhand, Himachal Pradesh) and eastern (Sikkim, Arunachal Pradesh). Armed motorised boat patrols in the

15th round of border talks between India's National Security Advisor Shivshankar Menon and his Chinese counterpart Dai Bingguo in January 2012, will help prevent border flare-ups between the two armies".

In the Western sector, the Ladakh-Aksai Chin area, the LAC is even more ambiguous because the paucity of easily recognisable terrain features on the Aksai Chin makes it difficult to accurately co-relate the ground with map. Both sides habitually send patrols up to the point at which, in their perception, the LAC runs. These patrols leave 'tell-tale' signs behind in the form of *burjis* (piles of stones), biscuit and cigarette packets and other similar markers in a sort of primitive ritual to lay stake to territory and so assert their claim. While the government invariably advises caution, it is extremely difficult for commanders of troops to advocate a soft line

navigate up to the agreed and well-defined LAC on the ground and avoid transgressing it, even unintentionally.

In this light, the Chinese intransigence in not being willing to exchange maps showing the alignment of the LAC in the Western and the Eastern sectors is difficult to understand. In 1988, China's leader Deng Xiao Ping had told visiting Indian Prime Minister Rajiv Gandhi that "the territorial dispute is a problem left over from history and it should be left for future generations to resolve". Early resolution of the dispute is in the interest of both the countries as it will end the suspicions and hostility of the past and free both the countries to shape a more friendly future for mutual benefit. China and India must resolve the territorial and boundary dispute on the basis of historical records, geography,



Indian Army ZSU-23 twin barrel air defence gun in vicinity of the Siachen glacier.

strategically-located Trig Heights and Pangong Tso Lake in eastern Ladakh have also been intensified by the PLA since 2009. Chinese troops damaged a 200-feet long stonewall in Yangtse area of Tawang in Arunachal Pradesh in 2011, which was subsequently re-built by India after lodging a strong protest with China. India hopes "that the new bilateral boundary coordination mechanism, which became operational after being inked during the

to their subordinates. There is an inherent contradiction in sending armed soldiers to patrol what they are told, and believe are, Indian areas and then giving them orders that they must not under any circumstances fire on "intruding" Chinese soldiers. This is the reason why it is operationally critical to demarcate the LAC on the ground and on the map. Once that is done, the inadequacy of recognisable terrain features can be overcome by exploiting GPS technology to accurately

security parameters and interests of the people who live in the area. Meanwhile, it is in the interest of both the countries that peace and tranquillity should continue to prevail on the border.

Previous agreements on resolution of the territorial dispute and those designed to build confidence include the *Agreement on Maintaining Peace and Tranquillity Along the Line of Actual Control* in the India-China Border Areas, 7 September 1993;

the *Agreement on Confidence Building Measures* (CBMs) in the Military Field Along the Line of Actual Control in the India-China Border Areas, 29 November 1996; the *Agreement on Political Parameters and Guiding Principles for the Settlement of the India-China Boundary Question*, 11 April 2005; the *Protocol on Modalities for the Implementation of Confidence Building Measures in the Military Field Along the Line of Actual Control in India-China Border Areas*, 11 April, 2005; and, the *Agreement on Establishment of a Working Mechanism for Consultation and Coordination on India-China Border Affairs*, 17 January 2012. The *Border Defence Cooperation Agreement* (BDCA), the latest in the series, was signed during Prime Minister Manmohan Singh's visit to Beijing in October 2013.

The BDCA commits the two sides to "periodic meetings" of military and civilian officers and to exchange information – including information about military exercises, aircraft movements, demolition operations and unmarked mines. It emphasises the avoidance of border patrols "tailing" each other and recommends that the two sides "may consider" establishing a hot-line between military headquarters in both countries. However, this agreement too substantially falls short of removing the anomalies and impracticalities of the previous agreements that have not worked well as it does not address the root cause of the ongoing tensions, that is, the non-delineation of the LAC.

Raising the Mountain Strike Corps

As long as the territorial and boundary dispute with China remains unresolved, though the probability of conflict is low, its possibility cannot be ruled out and India must prepare for such a conflict. With its present military capabilities and defensive strategy, India is well poised to defend its territory against Chinese aggression. However, that is not adequate to deter aggression. India must upgrade its military strategy against China from *dissuasion* to *deterrence*. Only having a capability to take the war into Chinese territory will deter the adversary from initiating another border war. Such a capability is essentially provided by strike formations of the army combined with the ability of the Indian Air Force to dominate the skies over Tibet to give army commanders the freedom to inflict punitive damage. The Indian Army needs at least two Mountain Strike Corps to take the war into

Chinese territory – one each for Ladakh and Arunachal Pradesh.

On 17 July 2013, the Cabinet Committee on Security (CCS) finally approved the army's proposal for raising such Strike Corps for the mountains. Though the approval came after considerable delay, it is a pragmatic move that will send an appropriate message across the Himalayas. It will help India to upgrade its military strategy against China from dissuasion to genuine deterrence as the Mountain Strike Corps, in conjunction with the Indian Air

equip over a period of five to seven years. Approximately 90,000 new personnel will be added to the army's manpower strength, including those in ancillary support and logistics units. The army has already raised the 56 and 71 Mountain Divisions and deployed them in Arunachal Pradesh to fill existing gaps in the defences. Some elements of these Divisions will act as readily available reserves for the new Strike Corps to add weight along the axis of attack and exploit success. These Divisions will also be employed to secure launch pads for offensive operations across the Himalayas. Hence, these must be seen as playing a significant supporting role for the Mountain Strike Corps.

As the territorial dispute with Pakistan over Jammu & Kashmir is also in mountainous terrain, there is very high probability that the next conventional conflict India will again break out in the mountains. Since the war will be fought under a nuclear overhang, particularly with Pakistan, there is a fair possibility that it will remain confined to the mountains so that it does not escalate out of control to nuclear exchanges. Hence, it was time for India to pivot to the mountains in its quest for building military capacities and it is creditable that the government has given the go ahead to raise this new Mountain Strike Corps.

In any future war that the armed forces are called upon to fight in the mountains, gaining, occupying and holding territory and evicting the enemy from occupied Indian territory will continue to remain as important military aims. While these will be infantry predominant operations, no war plan will succeed without achieving massive asymmetries in the application of firepower to destroy the enemy's combat potential and infrastructure. Therefore, Army-IAF operational plans must be fully integrated, must be jointly evolved, meticulously coordinated and flexible enough to be fine-tuned to exploit fleeting opportunities and to take advantage of the enemy's reactions during execution. This is especially so in the mountains where the military aims and objectives are inherently limited in scope because of the terrain. Both the Services must work together to create the capabilities that are necessary to take the battle well into enemy territory during any next war in the mountains.

As artillery batteries and regiments cannot be moved and re-deployed easily,



Force, will provide the capability to launch offensive operations across the Himalayas so as to take any future war into Chinese territory.

First of the new Mountain Strike Corps (XVII) will comprise two infantry divisions and will be supported by three independent armoured brigades, three artillery brigades to provide potent firepower, an engineer and air defence brigade each, an aviation brigade and units providing logistics services. The Corps will cost Rs 64,000 crore to raise and

operations in the mountains place a premium on battlefield air support. Operational mastery over air-to-ground strikes can influence the outcome of tactical battles in the mountains extremely favourably. Firepower ratios can be enhanced to levels necessary for achieving overwhelming superiority only through major upgradation in the availability of artillery guns, rocket launchers and missiles and offensive air support. A contract for the acquisition of 144 howitzers of 155 mm calibre has been hanging fire for long and needs to be expedited. The new artillery units that will be raised must be equipped with short-range ballistic missiles (SRBMs) that can engage targets deep inside Tibet from deployment areas in the plains. Precision-guided munitions (PGMs) need to be acquired in large numbers both by the artillery and the IAF to accurately destroy important targets such as communications centres. The government must also hasten the acquisition of intelligence, surveillance and reconnaissance equipment.

The peculiarities of terrain and the lack of sufficient road communications, particularly lateral roads that connect the road axes leading to the border, will place heavier demands on helicopter lift for the movement of reserves within divisional and brigade sectors. At the operational level, only an 'air assault' formation can turn the tide through vertical envelopment and enable deep offensive operations to be carried out when employed in conjunction with Special Forces. An air assault brigade group inducted across the LoC or LAC by helicopters after the IAF has achieved a favourable air situation can seize an objective in depth. Ideally, each of the Infantry Divisions of the strike Corps must have an integral air assault brigade to provide the requisite airlift support. Air-mobile operations can also play a major role in influencing the course of the war. During Operation *Parakram* in 2001-02, an almost complete Brigade Group was airlifted to Kashmir Valley to enhance the reserves available in XV Corps for offensive operations. In addition to attack helicopters, which will provide sustained firepower support, a large number of utility helicopters will be required to support offensive operations across the Himalayas, comprising both medium- and heavy-lift helicopters.

The successful launching of operations by the Mountain Strike Corps will of

course depend on the availability of good infrastructure, including double-lane roads with all-weather capability and suitably placed logistics nodes. Unfortunately Indian plans to upgrade the infrastructure in the frontiers bordering China have not been progressing at an adequate pace. In fact, there have been inordinate delays also because of the lack of environmental clearances and other non-military reasons. Simultaneous to the raising of the new Strike Corps being equipped and trained, the government must make vigorous efforts to speed up completion of these infrastructural projects, otherwise, the army will have a new Strike Corps but not able to launch and sustain it effectively.

In summary, it is of concern that the military gap between India and China is growing steadily, with the PLA modernising at a rapid pace thanks to the double-digit

resolution of the dispute till they are in a much stronger position in terms of comprehensive national strength and then dictate terms. The rapidly blossoming strategic partnership between China and Pakistan is also a major cause for concern. During any future conflict with either China or Pakistan – even though the probability is low – India may have to contend with a two-front situation as each is likely to collude militarily with the other, a situation for which the Indian armed forces are not prepared. It is in India's interest to strive for an early resolution of the territorial dispute with China so that India has only one major military front to contend with.

But overall, as two large countries with a shared border and a long history of peaceful co-existence, the governments of China and India have a responsibility to discharge towards their own people and



Indian and Chinese Army officers at the border in Arunachal Pradesh

annual growth in the Chinese defence budget while India's military modernisation plans continue to remain mired in incredible red tape. Chinese armed forces have surged ahead of India's in many areas of defence modernisation and the gap is slowly becoming unbridgeable. China's defence budget with growing annually between 16 and 18 per cent. In a decade or two, China may were attempt to force a military solution to the territorial dispute with India, perhaps after "settling" the Taiwan issue and India forced to accept an unequal settlement because of its military weakness.

China's negotiating strategy on the territorial dispute is to seemingly stall

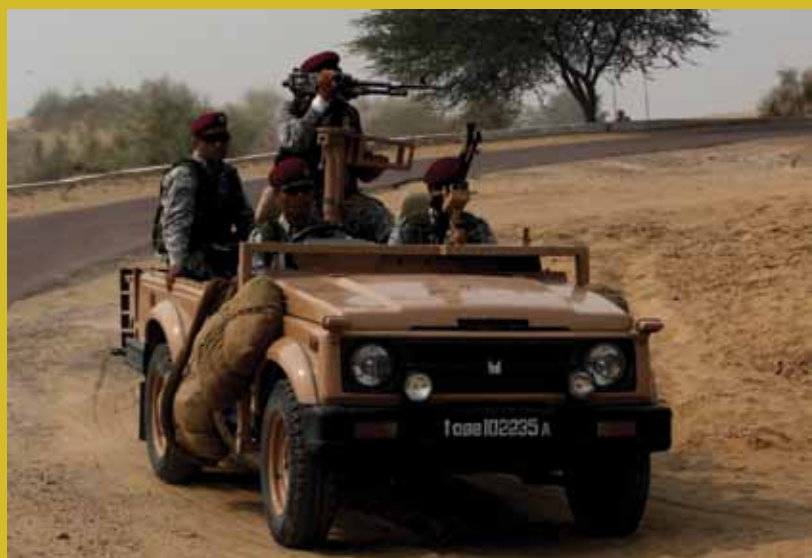
the people of Asia: both can and must work together in the interest of peace, stability and the future prosperity of Asia. Healthy competition for markets can have positive spin offs as long as it is conducted in a spirit of cooperative security. China must not hold resolution of the territorial dispute hostage to its successful integration of Tibet with the national mainstream. Once the long-standing territorial dispute is resolved, there is no reason why the dragon and the elephant cannot dance together.

(The author is a Delhi-based strategic analyst and was earlier the Director, CLAWS)

Joint Indo – Russian Ex INDRA-2013



Exercise INDRA 2013 took place in late 2013 at Mahajan Field Firing Ranges, in South Western Command, with an impressive opening ceremony that saw the unfurling of the National Flags of both Countries to the strains of “Jana Gana Mana ...” and “Russia Sviashennaiia Nasha Derzhava ...” Indian and Russian soldiers stood side by side, with their tanks and infantry combat vehicles in the background and gave a ceremonial salute. Brigadier VM Chandran welcomed the Russian soldiers, and in his inaugural remarks highlighted the “historic legacy of shared beliefs, related to democracy, freedom, equality and justice that were precious to both Nations, as also the progressive defence cooperation and mutual understanding between both the Armed Forces.”



A Combat Group strength of Russian Army personnel and an equal complement of Indian soldiers from South Western Command took part in the two week long event, that witnessed integration of their tactical and technical skills in a UN peace enforcement scenario involving mechanised forces. State of the art equipment for surveillance and target acquisition specialist weapons for close quarter battle, explosive and IED detectors, as well as the latest communications equipment was fielded for the Exercise.



Both sides jointly planned and executed a series of well integrated tactical drills for neutralisation of visualised threats that may be encountered in UN peace keeping operations.



Images of the Joint Indo-Russian Exercise in India's



South-Western Command during October 2013

Army Aviation in Future Battle Space

VAYU

Interview with

Lt Gen PR Kumar,
Director General Army Aviation



The Army is increasingly looking to aviation as a tactical support asset and mobility enhancer



Lt. Gen. PR Kumar

VAYU : Could you please enumerate on salient features of the AAC's plan formulated for 2027-2030. What will be the operational shape and size of the Corps by 2030 ?

DGAA : The pace of Army Aviation modernisation has been synchronised with overall growth of the Army. Substantial progress has been made over the past 27 years, wherein Army Aviation has grown from the erstwhile Reconnaissance and Observation roles utilising the Chetak and Cheetah helicopters. The Long Term Perspective Planning (LTPP) of the AAC has been envisaged to make the Arm a matching component of the Combined Arms Team to operate in full spectrum of operations. In addition to the Reconnaissance and Observation capability, the Arm will also have capability of providing attack and

lift capability in the battlefield. The Arm is structured to provide each of these capabilities as an integral component at the operational level in each Corps.

VAYU : It has been stated by an analyst that "the present force structure of the Army Aviation Corps inhibits it from being able to perform the roles envisaged". What are the essential roles envisaged by the Corps and what measures are afoot to achieve capability to perform them ?

DGAA : Within the overall operational context of the Indian Army, Army Aviation has been entrusted with Combat, Combat Support and Combat Services Support roles that would effectively integrate the aviation resources in the combined arms team. It will combine speed, mobility, and firepower in the attack and assault forces,

while moving and sustaining combat power at decisive points on the battlefield with its cargo/utility helicopters. It is self-evident that Army Aviation needs platforms for reconnaissance and surveillance, utility/lift platform for mobility of ground forces in Tactical Battle Area and attack assets for fire support and direct attack roles in support of ground forces. The LTPP 2027 has harmonised requirements of Army Aviation to execute these roles.

VAYU : With its genesis in 1986, the AAC has already celebrated its Silver Jubilee and is proud of an enviable record of performance, not only in battle but also in relief and rescue operations from time to time. Yet, it has been pointed out, its surge towards becoming a full-fledged air arm of the Army is being thwarted

HAL



Indian Army Aviation faces unique challenges, such as the constraints of high altitude operations

by “certain factors”. What are these stumbling blocks, if any, and what is the strategy to overcome them ?

DGAA : The future battle space envisages integrated employment of all arms, based on combined arms concept, in order to develop an optimal combat power. The field force commander will be required to ‘Look Deep’ and ‘Strike Deep’ by harmonising all the combat resources at his disposal in the Tactical Battle Area (TBA). This will place a high premium on Effect Based Operations (EBO) which calls for massing of effects (fires) and forces (manoeuvre) at decisive points through the depth and

extent of the Tactical Battle Area. Army Aviation primarily operates in the ‘ground regime’ as part of the combined arms team of the ground forces. Its missions, operational concepts and tactics are all terrain-independent and closely follow the operational considerations of the ground forces. Look at it this way : Army Aviation ‘attack’ assets (including Attack Helicopters, Rudra and Light Combat Helicopters) contributes to fire support together with Artillery, tanks and Infantry weapons; its ‘tactical and logistics lift’ assets are superior to a High Mobile Vehicle and faster, being terrain-independent, and its reconnaissance

and surveillance assets provide an elevated vantage point to commanders to look on ‘the other side of the hill’. It may be understood that all Army Aviation assets are primarily directed towards and meant for ground operations by using medium of the air. A perceptive assimilation of this concept has been acknowledged by all stake-holders. With vesting of ownership of attack helicopters to the Indian Army, this indisputable basic requirement of the Army has been resolved.

VAYU : Is development of the Army Aviation Corps from its present status being modelled on its counterparts in ‘developed countries’, or is it driven by indigenous considerations and philosophy ?

DGAA : India as an emerging regional power needs matching military capability to meet all challenges through the entire spectrum of conflict. Army Aviation is an ideal terrain-independent manoeuvre arm which will be a major force multiplier both in war and peace. Development of a long term growth plan is always a comprehensive, all inclusive exercise which assimilates the trends worldwide to find a pragmatic solution to own specific requirements. Towards that end, it is imperative to analyse strategic and operational concepts, operational methodologies and equipment



HAL-built Lancer and Dhruv helicopters on exercise

Eurocopter



Army Aviation has benefited greatly from indigenous programmes such as the HAL Dhruv ALH

philosophy not only of advanced armies in their unique operational context, but also analyse threats posed by assets held by our likely adversaries. This is then followed by own threat perception and operational doctrine to arrive at a suitable development model. Hence, the Army Aviation development plan is a balanced mix of all these practical considerations.

VAYU : Kindly review the AAC's overall plans to acquire new assets ? The Government's stress being on seeking indigenous sources for equipment, will HAL be able to meet most of the requirements and undertake manufacture through transfer-of-technology (TOT) route in case of equipment not being manufactured by it at present ?



Lt Gen PR Kumar, DG Army Aviation



Increased mobility and air assault operations will be a tremendous asset to future Army operations

DGAA : As brought out earlier, Army Aviation has developed a very pragmatic and balanced growth plan which will be implemented by a judicious mix of indigenous and Transfer of Technology (TOT)/ MTOT routes. In today's era of highly integrated global industrial landscape, the boundaries between indigenous and foreign equipment are blurring to the vanishing point. Government stress on indigenous sources of equipment is a right step which in the long run will give flexibility to upgrade and modify the equipment based on operational requirements. Presently, most of the AAC equipment is being sourced from HAL. At the same time, the Army also plans to acquire some helicopters through global procurement with TOT/MTOT likely being entrusted with HAL or any other suitable aviation industry. Encouragement of Public- Private partnership is a stated policy.

VAYU : The first HAL-Rudra Squadron has recently been raised for eventual deployment in the battlefield. Are there plans to raise more Rudra Squadrons ?

DGAA : The first 'Rudra' squadron has commenced raising. It is a landmark event which will bring in 'offensive capability' in Army Aviation to effectively integrate within the combined arms team. This is also a harbinger of significant enhancement in the operational bandwidth of the Army Aviation Corps. The Army plans to raise a number of more such units to meet operational requirements as enshrined in the LTPP 2027.

VAYU : Although Unmanned Aerial Vehicles (UAVs) are presently placed under command of Artillery units, is it not more practical to have these operated by the AAC in keeping with its exclusive responsibility to manage the 'air' rather than the 'ground' aspect of Army operations? If so, what steps are being taken in this direction ?

DGAA : UAV as an aerial platform is more organic to Army Aviation than to any other Arm. However, the prime task presently being undertaken by the UAVs is surveillance, which is one of the primary roles of Artillery. Therefore, there is a case to place this equipment either with Artillery or Army Aviation, as per the perception of various armed forces in the world . While some have placed UAVs under Army Aviation, in India, these are placed under the Artillery. However, Air



Transport of materiel and personnel is a vital role for Indian Army Aviation



Ageing HAL Cheetah helicopters have been due for replacement for over a decade



HAL Krishak AOP aircraft, operated by No. 12 AOP Flight under the redoubtable Atma Singh, were prominent in the epic Laungewala Battle of December 1971.

Air Force played their roles effectively. This battle holds an important lesson for our military leaders to carefully delineate the roles/missions based on requirement of 'Integrated' and 'Integral' capabilities to be provided at various levels. At operational strategic level, we need joint operations by integrated forces consisting of elements of all three Services. While at the tactical level within TBA, we need integral assets under command of TBA Commander to significantly increase responsiveness in a highly mobile and fast-paced battlefield. As is evident from the success at 'Laungewala', it is Army pilots who are completely well-versed with infantry/armoured tactics and have excellent knowledge of the terrain, and could effectively direct Indian Air Force fighters to decimate enemy tank forces.

Space Management of all aerial assets in the Tactical Battle Area up to 100m has been entrusted to Army Aviation.

VAYU: In the 1971 Indo-Pak war, an Army Observation Post Flight flying Krishaks commendably directed IAF Hunters in the Laungewala area for attack on and decimation of Pakistani armour. What are the lessons in this epic battle for the future ?

DGAA: The epic battle at Longewala which decimated a Pak Armoured formation was a copy-book exponent of jointmanship and a prominent example of combined air land battle in which both Infantry and Army Aviation of Indian Army and Indian



The Army is receiving a boost to its combat aviation capability with acquisition of HAL Rudra gunships (photo: Angad Singh)



Helicopters remain one of the most crucial assets in demanding high altitude environs



Lt Gen PR Kumar, DG Army Aviation is also Colonel Commandant of the Regiment of Artillery



The Indian Army is going to be one of the largest operators of the HAL Dhruv and its variants

VAYU: Considering that Army Aviation is basically officer-centric, it has been learnt that owing to limited promotional prospects there is minimal incentive to volunteer for joining Army Aviation. How do you ensure that the career prospects and promotion to higher ranks of aviators are commensurate with those of officers serving in other arms?

DGAA : Army Aviation is a relatively younger arm which is officer heavy by virtue of its operational requirement. It is also a relatively smaller arm in terms of units/formations. The emotional and aspirational needs of the officers are well understood and are being adequately addressed.

The DG Army Aviation : Lt Gen PR Kumar VSM

Lt Gen PR Kumar, VSM is an alumni of the National Defence Academy, Khadakwasla, and was commissioned into the Regiment of Artillery on 15 December 1976, and during his long and illustrious career, has held a variety of sterling and balanced portfolio of Command, Staff and Instructional assignments. After early years of regimental service, he attended the Air OP, LGSC courses and graduated from the DSSC Wellington, as also attended the High Command and NDC courses. He has been awarded the M Phil (Defence and Strategic Studies) degree from the Devi Ahilya Vishwavidyalaya Indore and Madras University.

Lt Gen PR Kumar is an aviator and has commanded the 316 Medium Regiment in the western sector, 80th Infantry Brigade on the LoC, 23rd Infantry Division and then the vital Strike Corps in the South Western sector, 'Strike One'. The General thereafter took over the Army Aviation Directorate, and is the Colonel Commandant Regiment of Artillery and Colonel Commandant Army Aviation.

Apart from an extremely successful Army career, Lt Gen PR Kumar is also a keen sportsman with a current focus on golf.



Self AD

Maritime Security of India

Future Challenges*

Admiral (Retd.) Arun Prakash on crafting a maritime security policy



This seems to be a most appropriate time to be discussing nautical issues, and there could not be a topic more pertinent than maritime security, which term connotes different things to different navies. While some perceive maritime security in a narrow sense as measures for force-protection and defence against sabotage, others include actions to combat terrorism and illegal activities like piracy and trafficking; still others expand it to embrace the protection of territorial waters and sea lanes. Adopting an inclusive approach, we in India define maritime security as comprising a collection of all the issues that pertain to

the seas, and have a bearing on national security. These include, inter-alia, seaborne trade and infrastructure for its pursuit, management of sea resources, environmental issues and employment of naval forces.

However, for those whose mental picture of 'maritime security' evokes images of warships and submarines, a lot has happened in the recent past to draw comfort from. The nuclear reactor of India's first ballistic missile submarine (SSBN) went critical on 9 August 2013 in Vishakhapatnam, to be followed, three days later, by the launch of the indigenous aircraft-carrier in Kochi. Earlier, in 2012, a

Russian nuclear-powered attack submarine had been inducted on a 10-year lease. Over the next decade, the Indian Navy expects delivery of seven stealth frigates, six diesel submarines, and 30 other warships, apart from over 150 fighters, maritime-patrol aircraft and helicopters. And our brand-new aircraft-carrier INS *Vikramaditya* has just arrived from Russia.

All these acquisitions will cost the exchequer in the region of about US\$ 25-30 billion, and we must note two important aspects in this context. Firstly, there are not many navies, world-wide, which have seen, in recent years, or are likely to see, in the midst of

a global economic downturn, such significant accretions to their order-of-battle. Secondly, this force build-up, once complete, will not only enhance the Navy's combat capability by an order of magnitude, but would also alter the balance of power in the Indo-Pacific region, provided necessary strategic guidance is forthcoming from government.

The question that begs an answer, then, is: if such a happy prospect prevails at sea, why do we need to discuss maritime security in this forum?

Ambit of Maritime Security

One reason, as I just mentioned, is the ambivalence about what constitutes maritime security. The other is that maritime security has many dimensions, of which some, like force-structures, capabilities, threats and strategies, find frequent mention. In this discussion I intend to give priority to some lesser known and neglected aspects of our maritime-matrix, which require attention, and then I will address the threats and challenges at sea.

must be viewed in a holistic manner. Therefore, many shortcomings in the civilian maritime domain which have an adverse impact on maritime security need to be set right.

Lastly, we need to peer at the crystal ball and see how well prepared we are for future maritime security challenges.

Let us, first, take a look at history, in order to recall the roots and provenance of India's maritime growth and to trace the decline of its maritime power. Otherwise, we are in danger of invoking George Santayana's curse that those 'who forget history are condemned to re-live the past'.

The Roots of India's Maritime Growth

Although India's ancient maritime tradition pre-dates Greek, Roman and Carthaginian exploits in the Mediterranean, not enough is known about it, because we had neither a Herodotus nor Thucydides to record history and our past suffers from a lack of documentation. For this reason, we

system of monsoon winds, it was the Indian Ocean region, and not the Mediterranean or Aegean Seas, which saw the world's first oceanic sailing activity. Arguing that ancient Hindus possessed the skills to construct sturdy ocean-going ships and knew the use of a magnetic compass for accurate navigation, he clinches his extensive arguments by stating that: "*Millenniums before Columbus sailed the Atlantic and Magellan crossed the Pacific, the Indian Ocean had become a thoroughfare of commercial and cultural traffic.*"

Panikkar paints a fascinating picture of India's maritime past as he describes the activities that took place in the 4th century BC Mauryan Empire. He provides evidence that the waters of the Bay of Bengal witnessed a continuum of commercial colonisation as well as cultural and religious osmosis by sea from India's east coast ports to south-east Asia. The existence of ancient Hindu kingdoms right across SE Asia, then known as *Suvarnabhumi*, is still vividly evident in the

Firstly, maritime security lies in the mind, and needs to be dealt with on a cognitive plane. For centuries we have remained ignorant about our ancient maritime tradition and its subsequent decline. When queried, we do not assert India's right to revive this hoary maritime tradition.

Secondly, while rejoicing over the Indian Navy's growth we need to remind ourselves of its basic purpose or *raison d'être* and the fact that sustenance of a powerful and expensive navy requires the support of a sound industrial base.

Thirdly, it is necessary for our decision-makers to appreciate that maritime security

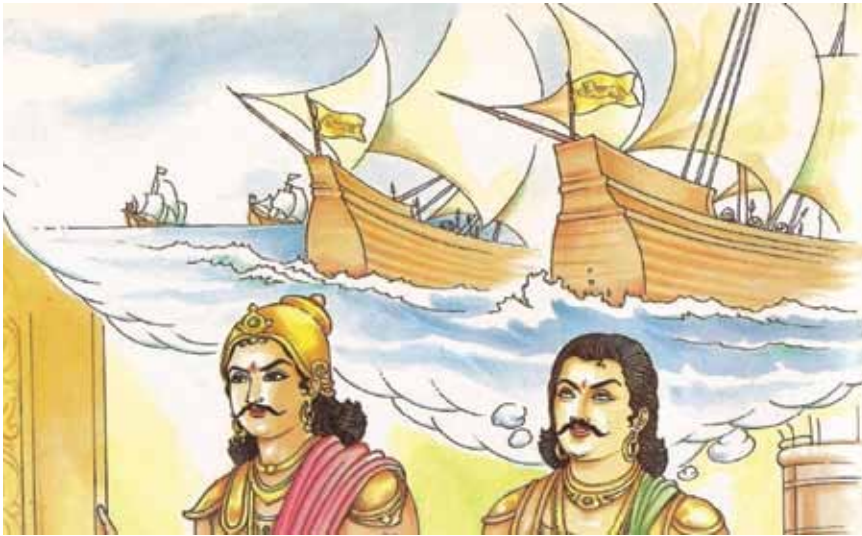
have had to accept accounts, authored by Western historians, which rarely make mention of the seafaring skills of the ancient Arabs, the Chinese, or Indians. And yet, tangible evidence of India's widespread cultural, religious and linguistic imprint – dating back 2-3 millennia – is available. It is found, not just around the Indian Ocean rim, but extending, from the Mediterranean to the Pacific.

A lone Indian voice in this historiographic void is that of Sardar KM Panikkar, statesman, diplomat and visionary. According to Panikkar, because of its earlier civilisation and its predictable

architecture, culture and religious beliefs of this region.

Panikkar also reminds us that this cultural empire could not have been sustained without the endeavours of skillful and courageous Indian seafarers who braved the turbulent Bay of Bengal for generations. Significantly, Panikkar debunks the thesis that overseas travel for Hindus had been banned by a Brahmanical fiat saying that the 'ban' perhaps applied only to people in north India.

How did, then, the maritime decline of India come about?

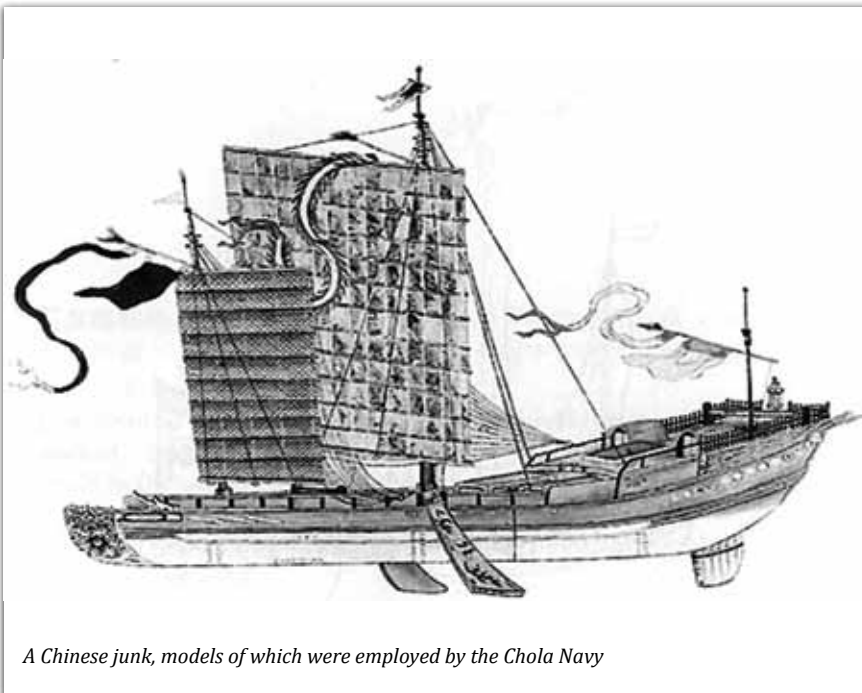


Ancient Indian naval power reached its zenith under the Sri Vijaya and Chola Empires

The Decline of India's Maritime Power

From the 5th century AD, command of the eastern waters and Malacca Straits passed into the hands of a great Indian maritime power, known as the Sri Vijaya Empire, based in Sumatra. The Sri Vijaya kings retained mastery over the surrounding waters through a powerful navy, and controlled all shipping traffic. In the year 1007 AD, the Indian Emperor Rajendra of the South Indian Chola dynasty fitted out a powerful fleet and challenged the Sri Vijayas. The ensuing 100-year war

“While to other countries the Indian Ocean is only one of the oceanic areas, to India it is the vital sea. Her future is dependent on the freedom of its waters.”



A Chinese junk, models of which were employed by the Chola Navy

weakened both empires and heralded the serious decline of Hindu sea power.

During the 12th and 13th centuries, as Central Asian hordes poured down our mountain passes to conquer the rich Gangetic plain, India's maritime power gradually withered, and oceanic trade passed into the hands of the Arabs. In May 1498, when the Portuguese adventurer Vasco da Gama arrived off Calicut, the Sultanate of Delhi was ruled by the Afghan Lodhi Dynasty, while Southern India was divided between the Bahamini and Vijayanagaram kingdoms. None of them were blessed with a maritime vision, much less a navy and India's maritime prowess went into rapid decline.

Panikkar, however, reminds us that there were brave and resolute sea captains who led indigenous naval forces, and put up determined resistance against seaborne interlopers. While nautical heroes like Kunjali Marakkar and Kanhoji Angre constitute bright spots in an otherwise bleak maritime scenario, they commanded coastal forces which could never match the oceanic supremacy of the Europeans.

Fifteenth century Europe had seen many advances in the areas of shipbuilding and ocean navigation as well as metallurgy and cannon founding. We must note that it was this technological edge, which enabled European merchant-adventurers to undertake long-distance voyages into uncharted oceans, and to overwhelm natives of eastern lands. The toe-holds they gained, in the form of trading posts, eventually metamorphosed into full blown Empires.

Panikkar consistently emphasises that India's fate has been determined not on land frontiers, but on the oceanic Expanse that washes its three sides. He declares that India will be in peril if the Indian Ocean ever ceases to be a 'protected sea.' Lamenting our inherited sea-blindness, Panikkar sounded a clear warning in 1945: *“While to other countries, the Indian Ocean is only one of the oceanic areas, to India it is the vital sea. Her future is dependent on the freedom of its waters.”*

Having established India's historical maritime credentials and the criticality of our maritime security to national survival, let me change tack from Panikkar to Mahan and seek the latter's wisdom regarding the purpose of sea power.

Elbit



The Purpose of Sea Power

American strategist Admiral Mahan, writing in 1902, says: *“War has ceased to be the natural, or even normal, condition of nations, and military considerations are subordinate to the other great interests they serve : economics and commerce.”* He insists that since the true path to national prosperity and greatness lies in peacetime trade, ensuring access to sources of economic well-being, i.e. foreign trade, commerce and natural resources are of paramount importance; sea power being only a means to this end. A hundred years after he made this pronouncement, we, in India, need to pay heed to Mahan’s words.

In our own context, the dramatic growth of India’s economy has been stimulated by the powerful phenomenon of globalisation leading not just to large foreign direct investment in India, but also heavy Indian investment abroad. Thus, along with an Indian diaspora of over 20 million, we also have growing economic interests world-wide. India’s economy as well as progress and prosperity depend on international trade, which is carried overwhelmingly by sea, as is energy, the lifeblood of our industry. These factors, coupled with the prospects of harvesting oceanic resources and India’s growing international profile, have helped awaken an overdue realisation of our dependence on the seas.

A fortuitous sequence of events has also alleviated the inherited continental-mindset of India’s decision-makers, which engendered the so-called ‘sea-blindness’ syndrome. Over the past decade and a half, the trauma of rampant piracy, the 26/11 exposure of India’s soft coastal-underbelly, its ‘Look East’ initiative and the looming menace of China’s Navy have stimulated a sharper focus on maritime security.

The fact is that India is a maritime nation, not just by historical tradition but

also because its geophysical configuration and geo-political circumstances makes it as dependent on the seas as any island nation. Let us remember that with 11 maritime states and island territories India probably has more seafaring people than the population of most European countries. When we say that a ‘maritime awakening’, has recently occurred in India, we must remember that it is largely confined to the national-security elite. It has not affected most decision-makers in other sectors of the government, as well as much of the populace.

We need to be quite clear that contrary to popular perception, a country’s maritime strength does not exclusively reside, in its navy, which is merely one of a number of components that complement each other in contributing to maritime security. In fact, by creating an expensive navy and neglecting the other constituents of maritime power we are indulging in self-delusion. There is an urgent need to focus on the other aspects, many of them belonging to the civil sector, that are needed to make India a complete maritime nation.

Before I explore the linkages of the civilian maritime sector with maritime security, let me touch upon the kind of support that our navy seeks, but rarely receives from national industry.

The Missing Industrial Underpinning

It is a quirk of fate that India has become a significant military and economic entity, with great-power aspirations, before it has become a significant industrial power or even a major trading nation. Thus India finds itself in an anomalous situation wherein it possess nuclear weapons and boasts of the world’s 5th or 6th largest armed forces, but is forced to support their

DCNS



Hoisting of the Indian Naval Ensign on the stern of INS Vikramaditya

operational requirements through massive imports. There is inadequate realisation of two facts : one, that every piece of hardware that the Indian armed forces acquire from abroad places them at the mercy of the seller nation for the lifetime of the equipment, and two, that if our peacetime arsenals remain half-empty –whatever the reason – how will we ever fight a war?

The nonchalance with which we continue to import huge quantities of defence hardware not only undermines our security but renders all talk of ‘strategic autonomy’ quite meaningless. India is fortunate in having a vast defence technology and industrial base (DTIB) which could be the envy of developed nations. This base comprises thousands of talented scientists working in a network of sophisticated DRDO laboratories backed by the advanced production facilities of the ordnance factories and defence production units. And yet, India’s DTIB has rendered our armed forces hollow by failing to deliver, for six decades, capabilities they direly need. A willing and capable private sector has continuously been kept out of defence production while many PSUs have hoodwinked the nation with spurious claims of ‘transfer of technology’ and ‘indigenisation.’



The great Indian Peninsula with various seaports

Atlas Elektronica



In a related context, it is preposterous and irrational that while the MoD has no qualms about importing billions worth of weapons from abroad, it should strongly resist any suggestion about private Indian companies entering the defence sector. This single measure has deprived the navy of the support that a capable private sector industrial base could have provided, in peace and in war. Consequently, the navy's operational readiness remains hostage, on one hand to the inefficient and complacent public sector, and on the other, to unreliable foreign suppliers.

If all these shortcomings are worrisome, of equal concern is the continuing inability

or unwillingness of the political leadership to address them in a meaningful way. But let us now turn to the civilian aspects of the maritime domain.

The Civil Maritime Domain

Considering that 97% of our trade is carried by sea, the civil maritime sector, defined by the Ministry of Surface Transport as encompassing port operations, the merchant fleet, the shipbuilding industry and trained human resources, is a vital component of maritime security. Interestingly Admiral Mahan, while stipulating the conditions vital to the maritime power of a nation, also included 'character of the government and

its institutions'. In our case, this lacuna is sadly apparent in the neglect shown by the Government of India towards the maritime sector since independence.

Today there is no single government agency which has either the span of responsibility or the authority to act as the focal point for India's maritime policies and interests. As many as sixteen different ministries, departments or organisations (including the Indian Navy and the Coast Guard) are involved in ocean-related matters and most of the time there is complete lack of coordination between the different organs of the government. Moreover, generalist bureaucrats have been placed in positions which require specialist maritime knowledge and expertise. This has resulted in a lack of direction and even confusion in certain areas like coastal and port security, traffic management, pollution control, fisheries regulation and anti-piracy measures.

Organisations like the Directorate General of Shipping and respective Port Trusts which are mandated to exercise regulation and control in all such matters, have neither the means nor the inclination to act. On the other hand, timely help and advice is never sought from professional maritime organisations like the Coast Guard and Navy, which possess adequate means and ability.

We have just observed the 5th anniversary of the 26/11 terror attack on Mumbai, but



Selex

even the trauma and humiliation of this tragic event was insufficient to shake the government out of its apathy to undertake formulation of a maritime security policy or constitute an advisory body for maritime security. All that happened was some re-allocation of duties between the navy and the coast guard, which has further confounded an already confused coastal security scenario while state police forces remain most reluctant to have anything to do with the seaward patrolling.

All this is not to say that the government is oblivious of the huge potential of the maritime sector and its shortcomings. Proof

either directly or indirectly, on maritime security I will touch upon them briefly.

Ports and Harbours

The navy is a regular user of all major ports, and resident in many of them. Naval operations are profoundly affected by the functioning of these ports, and the navy is often asked for assistance in times of crisis. In wartime the navy will need to guard them and ensure their efficient functioning – often in the face of enemy action.

To a mariner, India's 13 major and 176 minor ports present a distressing prospect. Badly congested, poorly managed

planning and investment would be needed to bring Indian ports to anywhere near international standards. Moreover, unless hinterland connectivity in terms of efficient railroad and fast highway connections are available, investment in ports may be rendered infructuous.

Shipping Industry

A nation's merchant fleet is yet another strategic asset, and now crude-oil and natural-gas carriers and container ships are almost as important as warships in the security matrix. During war, a key objective of the belligerents will be to



India's merchant fleet is the 15th largest in the world, yet woefully inadequate for the needs of the nation

of this lies in the fact that three successive Ministers of Shipping and Transport have, in a period of just seven years, issued three 'maritime perspective plans'; the latest being 'Maritime Agenda 2020', issued in 2010. The common thread that runs through all these plans is their grandiose concept and unrealistic targets, without any mention of a roadmap, a time schedule or a monitoring mechanism. Obviously they have been drawn up to impress the public.

Three major aspects of the civil maritime sector addressed by these perspective plans are ports, the shipping industry and shipbuilding. Since all of them impinge

and lacking in facilities for dredging, mechanisation and storage, they are grossly inadequate to meet the cargo-throughput requirements of our growing economy. Indian ports stand out in stark contrast when compared with the efficient cargo handling and quick turn-around times available all over the Asia-Pacific, including China and even neighbouring Sri Lanka.

The new Maritime Agenda, ambitiously, aims to quadruple cargo throughput by 2020, but most Indian ports are already operating at close to 100% capacity and any enhancement will require massive expansion programmes. Considerable

deprive the opponent's industry of vital raw materials and fuel, and to starve his civilian population by attacking merchant shipping. Ideally, therefore, the country should own and control as much of its shipping as possible so that it can ensure adequate reserves. It would interest readers to know that in order to meet India's daily need of 3.1 million barrels of oil, at least two VLCCs (very large crude-carriers) must unload at the Vadinar terminal in Gujarat every single day of the year.

India's merchant fleet, 15th largest in the world, has been almost static, for some years, at 1000 ships totalling 10 million



India is looking to accelerate its seabed exploration programmes

tons. This fleet can carry less than 10% of our foreign trade, and is not only woefully inadequate for India's needs, but also lacks container, product and specialised carriers. Dependence on foreign shipping means not just a loss of earnings but also represents a strategic vulnerability. Considering the fact that the Indian seaborne trade is set to double or triple by 2020, the Indian

shipping tonnage needs to be speedily augmented in order to arrest further decline in the share of Indian ships.

Our most spectacular failure has, however, been in the field of shipbuilding.

Shipbuilding

While the basic driver of shipbuilding is global seaborne trade, it is a strategic industry

which an emerging power like India has been gravely remiss in not nurturing. Apart from constituting the foundation and support of a nation's naval power, the shipbuilding industry generates huge secondary and tertiary benefits in terms of ancillary industries, skilled manpower and employment creation, which can transform the economy. Of all the Indian flagged merchant vessels, just over 10% have been built in Indian shipyards, because of higher costs, lengthy delivery periods and, sometimes, due to indifferent quality. Countries like China, South Korea, Japan and even Vietnam and the Philippines have marshaled their strengths to create a shipbuilding industry which produces quality ships at competitive prices. While these nations have monopolised the world's ship-building market, it is a measure of India's myopic vision that we have failed to capitalise on our many natural advantages and to create a dynamic shipbuilding and ship-repair industry.

Indian shipyards contribute just 1% of the global market share. The target of achieving 5% share of global shipbuilding in next seven years set by the Maritime Agenda-2020 is quite unrealistic, because even a marginal increase capacity will call for a herculean effort especially



The nuclear powered INS Chakra, on lease from Russia, is a potent weapon of offence and deterrence with the Indian Navy



Jiangkai II-class frigate of the PLA Navy

during the current shipping slump. Any endeavour to boost the shipbuilding industry will require drawing up of a national strategy which designates shipbuilding as a priority sector and provides active support in terms of levies, financial subsidies, and availability of raw materials and training of manpower. So much about civil shipbuilding, but what ails our defence shipyards? After all, of India's 28 shipyards (China has over 800) eight are owned by the MoD.

The Defence Shipyards

No nation has ever become a maritime power by importing naval hardware from abroad, and competent warship building shipyards are the *sine qua non* for achieving ascendancy at sea. In their long-term vision of creating a competent maritime force, India's naval leadership has remained steadfast in their resolve to have it built in Indian shipyards, even in the face of acute scepticism. Regrettably, this commitment to indigenisation has not been reciprocated by the industry with equal passion.

The public sector work-culture has kept the efficiency and productivity of these

shipyards at dismal levels. Most warship building projects have been afflicted by huge time delays and embarrassing cost overruns. This has not only had an adverse impact on the navy's force-levels but also eroded its credibility with the Ministry of Finance. These yards, under the tight control of the Department of Defence Production are not funded to undertake modernisation or up-gradation. Nor are they encouraged to demonstrate commercial, financial or technical innovation, and they would all benefit from adoption of modern technical practices and human resource management methods.

The real cause for serious concern relates to the tendency which makes us declare that a newly delivered warship is, for example, '75%-80% indigenous'. While some may consider this an acceptable piece of public-relations hyperbole, such statements actually cause grave harm because they lull us into complacency. The truth of the matter is that the propulsion, weapons, sensors, electronics and many other systems that go into every warship that we build indigenously, are either imported or

assembled in India under licence. Therefore the chances are that the ship may actually be 75%-80% imported by value !

Seabed Exploration

The last issue I want to mention, in passing, is that of seabed exploration. India is the owner of a huge EEZ, and was granted status of a 'pioneer investor' in a large patch of Indian Ocean by the International Seabed Authority as early as in 1987. The seabed promises to yield vast resources of mineral wealth, embedded in poly-metallic nodules, which lie on the ocean floor.

Unfortunately, India's Department of Ocean Development and now Ministry of Earth Sciences has dabbled only perfunctorily in seabed research. On the other hand, China has established a huge lead in the area of seabed exploration technology by producing the world's deepest diving vehicle which can go down to 7000 metres. If information about the presence of strategic rare-earth metals on the seabed is true, India needs to accelerate its own programmes so that it is not left too far behind.

Against this, somewhat gloomy but realistic backdrop, let me now shift gears



BrahMos cruise missile being fired from the guided missile destroyer INS Rajput

and provide a brief glimpse of the strategic challenges that we are likely to face in the foreseeable future, their maritime implications, and how well equipped we are going to be to deal with them.

Maritime Challenges

India's main strategic challenge comes from its prosperous northern neighbor, China. Without entering into a detailed discussion about respective capabilities and intentions, it can be said that China and India are going to make uneasy neighbours. For the two nuclear-armed nations to rise, almost simultaneously, without conflict will require either adroit diplomacy or a miracle – possibly both. The all weather Sino-Pakistan alliance, with its strong anti-Indian slant, further complicates our security problems.

The Kashmir and Sino-Indian border disputes, although far from the sea, could have maritime repercussions if India attempts to employ countervailing strategies in the Indian Ocean. Our cautious and hesitant reaction to border intrusions by both China and Pakistan earlier raised questions about India's political resolve and military preparedness in the face of repeated provocations. The incidents also conveyed the warning that we need to be prepared for collusive action by both armies. To exacerbate India's security predicament, the Pak Army-ISI combine awaits the withdrawal of US forces from Afghanistan to unleash its strategic reserve of Taliban on Kashmir.

Within the Sino-Indian strategic equation, the maritime dimension is a relatively new factor. The rapid growth of both economies has led to increasing reliance on energy and raw materials, and transported by sea. This has focused sharp attention on the criticality, for both economies, of uninterrupted use of the searoutes for trade and energy transportation. Thus, while the PLA Navy makes forays into the Indian Ocean, the IN has newfound commitments in the South China Sea.

The seas around us are rife with hazards and uncertainties, whether it is rampant piracy, maritime terrorism, and proliferation or inter-state tensions. Natural disasters and the impact of climate change, too, present a severe threat to coastal nations and low-lying islands in our region. After its sterling performance during the 2004 tsunami, it will be the unstated expectation of our neighbours that the IN will promptly come to their assistance in times of natural calamity.

Against this backdrop, and given the trans-national reach and versatility of maritime power, not only is the IN going to find greater salience in India's national security matrix, but will also play a vital role in sustaining India's economic prosperity. India's long-term maritime roadmap, therefore, requires special focus on three vital factors.

The navy's biggest challenge is going to be the timely replacement of ageing platforms and obsolescent equipment. The envisaged order of battle of about 150-170

ships and submarines, and possibly 250-300 aircraft, assumes certain delivery rates from shipyards and aircraft factories, which they seem incapable of meeting. At the same time, our other major source of hardware, the Russians, have brazenly reneged on costs as well as delivery schedules, in violation of solemn agreements. One of the more serious challenges before the navy's leadership will be to persuade the Russians as well as Indian DPSUs to deliver on time and within cost.

The failure to acquire even a reasonable level of self-reliance in major weapon systems in the past 66 years has made India the biggest importer of arms world-wide and this must count as a failure of the DRDO and DPSUs. Crafting a viable and time-bound strategy which will persuade the DRDO to develop, reverse-engineer or import the technology for weapons and sensors for our indigenously-built warships will constitute another major challenge for the IN.

China's pursuit of a, so called, 'string of pearls' strategy tends to draw considerable attention in strategic circles due to its high-profile economic connotations. While India may not be able to match China's financial munificence, the Navy's 'foreign cooperation' initiatives have ensured creation of a favourable maritime environment in the region. Apart from activities such as exercises, joint-patrolling, port calls and flag-showing deployments, the navy's out-reach also includes provision of maritime security on request by neighbours. Agreements exist with almost all IOR countries that permit IN ships, submarines and aircraft to avail of refueling and turnaround facilities at very short notice.

Maritime Game-changers

Against this background, there is expectation that the IN could tilt the balance in the South Asian power-game. While a Maritime Strategy is in place, given India's current national security outlook, the crafting of a cohesive national strategy appears an unlikely prospect. Nevertheless some aspects of the Navy's force-accretion plans, which will endow the nation with a number of powerful maritime capabilities, bear mention here.

Intense maritime activity in the Indian Ocean and the huge area that has to be kept under surveillance requires substantial reconnaissance and anti-submarine capabilities. The expected advent of the PLA Navy, especially its

nuclear submarines, into the Indian Ocean will lend urgency to the maritime domain awareness (MDA) task. The IN has evolved a multi layered surveillance capability with deployment of task-optimised aircraft, as well as unmanned aerial vehicles for each layer. The ‘icing on the cake’ is the recently launched GSAT-7 communication satellite, meant exclusively for IN use, which will facilitate the networking of sensor and weapon data across its vast footprint.

The arrival of INS *Vikramaditya*, with its complement of MiG-29K fighters and Kamov-28/31 helicopters, will boost the navy’s capability to exercise sea-control and to project power over the shore. Current plans envisage a second (and perhaps third) indigenously-built carrier joining the fleet in the 10-15 years. Given the wealth of carrier operating experience available in the IN, these ships are capable of tilting the balance of power in our region.

Operationalisation of the SSBN *Arihant* will ensure that India has an invulnerable 2nd strike capability, thus enhancing the effectiveness and credibility of its nuclear deterrent. As the Service responsible for safe and efficient conduct of SSBN operations, the IN will also be custodian of their nuclear-tipped ballistic missiles, thus

enhancing its status and importance in the national security totem-pole.

The induction of the nuclear-powered attack-submarine (SSN) INS *Chakra* has placed a powerful weapon of offence and sea-denial in the hands of the IN. Unlike warships which remain vulnerable to detection and attack from all three dimensions, a SSN on patrol vanishes from sight to reappear as the deadly nemesis of ships and submarines. Apart from the anti-shipping role it can also undertake, with virtual impunity, tasks as varied as surveillance, special-operations, intelligence-gathering and land-attack.

Maritime Security Policy

As a former naval person I feel that a strong and balanced navy is vital for India’s march towards major power status. Such a force will soon be a reality, largely through the navy’s foresight and indigenous efforts. However, it is necessary for the decision-makers to understand that the navy, by itself, constitutes just one pillar of the country’s maritime capability, and without the rest of the structure, including strategic guidance, to complement and provide support, the edifice of naval power will remain hollow and vulnerable.

Asian countries which have brought holistic focus on their maritime sector have not only reaped tremendous economic benefits but also reinforced their maritime security. While the neighbourhood has moved on, India’s ports and infrastructure remain inefficient, our shipbuilding industry is sluggish, merchant shipping grows at snail’s pace, seabed exploitation is stagnating, and human resource development is inadequate. Our trade-dependent economic progress is undergirded by these essential components of maritime power, but a lack of strategic vision has resulted in failure to exploit the maritime sector; with adverse implications for maritime security.

A nation with India’s maritime assets, challenges and opportunities urgently needs a multi-disciplinary maritime advisory body to conceptualise a vision, draw up plans and monitor activities in the maritime domain. The first task of such a body should be to craft an overarching Maritime Security Policy and thereafter to undertake its integration with India’s Maritime Strategy. Only such a synergy can ensure that we draw maximum advantage from the maritime sector – to benefit our economy and also to reinforce maritime security.

** Based on the Admiral’s presentation at the YB Chavan Memorial Talk at the IDSA.*



Guard of honour amidst snowfall next to INS Vikramaditya

Russian Navy Rising

The Borei-class Submarines

Flag-raising ceremony on the ballistic missile submarine Alexander Nevsky on 23 December 2013, at Sevmash shipyard (photo: Oleg Kuleshov)

One of Russia's most complex and ambitious weapons programmes, the Project 955, *Borei*-class, fourth-generation strategic nuclear missile submarine (SSBN) reached several

important milestones in 2013. In December 2012, the Russian MoD had signed the acceptance certificate for the first boat in the series, the *Yuri Dolgorukiy*. On 23 December 2013, it formally took delivery of

the second boat, the *Alexander Nevsky*. The Russian Navy is expected to receive another six submarines of this class, for a total of eight. The third boat, *Vladimir Monomakh*, has already entered begun trials and after



The commissioning ceremony of the Alexander Nevsky (photo: Oleg Kuleshov)

a series of missile launches it will join the fleet some time in 2014. The hulls of the fourth and the fifth submarines in the series are now being built using modified *Borei-A* specifications at the Sevmash shipyard in Severodvinsk, the shipyard that built the *Vikramaditya* aircraft carrier for the Indian Navy.

The *Borei*-programme has emerged from a period of uncertainty caused by early manufacturing problems with the submarine's main weapons system, the *Bulava* SLBM and there is now little doubt that the original plans to build eight



Alexander Nevsky in the White Sea



Alexander Nevsky undergoing sea trials

Borei-class boats will be fulfilled. There are no longer any technical risks that could conceivably derail the programme. Having been accorded top priority by the Kremlin, financing is secure and is certain to be spared any budget cuts in the near future. Even if the Russian economy deteriorates and Moscow is forced to reduce its arms procurement spending (which is currently slated to reach 500 billion euros in 2011-2020), *Borei* and all the other nuclear-related programmes will remain sacrosanct. All of this means that Russia has taken arguably the most important step in augmenting its strategic nuclear deterrence capability since break-up of the Soviet Union.

The fourth-generation Russian SSBN

The *Borei* programme was conceived by the Soviet Union as an answer to America's *Trident* system. Initially, Soviet engineers developed the *Typhoon* system, which

consisted of Project 941 third-generation SSBNs and the D-19 solid-fuel missile system with R-39 missiles. But the Project 941 submarines were very large and extremely expensive and in the period 1981-1989 Moscow managed to build only six of them, not enough to achieve numerical parity with the U.S. fleet of 18 *Ohio*-class submarines used in the *Trident* system. As a stopgap solution, the Soviet/Russian Navy continued to build the cheaper Project 667 nuclear missile submarines, which were upgraded to Project 667BDRM specification (representing 2+ generation technology). Six Project 667BDRM boats were built between 1985 and 1992.

Nevertheless, the Soviet Union proved unable to come up with a fitting response to the *Trident* system. Its fleet of strategic submarines (which was already operating too many submarine designs) had acquired another two SSBN types. These boats were armed with two new types of missiles, which

were inferior, each in its own way, to the *Trident-2* missiles the Americans began to use with their *Ohio*-class submarines in the late 1980s. The Soviet Navy's R&D centres had begun work on the future fourth-generation SSBN design back in 1978. Their objective was to make sure that the new Soviet submarines would turn out "equal or superior" to America's *Ohio*-type boats. In November 1985 the Communist Party Central Committee and the Soviet Cabinet of Ministers authorised the Leningrad-based Rubin design bureau (the developer of all Soviet SSBNs) to launch the development of Project 955 fourth-generation SSBN. Rubin began to draw up the Project 955 *Borei* engineering design in 1990.

The development of Russian nuclear missile submarines was seriously affected by break-up of the Soviet Union and the deep economic crisis that followed. But despite economic woes, the Russian government designated the modernisation of SSBN fleet



Russia's first Borei-class submarine, the Yuri Dolgorukiy (photo: Sevmash)

as a top priority for its nuclear forces and for the Navy in general. One of the reasons for this was the START-1 (strategic offensive nuclear reductions) treaty Moscow and Washington signed in 1991. Under terms of the treaty, the nuclear missile submarine fleet accounted for up to 50 per cent of the agreed nuclear ceilings. The government in Moscow therefore decided to start building a series of new Project 955 SSBNs.

The first boat in the series, *Yuri Dolgorukiy*, was laid down at the Sevmash shipyard in Severodvinsk in November 1996. Amidst the severe economic crisis

that followed breakup of the Soviet Union in 1991, the programme predictably faced chronic funding shortages. Another major problem was fragmentation of the supply chain as many of the critical component supplies were based in newly-independent, former Soviet republics. In the period between 1997 and 1999, no discernable progress was made towards completion of *Yuri Dolgorukiy*.

Problems also emerged with the new submarine's main weapons system, the D-19UTTKh *Bark* SLBM. All three of the test launches made from the firing range

in Nenoks in 1993-1997 ended in failure, for various reasons. In September 1998 the MoD shut down the *Bark* programme altogether. Before the year's end it issued a tender for the development of a new solid-fuel missile system, codenamed *Bulava*, for Project 955 submarines. Two bids were submitted; the MoD choosing the design proposed by the Moscow Thermal Technology Institute (MIT, led by Y.S. Solomonov). The institute's *Bulava*-30 SLBM was to weigh about 36 metric tonnes. The *Bulava*-30 design was chosen despite the fact that the MIT had no previous



The Yuri Dolgorukiy undergoes trials (photo: Sevmash)

experience in designing sea-based missiles. Part of the reason for the MIT's selection was that at about the same time the institute had successfully completed the development of the *Topol-M* ground-based ICBM. The institute said that it would use many of the solutions developed for the *Topol-M* in the *Bulava-30* design.

The rapid economic recovery that began in Russia post-1999 enabled the government to increase spending on the *Borei* programme and work on the *Yuri Dolgorukiy* resumed. The hull was completed in 2005. On 15 April 2007 the boat was moved from the assembly floor to the Sukhona floating launch dock. It was launched on 12 February 2008 followed by launch of the submarine's nuclear reactor on 21 November. Harbour trials began on 17 March 2009, and the first stage of sea trials was held between 19 June and 10 July.

Problems with the Bulava

The submarine used as the test bed for the *Bulava* SLBM was a modified Project 941 SSBN that was upgraded in the 1990s and re-named *Dmitry Donskoy*. The first throw launch of a *Bulava* mock-up was made from that boat in December 2003. The launch of a dimension and mass-accurate mock-up of the SLBM from a submerged position followed in September 2004, and in September 2005, the *Dmitry Donskoy* performed the first successful test launch of a working prototype of the missile.

The second *Bulava* test launch from the *Dmitry Donskoy* in September 2005 was also successful – but then came a series of failures. Out of the six launches attempted by the submarine in 2006-2008, four failed completely, and two were only partially successful (in both cases the missile failed at the warheads' dispensing stage). There was a successful launch in November 2008, followed by three failures in a row in the space of 12 months. During another attempt, the submarine's own launch system failed.

Finally, in October 2011, the *Dmitry Donskoy* performed two successful *Bulava* launches in a row. On 28 June, 2011, the *Bulava* was successfully launched from its intended carrier, the first submarine in the Project 955 series. As part of a joint state trials programme of the SLBM and the Project 955 SSBN combination, the *Bulava* was successfully launched from the *Yuri Dolgorukiy* in August and October

2011. On 28 December, 2011 the boat successfully fired a salvo of two missiles.

The successful completion of the *Bulava* saga put the whole *Borei* programme out of 'danger'. It is also worth emphasising that the problems with the SLBM were not due to any flaws in its design but all stemmed from poor manufacturing standards. In other words, the nature of the difficulties were organisational rather than technological. The Russian government regards the *Borei* programme as a very important priority, and Moscow is making energetic efforts to revitalise the Russian defence industry as a whole. There is little doubt, therefore, that any remaining problems with manufacturing quality will be eliminated – at least with regard to the *Borei*.

Series production

The Russian economic recovery in the 2000s enabled the government to resurrect previous plans under which a whole series of the *Borei* boats was to be built. Under the previous State Armament Programmes for 2007-2015 and the latest programme that covers the 2011-2020 period, the Russian Navy will receive a total of eight *Borei* submarines.

The second Project 955 *Borei* boat, *Alexander Nevsky*, was laid down at Sevmaash on 19 March, 2004, followed by the third boat, *Vladimir Monomakh*, on 19 March, 2006. *Alexander Nevsky* was launched on 6 December, 2010, followed by the commencement of sea trials on 22 October, 2011. The submarine entered service with the Russian Navy on 23 December, 2013.

The third boat in the series, *Vladimir Monomakh*, began trials in January 2013. The manufacturer's internal trials were completed in December and the state trials are still in progress.

The five remaining SSBNs in the series will be built to improved Project 955A (*Borei-A*) specifications. Each will still carry a set of 16 *Bulava* SLBMs.

The Sevmaash shipyard started building the first Project 955A boat (and the fourth in the *Borei* series) in late 2009, but the official laying-down ceremony was held only on 30 July, 2012. Each successive Project 955 submarine is taking less time than the previous one to complete. It is safe to assume that all the remaining boats in the series, starting from No 4 or 5, will take no more than four or five years to launch.

Borei-class SSBN in the Russian nuclear deterrence system

The Russian MoD originally wanted to assign all Project 955 submarines to the Pacific Fleet and to that end it started building the required coastal infrastructure in Vilyuchinsk, on the Kamchatka peninsula. It now appears that only the first boat in the series, the *Yuri Dolgorukiy*, will continue to serve with the Northern Fleet but all the others will definitely be assigned to the Pacific Fleet. The first two Project 955 SSBNs, *Yuri Dolgorukiy* and *Alexander Nevsky*, are expected to enter routine service in 2014.

Moscow's decision to deploy the *Borei* boats in the Far East provides certain grounds to suggest that they will primarily be used as an instrument of nuclear deterrence against China rather than the United States. Another piece of evidence in favor of this suggestion is that unlike Russia, China is not bound by the Intermediate Nuclear Forces (INF) treaty; in fact, Beijing is rapidly increasing its arsenal of intermediate-range missiles, which poses a threat not only to Russia but to India as well. The decision to deploy the *Borei* submarines in the Pacific may be a part of Moscow's response to that threat. Unlike the United States, China does not have a formidable anti-submarine capability, and the *Boreis* will remain completely invulnerable to Chinese defences for many years to come. At the same time, the *Bulava* SLBM is capable of defeating existing and future missile defences, making the *Borei-Bulava* combination an effective instrument of deterrence against the United States as well.

Borei as an indicator of Russian defence industry policy

On the whole, the *Borei/Bulava* programme has been a success and an outstanding achievement of the Russian defence industry, and clearly demonstrates that catastrophic consequences of the 1990s crisis in the defence sector have been overcome. The Project 955 submarines and their *Bulava* missiles show that the Russian strategic nuclear deterrent remains fairly advanced and very capable. They are also proof that with sufficient political will, Russia can still bring to a successful conclusion complex and ambitious technology programmes.

In addition, the *Borei/Bulava* program reflects some distinctive features of Russian defence industry policy over the past decade. One of these features is that for all the technical and economic difficulties, most of the Russian weapons programmes launched in the late 1990s are extremely ambitious. The *Bulava*, for example, is a radically new design that has very little in common with the old Soviet SLBMs. Essentially, this is Russia's first sea-based solid-fuel ICBM;

Defence Forces and the Strategic Missile Troops (new types of ICBM). Such an approach not only meets the current needs of the Russian armed forces, but also lays solid foundations in terms of the country's future military security requirements.

Implications for India's security requirements

This author strongly believes that defence technology cooperation between Russia

assistance to India in developing the naval component of the Indian nuclear deterrent. Cooperation in this area would mean that military-political partnership between India and Russia is becoming as close as the partnership between the United States and Britain. Of course, it may still be premature to speak about the possibility of the kind of deep cooperation that now exists between America and Britain under the *Trident* programme, nevertheless, some individual



The Yuri Dolgorukiy at Sevastopol shipyard (photo: Sevastopol)

in terms of its size, mass and performance it is quite similar to American SLBMs. In fact, the entire State Armament Programme 2020 is highly ambitious; and involves many bold decisions which show that Russia is prepared to take serious technological risks. For example, the Russian MoD intends to replace all the existing armoured vehicles with three radically new families of armoured platforms (*Bumerang*, *Kurganets*, and *Armata*). None of these platforms represents a mere evolution of previous-generation technology. Similarly bold and ambitious programmes are underway in the Air Force (the PAK FA fighter and the PAK DA long-range bomber), the Aerospace

and India should include sub-strategic and strategic systems, including nuclear missile and missile defence technologies. In fact, the two countries' cooperation is no longer limited to conventional weapons and India and Russia are already working together in such areas as powerful sub-strategic systems, including multirole nuclear-powered submarines, aircraft carriers and heavy, long-range, versatile and multi-platform supersonic missiles.

It may sound revolutionary and possibly even unrealistic at this time, nevertheless, this author is convinced that it would be in Russia's own security and commercial interests to provide the most energetic

elements of the *Borei/Bulava* complex could potentially be used in the sea-based nuclear deterrence forces now being built by India. There is no doubt that the United States would vehemently oppose such an idea. But China's continued growth, and the fact that India itself is now closer to becoming a "proper superpower", may soon make discussions of Russian-Indian cooperation on fourth-generation SSBN less hypothetical and more realistic.

Konstantin Makienko

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DRDO's New Momentum

"Fast tracking into the Future"

In conversation with
Mr Avinash Chander



India is unique amongst countries of the world in having multi-level strategic deterrence capabilities, and its Defence Research & Development Organisation (DRDO) must certainly be given credit in large measure for this distinction. As the R&D front of the Ministry of Defence, the DRDO's mandate is to empower the nation with cutting edge Defence technologies, being responsible for design, development and leading to production of new generation weapon systems, platforms, sensors and allied equipment.

This human resource of 28,000 personnel, including distinguished scientists and highly experienced technicians, work in 52 laboratories throughout India, covering a wide spectrum of the needs of modern armed forces.

The Scientific Advisor to the Defence Minister, Secretary Department of Defence R& D and DG DRDO is Mr Avinash Chander who was appointed to this vital position on 1 June 2013. On eve of DefExpo 2014, Vayu had the privilege of an exclusive meeting and interaction with him at his office in DRDO Bhawan, New Delhi. A free wheeling account of his candid conversation is recalled, along with background notes for reference.

That unmanned aerial vehicles (UAVs) are an increasingly important factor in future air warfare is a given and Avinash Chander reinforced that by reviewing this as DRDO's thrust area for the future. Of the various programmes underway, DRDO is well ahead with its Nishant UAV developed by the ADE for the Indian Armed Forces. The Nishant is primarily tasked with intelligence gathering over enemy territory and also for reconnaissance, training, surveillance, target designation, artillery fire correction, damage assessment, ELINT

and SIGINT. This UAV has an endurance of 4 hours 30 minutes and has completed development phase and user trials.

Moving on to the Rustom I, this basic design was derived from NAL's light canard research aircraft (LCRA) but one which has been a very useful technology demonstrator, with several successful flights and attainment of a speed of 140 kmph, ceiling of 11,500 ft and endurance of just over 2 hours.

The much more contemporary and larger UAV, Rustom II is being developed by ADE as an indigenous programme and a full scale mock up was displayed at Yelahanka, during Aero India 2013. Taxi trials are to commence at Kolar at just about the time of DefExpo 2014 with first flight planned for the second half of 2014. Payloads, which include optical, electronic and SAR systems for the Rustom II will initially be imported but gradually indigenised as the programme matures.

Unmanned combat aerial vehicles (UCAVs) are also on the design board, these futuristic weapons of war being stealthy and carrying precision guided munitions: however, there is no timeline forecast for this but perhaps this would take another decade for service entry.

Mr Avinash Chander was enthusiastic about the DRDO's work on small, micro and mini UAVs to be employed for a



Mockup of DRDO's Rustom II medium altitude long endurance UAV

IAI Elta



Tejas LCA with representative underwing stores



The first AEW&C aircraft with DRDO-developed radar on Embraer EMB 145. Two such aircraft are now carrying out development test flights with a third to be delivered later this year. (photo: Angad Singh)

variety of purposes including intelligence and working in 'swarm groups' and this is an area in which many Indian academic institutions are being involved to work in conjunction with the ADE.

Last but not the least, DRDO is studying development of very long endurance, solar-energised high altitude UAVs, which would be of a totally new dimension.

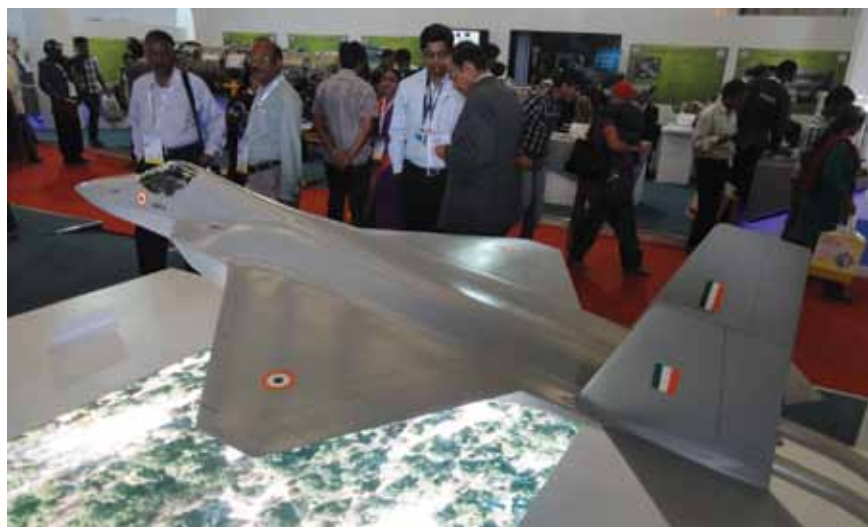
Coming to the Tejas light combat aircraft programme, subject of hyper media attention and analyses is, Avinash Chander accepted that the LCA is a great challenge for both the DRDO and HAL. The programme has certainly accelerated during the second half of 2013 and this is evidenced by numerous achievements including expansion of flight envelope, increased AOA, successful completion of

weapon trials (for IOC) and recording of 500 flights in the calendar year, culminating in award of the initial operational clearance (II) on 20 December 2013 (*see article in this issue*). Still, there is a considerable way to go before the LCA is truly 'accepted' for operational service by the Indian Air Force, but HAL are steadily moving beyond the so far 'hand crafted' prototypes and limited series production aircraft, now engaged in buildup of manufacturing facilities and honing of contemporary manufacturing techniques and formation of shop floor task teams comprising personnel from HAL, ADA and CEMILAC.

Test flights of the two-seat LCA trainer should recommence in 2014 and facilitate conversion training of IAF squadron pilots even as HAL plan to deliver the first series

production LCAs during the summer of 2014. Then, there is an entire world beyond India's shores waiting for just such an affordable multirole fighter. In fact the LCA, both the fighter and trainer variants, have an exciting export potential, being arguably the lightest fighter extant which could compete to replace many earlier generation fighters being phased out in the world.

Work on the next generation advanced medium combat aircraft (AMCA) is afoot with the Air Force and DRDO "fully committed" to this follow on programme which could certainly take advantage of the many cutting edge technologies and years of experience gained with the LCA. Presently, a suitable power plant is being identified but must be one that provides a no-risk option for this brand new airframe.



Model of the advanced medium combat aircraft (AMCA)



Mr. Avinash Chander speaks with Pushpinder Singh of Vayu, with Dr. Ravi Gupta of DRDO on his right.

Coming to land systems: the Indian Army and DRDO are working together to meet the requirement for the futuristic main battle tank (FMBT) and such an armoured fighting vehicle must be unique for operations in the varying terrain of the Indian subcontinent, including the high mountains of the north and east.

Mr Avinash Chander was characteristically candid throughout his conversation and explained the reasons for the failure of the maiden test flight of the prototype Nirbhay cruise missile. The system had actually performed “flawlessly”, from take off to cruise, carrying out manoeuvres

and meeting all parameters except towards the end when a gyro malfunctioned and the missile dropped into the shallow waters off the Coast. The problem was identified after its recovery and suitable modifications made: trials are to recommence shortly.

The question on next test of the Agni IV IRBM was moot, with the test successfully



Nirbhay cruise missile at launch



K-15 Sagarika launch from underwater

conducted a few days earlier (*see this issue*)! Meanwhile, India's subsurface nuclear deterrent missile, the K-15 Sagarika will be deployed with its designated carrier, the nuclear submarine INS *Arihant* during the course of 2014 and there is great confidence in the combination soon becoming operational in Indian Navy service. After the nuclear reaction on the INS *Arihant* went critical on 10 August 2013, the submarine is to proceed on sea trials which will include underwater trials of its prime weapon, the K-15 Sagarika, earlier test launches having been very positive.

As for other DRDO missile programmes, the Nag anti-tank fire-and-forget missile has a new seeker-head and trials in the exacting desert environment are to commence soon. The Nag will be followed by the shorter range, lighter shoulder-fired version (Nagin?) which is of the same class as the Spike and Javelin. The air-launched version is the Helina whose preliminary firing trials took place at the Pokhran firing ranges in 2013.

There is positive news on the Astra beyond visual range air-to-air missile; air-launch trials of the present version, with a range of 40 km, will take place in February-March 2014, from a Sukhoi Su-30MKI in February-March 2014. After qualification, the Astra is also to be integrated with the LCA after its release to service. DRDO are very confident on the successful progress of the Astra moving to the longer range Mk.II (100 km) and beyond, the Mk.III being designed for range of 150km.

The last subject of this interaction concerned the LR-SAM programme and Mr Avinash Chander was confident of its future success. DRDO are moving ahead, with rocket motor trials taking place presently and test launches planned for mid-2014.

Beyond DRDO's impressive headquarters building in New Delhi, the peoples of India were provided a view of DRDO's wide range of products displayed during the Republic Day Parade on 26 January 2014 : while the Arjun main battle tank rolled down Rajpath on its own power, the tableaux on trailers displayed the Tejas LCA, Astra and Helina missiles, a range of UAVs including the Netra mini UAV and Nishant, the Daksh remotely operated vehicle, autonomous underwater vehicle (AUV), Muntra S tracked surveillance vehicle and other remotely operated vehicles.

Undoubtedly, the DRDO is inspired by its motto 'Balasya Mulam Vigyanam,' which translates as 'the Source of Strength is Science,' and the country has certainly reposed its faith in this as such.



Nag anti-tank guided missile trials



Astra BVRAAM displayed under LCA





“Bang !” on Target

German Army Tiger equipped with 4-tube PARS 3 LR launcher (MBDA photo)

In October 2013, Vayu visited missile manufacturer MBDA's facilities in Europe, to be briefed on a wide range of MBDA products that are either actively on offer to India or are relevant to the Indian market in the future. First of two reports on the trip, published last issue, covered MBDA's maritime products. This second part covers munitions more relevant to the Army and Air Force.

is important to note that MBDA's track record in cooperating with partners, be they private or state-controlled, bodes well for their future in India, where offsets via local industrial participation are becoming all-important.

PARS 3 LR

PARS3LR (3rd generation missile / Long-Range) is main armament for the Eurocopter Tiger helicopter ordered

by the German Army, enabling the platform to achieve its required operational performance. It is a high-precision fire-and-forget weapon capable of engaging armoured targets, mobile or stationary, such as armoured personnel carriers, battle tanks, field fortresses, bunkers and other high-value targets. The high-technology seeker head enables unambiguous target identification and designation at ranges up to 7,000 metres.

We start once again from Schrobenhausen, where MBDA Germany builds the PARS 3 LR anti-tank guided missile (ATGM) and Taurus KEPD 350 air-launched cruise missile (ALCM). Far from shying away from collaboration, both programmes involve industrial partners on a large scale - the PARS 3 LR being produced in collaboration with Diehl BGT Defence and the Taurus KEPD 350 ALCM in collaboration with Saab Bofors Dynamics. With both products currently only on offer for Indian Air Force requirements - PARS 3 LR for the HAL Rudra and Taurus for the long-range stand-off strike missile requirement - it



A Eurocopter Tiger equipped with a PARS 3 LR launcher (MBDA photo)



The HAL Rudra still awaits a weapons package and MBDA is hopeful that it can provide the necessary anti-tank capability for the platform (photo: Angad Singh)

The day-night, all-weather, fire-and-forget system allows the helicopter to “shoot and scoot” – to manoeuvre away immediately after firing a missile, thereby exposing itself to danger only as long as necessary to acquire and engage a target. The infrared seeker in the missile locks on to the target *before* firing (lock-on before launch) using targeting data from the optical

system integrated into the launch platform, which in case of the Tiger helicopter is a mast-mounted sight, but in case of the HAL Rudra or LCH, is nose-mounted. The missile guides itself to the target autonomously, requiring no further input or control from the launch platform.

The tandem shaped-charge warhead, which has been extensively tested, allows

the engagement of a wide variety of targets, including armoured vehicles equipped with reactive armour, as most new-generation battle tanks are.

On 30 June 2006, Germany’s Federal Office of Defence Technology and Procurement (BWB), MBDA Deutschland and Diehl BGT Defence signed a procurement contract for 680 PARS 3 LR ATGMs. Deliveries began in 2013 following extensive testing with the German Army Tiger helicopters.

So far, only one nation – Germany – operates the PARS 3 LR, but that may change soon. MBDA has had a longstanding relationship with Indian DPSU Bharat Dynamics Limited (BDL), with the latter producing the Milan 1, 2 and 2T variants of MBDA’s previous-generation ATGM for the Indian Army. It is this time-tested partnership that MBDA hopes will hold it in good stead with the PARS 3LR missile under evaluation as one of the contenders for arming the HAL Rudra (ALH-WSI) armed helicopter. While field evaluation trials were conducted in Sweden in 2012, a final decision from the MoD and the Army is still awaited. HAL had handed over the first Rudra helicopter to the Army at Aero India 2013 (see *Vayu II*/2013).



Twin-tube PARS 3 LR launcher being fitted to a Eurocopter Tiger helicopter (MBDA photo)

Walter Stammer, Vice-president Operations at MBDA Germany, said that all service requirements were met during the trials in Sweden and that the missile was “ideally suited” to the HAL Rudra. In fact, to meet Indian requirements, MBDA has already gone ahead and designed and built a prototype twin-tube launcher in collaboration with an Indian SME. Four such launchers can be fitted on the Rudra, and the prototype was shown to HAL officials following the field trials.

Should the PARS 3 LR succeed in equipping Indian Army Rudras, the offset obligations of the contract and MBDA’s existing partnership with BDL would see the missile ideally placed to go on to equip LCH as well as any suitable helicopter platforms operated by the Indian Air Force, the benefit to the MoD being the ability to standardise on a single ATGM type, streamlining acquisition and inventory. Additionally, MBDA has also signalled willingness to partner with Indian DPSUs or private firms to provide transfer of technology as well as to co-develop future systems.

Taurus KEPD 350

The Taurus KEPD 350 (Kinetic Energy Penetrator-Destroyer) weapon system programme commenced in 1998 with the pooling of the precision stand-off guided missile systems industrial capabilities of MBDA Deutschland with those of Saab Bofors Dynamics. A joint venture company, Taurus Systems GmbH, was established in Schrobenhausen and is responsible for the development, production, marketing and support of the KEPD 350 weapon system.

Today, the Taurus KEPD 350 is deployed on German Luftwaffe Tornado



A computer rendering of a Luftwaffe Eurofighter equipped with Taurus KEPD 350 missiles (MBDA photo)

IDS strike fighters and Spanish Air Force EF-18 Hornet aircraft, and has also been selected as the stand-off weapon for NATO Reaction Forces. Additionally, both Spain and Germany are planning future integration of the missile with their respective Eurofighter fleets. More recently, the Republic of Korea Air Force (ROKAF) has selected the missile to equip its Boeing F-15K Slam Eagle fighter fleet. Apart from these, the KEPD 350 can be integrated onto a variety of different aircraft, as demonstrated by a number of captive-carry flights carried out with Saab JAS 39 Gripen aircraft.

With a proven weapon and significant sales successes, MBDA has offered the

Taurus KEPD 350 to the Indian MoD to meet the Indian Air Force requirement for an air-launched stand-off missile. The missile will likely be integrated with the Sukhoi Su-30MKI in IAF service, and as a related offer MBDA has proposed tri-services modifications to the missile, making them suitable for surface-to-surface use by the Army or maritime strike by the Navy.

In its present configuration, the modular all-weather stand-off KEPD 350 is stealthy, accurate and lethal, particularly against hardened targets but is also equally effective against area targets. The KEPD 350 is designed to operate in dense air-defence environments and neutralise high-value stationary and quasi-stationary targets,



A Luftwaffe Tornado IDS equipped with a pair of Taurus KEPD 350 missiles under the fuselage (MBDA photo)

including air-defence assets themselves. Its accuracy and stand-off range capability ensures effective weapon delivery while minimising threat to the launch platform and crew.

The Taurus KEPD 350 uses 'Tri-Tec' navigation, with an inertial navigation unit as its core resulting in exceptional accuracy. The 'Tri-Tec' array of sensors allows the weapon system to utilise various combinations of three sensor inputs – GPS, terrain profile and infrared image information – to enhance accuracy and survivability.

The accuracy of the missile's guidance system on its extremely low-level ('nap-of-the-earth') flight requires a highly agile and manoeuvrable missile. To facilitate this, the Taurus KEPD 350 missile is equipped with a powerful Williams P8300-15 turbofan engine, allowing for high cruise speed at low level. Combined with the guidance system, this makes for quick and agile manoeuvres ensuring the missile stays precisely on the planned flight path. Survivability of the KEPD 350 is based on low observability and terrain masking, making manoeuvrability and guidance crucial characteristics of the missile.

The Taurus KEPD 350's airframe structure has been designed around the heart of the weapon- the Multi-Effect Penetrator, High Sophisticated and Target Optimised (MEPHISTO) warhead, which provides the all-important penetration capability required of modern stand-off missile systems. MEPHISTO employs a unique intelligent fuse, which is programmable and

allows the detonation of the penetrator to be pre-selected for a given level, deep within the target structure. This is achieved through layer counting and void sensing technology, ensuring the warhead enters far enough into a target for the detonation to cause maximum damage.

Beyond the missile itself, the Mission Planning System optimises the flight path taking the entire threat scenario for a particular theatre into account. It is designed to avoid the line-of-sight of all radars as far as possible but should this prove unreasonable due to the density of air-defence systems, the low-observability features (stealth shaping and low-level flight) are utilised. Additionally, the Mission Planning System plans a missile trajectory that orients the missile relative to threat radars in a manner that presents the lowest possible radar cross section.

Back to Lostock, the epicentre for MBDA's activities centring on the ASRAAM, Meteor and Brimstone product lines and their derivatives. The ASRAAM proposal to equip the IAF Jaguar fleet is at an advanced stage and has been widely reported on, and while no specific requirement for the Meteor or Brimstone exist as yet, MBDA is quietly confident that the sheer quality of these products could help them find a place in the future Indian Air Force inventory.

Brimstone

The basic Brimstone and its newer dual-mode seeker variant have been covered in comprehensive detail previously (*Things that go 'Bang'!* Vayu VI/2013) but there

are developments on the horizon that could result in extremely accurate, cost-effective munitions that are of tremendous relevance in the Indian subcontinent. The Brimstone family began in November 1996 as a lightweight 50 kg fire-and-forget missile intended for anti-armour use by the Royal Air Force. By 2008, the dual-mode Brimstone (DMB) had entered operational service, adding semi-active laser homing (SALH) guidance to the existing millimetre-wave radar (mmW) seeker.

The dual-mode variant is a precision strike low collateral damage weapon with man-in-the-loop capability and is able to defeat a wide range of static and fast moving targets whilst operating within restrictive rules of engagement (RoE).

Dual-mode Brimstone has been used extensively and successfully through major 21st-century conflicts such as those in Iraq, Afghanistan and Libya. The missile's performance, particularly its accuracy, has attracted the interest of a large number of air forces around the world. In fact, then Indian Air Force Chief of Air Staff, Air Chief Marshal NAK Browne, was personally briefed on Brimstone performance in Libya by his British counterpart, following the conclusion of the RAF's *Operation Ellamy* in that country.

SPEAR

Brimstone has had a successful development trajectory, with both the initial and current dual-mode variants being highly praised for their efficiency in combat. Owing to this, and with one eye fixed firmly on the future, MBDA has plans for further development of the missile, this third iteration aimed at marrying a massive increase in range to the already-demonstrated accuracy of the weapon.

Dubbed SPEAR – for 'Selective Precision Effects At Range,' – the new development will see a set of fold-out wings added atop the missile airframe, along with a new engine, resulting in a high subsonic stand-off range weapon in the 100+ km class. While the weapon will be operated by a multitude of aircraft, focus is undeniably on the F-35, with MBDA expecting to be able to fit four SPEAR missiles and one Meteor BVRAAM within each of the F-35's weapons bays.

The missile is still in the design stage but certain details are being firmed already, such as the length, which will remain



A Dual-Mode Brimstone missile being loaded on a triple ejector rack (TER) under a Panavia Tornado (MBDA photo)



Computer-generated image of a SPEAR missile in flight (MBDA photo)

a compact 1.8-2 metres. Retaining the proven DMB seeker technology is a given, but a unique new innovation is the ‘dial-a-yield’ multi-effect warhead, allowing operators to pre-select warhead power depending on missions.

While the UK MoD funds the SPEAR project, MBDA is cognizant of export requirements as well: for example longer or shorter range versions may be offered to customers for whom airframe dimensions are not of particular concern (ie: non-stealth aircraft operators). The missile was first shown as a full-scale mock-up at the Farnborough Air Show in 2012, and development has continued at a rapid pace since then, with an airframe and

propulsion system demonstration using a representative weapon design planned by the end of 2014.

ASRAAM

Arguably one of MBDA’s premier in-service air-to-air weapons is the ASRAAM. The programme was born out of a need to produce a single missile that could engage targets from point-blank out to BVR ranges, beyond which longer-range missiles such as the AIM-120 AMRAAM would take over as ‘pure’ BVRAAMs. Notably, the ASRAAM was among the last ‘UK-only’ defence programmes, with almost all MBDA projects today being collaborative efforts across nations and companies.

ASRAAM uses ‘lifting body’ technology that combines thrust and airframe attitude to maintain flight, eliminating the need for large fins and thereby reducing overall drag. It has four small fins at the very rear of the missile body for stability and steering only. Additionally, the detection hardware is not part of the seeker head, allowing for a small nose that only has to accommodate an aperture for the seeker optics while the detection hardware is located elsewhere within the missile, dramatically improving the missile’s aerodynamics. The seeker itself is an imaging infra-red, 128×128 element focal plane array, with lock-on after launch (LOAL) capability, allowing it to detect and engage targets over 90° off the centreline of the launch aircraft (‘off-boresight’ engagement).

Compared with the other major Western close-combat missile, the AIM-9 Sidewinder, the ASRAAM has more propellant and a larger, smokeless rocket motor which endow it with far superior kinetic qualities resulting in a much larger ‘no-escape zone’ (NEZ) – the arc within which an engaged aircraft cannot outrun a chasing missile. The missile’s high impulse at launch results in excellent ‘off the rail’ characteristics, facilitating quicker engagements at short range, effective off-boresight tactics and the lack of smoke improves combat efficiency of the pilot and does not affect the engine(s) of the launch platform.

At present, the ASRAAM is the longest-ranged and fastest (Mach 3+) within visual range (WVR) missile in service worldwide. It is used on all UK RAF Tornados



RAF Eurofighter firing an ASRAAM – note lack of smoke plume from the rocket motor (photo: Geoffrey Lee/UK MOD)



ASRAAM test fit inside an F-35 weapons bay (MBDA photo)

presents unique challenges for missile integration given that most missiles are attached the other way round! Additionally, location of the pylon makes the engine intakes and pilot's field of view particularly susceptible to the ill effects of efflux from missile exhausts.

This is precisely why MBDA is confident that ASRAAM is the ideal all-aspect missile for the Jaguar – the impulse at launch clears the missile from the pylon, and indeed the vicinity of the aircraft, with immense rapidity, and the smokeless combustion affects neither pilot visibility nor engine performance or safety. Additionally, the missile's performance characteristics, specifically its high off-boresight capability, long range and large NEZ, mean that the Jaguar is in no way at a disadvantage in a dogfight simply because it is restricted to a single missile type, unlike most other fighters that can be equipped with both BVRAAMs and SRAAMs/CCMs. Moreover, because the IAF Jaguars have been upgraded through their service lives, incorporating contemporary technology such as helmet-mounted targeting systems, the aircraft, despite its age, is well placed to integrate and operate current-generation missiles such as ASRAAM.

ASRAAM integration, captive-carry flight trials and live-fire testing have all been conducted with the Jaguar, using both ex-RAF aircraft as well as active

and Typhoons and can be cleared for integration on all variants of the F-35 as well. Additionally, it was used on British Harriers prior to the retirement of the type. Outside of the UK, the Royal Australian Air Force uses the ASRAAM on their F/A-18 Hornets. Other aircraft cleared to use the ASRAAM, but not currently in service with the missile, include the F-16 and Jaguar (the latter tested and cleared by MBDA exclusively for the Indian Air Force).

The Jaguar is unique among contemporary operational fighters in that its air-to-air missiles are carried on a pylon *above* the wing, rather than slung below, as is the case with all other combat aircraft. Considering the aircraft's primary role as a strike platform, this enables the underwing and fuselage pylons to be devoted solely to the carriage of air-to-ground ordnance and fuel, without robbing the Jaguar of the ability to defend itself against airborne threats. However, the overwing pylon



ASRAAMs mounted on overwing pylons of an ex-RAF Jaguar (MBDA photo)

Indian Air Force aircraft at the Aircraft and Systems Testing Establishment (ASTE) based in Bangalore. Sources from both MBDA and the Indian Air Force report positive impressions from these tests. In fact, during one of the live-fire trials, a test pilot thought that the missile had ‘hung’ on the pylon (failed to fire) because he hadn’t seen it launch – it turned out that the missile’s speed and lack of smoke plume meant he had simply missed it as it left the wing!

With the Jaguar slated to continue in IAF service for decades more, and its place in the IAF order of battle remaining highly significant even today, the importance of arming this strike platform with the ability to tackle airborne threats is crucial.

Meteor

If the ASRAAM is the premier contemporary air-to-air missile built by MBDA, then the



Computer rendering of a Meteor missile in flight, with intakes open (MBDA photo)

rocket (TDR). TDR propulsion provides long range, a high average speed (Mach 4+), a wide operational envelope from sea level to high altitude, a flexible mission envelope via active thrust control, relatively simple design, and logistics similar to those of conventional solid rocket motors.

engagements in order to maximise kill-probability.

The ramjet portion of the missile has been the focus area for development efforts, as this is the part that is crucial to the missile’s performance. Regulating combustion and ensuring ideal flow conditions through



Meteor missile during testing, carried out by a Saab Gripen fighter

future surely belongs to the Meteor. The Meteor is a six-nation partnership to build an uncompromising beyond visual range air-to-air missile for the 21st century. The programme involves industrial input from the UK, Germany, France, Italy, Sweden and Spain, and is headed up by a Joint Project Office located in the UK.

The Meteor is unique in that it is propelled by a combination of rocket and ramjet thrust – called a *throttleable ducted*

At launch, a rocket ignites to provide initial acceleration up to ramjet speed. At this stage, the missile behaves like a conventional rocket, and the distinctive underbody intakes remain closed. However, once the rocket reaches sufficient speed for ramjet operation, the intakes open and the now-empty casing of the rocket motor behaves as a combustion chamber for the ramjet propulsion system. The throttleable motor allows for long range, adjusting to

the intakes is tremendously challenging. In fact, this affects missile control as well: while most missiles use ‘skid to turn’ steering, where rear-mounted fins ‘throw’ the airframe into a turn, Meteor steers almost like an aircraft, banking into turns so as to ensure airflow through the ramjet is not disrupted.

Additionally, since the missile uses a combined rocket and ramjet, it has no ‘peak’ speed as most conventional rocket-powered

missiles do : it accelerates from launch and then sustains a consistent speed through ramjet combustion. Like the ASRAAM, the Meteor has an enormous no-escape zone, largely as a result of its unique propulsion system.

The seeker draws from existing technology used in the MICA and ASTER programmes, combining MBDA and Thales knowhow from their 4A active anti-air seeker project. It uses a datalinked inertial guidance system coupled with active radar homing in the terminal phase, resulting in high levels of accuracy as well as flexibility throughout the engagement as a result of the datalink.

All this translates to shorter engagements with lower 'time to kill,' longer effective range, better target discrimination, improved situational awareness (via datalink), and combat flexibility through third-party targeting such as a networked fighter or AEW&C aircraft. The seeker technology and one-of-a-kind engine guard against early obsolescence and make the Meteor an ideal missile to replace stocks of ageing BVR missiles around the world.

The Meteor will be operational first with the Swedish Air Force on the JAS 39 Gripen multirole fighter by the end of 2014, followed shortly by France with the Rafale

Additionally, since the missile uses a combined rocket and ramjet, it has no “peak” speed as most conventional rocket-powered missiles do – it accelerates from launch and then sustains a consistent speed through ramjet combustion.

C, B and M. The other partner nations will operate the missile from the Eurofighter Typhoon, and the UK and Italy will also use them to equip their F-35s.

Should the M-MRCA contract for 126 Rafale fighters be signed, the Meteor will almost certainly be included in the weapons package, but interestingly, reports suggest that the Indian Air Force is also interested in acquiring the missile to equip its Su-30MKI fighters, which are of Russian origin.

Whichever aircraft bearing saffron, white and green roundels eventually carries the missile, there is no question that it has all the potential to dramatically alter the air superiority equation in South Asia.

Angad Singh

MBDA is a European defence organisation backed by three major aeronautical and defence shareholders - BAE Systems (37.5%), EADS (37.5%) and Finmeccanica (25%). The company was created in 2001 after the merger of the leading missile manufacturers of France, Italy and the UK, and reached its present structure with the acquisition of the German subsidiary EADS/LFK in March 2006.

The firm combines a large portfolio of operational products with a strong focus on R&D to develop products across the land, sea and air domains, and currently works with over 90 armed forces worldwide, including a number of strategic multi-national programmes, such as the six-nation Meteor BVRAAM, the Franco-British stand-off cruise missile, Storm Shadow/SCALP, and a family of air defence systems based on the Aster missile that is in service with France, Italy and the UK.



Meteor mounted on a Dassault Rafale fighter (photo: Thierry Wurtz /MBDA)

HYD AD

Year of the UCAV

Unmanned combat accelerates



Dassault nEUROn
(France)

12.5m
wingspan



Northrop Grumman X-47B
(US)

19m
wingspan



BAE Systems
(UK)

10m
wingspan

As Unmanned Combat Aerial Vehicle (UCAV) prototypes take to the skies, TIM ROBINSON asks: “is this the beginning of the next generation of air warfare?”

The past decade since 9/11 and the subsequent war on terror, including operations in Afghanistan, Iraq, Libya and elsewhere have seen an explosion in military UAV/UAS types and missions — ranging from B-737 wingspan-sized Global Hawks, to mini and nano-helicopters. Armed ‘drones’ are now an established weapon system. Yet the majority of these platforms have had one thing in common; they are all designed to work in permissive environments against enemies that lack SAMs, AAA and fighter defences. However, that is now about to change with a new generation of unmanned vehicles — the UCAV. These, unlike the armed-UAVs, are designed from the beginning with stealth in mind to penetrate hostile airspace and complete their mission. Removing the pilot also means that the aircraft’s vertical profile can be reduced, lowering its radar cross-section (RCS). It is no coincidence, then that almost all these low-observable aircraft share the same triangular radar-defeating shape.

Building on a decade or so of research subscale prototypes and models, companies and governments across the globe are now working to develop new technology demonstrators. In the past year or so two European UCAV demonstrators have flown while, in the US, a naval UCAV has made history with the first carrier deck launch. Beyond the US and Europe, nations such as China, India and Russia are also looking to develop their own UCAV programmes. Let’s take a look at the current projects.

Northrop Grumman X-47B

On 14 May 2013 off the coast of Virginia, the US Navy conducted a historic event in naval aviation — the first catapult launch at sea of a UCAV from an aircraft carrier, the USS *George H.W. Bush*. The UCAV in question? The Northrop Grumman X-47B which first flew in 2011. This is a 19m wingspan stealth UAS, with a P&W F100 engine and 2,100nm range. This demonstrator, currently under the US Navy’s UCAS-D (Unmanned Combat Air System Demonstration) was spun out of DARPA’s earlier USN/USAF J-UCAS (Joint -Unmanned Combat Air Systems). J-UCAS, which saw an earlier Northrop Grumman UCAV, the X-47, evaluated with Boeing’s X-45, was axed in 2006, leaving the Navy to go it alone with the UCAS-D. Northrop has built two flying X-47B prototypes for UCAS-D which, in the past year have carried out carrier interoperability tests, the first land-based catapult launch and, on 4 May, the first arrested landing at the US Navy’s test centre at Patuxent River. The next series of tests started in mid-May, beginning with an at sea launch from the USS *George H.W. Bush*.

Should these tests validate the decade of work on this concept, the US Navy plans to move to the next stage with an operational version, UCLASS (Unmanned Carrier Launched Airborne Surveillance and Strike System). An RFP for this is expected to be launched shortly, with the UCAV expected to be in limited service by 2020. Already industrial competitors are jockeying for position to win this contract. NG

itself is expected to offer a development of the X-47, the X-47C. Boeing, meanwhile, building on experience with its X-45 and privately-funded Phantom Ray demonstrator is also expected to bid. General Atomics has a low-observable jet-powered design, the Predator C - Sea Avenger. Finally, in April 2013 Lockheed Martin revealed its proposal for UCLASS, with a UCAV design that echoes the RQ-170 Sentinel.

Dassault nEUROn

But late in 2012, while the X-47 was undergoing tests in the US, across the Atlantic another UCAV made its first flight on 1 December at the Istres test centre in France. This was the €405m pan-European Dassault nEUROn demonstrator. This 12.5m wingspan vehicle, which is powered by a R-R Adour engine, is equipped with a weapons bay building on Dassault's earlier experience over the previous 13 years with subscale demonstrators such as the *Petit Duc* and *Moyen Duc*. Although Dassault is the prime contractor, the nEUROn has been expanded into a larger pan-European project, with other partners consisting of Greece's EAB, Italy's Alenia, Spain's EADS CASA, Sweden's Saab, and Swiss RUAG Aerospace. Saab, in particular, also brings its experience of sub-scale stealth demonstrators, like FILUR, to the programme. The nEUROn has a two-year test programme ahead of it, with flight tests in France and then operational tests in Sweden, culminating in weapon-release tests. Despite its weapons bay, this is still very much a technology demonstrator aimed at building up European expertise in this area. Whether another demonstrator or a production UCAV is the next step probably hinges on Anglo-French UCAV collaboration decisions and the willingness of the UK to merge its project, below, into a larger European programme.

BAE Systems Taranis

The second stealth UCAV demonstrator from Europe is probably, outside China, the most secretive; BAE Systems' Taranis. Named after the Celtic god of thunder, Taranis was first publically unveiled in 2010. It builds on BAE's experience in autonomy and UAS from UAVs such as Herti, to earlier projects like Raven and Corax. Additionally, BAE also has experience of low-observable platforms, through projects such as Replica. Though like nEUROn and the X-47B, it is a technology demonstrator not an operational weapon system, with the stated intention of 'informing' plans for the UK's combat capability. This then links into earlier FOAS (Future Offensive Air System) MoD studies which aimed at developing a replacement for the Tornado strike aircraft. However, as

noted above, the MoD is extremely coy about Taranis and its capabilities. Informed observers suggest that, like the nEUROn, the vehicle is powered by a R-R Adour engine. But, while the nEUROn flew in France, BAE is understood to have transported Taranis to Australia to the vast Woomera range to make its first flight there. It follows the company's pattern of testing other UAV products in these large uninhabited ranges which simultaneously provides extra safety and also protects a stealth design from prying eyes.

Beyond this, the UK is engaged with France on UCAV collaboration. This perhaps will see, if the requirements converge, a joint Anglo-French UCAV demonstrator, or potentially even the leap to a production version. However, with the European aerospace industry desperate for a new combat aircraft programme, the devil is likely to be in the detail.

Now, China

But Europe and the US are not the only ones interested in this leap in combat aircraft technology. Recent years have seen a massive explosion in China's military aircraft projects, including a number of UAVs. Some of these, it is clear, are intended to be armed. There also appear to be signs of UCAV research, including sub-scale demonstrators. Only in May 2013 there appeared images on the Internet of what is claimed to be a Chinese UCAV, the *Lijian* (*Sharp Sword*), undergoing taxiing tests. Gauging whether any of these designs, sometimes spotted in model form at exhibitions, on leaked webpages or on academic posters, will reach production or enter service is problematic. But the strategic surprise of China unveiling not one but two new stealth fighters in quick succession shows that Beijing is serious about expanding its military aircraft capabilities. It clearly sees UCAV technology as an avenue worth pursuing.

And India

Another rising power in the Asia-Pacific, India is also developing its own UCAV technology demonstrator programme, the Indian Unmanned Strike Air Vehicle (IUSAV). The air vehicle from the Defence Research and Development Organisation (DRDO) is called Aura and is currently in the design and optimisation stage. Aura will feature weapon bays for precision missiles and will be powered by India's Kaveri engine. A first flight is planned for the 2015-16 timeframe.

Finally, Russia

Russia, too, has had its own UCAV programme, in the form of the MiG *Skat* (Manta Ray) demonstrator, a full-size model of which



Shenyang/Hongdu *Lijian*
'Sharp Sword'
(China)

14m
wingspan



MiG Skat
(Russia)

11.5m
wingspan



DRDO AURA
(India)

15m
wingspan



was unveiled at the 2007 Moscow Air Show. Interestingly, a manned version of this tailless vehicle was planned, possibly because of a lack of experience in these flying wing designs compared to western companies. However, the *Skat* is now believed to have been shelved, with MiG's experience on this project to be merged with Sukhoi in developing a new heavyweight strike UAV. Russia's immediate need, however, is ISR UAVs, which may explain why it has reset its UCAV effort.

Black programmes

In addition to these public 'white world' efforts it is also probable that a number of 'black' classified UCAV prototypes are also in development or even may be in limited service already. It is notable, for instance, that Israel, one of the premier nations in exploiting and developing unmanned systems, has not yet revealed a UCAV technology demonstrator, leading some to speculate it may be working on a clandestine UCAV project.

Further speculation exists around a rumoured US long-endurance stealthy UAS that may be the real reason why the Global Hawk HALE platform could be retired. This, according to at least one media report, may have a bomb-bay, giving it a precision strike capability.

Enabling technologies

Yet the introduction of UCAVs into service as they stand might not qualify on its own as a revolution in combat aviation. An unmanned, less flexible F-117 strike aircraft might be the equivalent. However, there are other technologies now under development that, if added to the UCAV, promise a true transformation in military aviation.

Firstly, is the concept of 'UCAV wingmen'. With a two-seat manned fighter, a backseat weapons officer could command UCAVs to strike SAM threats ahead of a vital attack or use the LO vehicles to thread between air defence zones to clear the way for manned, unstealthy fighters. Advances in HMI (human machine interface) or voice recognition may mean that a single pilot could control them, treating each UCAV like a human wingman that responds to voice or datalink commands. This may even also allow a stealth fighter datalinked to UCAVs with BVRAAM air-to-air missiles as a sort of 'in-flight reload' — allowing a massive volley of first shots without putting extra humans at risk. Human-UAV wingman control has already been tested in the UK using a Tornado and a BAC 1-11 as a surrogate UAV.

Another enabling technology is air-to-air refuelling. Although some UAVs feature extreme persistence, adding an AAR ability would allow UCAVs to refuel and stay on station almost indefinitely, barring weapon reloads or limitations in the reliability of other systems on board. Challenges remain (would a UCAV tanker also need to be low-observable and would avionics now need space-satellite levels of reliability?) but again this concept is already being tested. In 2012 NASA flew two Global Hawk UAVs in close formation as part of unmanned AAR tests. Meanwhile, in the UK, Cobham has been investigating automated probe-and-drogue refuelling as part of the civil ASTRAEA project. The UCAS-D programme also includes automated aerial refuelling trials.

The final piece in this puzzle is the potential of directed energy weapons (DEW), either lasers or microwave weapons to equip these UCAVs.

This may in fact be the biggest breakthrough in combat aircraft since the introduction of the jet engine.

A rechargeable weapon with unlimited shots, carried by an invisible strike aircraft able to stay aloft for days, perhaps weeks at a time, would truly be 'Star Wars' technology.

Challenges

Yet, despite the potential advantages of these UCAVs, there still remain a number of obstacles to developing and fielding such airborne weapon systems. The first, quite obviously, is cost. As the complexity of a UAV increases and its systems become more refined, so does the cost increase. Add stealth, and a UCAV becomes anything but a throwaway disposable asset. Some observers estimate that a production UCAV could cost as much as a F-35. For today's western militaries, including the US, where it has had to ground one-third of its combat air wings last year due to sequestration, cost is a major concern. It is thus likely that true UCAVs will be niche weapon systems, affordable by only the wealthiest powers for the near future. Replacing strike aircraft one-for-one, therefore, seems highly unlikely.

This neatly leads on to the second challenge. If the market is still unknown, can UCAVs support the previous manned fighter industrial footprint? There is also the question whether today's UCAVs will lead to the quick extinction of the manned fighter, or whether these programmes will help bridge the gap between today's fighters and notional 'sixth generation' combat aircraft. The jury on this still appears to be out but industry faces hard choices. Previously in Europe, for example, splits in fighter requirements and industrial haggling led to the Dassault Rafale, Eurofighter Typhoon and Saab Gripen. Will this be repeated for any European UCAVs, where production numbers might be even lower?

The final obstacle, according to some insiders, may be the biggest. That of culture. Although UAVs have grown enormously in the past decade or so, it is because they have taken the dull, dirty and dangerous roles. UCAVs on the other hand, potentially threaten the role of the fighter pilot and just as 'turkeys don't vote for Christmas' so the introduction of UCAVs may be resisted by vested interests. However, ingrained as this culture may be, it is likely to change over time. Not too long ago, the USAF high command, for example, was dominated by the 'bomber barons', who elevated SAC into prime position. Today, when the USAF trains more UAV operators than fighter pilots, there may come a time when the 'UAV mafia' occupy the command slots.

And so

In conclusion, as these demonstrators take to the air, this is a highly significant time for the future of combat aviation. Although (ultra-classified black programmes aside) we are still some time away from operational squadrons of UCAVs, the trend is clear. This may in fact be the biggest breakthrough in combat aircraft since the introduction of the jet engine. Early UCAVs, like the early jet fighters, may be limited in roles and capability but these may quickly evolve. And, while fighter pilots may worry that a robot may eventually replace them, for the foreseeable future the UCAV will supplement manned fighters, bringing new capabilities to allow the fighter pilot to become a 'battlespace commander' and dominate space and, now with persistence of unmanned systems, time.

Welcome to the future!

Tim Robinson is Editor-in-Chief of AEROSPACE, published by the Royal Aeronautical Society.



DRAGON RISING

This image appeared on Chinese internet forums showing what purports to be the 'Sharp Sword' UCAV undergoing taxiing tests.





RAFALE: The Mission Possible

Air Marshal (retd) Anil Chopra

As the aircraft carrier INS *Vikramaditya* sailed towards the warmer Indian Ocean, it also warmed the cockles of Indian hearts that had waited for its arrival for over 5 years. Now, all eyes are set, and some fingers crossed, for signing of the mother-of-all-deals, the near \$20 billion Medium Multi-Role Combat Aircraft (MMRCA) Rafale contract. The Indian Air Force, the aviation industry and the national security establishment have great stakes in early conclusion of this game-changing deal.

The IAF's dwindling fighter squadrons, currently near an all-time low of 34, are the cause of serious concern. With 50 percent offset obligations, the Indian aviation industry is virtually salivating in expectation of their share of this huge business that

could also infuse latest technologies. With two not-so-friendly nuclear neighbours with whom we have serious boundary disputes, and have actually gone to war, national security requires strong air power which has become the dominating means of prosecution of war. A recent statement by the Deputy Chief of Air Staff, Air Marshal S Sukumar that the Rafale deal would be signed "within this financial year" was like a flicker of a candle in the wind.

With continuing delays in development of the indigenous ADA-HAL Light Combat Aircraft (LCA) and inevitable phasing out of MiG-21s and MiG-27s, and in time, MiG-29s and Jaguars, there is urgent need for a replacement aircraft. The requirement of 126 MMRCAs (six squadrons) was first

mooted by the IAF in 2001. After much iteration, the final Request for Proposal (RFP) was issued in August 2007. The Boeing F/A-18 Super Hornet, Eurofighter Typhoon, Russian MiG-35, Dassault Rafale, Lockheed F-16 Super Viper and Saab JAS 39 Gripen were the shortlisted types. The first 18 aircraft (one squadron) would be procured from the selected OEM in 'fly away' condition and the remaining 108 manufactured in India by HAL with full Transfer of Technology (TOT). Value of the contract was estimated at \$14.92 billion. There was an option clause for 74 additional aircraft.

After rigorous flight and ground evaluation, the Rafale and the Typhoon were determined as technically compliant. On 31



and manoeuvrability, even at low speeds, plus super cruise (sustained supersonic flight without engagement of afterburners). The Rafale which is in service with both the French Air Force and carrier-based with the French Navy, would eventually become the lone combat aircraft type operated by the French. Although not a full-aspect stealth aircraft, the Rafale has reduced radar cross-section (RCS) and low infra-red signature, thanks to extensive use of modern composite materials.

The Rafale's 'glass cockpit' is designed around the principle of data fusion, wherein a central computer intelligently selects and prioritises display information for focussed command and control. An integrated direct voice input (DVI) system allows a range of aircraft functions to be controlled by the pilot's voice command. There is an advanced hands-on-throttle-and-stick (HOTAS), with a right-handed side-stick control. The pilot-friendly cockpit is fully compatible with night vision goggles (NVG) while an on-board oxygen generating system (OBOGS) eliminates the need to carry bulky oxygen storage cans. Rafale's advanced avionics suite includes the passive front-sector electro-optical system operating in both the visible and infra-red wave lengths. The Rafale features an integrated electronic survival system named SPECTRA (by Thales), which protects the aircraft against airborne and ground threats. The Areos all-weather, night-and-day-capable reconnaissance system has the ability to transmit information such as images in real-time to ground stations. The Rafale is now flying with Active Electronically Scanned Array (AESA) radar.

Best Manufacturing, Best Practices

The win-win situation continues for the many other players. Specific Transfer-of-Technology (ToT) clauses make it incumbent on the OEM to ensure this happens. As such the AESA radar, advanced cockpit avionics, OBOGS, integrated digital fly-by-wire controls, stealth features, composite structures, RCS reduction and self-protection features will be game changers in the arena of South Asia. The overall value of the radar, electronic systems, communications and self-protection equipment is about 30 percent the cost of the entire aircraft. The offset clause of 50 per cent will bring in nearly \$10 billion worth of work for Indian companies, with Hindustan Aeronautics as the main beneficiary. It is recalled that when HAL started the Jaguar assembly, this greatly improved component manufacture, sheet metal work, milling of turbine blades, and other manufacturing practices. Setting up of the Mirage 2000 overhaul facilities again brought many best industry practices to HAL and also changed the mind-set and work culture at shop floor and management levels. The big question, however is, does HAL have the capacity to absorb such huge amounts within the short timelines? Has HAL created big enough vendor-base to outsource tasks? Will HAL be able to maintain the production quality standards?

Meanwhile, Indian industry at large has also been waiting to get invited! In May 2001, the Indian Government opened defence industry for up to 100 percent private sector participation and up to 26 percent Foreign

January 2012 it was announced that Dassault Rafale had won the competition owing to its lower life-cycle costs. The Rafale thus emerged "a world beater" after a very tough competition of "the best among of the best."

Rafale and induction of technologies

The Rafale is described as a state-of-the-art multirole combat aircraft capable of simultaneously undertaking air supremacy, air-interdiction and reconnaissance tasks as also airborne nuclear deterrent missions. In addition to this great operational capability, Rafale would infuse new technologies into the IAF. The large-delta winged fighter, with all-moving canards, has very high agility





Direct Investment (FDI), both of course “subject to licensing”. Major private-players in the defence sector today include Tata Advanced Systems Limited (TAS), Larsen & Toubro, Kirloskars, Mahindra Defence Systems and Ashok Leyland. Dassault were looking for a suitable Indian offset partner, their focus initially being on the Tata Group, with their historical connection in aviation. Reliance Industries, being the very well endowed financial group, was another choice, and one which they took. Indian industry strengths are well known, which can rapidly progress from small component manufacture to sophisticated electronics, software, critical engineering components, complex sheet metal work, high quality milling etc. Synergising the activities of DRDO, HAL and Tier-I Industry would have to be coordinated.

However, the management of offsets is a major task in itself. There is an Indian

company, Offset India Solutions (OIS), which has recently come about to extend a partnering approach and provide “customised expertise to international companies for fulfilling their Offset obligations throughout the lifecycle”, acting as an interface between Indian manufacturers and foreign companies. Others too have set up major ventures in India : Thales and Safran have traditionally a strong presence and relationship with Indian companies. The Safran group has already invested in India through Safran Engineering Services, with Snecma HAL and Turbomeca-India Engines as their major component. Thales also has joint venture agreements with BEL and Samtel for avionics and with Roltas for C4ISR systems, besides having a software development company in Chennai for global customers. Thales too has a major stake in India with the on-going Mirage

2000 fleet upgrade in France and are surely and anxiously awaiting conclusion of the Rafale contract. The MMRCA contract is humongous and could prove to be a turning point for India’s aerospace industry and a game changer particularly for the emerging private sector.

The New Missions

The Rafale, poetically in French means a ‘sudden gust of wind or squall.’ As the world awaits formalisation of this ‘fighter deal of the century’, let us examine what this ‘omni-role’ fighter would mean to India’s national security. Incorporating most advanced technologies with an open and highly adaptive architecture, the Rafale can efficiently perform all types of missions in day or night, in all-weather conditions, both stand-alone and in mixed-formation operations, which gives it high levels of strategic flexibility. The Rafale has been operationally employed over Afghanistan, Libya and Mali.

Defence analyst Chris Pocock succinctly described the first mission to Mali, which was a four-Rafale, 3,400-mile, air interdiction operation launched at night. The aircraft took off from an airbase in France with less than 48 hours’ notice and went on to destroy 21 identified rebel targets in the middle of Mali. They were each carrying three 2,500-litre external fuel tanks, with either six 500lb GBU-12 laser-guided bombs and a Thales Damocles designator pod, or six Sagem ‘Hammer’ AASM (Armement Air-Sol Modulaire), air-to ground modular GPS precision guided smart bombs. They



landed back at N'Djamena in Chad after 9 hours 45 minutes in flight, having been mid-air-refueled six times. Up to six aircraft subsequently flew daily day and night from N'Djamena to targets 800 miles away on reconnaissance and close-air-support (CAS) missions.

Lt. Col. Francois Tricot, commanding officer of one of the two French Air Force Rafale squadrons paid handsome tributes to the air crew : "To RV (rendezvous) with air refuellers, at 0200 hours over a dark continent when you are miles from anywhere, was commendable and reassuring, and proves that our interoperability training works !" He noted that the new generation reconnaissance pods contain long-range infrared band and visible spectrum sensors that can image from high altitude, as well as on high-speed, low-altitude missions. To save time interpreting the imagery, some preselected frames are data-linked to a ground station. "The Rafale can launch 12 Hammers within a minute and hit targets dispersed over a wide area" said Tricot. The Rafale can now also carry the longer-range 500lb GBU-22 and heavier 2,000lb GBU-24 laser-guided bombs. Availability rate of the Rafales was over 90 percent, despite tough deployment conditions.

The Indian Air Force has seen similar availability rates with its Mirage 2000 fleet. Mali also saw interoperability of Rafales with some of the aircraft types which also fly with IAF, which includes the IAI Heron UAV, the Boeing C-17, Lockheed Martin C-130 and Il-76, among others.

In action over Afghanistan and Libya, the Rafale has been tested over deserts, seas and high mountains. They have flown air defence, long range strike, maritime strike, reconnaissance and SEAD (Suppression of Enemy Air Defences) missions, which are a great portent of how the IAF will be able to employ the Rafale across the spectrum of missions.

The aircraft's multi-role capability is significantly enhanced by simultaneous management of systems for multiple missions, with the pilot acting as the 'battle manager'. Rafale's land and carrier-based versions have minimal differences, and in fact this is the only non-US fighter also cleared to operate from US aircraft-carriers. The Rafale has been thoroughly tested in large number of multi-national exercises such as Red Flag, Advanced Tactical Leadership Course exercise at UAE, 'Tiger' meet, Indo-French exercise 'Garuda' and others.

Commercially available modular data processing units allow continuous upgrades and seamless integration of new weapons. With max take-off weight being 2.5 times its empty weight it gives the Rafale great fuel and weapon carriage combinations with a phenomenal external load of nine tons. Visual and Beyond Visual range (BVR) MICA missile variants, modular bombs with option of GPS/infra-red/inertial kits, long range stand-off air-to surface (ground/sea) weapons, laser-guided bombs, 30mm cannon with 2500 rounds per minute, makes this a very potent weapon platform. Stealth features and the electronic warfare

suite improves its survivability. The Rafale has great man-machine interface. Being a 'mid-sized' aircraft, albeit twin-engined, allows for high reliability while its modular concept, including for the M-88 engine, reduces maintenance man-hours, costs and down-time, and also reduces spares inventories. Embedded in the design is easy accessibility, making the Rafale a 'maintenance man's dream machine'.

Extended mission ranges will allow Rafales of the IAF to dominate South Asian skies and project power through 'air-sovereignty' missions extended to Indian Ocean littorals, so meeting India's global aspirations. Benefits of transfer of modern technology would mean imbibing extensive technical knowledge. France is the only western country outside USA with an encompassing range of aviation technologies: cooperation would be mutually beneficial to India and France.

Events in recent decades, in the Falklands, Iraq, Bosnia, Kosovo, Afghanistan, Libya, Mali and Utrrakhand have confirmed that air power is always the first military component to be engaged in crises or conflicts. Military aviation undoubtedly remains the most strategic weapon. In modern warfare, air dominance from the very start is an imperative, so that ground and maritime operations can be conducted safely and efficiently. India now awaits this unique force multiplier carrying its national colours.

Images of Rafale from Dassault Aviation



The writer was among the first group of pilots who converted in France on Mirage 2000s. He also was the head of ASTE, the IAF's Flight Test Centre

Fingers Crossed!



Defence Minister AK Antony heads the DAC, which approved the new DPP

Tata Power SED has already demonstrated a mounted 155mm howitzer and will gain from the amended DPP

Defence Procurement Procedure Amendments

On 20 April 2013, the Defence Acquisition Council (DAC) approved amendments in the Defence Procurement Procedure (DPP) with focus on enhancement of indigenous content in defence products and solutions. The new policy would focus on the two objectives of infusing greater efficiency in the procurement process and strengthening the defence manufacturing base in the country. This will help in reducing vulnerability resulting from over dependence on foreign imports by strengthening the Indian defence industry. Recently, Defence Minister AK Antony said, "The only way forward for the country is rapid indigenisation of defence products, with both the public and private sectors playing pivotal roles in this endeavour". He also said that the government will make all efforts for creating a level playing field for Indian defence manufacturing industries vis-à-vis global players and also between the public and private sectors.

Highlights of the amendments in the DPP are :

- Introduction of a specific order of categorisation for acquisitions.
- Release of a public version of the Long Term Integrated Perspective Plan (LTIPP) for the industry in order to

direct its infrastructural capabilities and investments.

According to the DPP amendments, if any category has to be selected, the proposal must state reasons for not selecting the higher categories. Sequentially going through the priority list may be feasible in certain cases, however execution of this procedure across the board would be impossible. It has been stated that the right of refusal will be with the Indian industry.

- Elimination of the clause of nomination for Maintenance Transfer of Technology (MTOT) to Defence Public Sector Undertakings (DPSUs) and Ordnance Factories (OFs).
- Advance consultations for 'Make' procedure.
- Simplification of the complex 'Buy & Make (Indian)' procedure.
- Clear definition of what constitutes indigenous content.
- Ensuring faster progress in 'Make' and 'Buy & Make (Indian)' cases.
- Finalisation of the defence items list.
- Licensing for dual use items.
- Consultations on security guidelines for Indian defence industry.
- Resolution of tax related issues.
- Provision of funds for Micro, Small and Medium Enterprises (MSMEs) in the defence sector.
- Freezing of the Service Qualitative Requirements (SQRs) before the Acceptance of Necessity (AON) stage and reducing the AON validity from two years to one year.
- Provision of enhanced financial powers to Service Chiefs and decision making powers to DAC.

OIS

The major shift in the proposed DPP has been redefinition of procurement categories into five and their prioritisation. For all capital acquisitions, “Buy (Indian)” would be the topmost priority and “Buy (Global)” having least priority. According to the revision, if any category has to be selected, the proposal must state reasons for excluding the higher preferred category.

The order of priority of the acquisition categories are:

- Buy (Indian)
- Buy & Make (Indian)
- Make (Indian)
- Buy & Make with ToT, and finally
- Buy (Global).

The DAC has approved release of public version of the 15 year Long Term Integrated Perspective Planning (LTIPP) (2012-2027) outlining the Technology and Capability Roadmap (TPCR), aiming to provide guidance to the defence industry for planning their infrastructural capabilities, directing their Research & Development (R&D) and technology investments. It is a good move on part of the government however, it remains to be seen how well the industry makes use of the presented opportunity. The DPP amendment discards the nomination of OFB and DPSUs for MTOT in order to encourage private sector participation in Maintenance, Repair and Overhaul (MRO) work. This measure is a step towards providing level playing field to the private players and will have a positive impact on the defence industry.

A clear definition of content providing the much needed accuracy and decipherability in indigenisation is likely to be enunciated in a forthcoming DPP. Earlier, the DPP only specified the amount of indigenous content mandatory for programmes under the ‘Buy (Indian)’ or ‘Buy & Make (Indian)’ categories. The process and criteria for licencing defence items will be defined clearly with dual use items not even requiring licensing. The revision postulates that the SQRs will have to be frozen before AoN stage and the latter is valid for one year as compared with the previous period of two years. This reform is expected to accelerate the acquisition process and save the users the agony of time delays. The financial powers of the Service Chiefs are proposed to be raised from Rs 50 crore to Rs 150 crore,

thereby giving flexibility to the decision makers for quick acquisition of low value but essential equipment. DAC has been entrusted with greater powers in the sense that all deviations from the DPP will have to be approved from DAC instead of the Defence Minister, which is positive manner of devolution of powers.

Most amendments will have a positive impact on the Indian private industry. However, there are apprehensions of the adverse outcome of category prioritisation on the defence modernisation drive. It is envisaged that the Indian industry would be able to acquire technology from foreign technology partners by forming Joint Ventures, partnerships etc. and so offer solutions to the defence forces. Though the purpose behind the approach is focus on indigenisation and encouraging the domestic defence industry, it is questionable whether on ground the approach will be pragmatically possible.



The ‘Avro replacement’ programme is an attempt to leverage the DPP to foster indigenous industrial capabilities

India does not possess the technological capability and expertise to develop and produce requisite defence systems indigenously and to meet all the military requirements on its own. The requirements of huge investments, infrastructure, experienced professionals and test facilities would present considerable obstacles in rapid indigenous production. The development and qualification process of defence equipment is very tedious and time consuming. The stringent ‘No Cost No Commitment’ (NCNC) trials (field

trials, Electromagnetic Compatibility/ Electromagnetic Interference (EMI/ EMC), quality assurance tests) by users in different environmental conditions involve considerable resources, capital and risks.

According to the DPP amendments, if any category has to be selected, the proposal must state reasons for not selecting the higher categories. Sequentially going through the priority list may be feasible in certain cases, however execution of this procedure across the board would be impossible. It has been stated that the right of refusal will be with the Indian industry. The industry would tend to opt for either of the first two categories. It will be very difficult for local industry to undertake projects like development/ production of critical equipment such as aircraft, missiles, sensors etc. Therefore, the categorisation committee should critically examine essential factors like capability of the industry, the difficulty

in mastering such technologies, foreign restrictions on military equipment and the urgency of induction of equipment by our armed forces before carrying out procurement categorisation.

In order to fulfill the existing operational voids, critical acquisitions would have to be handled on case by case basis to avoid potential risk of huge time delays resulting from a new, well intentioned – but untested – procurement system.

Karanpreet Kaur (CLAWS)

Jim Roche, Deputy CEO, Pilatus Aircraft

VAYU : In 2013, it was stated that Pilatus was exploring the aspect of setting up a facility in India for PC-12 support. What is the status of this proposal at the moment? Do you foresee expansion of such a facility into a full-fledged production line?

JR: The Pilatus philosophy for any venture is based on the concept “think big, start small”. With regard to the Indian market, we currently have an appointed PC-12 distributor Air Charter Services Pvt. Ltd in New Delhi who deals with the General Aviation (GA) market. The distributor function also addresses support for those PC-12 aircraft in a general aviation/private operator environment and while the business is small by comparison to our worldwide fleet of almost 1300 PC-12 aircraft, it is promising.

For Government Aviation products, all management and support is primarily directed from our HQ in Stans, Switzerland and, where appropriate, a local presence is established when the fleet is of a size warranting such an operation. As we do not yet have PC-12 aircraft operating with any GOI entity, there is no immediate need to establish such direct in-country support

infrastructure. However, as we progress our discussions with HAL on manufacturing the airframe (fuselage & wing) for the PC-12, to meet our off-set obligation in part, we also expect that at some time in the future PC-12 airframes can also be built in India to support the GA market. The availability of other competent entities already established in India in this field & also the supply chain sector, has not escaped our attention and we have started looking at such companies to support our long-term development.

VAYU : The PC-24 business jet was announced in 2013, and a prototype is expected to fly in late 2014. What has been the market response to this aircraft and what sets it apart from other offerings from earlier established players in the business jet space?

JR : The market response following the introduction of the PC-24 at EBACE in Geneva in May 2013 was simply overwhelming. Operators from various segments such as corporate flight departments, charter, air ambulance and the private sector have shown great interest in the PC-24. They were all extremely excited about the aircraft's super-



versatile capabilities combining the runway performance of a turboprop with a spacious, flat floor cabin and jet performance. No other business jet offers the possibility to operate from runways as short as 2,690 feet, no other business jet allows operation from unpaved surfaces like grass or gravel and no other business jet features a separate cargo door making loading of cargo a simple thing. In a nutshell, the PC-24 doesn't fit in any of the existing business jet categories but creates a class for itself: *The Crystal Class*.

VAYU : The first batch of IAF cadets trained on the PC-7 Mk II graduated in December 2013 and flight training with the PC-7 appears to be progressing smoothly. What work, if any, remains to fulfil your contract obligations, and what does the future hold for your involvement in the Indian military arena?



PC-7 Mk II at Aero India 2013

JR : Indeed, induction of the new Basic Trainer Aircraft into the Indian Air Force inventory proceeded smoothly and due to Pilatus' unwavering commitment to match the performance of PC-7 Mk.II with timely deliveries, the first training course was successfully completed by mid-December last year. Summarising the first training course on the new aircraft, the instructors and flight cadets at the Air Force Academy (AFA) at Dundigal expressed immense satisfaction with the excellent, highly conducive teaching environment afforded by the new Pilatus PC-7 Mk.II trainer, which dramatically boosted the quality of instruction.

The deliveries of aircraft will continue as planned and a steady stream of additional aircraft is being added on a monthly basis. Under the accelerated delivery schedule, all 75 basic trainer aircraft are expected to be handed over to the Indian Air Force by mid-2015.

On the Ground Based Training System (GBTS) side, the delivery is on schedule as well. The first simulator along with Ground Mission Debriefing System (GMDS) is planned to be inducted as per the timeline in the first quarter of this year and will certainly significantly enhance the quality of instruction. The remaining GBTS equipment such as the additional simulator, cockpit procedure trainers, avionics part task trainers and computer aided learning system will be delivered during the course of this year.

With regard to the future market in the government sector, we see a significant future growth potential not only in the trainer aircraft segment but also in other areas such as transport, air ambulance, special missions and intelligence, surveillance and reconnaissance (ISR).

VAYU : So far, Pilatus appears to have made little headway into the civilian market in the Indian Subcontinent. Are you hoping that will change with the PC-12 and PC-24? What are your plans in the civil aviation market in India?

JR : Compared with the number of almost 1300 PC-12s that Pilatus Aircraft Ltd delivered worldwide, since the first PC-12 delivery in 1994, the twelve PC-12s in India may look small at the moment. However, the number is constantly rising and Pilatus is very positive that the general aviation sector will prove to be a successful market segment for the Pilatus PC-12.

The PC-12 has a track record of reliability and flexibility in operation around the globe. The PC-12 has found tremendous popularity in a various number of roles – executive transport, cargo, air ambulance, airline, and government special mission applications. In India with its large number of airports and landing strips, we consider the PC-12 with its outstanding versatility and short take-off and landing capability as the ideal aircraft for the growing Indian aviation market. With the development of our latest aircraft, the PC-24, we would expect to further expand our presence in

the general aviation market combined with the proven capabilities of our PC-12 and PC-6 types. These aircraft types can also respond to the ever growing need of other government agencies such as paramilitary, agriculture, infrastructure support and air-ambulance response services.

VAYU : Following on from the previous question: Medanta, a leading Indian healthcare group, recently ordered a number of PC-12 aircraft equipped as air ambulances. Could you share details regarding a typical air ambulance configuration on the PC-12? If the air ambulance market expands further, what means will Pilatus employ to support these aircraft, for which serviceability is crucial?

JR : I have to admit that Pilatus is proud that the well-respected Medanta is relying on the outstanding safety, dispatch reliability and mission flexibility of our PC-12 aircraft.

In a typical air ambulance configuration, the PC-12 allows for safe, comfortable, and fast transport for one or two patients on stretchers and medical crews and their life-saving gear (Intensive Care Unit or ICU). Its standard, large 53"x52" (1.35m x 1.32m) cargo door allows easy loading of the patients on stretchers. The PC-12 has proven itself to be a flexible and cost-effective air medical transport solution throughout the world and in some of the most extreme environments. In India, Pilatus has appointed ACS (Air Charter Services) as the official Pilatus Centre for the sales and service of the PC-12. ACS is one of the leading maintenance organisations in India and approved by DGCA (Director General of Civil Aviation) India as a CAR 145 Certified Company. ACS runs a 24 hours/7 days service facility with capabilities from line maintenance to heavy maintenance. Medanta also relies on ACS' services to save lives with the PC-12.



PC-12

The 'Avro Replacement' Programme



C-27J Spartan

The Alenia Option

The 'Avro Replacement' programme is shaping up in becoming a great opportunity for India to comprehensively re-energise and standardise on processes focused on air transport assets and capabilities of the Indian Air Force. With the C-130J Super Hercules already in service and additional numbers of this aircraft type just ordered, and with the C-17 Globemaster III entering into operational service, the IAF is well into the process of upgrading its heavy and strategic transport airlift inventory with latest technology aircraft. To keep pace with this process, the 'Avro Replacement Programme' could well become an appropriate manner in which to address the IAF's medium transport fleet requirements, which in effect constitute backbone of the Indian Air Force's airlift capability.

The choices for the IAF are not many. Without taking into consideration the proposed Indo-Russian MTA, an important design and development collaborative programme that will achieve completion later in the decade, it is virtually only the Alenia Aermacchi C-27J and the Airbus Military C-295 which are realistic competitors to meet

the requirement. However, the two aircraft types, if generally considered comparable, are actually very different and belong to two different categories. The C-27J was designed, developed and tested as a 'true' military aircraft using military standards to produce a robust, safe and capable platform, one which has obtained Military Qualification Certificate. At the same time the aircraft is airworthy as per civil standards, as witnessed by its certification from the Civil Aviation Authority EASA in 2001, making it as flexible as possible in every operational environment.

Because of its outstanding climb rate, high G maneuverability and inherent rugged design, the C-27J was designed to operate from all types of unprepared surfaces, including sand, gravel and grass. Thus operating in the high Himalayas, in the Western deserts or the north east and to meet with the most demanding aid to civil power and disaster relief missions, the C-27J is well suited. Other aircraft types are essentially civil derivatives and usually lower in cost but are lighter, have less engine power are less robust, with lower performance and perhaps not capable of

operating safely in the harsh operational scenarios.

One clear advantage point for the Spartan is its ability to fly faster and higher, important in the high mountain environment of northern India which makes the C-27J more cost effective.

Another advantage in favour of the C-27J Spartan is that it is powered by the same engines (the Rolls Royce AE2100-D2A, of 4,650 shp) - and similar avionics of the C-130J already in service with the IAF and its loading systems are perfectly compatible with consequent savings in terms of economics, training and interoperability.

The large cross section (2,60 meters high, 3,33 meters wide) and high floor strength (4,900 kg/m load capability) of the C-27J allow for heavy and large complete military equipment to be loaded. The aircraft can, for example, transport fighter and transport aircraft engines, such as those used on the C-130, Rafale and Mirage 2000, directly onto their normal engine dollies without any special equipment, along with a palletised VIP transport module.

(Advertorial courtesy:
Alenia Aermacchi)



Ramta's mines and IED Detection System

UNIQUE DEFENCE SYSTEMS FROM ISRAEL

IAI Ramta developing new mine and IED detection system

Israel Aerospace Industries' (IAI) Ramta Division has completed the last phase of engineering testing and has begun building a technology demonstrator of the multi-sensor 'MIDS' (Mines and IED Detection System) for detecting deep buried and surface-laid mines and Improvised Explosive Devices (IEDs).

MIDS will be deployed on a rugged, commercial, light tracked or wheeled (manned and/or unmanned) engineering vehicle according to operator needs. It will operate advanced ground-penetrating radar (GPR) and metal detector (MD) arrays in high threat environments to identify deep buried and surface laid mines / IEDs along the advancing route of manoeuvring forces. The two main

arrays (GPR and metal detector) produce data combined to analyse readings in real time, minimising false alarms from non-threatening materials such as rocks, wood and other debris.

An onboard IAI-manufactured electro-optic payload with day/night cameras provides remote operators with situational awareness and enable visual surveillance from a safe distance. On-board navigation systems allow the vehicle to travel along a precise series of pre-programmed or operator designated waypoints and record and transmit the exact location of such discovered threats. The MIDS will carry a remotely operated weapon system slaved to the electro-optic payload for self-defence against enemy action or for detonating threats on the operator's command. The system will also be equipped with a small dozer blade able to clear obstructions,

and a lane-painting/marketing system for designating both a safe path for following vehicles or troops and for outlining the location of discovered threats.

The development and construction of this technology demonstrator is taking place at the company's Beer-Sheva facility, and slated to be ready for field-trials by the end of 2014.



ELTA's radar on an Aerostat platform

H3C

IAI Elta's multirole radar system for aerostats

Israel Aerospace Industries (IAI) has recently delivered a multi-role persistent surveillance radar system mounted on an aerostat platform to a 'unnamed' customer. The tethered aerostat solution enables detection of low flying and surface targets at the radar's maximum range by mitigating curvature of the earth and terrain masking limitations. The radar system, developed by ELTA Systems Ltd., an IAI group subsidiary, is based on the ELM-2022A multirole radar and is capable of detecting and automatically tracking maritime and airborne targets from small periscopes to large maritime vessels in high sea states and in high-density coastal environments. The radar also includes a Ground Moving Target Indication (GMTI) mode for detection of moving targets in designated areas. Additionally, an infrared/electro optical (EO/IR) system is installed on the aerostat and integrated with the radar, allowing enhanced identification capabilities.

The persistent single platform concept permits multi-sensor coverage of air, sea and ground, while lowering the surveillance costs and integrating tactical target management. The system can be operated both manually and remotely and can be deployed to different areas as a primary sensor or temporary gap-filler. The aerostat sensor system has recently passed rigorous acceptance testing and is in the final stages of delivery to the end user.

Elbit delivers Hermes 900 to the Americas

Elbit Systems has delivered a Hermes 900 unmanned aircraft system (UAS) to "a customer in the Americas." The package includes Hermes 900 unmanned air vehicles, Universal Ground Control Stations (UGCS) including installation in a mission control centre, advanced electro-optic systems and additional unique systems. Owing to high demand, ESL has increased its UAS production activities and will soon be delivering additional Hermes 900 systems to other international customers,

Elbit Systems Ltd. announced (on 31 December 2012) a second contract to supply a wide range of Hermes 900 UAS to the Israel Defence Forces (IDF). This contract, a follow-on to the initial IDF order for



Hermes 900 in 2010, requires development of additional advanced UAS capabilities as well as UAS maintenance services. On 27 January 2013, ESL received \$35 million contract from the Israel Ministry of Defence for the development of advanced features for Unmanned Aircraft Systems, including quick re-configuration of the UAS' payloads.

Rafael's Spyder mobile air defence systems

The Spyder ADS family, developed by Rafael, which includes the Spyder

SR (Short Range) and the Spyder MR (Medium Range) is an advanced, mobile, quick reaction, network centric air defence missile system. Spyder systems are based on the same operational concept and use most of the same elements, and may be deployed independently or in combined deployment. As a low level, quick reaction missile system, it is designed to engage and destroy a wide spectrum of threats, such as attack aircraft, combat helicopters, cruise missiles, UAVs and UCAVs as also standoff weapons. The Spyder SR





is an all weather, network-centric, self-propelled, multi-launcher, quick reaction air defence system, which enables 360° missile launching within 5 seconds of the target being declared hostile by the Spyder-SR system. The Spyder-SR system uses

Beyond Visual Range (BVR) intercepts. The missile has operational flexibility and multi-shot capability, and can be launched against hostile aircraft day or night and in all-weather conditions. Additional Derby capabilities include look-down/



Rafael's most advanced, air-to-air missiles: the Derby, active radar Beyond Visual Range (BVR) missile, and the Python-5, a sophisticated dual band Imaging Infra Red (IIR) missile.

The Spyder-MR System is a Medium Range Air Defence Missile System (MRADMS), essentially based on the same elements as the Spyder SR, designed to engage and destroy a wide spectrum of threats and enables 360° missile launching within 2 seconds of the target being declared hostile. Like the Spyder-SR, the Spyder-MR uses the Derby and the Python-5, both missiles containing a booster.

The combat proven Spyder ADS is in operation with several forces worldwide.

The Rafael Derby missile

The Derby missile, an active radar air-to-air missile produced by Rafael, provides fighter aircraft with outstanding and effective performance in both short ranges and

shoot-down, sophisticated fire and forget mode, and an advanced ECCM tailored to the customer's operational requirements. Derby's light weight allows it to be adapted to various modern fighter aircraft, including light fighters such as the F-5, Mirage and F-16. The Python-5 IR Air-to-Air missile complements the Derby medium range air-to-air missile, and together they offer superior war fighting capability to ensure air superiority. The Derby Missile is already in operation with several air forces.

IAI Ramta Super Dvora fast patrol boats

Israel Aerospace Industries' (IAI) Ramta Division will supply three Super Dvora Mk 3 fast patrol boats to the Israel Navy. The current contract builds on a previous order of four ships. The Super Dvora Mk 3 is mainstay of the Israeli Navy's ongoing security activities, used for patrol and protection of Israel's coasts and strategic assets, prevention of terrorist activities and infiltration, as well as preventing smuggling and illegal activity in Israel's Exclusive Economic Zone (EEZ) and beyond.

The Super Dvora Mk. 3, which is the fourth generation of boats of this type, was developed in close cooperation between IAI and the Israel Navy using lessons learned during operations. The boats include an advanced propulsion system to allow sharp and quick manoeuvring as well as



unique speed tailored to various modern threats and designed with a variety of combat, detection, defence and attack capabilities. The Super Dvora incorporates these features in its relatively small dimensions, while maintaining operational flexibility, the crews safety and survivability of the vessel.

The boats are considered as one of the world's most advanced vessels in the fast attack craft category thanks to its high speed as well as its advanced detection, navigation, communication capabilities, and precision fire, controller aiming for naval superiority in the close combat arena. The Super Dvora Mk 3 is being evaluated by several countries for protection of strategic facilities within their EEZ, and as a countermeasure against hostile marine activity.

IAI Ramta Division's general manager, Brigadier General (Res.) Nitzan Shaked is quoted "We act on fully understanding the needs of the arena and our products are uniquely tailored to user requirements. Ramta has been providing leading products over several decades while maintaining fruitful cooperation with customers. Our end-to-end solutions are provided with full responsibility for their operational capabilities, reliability, technology and integration."

IAI Tamam's new Ground Target Acquisition System



Israel Aerospace Industries' (IAI) has recently delivered its Ground Target Acquisition System (GTAS) to a NATO country's Artillery Forward Observer (FO) units. Developed and manufactured by IAI's Tamam Division, GTAS uses an innovative concept for ground observation and target acquisition. GTAS can be used on the ground or on a vehicle, is carried and operated by a single soldier and can be deployed quickly without the need for calibration and fine levelling. GTAS features remote control operation, thus enabling the operator to control the system from a distant and secure location. The system's capabilities include accurate target geolocation, automatic target tracking, versatile map capabilities, target database, media recording and playback, and connectivity to external C4I systems. GTAS is based on Tamam's field-proven MiniPOP integrated with a rugged lightweight tablet, a hand-held display and control, power packs, tripod and special backpack. The system's total weight is 14 kg. GTAS sensors include a FLIR, Day TV, LRF (Laser Range Finder) and optional Laser Pointer. The sensors are bore-sighted and packed in a hermetically sealed closure.

Controp's SPEED-A payload for aerostats

Controp's SPEED-A payload has recently been ordered by an additional customer – this time in Europe - for surveillance applications on aerostats and balloons. The SPEED-A is also being used by the Canadian Army onboard the Aeronautics' Skystar



300 surveillance aerostat. The SPEED-A is field proven and also used in Israel and multiple other locations with extraordinary results for base and force protection - as well as border protection - and is providing



“unsurpassed surveillance performance.” This extensive and proven operational experience with the SPEED-A provides optimal security of a Forward Operating Base (FOB) in order to ensure secured support of tactical operations.

Controp believes that the SPEED-A aerostat payload system can also be well used to provide unique and proven solutions for border protection, site security and force protection, thanks to its versatility for a variety of surface terrains and missions.

The SPEED-A is a unique EO/IR payload developed for use on tactical aerostats thanks to its being a state-of-the-art gimbal system, with three gyro stabilised axes. In addition to the pitch and yaw traditional axes, the SPEED-A is also stabilised in the roll axis (which compensates for the unique roll movement of balloons). The powerful Continuous Optical Zoom Lens in the Thermal Camera ensures continual viewing of the target during zoom-in and zoom-out, as well as Image Enhancement features for low visibility conditions. The SPEED-A is also available with an optional Laser Range Finder (LRF). Weighing only 23 kg, the

unique SPEED-A camera payload is ideal for static balloons, providing long-range performance capabilities and superior surveillance images.

Controp's FOX thermal imaging cameras

Controp has launched the FOX 1200mm and 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 viz. 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.

The new FOX-1400 TI camera has a 1400mm lens with x35 Continuous Optical Zoom lens, which provides exceptionally long range target acquisition and observation, with unmatched superiority of night vision. The new FOX 1400 has already been supplied as part of the SPIDER LR system to several operators as part of a long-range observation system for coastal protection and surveillance.

The FOX family of thermal imaging cameras includes the FOX 250, FOX 450, FOX-600, FOX 720 and FOX-1400, all including the Continuous Optical Zoom Lens which have tremendous advantage over traditional thermal imagers with incremental zoom capabilities. The FOX continuous zoom feature provides smooth transition between various fields of view and ensures eye contact with the target through the entire zoom magnifications as well as during video tracking. The improved

CONTROP

Turning Vision Into Reality

Innovative EO / IR Solutions for Surveillance, Defense and Homeland Security Applications



SPEED-A

LDP

DSP-1

SHAPO

T-STAMP

M-STAMP

D-STAMP

CONTROP's multi-sensor EO / IR payloads are perfect for air, land and sea applications. Ideal for most platforms including small UAVs, balloons, UAVs, helicopters, light AC, land vehicles, naval vessels, elevated masts, ground platforms and more.

- Surveillance
- Defense
- Homeland Security
- Airport & Air Base Security and Protection
- Seaport & Harbour Security and Protection
- Coastline Protection and Surveillance (Blue Border)
- Border Protection and Surveillance (Green Border)
- Critical Infrastructure Security and Protection
- And more!



SPEED-LR



SPIDER



SPEED-V



MEOS



T-VIEW



DANIS



FOX

**Please visit CONTROP at
DEFEXPO 2014
New Delhi, India
Israel National Pavilion
Hall 11, Booth 11.25C**

www.controp.com

CONTROP
Turning Vision Into Reality



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). FOX cameras can also be integrated with other systems through 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.

Boeing and IAI MLM Arrow 3 complete flight test

The next-generation Arrow 3 interceptor, co-developed by Boeing and Israel Aerospace Industries' (IAI) MLM Division, has completed its second successful flight test, further demonstrating its ability to enhance Israel's multi-tier anti-ballistic missile defence strategy.

Arrow 3 is the latest interceptor for the Arrow Weapon System jointly developed by Israel and the United States. It can be launched upon threat detection and engage threats at higher altitudes outside the Earth's atmosphere than previous interceptors.

The Israel Ministry of Defence and the US Missile Defence Agency have recently conducted flight tests to prove Israel's national missile defence system. At 7:58 a.m. local time on 3 January, an Arrow 3 interceptor was launched from an Israeli test range and performed accordance with its mission profile before terminating, as planned, over the Mediterranean Sea.



Elbit EWS for the Gripen

Elbit Systems EW and SIGINT- Elisra Ltd. (Elisra), has been selected for the integration and delivery of Elisra's Passive Airborne Warning System (PAWS-2) onboard the Gripen fighter. The system was selected following a comprehensive in-depth evaluation and testing of the system in various scenarios as well as in a live fire test. PAWS-2



is part of the Elisra family of IR based combat-proven Missile Warning Systems, now in serial production and operational service. The system is based on years of both operational and technical experience and provides a combination of an off-the-shelf protection capability with IR-CENTRIC growth potential to cope with future requirements expected during the life-cycle of the Gripen fighter system.

PAWS-2 is an infrared Missile Warning System (MWS), which enhances aircraft survivability through an automatic pilot warning against missiles that are targeting the aircraft. The system uses image and signal processing to detect and track the missile's hot plume as it appears against the landscape background surrounding the aircraft. By evaluating the missile's trajectory, PAWS-2 discriminates between threatening and non-threatening missiles, and after detecting threatening missile, alerts the aircrew with a warning signal and activates countermeasures. PAWS-2 provides threat information to other EW systems as part of an EW suite, as well as to avionics subsystems. PAWS-2 can also operate as a stand-alone system. The Israeli Air Force has also selected PAWS-2 to serve as the Missile Warning System for its new F-16I fighter aircraft.

HAL achievements in 2013



HAL's flagship: the Dhruv ALH (photo: Army Aviation PRO)



Dr RK Tyagi, Chairman HAL presenting model of HAL LCH to Minister of Civil Aviation Mr Ajit Singh during the Paris Air Show, 2013

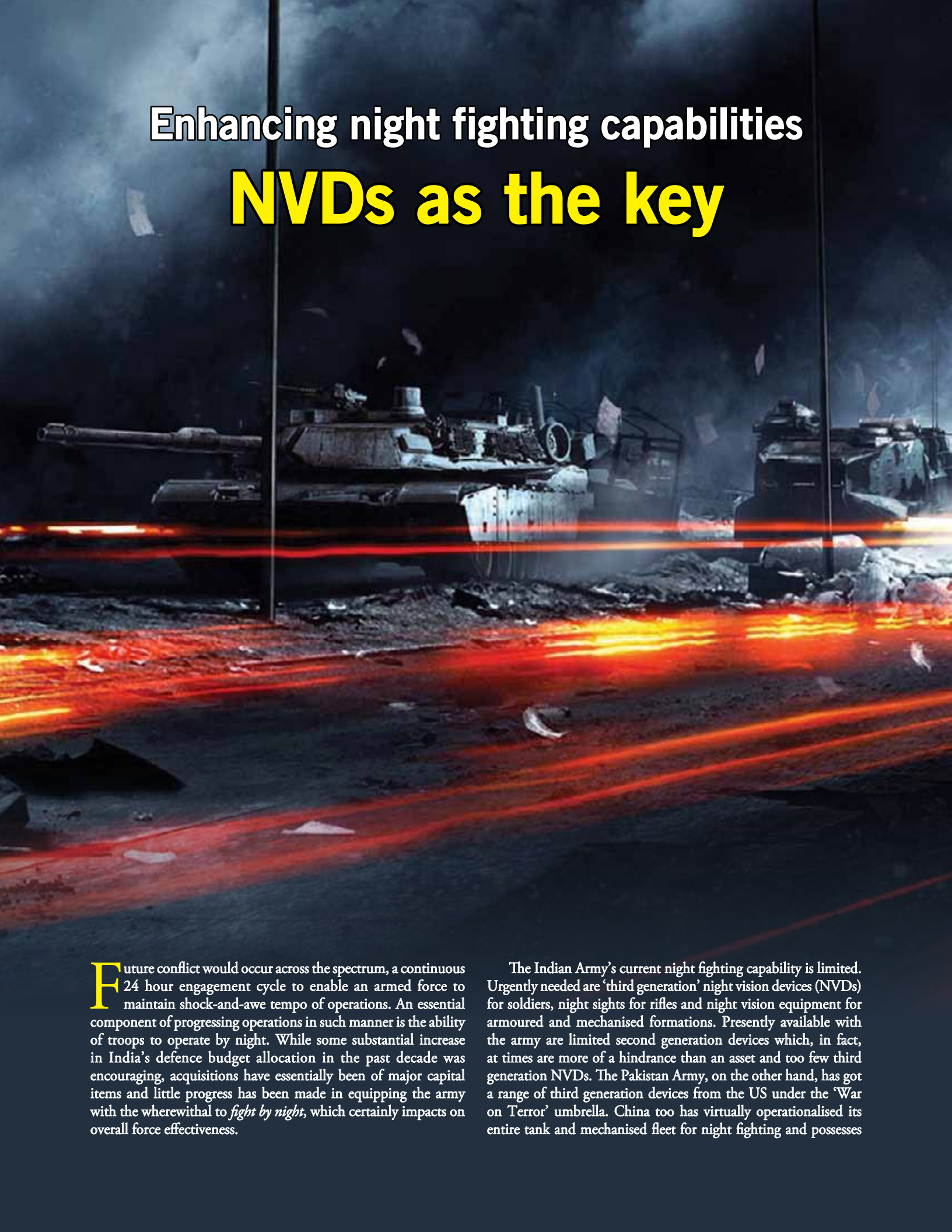
Dr RK Tyagi, Chairman HAL has reviewed the achievements of Hindustan Aeronautics Limited during the calendar year ending 31 December 2013.

- ☆ On 20 December 2013, Defence Minister AK Antony handed over 'Release to Service Documents' of the Tejas light combat aircraft (LCA) to the then Chief of the Air Staff, at a special function held at HAL, Bangalore. "This event paves way for entry of Tejas into operational service. More than 900 officers from HAL along with IAF personnel, scientists from the Aeronautical Development Agency (ADA) and others have worked together to ensure that this dream for India comes true". With this, India joins an elite club of very few nations with have this kind of defence capability even as HAL sets into the manufacturing mode for the Tejas.
- ☆ On 14 December 2013, the Indian Navy handed over a HAL Dhruv advanced light helicopter to the Maldives, prior to which two HAL Dhruvs supported the smooth conduct of elections in Nepal. Earlier, on 8 October, 2013, the HAL Dhruv fleet completed 100,000 flying hours thus achieving another landmark.
- ☆ On 6 November 2013 the Indian Navy inducted the first three Hawk advanced jet trainers manufactured by HAL at a ceremony at Vizagapatnam.
- ☆ On 5 November 2013, ISRO launched the Mars Orbiter Satellite and HAL has majorly contributed to this mission as well as to other important missions in manufacturing all the satellite structures launched till date by ISRO.
- ☆ R&D has remained under focus during the year 2013, with HAL filing 205 patents and establishing Chairs at Indian Institutes of Technology at Kanpur, Roorkee and Chennai. HAL's 10 R&D Centres were brought under the ambit of Committee of Institutional Network (COIN). HAL Board also decided to create an R&D corpus fund by earmarking 10% of annual profits of the Company for concentrating on advanced & applied research in the aerospace domain.
- ☆ HAL's synergy with the Defence Forces, MoD, DRDO and PSUs has continued and effective action plans formulated for the HTT-40 basic training aircraft, the Fifth Generation Fighter Aircraft (FGFA), Multirole Transport Aircraft (MTA), Medium Multirole Combat Aircraft (MMRCA), UAVs and 25 KN aero-engine, amongst others.
- ☆ As a diversification strategy, action plans for the Special Purpose Vehicle (SPV) responsible for developing a new regional transport aircraft, MRO, Airport operations as also for civil helicopters were further developed.
- ☆ HAL's focus on Quality, Customer Satisfaction, timely deliveries and indigenisation was further sharpened, the Year 2013-14 specially dedicated for enhanced quality.

Initiatives like Vendor Meetings, MoU with Transparency International, strengthening the supply base, employee survey and competency mapping and sector skill council in aerospace and aviation sector continued. A batch of 285 management trainees joined HAL, and in keeping with the highest standards of speed, transparency and governance, results of the recruitment were declared within 48 hours of personal interview (98,000 plus aspirants took the written test).

The Department of Public Enterprises (DPE) granted 'Excellent' rating to HAL for performance during the year 2012-13. On 12 December, 2013 the Standing Conference of Public Enterprises (SCOPE) announced *SCOPE Award for Excellence and Outstanding contribution to the Public Sector Management - Institutional Category-I for 2011-12* for HAL. On 19 December, 2013 Dainik Bhaskar gave Gold award to HAL in 'Defence Category' at Delhi, while on 20 December, 2013 the Institution of Engineers (India) gave the 'IEI Industry Excellence Award 2013' to HAL. Defence Minister AK Antony also awarded HAL with the 'Best Division Award' for Hyderabad and Individual Award Category for Foundry & Forge Division on 25 November, 2013. Apart from this, HAL also received various other awards for its outstanding performance in various areas.

Courtesy : HAL

The background image is a dark, high-contrast night scene of a battle. In the center, a tank is visible, partially obscured by smoke and debris. Several bright, horizontal orange and red laser beams or light trails cut across the lower half of the image, suggesting intense combat or targeting. The overall atmosphere is one of chaos and warfare.

Enhancing night fighting capabilities

NVDs as the key

Future conflict would occur across the spectrum, a continuous 24 hour engagement cycle to enable an armed force to maintain shock-and-awe tempo of operations. An essential component of progressing operations in such manner is the ability of troops to operate by night. While some substantial increase in India's defence budget allocation in the past decade was encouraging, acquisitions have essentially been of major capital items and little progress has been made in equipping the army with the wherewithal to *fight by night*, which certainly impacts on overall force effectiveness.

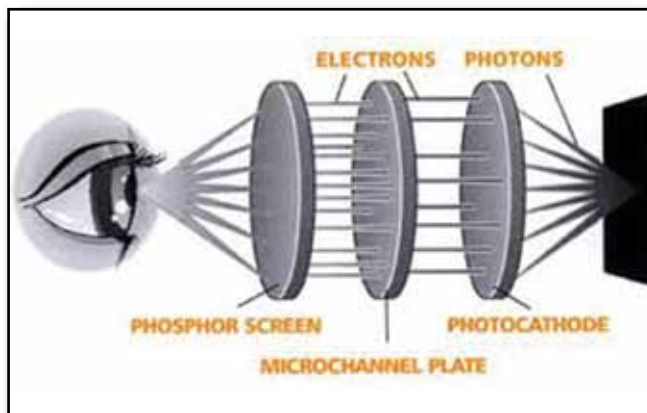
The Indian Army's current night fighting capability is limited. Urgently needed are 'third generation' night vision devices (NVDs) for soldiers, night sights for rifles and night vision equipment for armoured and mechanised formations. Presently available with the army are limited second generation devices which, in fact, at times are more of a hindrance than an asset and too few third generation NVDs. The Pakistan Army, on the other hand, has got a range of third generation devices from the US under the 'War on Terror' umbrella. China too has virtually operationalised its entire tank and mechanised fleet for night fighting and possesses



significantly higher night capability in other arms as well. Limited night fighting capability decreases force effectiveness and leads to reduced deterrence, thus providing a window of opportunity to the adversary.

However, the ability to design and develop (or directly procure) NVDs for the Indian Army is not as difficult as the other massive modernisation programmes undertaken by the Ministry of Defence (MoD). Although not as complex as a fighter or submarine, NVDs are crucial to India's security providing the army ability to fight at night and in other conditions of reduced visibility. Most advanced armies of the world have third generation NVDs as their core

equipment, complemented by earlier generation equipment, while fourth generation equipment is already in the test and field trial phases. According to Lt Gen PC Katoch (retd), former Director-General (Information Systems), the four important performance parameters of any NVD are its signal-to-noise ratio (SNR), resolution/clarity, modular transfer function and lifetime. "SNR is by far the most important parameter for an image intensifier tube [II tube]," states Katoch. An II tube constitutes 70 per cent of the cost of the device. A comparative analysis between 2nd and 3rd generation on the main four parameters of NVDs reveals such a gap in defence preparedness vis-à-vis other nations.



Other major advancements of third generation NVDs are the reduced halo effect visible mostly in urban environment, picture clarity particularly at the edges, enhanced images at reduced levels of available light, more panoramic view and self-contained power supply. Other add on technologies which can be used in conjunction with NVDs are thermal image intensifiers and infra-red illuminators which reduces the dependence on ambient light (starlight, moon light) and provide for a light source of its own, invisible to human eye of the adversary.



A contract for manufacture and delivery was awarded to Bharat Electronics Limited (BEL) in 2010 but not much has been prepared so far. BEL, which has invested in second generation sights and even set up a factory, has reportedly informed the Ministry of Defence that all procurements should be made through the PSU. In the meantime, BEL has asked the Army to wait till it finds a foreign partner to manufacture third generation devices "indigenously", but at the time of writing, BEL is yet to confirm a possible tie-up. Not surprisingly, foreign companies are not keen on sharing technology with a PSU and would rather tie up with private players for "hassle free" production. NVDs can form a strong case for private participation as the technology although advanced is not as complex as some other military platforms, and is a field which the government must open to India's private sector. It would have beneficial spin offs as the equipment has great usage in the private sector too especially in security related concerns.

Another drawback is the availability of power sources for foreign procured NVDs. Here again battery chargers were procured at the ratio of one for every 4 NVDs procured. As per the noted defence analyst Brig Gurmeet Kanwal, the usage pattern of NVDs dictates that each NVD must have its own charger and adequate battery supply must be catered for. Current authorisation patterns of chargers and lack of availability of batteries renders the equipment ineffective for most of its operational life. The solution could include production of batteries and power chargers in-house, which is pretty much a standard technology.

According to reports available in the public domain, the Indian Army needs some 30,000 third generation NVDs to meet its requirements as per the present war establishment (WE) authorisation. The large numbers required add substantially to cost but this could be reduced with indigenous manufacture. There is a need to further enhance these holdings as presently only one device is authorised per section and the need is to equip each infantryman with a NVD. As a first step, at least 50 per cent of the soldiers need to be so equipped.

2nd Generation

SNR: 12 to 20
Resolution: 40 to 45 lp/mm
Life: 5000 hours
Magnification: 20,000 X

3rd Generation

SNR: 22 to 30
Resolution: 64 to 72
Life: 10000 hours
Magnification: 30,000 to 50,000 X

NEW (REPLACE) MKU



NVDs are critical force multipliers which provide the ability to overwhelm an enemy when he is most vulnerable, which is at night. The Ordnance Factory Board at Dehra Dun has been providing the Indian Army with high resolution binoculars of acceptable

performance standards and are also working on NVDs for rifles used by the Infantry. Such examples of indigenous success should be strongly promoted. The equipment being procured or produced indigenously should be subject to range of battle field conditions and tests before ascertaining their acceptability.

It is obvious that night fighting capability of the Indian Army, particularly the infantry and Special Forces must be upgraded on a 'war footing'. The latest NVD technology which can be looked at is the black and white picture for night scenes as compared to the classic green hued image. Night time scenes appear remarkably more natural and clear in black and white combination. The night fighting capability is crucial to the success of critical defence programmes such as F-INSAS, new MBTs, Special Forces equipment and indigenous FICVs.

The ability to fight at night has been constrained since ancient times but in the 21st century, it is a matter of do – or die !

Raveen Janu
(CLAWS)

Sagem's JIM LR long range multifunction infrared binoculars

JIM LR is a multifunction infrared binocular equipment, used for observation, identification and precise positioning of targets. Integrated in combat tactical networks, JIM LR is a component of the intelligence cycle, close to the targets.

A compact unit weighting 3 kg, this integrates day vision, thermal vision, rangefinder, laser pointer, GPS and magnetic compass. The latest version adds additional functions: video recording (2 hours, 30 minutes), day-night image fusion to see through camouflage, anti-glare function in the infrared band, a laser pointer with a range of 2,500 metres. It offers run-time of 4 hrs. 45 mins. on a battery charge, and delivers enhanced reconnaissance and identification performance.

JIM LR can be used in several configurations :

- ★ In a stand alone configuration for combat, reconnaissance, protection. search and rescue.

- ★ With the new DHY 307 LW, compact laser designator for engagement of precision air-to-ground weapons (LGB Paveway II or AASM Hammer by Sagem). DHY 307 LW is developed and produced by CILAS (EADS)

- ★ As an optronic multifunction intelligence asset, when combined with a tactical terminal.

The performance of JIM LR binoculars can be enhanced in being used in conjunction with Sterna, a brand-new target location system. Developed jointly by Sagem and its Swiss subsidiary Vectronix, Sterna's performance is based on the innovative hemispherical resonator gyro (GRH), a technology patented by Sagem. Used in conjunction with the measurements by JIM LR or any other range finding binoculars, Sterna extracts precise target coordinates. Weighting less than 3 kg, Sterna was also designed with the special weight and energy requirements of forward observers in mind, since they operate in severe environments and cannot count on much supply support.

More than 5,000 JIM LR units are now in service or on order, including 2,000 with the French armed forces, and has also been ordered by several NATO forces, namely the United States, Denmark, Poland and the United Kingdom. JIM LR are used by special forces for intelligence, targeting in close-air-support action, dismounted combat operations, site protection, border surveillance, search and rescue.

Based on FELIN technologies (the integrated soldier system of the French Army) Sagem has developed the Odin, a day/night sighting system slaved with 20 to 25 mm machine guns and cannon, enabling high-precision firing for reduced munitions consumption. Odin can be installed on the weapons mounted on a helicopter's door and because of its ability to perform off-axis sighting, Odin provides complete protection for the gunner, while also enabling shooting at a high depression angle. Its modular design enables mounting on vehicles or tripod mounts.

Sagem also offers Sea Odin for fast landing craft.



DRDO

Transformation of the Indian Army



Technology as a Driver

The Indian Army transformation programme was initiated in 2009 with a clear mandate of “optimising resources, right-sizing for effectiveness and technology insertion”. The need to undertake such transformation process has been necessitated by the twin requirement to provide the Indian Army decisive military capability as well as remain operationally relevant. The triggering of this inescapable need is attributed to the dynamics of security environment in the regional and global context apart from the need to replace ageing technologies and modernise in tune with global developments. The Indian Army would therefore need to leverage emerging and newer technologies to provide impetus to modernisation plans and also support our envisaged doctrinal and conceptual shifts in warfighting.

Contemporary military technology and future advances will certainly enable military operations to be conducted with greater speed, precision and selective destruction. In order to fully exploit the potential offered by these technologies, it is therefore

imperative that any force restructuring or transformation takes into account the technology aspects, especially those in critical areas like ISR, command & control systems and precision guided weapons. Such technology acquisition and development has thus potential to emerge as a driver to support transformation of the Indian

Army and mitigate the risks associated with obsolescence and a perpetually low national technology threshold.

The Premise of Technology

An analysis of the capabilities of armies in developed nations and the operational exploitation of advanced



Column of present generation main battle tanks

IAI Malat

defence technologies and innovations in the field by the US and its allies in Iraq and Afghanistan, reveal a wish list that has been identified to support the transformation process, and is based on the following premise :

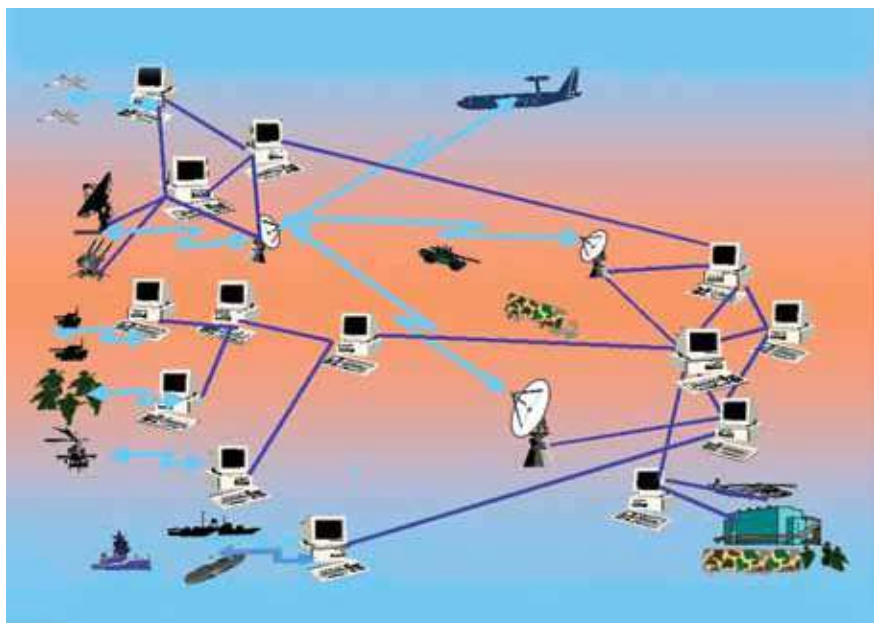
- ⦿ Weapon systems and platforms should facilitate mobile warfare i.e., emphasis will be on faster mobilisation and persistent ISR capability.
- ⦿ Dominant battle space knowledge with combined capabilities of Battlefield Management System (BMS), C4ISR and interoperability between theatres as well as the three Services.
- ⦿ Decisive neutralisation of regional threats and credible deterrence capability against extra-regional threats.
- ⦿ Range of capabilities across the spectrum of conflict.

- ⦿ Control the use of space and counter conventional and ballistic missile threats.

Technological Imperatives

The Technology Perspective Capability Roadmap (TPCR) approved by the Indian MoD in August 2012, and available in open domain, lists defence technological advances that the Armed Forces are looking for during the next 15 years timeframe. Of this list, the following are considered critical for capability development and supporting transformation :

- ⦿ Developing technological advances in battle space management, together with advances in accuracy and enhanced ranges of guided munitions and sensors, both on ground and airborne (UAVs and satellites).
- ⦿ Enable MBTs and other armoured vehicles to engage targets at longer ranges, beyond LOS.
- ⦿ Provide an information sphere to provide persistent situational awareness duly networked with sensors-and-shooters.
- ⦿ Robust mobile communication network.
- ⦿ Digital communication network using Battlefield Management System (BMS), communication satellites and Software Defined Radios (SDRs).



Command and control systems using computers and interfacing with battle and other sensors

Puma Infantry Fighting Vehicle developed by Krauss-Maffei Wegmann and Rheinmetall for the German Army



BEL



- ⦿ Network enabled capabilities to facilitate greater availability of shooter, shorter sensor-to-shooter response times and faster decision making.
- ⦿ Night fighting capabilities based on thermal imagery (TI) seekers with uncooled detector arrays for better sensitivity and enhanced ranges.
- ⦿ UGS (Unattended Ground Sensors).
- ⦿ Acoustic, seismic, optical, electro-optical (EO) and magnetic sensors with greater accuracy and improved ranges, for enhancing situational awareness.
- ⦿ UAVs with IR, SAR or ISAR via satellite data links for precision target acquisition, ISR and PSDA.
- ⦿ Indigenous GPS (IRNSS) for PNT and improved precision targeting.
- ⦿ Improve sensors, in accuracy and range, on board satellites, UAVs and ISR systems to provide positive identification of tanks, armoured vehicles, SAMs and other ground support equipment.
- ⦿ Fiberoptic communications to provide greater redundancy and higher security against cyber attacks.
- ⦿ Development of indigenous Future Main Battle Tanks (FMBT) and Future Infantry Combat Vehicles (FICV).
- ⦿ Development of anti-tank weapons to counter developments in armour protection technologies.
- ⦿ Development of information superiority to degrade adversary's combat potential while safeguarding own.
- ⦿ Developing a potent Area Missile Defence as a safeguard against possible tactical ballistic missile strikes.



Raytheon-Lockheed Martin Javelin next generation anti-tank missile

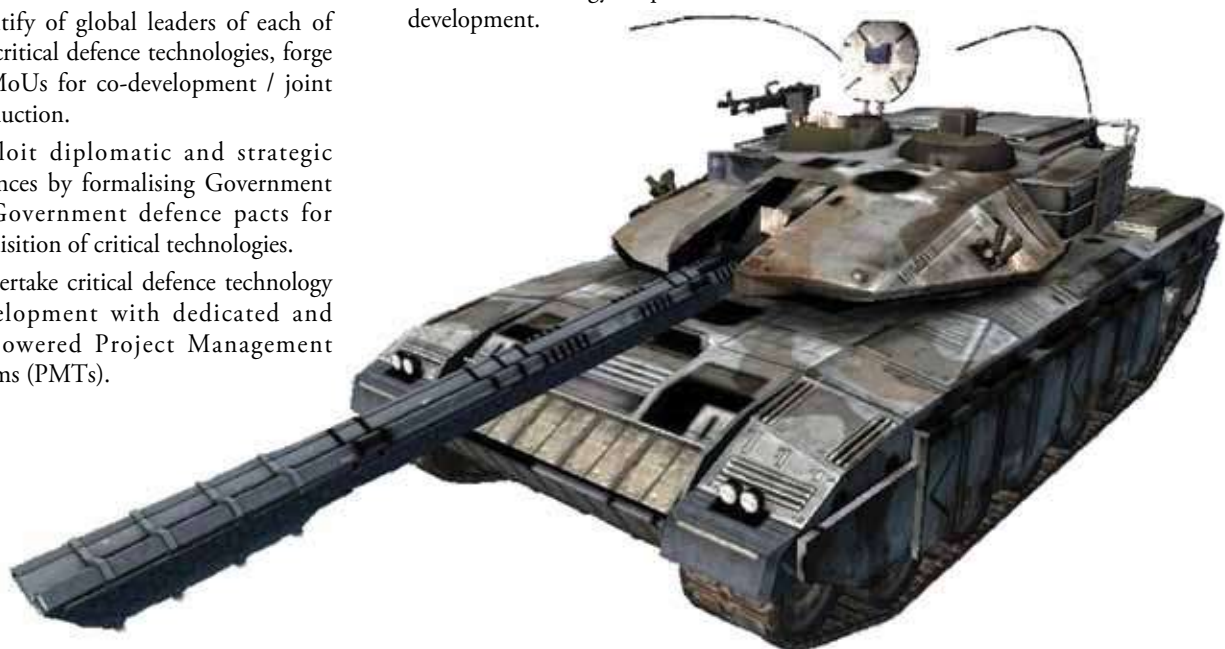
The Way Forward

No dream of transformation, leading to credible capability development, can materialise without induction of identified technologies. The following will facilitate defence technology acquisition and work towards realisation of the transformation endeavour :

- ⦿ Conceptualisation of a road map for development or acquisition of these critical defence technologies.
- ⦿ Formulate an acquisition strategy and evolve related acquisition methodologies for each critical technology.
- ⦿ Derive (and legislate) sacrosanct timelines for technology development and conversion into capability by production of resultant defence equipment.
- ⦿ Identify of global leaders of each of the critical defence technologies, forge of MoUs for co-development / joint production.
- ⦿ Exploit diplomatic and strategic alliances by formalising Government to Government defence pacts for acquisition of critical technologies.
- ⦿ Undertake critical defence technology development with dedicated and empowered Project Management Teams (PMTs).
- ⦿ Stakeholders be taken on board so that projects do not dissipate midway for vested interests.
- ⦿ Undertake periodic appraisal of technology acquisition/ development schemes and projects.
- ⦿ Actively involve academia, MSMEs and private sector defence industry in sharing technology and generation of parallel capacities with adequate security safeguards.
- ⦿ Identify various areas of dual use technologies to hasten development and absorption into commercial applications.
- ⦿ Earmark adequate national resources including infrastructure and allocation of dedicated budgets to facilitate defence technology acquisition and development.
- ⦿ HR transformation in new raisings, accretions and conversions, in sync with equipping plans related to induction of advanced defence technology into fighting units, thereby providing the cutting edge

This 'wish list', in the form of recommendations, is neither exhaustive nor a guaranteed solution to fast track the transformation process, which is highly dependent on equipping strategies and induction of newer equipment. Still, this is a multi-pronged approach, which keeps track of technology acquisition and development alongwith force structuring to ensure a secure future.

Bikramdeep Singh
Senior Fellow at CLAWS



Depiction of a possible future main battle tank (FMBT)

A GORDIAN KNOT

The Challenge of Offsets



The bulk of the long-awaited Mirage 2000 upgrade is to be conducted by HAL in India (photo: Dassault Aviation - G. Gosset)

India's Defence Offset Policy has been simplified and clarified several times after being introduced in 2005 as part of the Defence Procurement Procedure (DPP). When the offset policy was conceived, it was envisaged that there would be rapid indigenisation in defence and that the Indian defence industry would reap immediate benefits. However, nine years since its inception, the policy is still 'evolving' and the pace of indigenisation through offsets is far from expectations of the stakeholders. The major impediments in offsets procedures relate to conflicting government policies, bureaucratic procedures, inefficient managing body, execution problems and vested interests of some of the stakeholders.

The policy being in a nascent stage has been modified and amended numerous times. Some stakeholders resist the changes in the policy as they feel that the policy is being diluted while others want further amendments in the policy to suit their requirements. As a result, no consensus is reached among the stakeholders for an offset policy that is acceptable to all. Participation





Scorpene diesel-electric submarines are being built in India under a transfer-of-technology agreement facilitated by the DPP

of the domestic private industry is thwarted by many irritants such as taxes and licensing issues. The financial burden in the form of service tax, customs duty, VAT, exchange rate variations, while delays in obtaining industrial licenses to manufacture defence related equipment are major impediments for an upcoming private defence sector. The success of the IT industry certainly can be emulated for practical and effective application of policies and procedures, but the private industry views that the government does not provide requisite incentives for them to venture into defence and that most of their policies are biased towards the public sector.

‘Offsets’ is a complex subject and it takes time to understand the associated intricacies. Most of the decision makers have limited grasp of the essentials of offsets and hardly possess relevant experience in managing of them. In addition, the lack of accountability leads to lackadaisical attitude on the part of the concerned government officials towards offsets. Industry experts feel that in certain cases, vested political and personal interests of officials involved create detriments for the OEMs and indigenous industry. There is lack of coordination among stakeholders because of which



consensus on critical issues cannot be reached. As a consequence, different stakeholders have varied and divergent interpretations of the same clauses of offset contracts. This can be aptly discerned from the observations made by the CAG in the November 2012 report, wherein it was noted that several foreign vendors “misunderstood the offset guidelines and even tried to manipulate the contracts”.

Another challenge that needs to be addressed during execution of offsets relates to time and cost overruns. The private industry lacks relevant experience in defence production and has limited capability of technology absorption. The qualification criteria for military grade products are very stringent and some of the private companies do not visualise such complexities during the pre-contract stage. A very critical issue pertains to technology obsolescence where the technology becomes obsolete before it is even inducted. Electronics, for example, being at the forefront of critical technology, is the worst affected by obsolescence issues. The contract execution timelines are so long that most of the offset contracts become unviable during the final stages of implementation. Even the evaluation of ToT is judgmental in nature and there does not seem to be any standard scientific criteria to evaluate ToT, which can lead to mismanagement of resources. Industry-related issues pertain to misguidance by agents, misrepresentation of facts by industry, unethical practices by domestic companies, unrealistic expectations by the Services and frustration owing to delays. Some such issues came to light when the CAG examined sixteen offset contracts signed till February 2012 and released their observations in November 2012. A few issues highlighted by CAG relate to non adherence to DPP guidelines, waivers given by the MoD to foreign vendors, use of Direct Foreign Investment (DFI) in kind to discharge offset obligations, invalid Indian Offset Partners (IOPs) and unfulfilled penalty charges.

The gaps in implementation of the offset policy need to be honestly recognised and addressed at the earliest. It is essential to understand the formative idea of offsets and its potential to expedite industrial growth for strengthening the economic and military prowess of the nation. There is a requirement of increased interaction and cooperation among the stakeholders for mutually agreed upon offset related decisions. There needs to be a forum where all stakeholders can put forth their queries and views which are addressed in a time based manner. Investment towards R&D is one of the most important elements to enhance technology absorption and development capability. Israel and South Korea were successful in utilising offsets efficiently through a streamlined policy, clear vision and dedicated industry. In addition, they made adequate investments in R&D to enable absorption of technologies and carry out further developments.

India produces the largest number of IT and engineering professionals. The capital and resources of the private industry coupled with the pool of talented professionals needs to be directed towards developmental projects in defence sector. The armed forces need to play an active role to provide necessary support and guidance during the R&D and production stages. The CAG and other audit agencies could periodically examine the offset processes and contracts so that loopholes are plugged and concerned authorities take appropriate action against defaulters. Such a mechanism of probity, accountability and transparency needs to be evolved and implemented. The ToT mechanism needs to be properly evaluated based on set criteria without leaving any room for ambiguity.

The offset policy is evolving and it is natural for the process to be faced with challenges during its initial journey. However, continuous efforts by the concerned stakeholders to synergise their actions in filling the gaps will go a long way in making offsets a success story and creating a reliable and robust defence industrial base in India.

Karanpreet Kaur (CLAWS)





Sans offsets : the Su-30MKI air superiority fighter is manufactured under licence by HAL (photo: Angad Singh)

PGMs

The Great War Changer



US Reaper drone over mountainous country (Afghanistan ?) firing precision guided missile

That Precision Guided Weapons (PGMs) have changed warfare is now a cliché ! Directed against pinpoint targets, fired from land, sea, air and, soon, outer space, these have been in use post-Second World War but came into prominence during the Vietnam War. Richard Hallon of the Australia Air Power Studies Centre has described this as “the most important development of the twentieth century”. Major General Fuller, a reputed strategic analyst, considers “accuracy of aim” as one of the five recognisable attributes of weaponry, the other four being *range*, *striking power*, *volume of fire* and *portability*. Current PGMs are capable of fulfilling all these parameters effectively, destroying targets at incredible speed, thereby breaking the enemy’s will to fight.

Use of PGMs in Wars

Actually, attempts to use PGMs go back to the First World War, even though these were primitive and thereafter, such



Actual war picture of PGMs destroying the Thanh Hoa Bridge in Vietnam

Rafael



Paveway II Dual Mode Laser Guided Bomb (DMLGB)

efforts continued during the Second World War and then the Korean War but the real 'breakthrough' occurred during the Vietnam War when persistent efforts to destroy the Thanh Hoa Bridge, which connected North and South Vietnam, failed despite numerous bombings by the United States Air Force. It took almost five years to destroy the bridge by Laser Guided Bombs (LGBs) from A-7 Corsair attack aircraft of the US Navy, thereby severing the critical road link between North and South Vietnam.

The First Gulf War saw effective use of PGMs. Here, the Air-Land-Battle concept of General William Westmoreland was transformed into attacks on 'Centres of Gravity' as postulated by Colonel Warden of the US Air Force. The United States thereafter conceptualised the Air-Sea-Battle concept which extrapolates targets in an attempt to undertake amphibious operations followed by capture of key land targets. The First Gulf War concentrated on the 'shock-and-awe' approach, aimed at collapse of the command and control structure as also complete logistics system of the Iraqis.

PGMs were extensively used in the Bosnian conflict of 1999 where pilots flying B-2 stealth bombers took off from bases in the Continental United States and were briefed on their targets enroute. Use of PGMs was devastating. Then came the Second Gulf War, Libya, Afghanistan and sporadic actions by Israel against the Hamas and Hezbollah which saw intensive use of PGMs.

The 21st Century has ushered in combat drone attacks which have been extremely effective in North Western Pakistan, Afghanistan and Yemen. The Al Qaeda leader Said El Shahrer was killed in a drone attack in Yemen. The percentage of PGMs used by the United States has multiplied, from a mere 0.2 percent in Vietnam, to 8 per cent in the First Gulf War, 35 per cent in the Kosovo Conflict and 56 per cent in the Second Gulf War, Afghanistan and Libya.

Types of PGMs

PGMs come in various shapes and sizes : those which can be fired from the air, sea, outer space as also land. There are air-to-air missiles, joint direct attack munition (JDAM), LGBs, with unmanned combat aerial vehicles (UCAVs) firing Hellfire fire-and-forget missiles, air-to-ship missiles, air-to-ground missiles as also 'loitering' missiles. The US Navy has similar missiles which can be fired from ships and submarines.

The Army primarily has three types of PGMs, the first of which are course-corrected, area effect warheads like the Excalibur and Guided Multiple Launch Rocket System. Then there are sensor-fuzed, shoot-to-kill types like the SADARM and Bonus. Then those which are terminally homing, or hit-to-kill-the-target by Krasnopol. Precision Guidance Kits (PGK) take the form of Course Correction Fuzes fitted on the nose of a projectile to give unprecedented Circular Error of Probability (CEP).

Proliferation of PGMs

The employment of PGMs is based on nature of the target. All NATO countries, Russia, China, Australia, South Korea – and



Precision Guided Bomb carried by IAF Mirage 2000s

PGMs come in various shapes and sizes : those which can be fired from the air, sea, outer space as also land.



Indian Air Force Mirage 2000H over the Karakoram

of late, Pakistan - use PGMs extensively. The United States has taken a conscious decision to raise its stocking levels by 50 percent. So as to ensure that a PGM is effective, it is extremely important to accurately locate the target and therefore, target location by devices like satellites, unmanned aerial vehicles (UAVs), aerostats, battlefield surveillance radars (BFSRs) and the long-range reconnaissance and observation system (LORROS) are essential to provide accurate inputs which are gainfully employed to optimise target intelligence.

Employment of PGMs in India

The Indian Air Force first successfully employed LGBs, as also PGMs, launched from Mirage 2000s with Litening Pods for attacks on Tiger Hill and Muntho Dhaho in the summer of 1999. The IAF has steadily inducted PGMs in adequate measure to meet its operational commitments, which include air-to-air, air-to-ground, ground-to-air and ground-to-ground munitions. The Indian Navy is similarly inducting a wide variety of PGMs, which can be fired from ships, submarines and from the air by naval aircraft.

According to India's Long Term Integrated Perspective Plan (LTIPP) and Technology Perspective & Capability Roadmap (TPCR), requirement of PGMs with a CEP of 3 metres is stated.

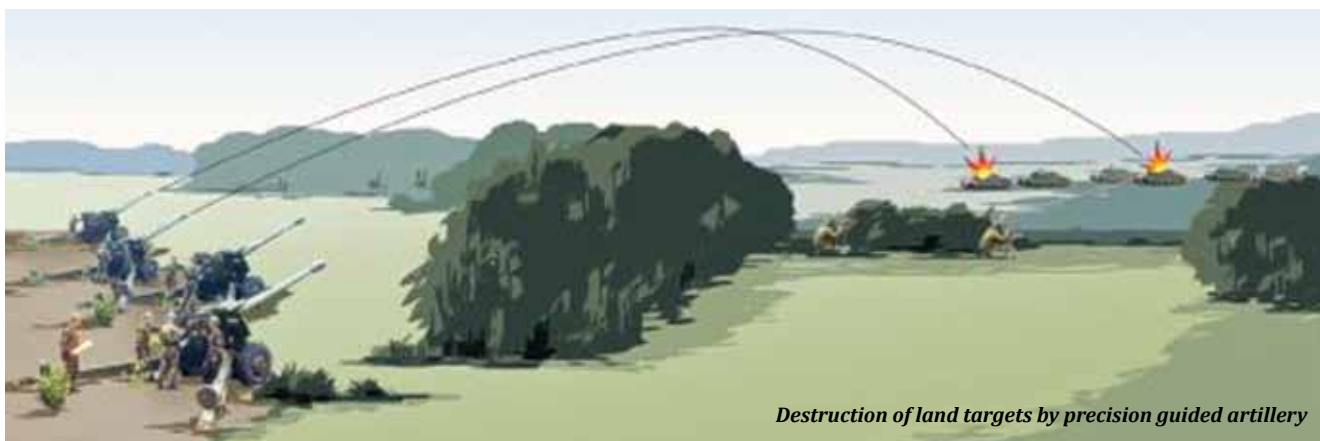
The Indian Army currently deploys the Krasnopol, which is suitable for operations in both plains and mountain terrain, and reportedly has terminally guided munitions with Smerch rockets. The BrahMos Cruise Missile has a low circular error of probability (CEP) and can be employed for surgical strikes on strategic targets. Efforts are on to acquire 'Fire and Forget' anti-tank guided

missiles (ATGMs) for the Army's main battle tanks, infantry combat vehicles and attack helicopters. Still, the percentage of actual holdings is miniscule compared with the requirement.

Precision attacks are required against key targets such as terrorist headquarters, vital bridges, command and control centres, air defence centres and missile locations, as also bridging columns, AFVs and artillery emplacements. There is need to score direct hits or be as close depending on the nature of target. Therefore, there is need for deploying adequate numbers with the Indian Army to meet its commitments in the tactical, operational and, in combination with the Air Force, the strategic domain. There is urgent requirement for artillery guns and rockets employing a mix of Course Corrected, Sensor Fuzed and Terminally Homing ammunition. It should be noted that according to India's Long Term Integrated Perspective Plan (LTIPP) and Technology Perspective & Capability Roadmap (TPCR), requirement of PGMs with a CEP of 3 metres is stated.

While the Indian Army's targeting capability needs improvement through better Command, Control, Communication, Computers, Information, Intelligence, Surveillance and Reconnaissance (C4I2SR), engagement capability needs to be enhanced with PGMs. Detailed studies need to be undertaken to decide the percentage based on specific targets and matching weaponry. Operationally, the issue needs to be addressed at the earliest to match all adversaries who are already in the process of equipping themselves with this weaponry.

Maj Gen (Retd) P K Chakravorty, VSM
(Courtesy CLAWS)



Destruction of land targets by precision guided artillery

High Definition Sensors from IAI's Tamam

Thermal imaging systems indeed have evolved greatly since early days of the Forward Looking Infra-Red (FLIR) systems of the 1980s. Today's IR sensors are integrated into multispectral systems, offering high definition quality imaging in the visible and infra-red bands. While aspect ratio is often kept at 4:3, to maintain backward compatibility with existing optical and display systems, the modern IR sensors provided by IAI Electro-optical specialist Division, Tamam, of IAI's Systems Missiles and Space Group, are offering unprecedented image resolution, clarity and details. These modules are provided as part of new systems, or retrofit modules for existing equipment, enabling users to maintain their investments in high power telescopes required for long range observation and surveillance.

As an example, the new HD quality thermal channel integrated into the Tamam MOSP multisensor, stabilised EO payload employs a high power 900 mm telescope deploying folded optics to gain superior Space Weight and Power (SWaP) advantages. This approach enables users to achieve very high power zoom within small physical dimensions. "We have already done that in the MOSP, and now implement this approach in smaller day/night payloads, of the POP300 class" stated a senior IAI executive.

Daylight channels are also transforming from the 3:4 aspect ratio to the modern 16:9, optimised for High Definition (HD) video industry standard, while simultaneously, detector matrix is also increased to 1080x1920. This approach enables manufacturers such as Tamam to utilise commercial, off the shelf cameras, offering maximum benefit for the customer, enabling performance improvement through simple systems upgrades. The advanced optics feature multi-channel operation, simultaneously supporting Standard Definition (SD) and HD images, which are adept at displaying multiple images side by side on the same screen or on different displays. The ability to deliver SD is important for operation with displays, devices and datalinks that do not support HD, such as small displays used in tactical

vehicles, wearable eyepieces and avionic displays.

Another feature introduced with HD-supported payloads is integration of the compression-decompression unit. As part of the compression process, this function also performs image sampling and digitisation, thus enabling better integration and utilisation of advanced digital datalinks, supporting rapid transfer of large volumes of data at a high level of security. IAI's datalinks and payloads are currently supporting industry standard H.264 protocols, enabling end-to-end digital data transfer.

SD/HD imaging is often required to support systems integrated in special-mission manned platforms, where intelligence analysts in the cabin of special mission aircraft or maritime surveillance aircraft can utilise different sources to gain superior situational understanding.

One of the inherent advantages of HD sensors is the wide area coverage they provide. This capability has become an essential element in terrain dominance. Such applications are required by military forces for maintaining persistent surveillance over a wide area, monitoring all activities within that footprint. While the wide area sensor acquires and processes the large picture, specific areas of interest can be frequently revisited by optically or digitally zooming-in the same sensor or by other sensors, enabling analysts to monitor specific activities and compare it to images of the same location or similar objects, procured at different times.

When monitoring multiple activities over a wide area, operators also require the ability to track targets, an advanced function which is also supported by the new payloads from Tamam. The M19 payload is an example of such an advanced system. Developed by Tamam as the standard EO mission payload for the Heron II Medium Altitude Long Endurance (MALE) Remotely Piloted Aerial System, this payload is 19" inch high and 22.6" wide thus supporting larger apertures and more powerful telescopes.

The distinctive oval shape makes the new payload also compatible with the ground clearance required for IAI's Heron I.



This powerful payload comprises daylight and IR channels, both supporting full HD, with the IR utilising an 11" aperture. The daylight channels comprise the HDTV, NIR, narrow-medium and medium wide area plus laser rangefinder and target designator. M19 can also accommodate an LLTV and SWIR channels as an option.

SWIR (Short Wave Infra-Red) is another innovative offering from Tamam, representing the latest trend in imaging, whilst exploiting the short-wave IR waveband to deliver superior image quality. An added benefit is the ability to see a laser spot directly in the image, unlike LWIR or MWIR detectors that were hitherto blinded to laser spots for self boresighting. New SWIR detectors are currently being produced in Israel and are readily available for a number of applications.

Currently, Tamam is working on the development of common optics, enabling all optical systems on board to 'look' through a single optical assembly, thus providing longer observation ranges and potentially reducing weight, complexity and cost.



Thales Flycatcher Mk2 air defence fire control radar

Thales, which is a leading producer of advanced air defence systems, has been partnering with defence forces across the globe with a view to offer optimum on-ground protection and contribute more effective and efficient operations.

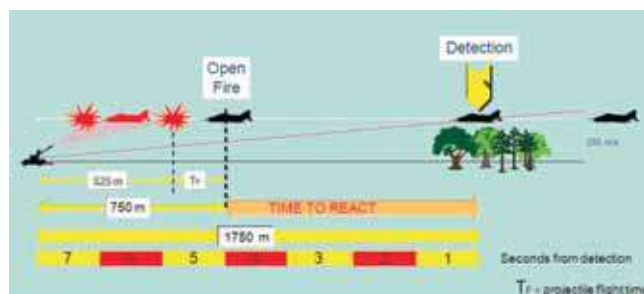
One of the key products in this space is the Flycatcher Mk2, an air defence fire control radar for operations in any theatre, against an array of threats. This system is equipped with sophisticated 4D multi-beam surveillance radar, which combines high detection probability with low false alarm rate. The surveillance and track radars are coaxially constructed in the Flycatcher Mk2, since this is the best way to ensure a quick and unambiguous hand-over from surveillance to track radar. The Flycatcher Mk2 is capable of providing not only weapon control for air defence guns, but also target information for man portable air defence systems (MANPADS) in the vicinity of the radar.



A combined surveillance and track radar is the best way to ensure quick and unambiguous hand-over from surveillance to track radar. The Combined Antenna System shortens the deployment time and allows both sensors to see in all directions simultaneously, without blanking, contrary to non-combined sensor configurations (photo: Thales)

Fire controlled gun and MANPADS air defences are the last line of protection to ensure the survivability of high value assets. Since the essence of radar detection is line of sight, the positioning of air defence radars defines quality of the air defence, which also means that the radar of an air defence system is the most difficult component to hide from enemy reconnaissance. The larger the variety and number of radars required, the easier it becomes for an enemy to estimate air defence capability and to plan their attack strategy. Often the presence of certain radar systems indicates the weapon type being used for air defence, while intelligence information leads to more dedicated attack profiles, using the weak spot in air defence and reducing the survivability of the high value assets protected.

The Flycatcher Mk2 has co-located surveillance and track radar, which provides an effective manner to prevent errors in target hand-over and also minimises the number of radar locations required to protect a given area. The Flycatcher Mk2 design has been focused on minimising the detection and engagement time of targets appearing suddenly at short ranges (including aircrafts pitching up or helicopters popping up).



Operational scenario with incoming fighter aircraft (typically at a speed of 250m/s): the picture shows a fighter approaching behind natural masks or in cluttered environment. From time of detection to open fire (time to react) there are only 4 seconds. Short reaction time and errorless transit from surveillance to track radar is indispensable in such a situation (photo: Thales)

The short reaction time is made possible by the Flycatcher Mk2's multi-beam technology and combined antennae that avoid complex and lengthy calculation to compensate for misalignments of different antennae on traditional two-antenna systems. The co-axial mounting of track and surveillance radar obviates errors in angular references and the smallest possible acquisition area for the track radar during target hand-over from surveillance to track.

Much attention is given to the surveillance component to ensure minimum delay between target 'unmask' and reliable detections, with virtually no false alarms. The surveillance radar plays a critical role since it has to perform these detections in cluttered environment for targets with large differences in speed, size and attack angle. To fulfil these requirements, the Thales 4D multi-beam concept was applied in X-band to create excellent performance for low flying target detection and compact antenna design to support the mobility requirements.

Manoeuvrability of modern fighters is such that a minimum instantaneous elevation beam of 11° is required to ensure that a pitch-up attack can be detected and tracked. Detailed analyses confirm that 'pencil beam' radars often miss pitch-up attacks. In similar scenarios, the Flycatcher Mk2 multi-beam concept scans the total elevation coverage during each scan by using one transmit beam and 16 receiving beams, ensuring that the target cannot be missed.

BEL at DefExpo 2014 :

R&D capabilities, focus on C4I Systems

Bharat Electronics Limited (BEL) showcased its R&D thrust at DefExpo 2014, displaying its latest range of products and systems, developed in-house and jointly with the DR&DO.



The 2D Bharani Radar

Main highlight at BEL's stand is its Network Centric Warfare (NCW) systems developed indigenously for the Indian defence forces. NCW solutions for the Indian Navy include the Combat Management System, which transmits tactical data from the ship's sensors to provide decision support to the ship's commander. The Composite Communication System, an IP-based New-Generation voice, data and video integrated system, is also on show. The software for all these solutions, too, has been developed in-house.

BEL's display focuses on key elements developed for various C4I systems, designed for all three Services, including computing elements in various forms, right from wrist-wearable computers, hand-held computers and Tablet PC to rugged laptops; communication equipment such as Software Defined Radio with different variants, Advanced Interoperability Communication System, HF Radios and Point to Multi Point Radio Relays, besides encryptors such as IP encryptor and Bulk Encryptor, Multi Network Connectivity Device and Futuristic Commando System solutions.

Research & Development has been BEL's forte, with the company laying increased thrust on development of new technology modules, on show at the exhibition; Microwave Power Modules and TR Modules for use in radars, MEMs-based products for use in sonars and microwave components used in air-borne EW systems. BEL's key surveillance radar segment on show is the 3D Central Acquisition Radar, 2D Bharani Radar, 3D Aslesha Radar and



3D Central Acquisition Radar Rohini

Battlefield Surveillance Radar-Extended Range (BFSR-XR) as also Identification Friend or Foe (IFF Mk.XII) along with Advanced Tactical Display and EMP Shelter.

BEL also highlights its contributions to the Electronic Warfare and Avionics segment with an impressive display of the Radar Finger Printing Systems (RFPS), avionics components for Light Combat Aircraft (LCA), including the Digital Flight Control Computer and other cockpit modules. Also on display is the latest range of laser technology based products, night vision products based on latest generation Image Intensifier Tubes and Thermal Imaging technologies, Holographic Weapon Sight and batteries.



Software Defined Radio-manpack

Airbus Helicopters' propose EC725 for the Indian Navy NMRH programme

Airbus Helicopters' EC725 is the most adaptable and cost-effective solution to respond to the requirement of the Indian Navy for a quickly deliverable Naval Multi Role Helicopter.

The EC725 solution for Indian Navy is based on a proposed multi-role configuration that provides maximum flexibility and utility for operations in the following mission scenarios: ASW, ASuW, special operation, commando operation, amphibious assault, troop carrier, ELINT, SAR, external cargo carrying, casualty evacuation, communication duties and CSAR.

The EC725 is the most recent addition to the Cougar family, which itself has grown from the vast experience gained over many years with its civil variant, the Super Puma. The Super Puma and Cougar family of around 650 helicopters has amassed more than 3.3 million flight hours and is used by 86 operators in 46 countries. Worldwide military operators of the 470 Cougars delivered span 33 nations; including 29 Air Forces, 7 Army Aviation units and 5 Navies.

The EC725 represents a major technological advancement and is the latest version of this medium lift (11-ton class) helicopter. It has been designed for today's most demanding military missions. Introduced in 2005, the EC725 is already a combat proven multi-role helicopter and has seen combat service worldwide, including Lebanon, Afghanistan and recently Africa. The EC725 has operated from ships and ashore. It is a truly multi-purpose, versatile military asset. Special operations, combat SAR and personnel recovery require performance, precise navigation and survivability. The EC725 is outstanding in these aspects and thus perfectly fits Indian Navy requirements for ASuW, special forces, amphibious assault, troop carrier, SAR and CSAR operations.

The EC725 has been developed jointly with the French Armed Forces for the most demanding of missions: tactical airlift and special operations. These origins

allow EC725 to perfectly fulfill troop transportation missions with maximum effectiveness, survivability and maintenance simplification. Airbus Helicopters has also included in its design the most demanding civilian specifications for SAR and offshore operations concerning safety, comfort, availability and low cost of operation.

Airbus Helicopters in India : A Long Track Record

- Since 1962, Hindustan Aeronautics Limited (HAL) has manufactured over 600 Chetak and Cheetah helicopters - modified versions of the successful Alouette and Lama Helicopters - with full and unrestricted sharing of production and maintenance technical know-how from Airbus Helicopters.
- In 1984, Airbus Helicopters was associated with HAL in development of the Advanced Light Helicopter (ALH).
- Strategic Partnership Agreement entered between Airbus Helicopters and HAL, to cover new co-operation activities.
- Sourcing agreement entered into force for airframe structure and composite work packages of Ecureuil/ Fennec

aircraft, including HAL in Airbus Helicopters' global supply chain.

The link between India and Airbus Helicopters has always been a partnership approach rather than a client-buyer relationship. For over 50 years, licenced production, sharing of technical know-how and sourcing have been key elements and remain the core of Airbus Helicopters's strategy in India.

Being the owner of its technology, Airbus Helicopters has the ability to deliver unique know-how transfer and high quality activities in the frame of the co-operation proposal associated with the Indian Naval Multi Role Helicopter (NMRH) programme.

Airbus Helicopters has been very successful in developing and implementing co-operation packages worldwide. Airbus Helicopters has already developed a sound industrial co-operation on previous licenced programmes and is therefore confident to be in the best position to become a privileged contributor to the development of Indian aeronautical industry, and the Indian NMRH programme.

(Courtesy Airbus Helicopters)



VAYU Interview with

Loïc Piedevache, Country Head, MBDA India



VAYU: The MBDA ASRAAM has been evaluated by the Indian Air Force with a view to equipping the Jaguar strike fighter fleet with the missile. Could you share some details from the evaluation process as well as the current status of the acquisition?

LP: We can't reveal details of the firing evaluation trials apart from saying that ASRAAM proved its capabilities as we expected and had no difficulties in meeting the trial objectives. As a result ASRAAM has indeed been selected by the IAF. This air domination weapon is ideally suited for a bomber like the IAF's Jaguar. It has the necessary speed off the rail to safely clear the aircraft's over wing pylons and the shoot up ability to defend against aircraft with height advantage (the Jaguar is a low-flying aircraft and an attacker will almost invariably come in from above). Most importantly, ASRAAM has been designed to ensure 'first shot, first kill' to avoid getting involved in a close quarters dog fight, the very last thing a bomber wants to do against much more agile and faster fighter aircraft.

VAYU: It was reported late in 2013 that the VSHORAD tender had entered a period of uncertainty with the 'late entry' of the FIM-92 Stinger MANPADS. Could you elaborate on this and give a few details regarding the state of the competition as it stands today?

LP: India's VSHORAD competition is still ongoing so it is not the moment to go into any details. As you know, we are proposing MBDA's Mistral MANPADS system. Naturally we are confident that Mistral offers the best technical and operational solution to India's requirements with regard to the other competitors, we are also in a position to advance an industrialisation solution which could see the missile produced in India with all the transfer of technology that this implies. Mistral is already being delivered to India to arm the ALH Rudra helicopter, so an Indian production line for this

missile would result in significant logistical and stock management advantages as well.

VAYU: During the MBDA media trip in October 2013, Vayu was informed that MBDA had already conducted work on a twin-tube PARS 3 LR launcher for the HAL Dhruv/Rudra platform. What is the status of the air-launched ATGM programme at present?

LP: Yes, in line with our partnership strategy in India, we have been working with a local partner in the development of the PARS 3 LR twin launcher. PARS 3 LR has proven itself in number of demanding tests for the German Army on its Tiger helicopter. These tests have shown that it is the optimum weapon, not only for rapidly stopping an assault led by a column of rapidly moving tanks across an open battlefield, but also in dealing with moving armoured targets in a more complex urban environment.

We have also carried out Firing Evaluation Trials (FET) in the presence of an Indian evaluation team. These trials not only successfully demonstrated the exceptional performance of PARS 3 LR, they also showed that the weapon was able to satisfy all the technical and operational criteria stipulated by the Indian RFP (Request For Proposals).

VAYU: What are the key products that MBDA is showcasing at Defexpo 2014?

LP: MBDA's stand at DefExpo 2014 will be divided into four distinct areas: ground based air defence, combat aircraft weapons, maritime superiority and battlefield systems. Each area will feature the latest advances in their respective domains and together will demonstrate MBDA's unique status as the only company in the sector with a product catalogue capable of meeting the guided weapons requirements of all three armed services.

We will be showing a range of air-launched weapons capable of maximising the IAF's future operational effectiveness. These range from short range to beyond visual range air-to-air combat

weapons such as ASRAAM, MICA and Meteor as well as two leading stand-off cruise missiles - Storm Shadow/SCALP and Taurus KEPD 350.

With discussions having been concluded and a decision expected shortly to proceed with a short range surface to air weapon to fill a recognised capability gap within the Indian Air Force and Navy, a full scale model of the SR-SAM missile will take pride of place on the company's stand. Often referred to as MAITRI, this programme sees MBDA supporting the DRDO and represents the cornerstone of MBDA's long term partnership and cooperation strategy in India. Displayed for the first time in India will be a weapon system that represents a major advance for the battlefield. This weapon, MMP is being developed as a highly advanced successor to the successful MILAN with a range of important features placing it well beyond the capabilities of the competition. MMP is a member of a new family of fifth generation weapons that feature both fire-and-forget and man-in-the-loop capabilities. What should raise interest at DEFEXPO 2014 is that this new family offers the opportunity of a co-development with India in meeting the Indian Army's own future specific requirements, something we are actively discussing at the moment.

VAYU: The large order for MICA AAMs to equip the IAF Mirage 2000 fleet must have been a welcome one given the delays usually faced when dealing with Indian bureaucracy. However, this order does have offset obligations - could you share details on how the offset obligations are being met? Are you partnering with DPSUs or private firms?

LP: We were of course extremely pleased to receive the MICA order as not only does it provide the ideal weapon for the Mirage, it also further cements our longstanding relationship with the IAF and Indian industry. Elements of the MICA underwing and fuselage launch systems are being produced in India bringing us into close contact with both DPSUs and private firms. The contract gave a timeline of around nine years for the fulfilment of the direct offsets - currently things are progressing very well and we fully expect to meet our contractual obligations without any difficulty.

VAYU: The Meteor BVRAAM programme is being keenly watched around the world. Could you share a status update on the programme?

LP: 2012 saw the successful completion of missile development firing trials. Integration work is currently underway on all three of the intended platforms - Rafale, Eurofighter Typhoon and Gripen. Production contracts have also been received from all the programme partner nations, the UK, France, Germany, Italy, Sweden and Spain.

Irkut MC-21 and Yak-130 programme updates

Towards the end of 2013, Russian Deputy Prime Minister Dmitry Rogoz disclosed that the Irkut MC-21 airliner would be designated as the Yak-242 once the type goes into series production. The Yak-242 designation was originally slated for a 130- to 180-seat twin-engine airliner proposal dating back to the early 1990s, which proposal never saw fruition but was eventually evolved into the MC-21. Thus this announcement is seen as an acknowledgement to the genesis of the MC-21 programme.

Rogozin made the announcement during his visit to the Irkut plant “to verify the preparedness of the Russian aircraft industry to meet not only state defence orders but to develop civil products”. He was accompanied by Irkut chief Oleg Demchenko, and were shown initial assemblies for the first prototype MC-21 during the visit.

Irkut is set to reveal the first MC-21 prototype in mid-2015, EASA certification followed by first deliveries are planned in 2017. Production will take place at the Irkutsk Aviation Plant, which has undergone extensive modernisation. The total development programme cost is about \$5 billion, of which the Russian government is providing \$2.8 billion. Internal funds from Irkut and other programme participants amounts to \$1.7 billion.

Irkut’s parent company United Aircraft Corporation (UAC) has reported that Russian and foreign companies have signed contracts for more than 250 MC-21s, including 135 as firm commitments.

During his visit to the Irkutsk aircraft manufacturing plant December 2013, which makes Yak-130 combat trainers, Lieutenant General Viktor Bondarev, Commander-in-Chief of the Russian Air Force, announced that the RuAF is planning to order an additional batch of Yak-130s.



MC-21 flight deck mock-up (photo: Alex Beltyukov)

The current contract with Irkut Corporation, which manufactures the trainers is for 55 Yak-130s, of which a total of 42 aircraft have been delivered so far, with first deliveries beginning in 2009.

Lt Gen Bondarev said “it is certain” that a new contract for additional Yak-130 deliveries would be signed and also confirmed that the Russian Air Force would soon form a new aerobatics team flying Yak-130s.



Yak-130 coming in to land (photo: Dmitry Zherdin)

Success on all fronts for Sikorsky

Sikorsky Innovations for DARPA X-Plane Phase 1

Sikorsky Innovations, the technology development organisation of Sikorsky Aircraft Corporation, has been contracted for Phase 1 of the Vertical Take-Off and Landing Experimental Aircraft (VTOL X-Plane) programme by the US Defence Advanced Research Projects Agency (DARPA). The proposed effort is valued at \$15 million to develop preliminary design for the VTOL X-Plane, a high-speed vertical takeoff-and-landing aircraft with the hover capability of a helicopter.



Sikorsky Innovations is teamed with Lockheed Martin's Skunk Works for the VTOL X-Plane development of its Unmanned Rotor Blown Wing concept. The Rotor Blown Wing represents a unique integration of fixed wing aerodynamics and advanced rotor control to provide a low complexity configuration capable of meeting the challenging DARPA programme goals.

S-70i Black Hawk helicopters for Royal Brunei Air Force

Two Sikorsky S-70i Black Hawk helicopters were inducted into the Royal Brunei Air Force following an unveiling attended by His Majesty the Sultan at the Brunei International Defence Exhibition (Bridex) in December 2013. Two more S-70i helicopters are currently undergoing the process of acceptance with the Royal Brunei Air Force.

Equipped with a suite of advanced avionics and sensors, these multirole helicopters can perform a variety of missions



over land and water, including search and rescue, humanitarian relief, anti-piracy, troop transport and medical evacuation. The Brunei Ministry of Defence ordered 12 S-70i Black Hawk helicopters in December 2011, all of which are set to be delivered by the end of 2014. The contract includes ground support equipment, spares and technical training.

MH-60R Seahawk 'Romeo' for Royal Australian Navy

Australian Defence Minister David Johnston hailed the delivery of the first two of 24 US-built MH-60R Seahawk 'Romeo' maritime combat helicopters to be acquired by the Royal Australian Navy's Fleet Air Arm as an "outstanding success."

Produced jointly in the United States by Sikorsky and Lockheed Martin, and in operation with the United States Navy (USN) since 2005, the Romeo is an evolution of older Seahawk variants which it is replacing, building on the known and proven Seahawk platform but incorporating state-of-the-art sensors in an open architecture, integrated mission system.



AIR 9000 Phase 8, the project designation for the acquisition of new multi-role helicopters, was approved in June 2011 with a budget of \$3.2 billion. The delivery of these first two aircraft was achieved on budget and six months ahead of schedule. The aircraft will be equipped with a sophisticated combat system designed to employ the Hellfire air-to-surface missile and Mark 54 anti-submarine torpedo.

CHC S-92 helicopter fleet continues to grow

Canadian firm CHC Helicopter has signed a multi-year contract to purchase nine Sikorsky S-92 helicopters, with options to acquire up to 15 more for use in transporting offshore oil workers and for possible search and rescue operations. CHC's aircraft fleet currently includes 110 helicopters made by Sikorsky including 38 S-92 and 67 S-76 aircraft. Deliveries of the first five new S-92 helicopters are scheduled for 2015 and the remaining four in 2016. Once CHC exercises the options, those aircraft would be delivered between 2015 and 2018.



A CHC Helicopter S-92 (photo: Gary Watt)

Continued contracts for Lockheed Martin



US Government receives 200th C-130J Super Hercules

An MC-130J Commando II designated for Kirtland Air Force Base, New Mexico, was ferried from the Lockheed Martin plant on 5 December 2013. This MC-130J has the distinction of being the 200th C-130J Super Hercules delivered to the US Government, which is the largest Super Hercules operator. This aircraft is assigned to Air Force Special Operations Command (AFSOC). The Commando II supports such missions as in-flight refueling, infiltration/exfiltration, and aerial delivery and resupply of special operations forces.

JASSM production contracts

On 19 December 2013, Lockheed Martin received two production contracts totaling \$449 million from the US Air Force for continued production of the Joint Air-to-Surface Standoff Missile (JASSM) and its Extended Range (JASSM-ER) variant. The Lot 11 and Lot 12 contracts include production of 340 baseline missiles and 100 ER missiles.

Armed with a dual-mode penetrator and blast-fragmentation warhead, JASSM and JASSM-ER cruise autonomously by day or night in all weather conditions. Both missiles share the same capabilities and stealthy characteristics, though JASSM-ER has more than two-and-a-half times the



range of the baseline JASSM for greater standoff margin. These 2,000-pound cruise missiles employ an infrared seeker and Global Positioning System receiver to dial into specific target aimpoints.

Production contract for Paveway Training Rounds

Lockheed Martin received an \$84.5 million contract on 23 December 2013 from the US Navy to produce Paveway II Enhanced Laser Guided Training Rounds (ELGTRs). Under the four-year indefinite-delivery indefinite-quantity (IDIQ) contract, Lockheed Martin will

deliver ELGTRs, shipping containers, logistics and product support to the US Navy. This contract extends delivery of ELGTRs to the US Navy through 2018. Lockheed Martin has produced advanced training solutions for the US Navy, Marine Corps and international customers since Laser Guided Training Round production began in 1992, and has delivered more than 130,000 training rounds to date.



ELGTR emulates cockpit indications, release and terminal characteristics of the Paveway II laser guided weapon systems to provide affordable, high-performance aircrew training without depleting tactical inventory. Recognised worldwide as the 'only live-fire training solution' for warfighters, the ELGTR is compatible with F/A-18, AV-8B, F-16 and various international aircraft.

Saudi Arabian order for two C-130J Super Hercules

Lockheed Martin has entered into an agreement — known as an Undefined Contract Action — with the US Government for the Foreign Military Sale of the first two of 25 potential C-130J Super Hercules airlifters for the Kingdom of Saudi Arabia. Specifically, this contract is for the purchase of two KC-130J refueling tankers.

The Kingdom of Saudi Arabia is the 16th country to choose the C-130J Super Hercules to meet its airlift needs, citing the aircraft's availability, flexibility and reliability. C-130Js currently are deployed in two combat theatres where they operate at a high tempo efficiently and reliably. Recently, the C-130J worldwide fleet surpassed 1 million flight hours, which were logged beginning with the C-130J's first flight on 5 April 1996 through 30 April 2013.

Boeing positioned for growth in services & support business

The services and support market is a significant growth area for Boeing in India, the Company working with the Indian Air Force and Indian Navy to provide training and support of Boeing platforms such as the P-8I maritime reconnaissance and anti-submarine warfare aircraft and C-17 Globemaster III strategic airlifter and VVIP transport aircraft.

Boeing is supporting the IAF's C-17 Globemaster III fleet through its *C-17 Globemaster III Integrated Sustainment Programme (GISP) Performance-Based Logistics (PBL)* contract. The C-17 GISP 'virtual fleet' arrangement ensures mission readiness by providing C-17 customers globally access to an extensive support network for worldwide parts availability and economies of scale, making the C-17 even more affordable to own and operate. The C-17 GISP is a system-level partnership with the US Air Force, where the customer pays for 'readiness', rather than specific parts or services.

Boeing supports the Indian Navy's P-8I fleet in providing spares, ground support equipment and field service representative support. Boeing's integrated logistics support enables the highest state of fleet readiness at the lowest possible cost and has demonstrated reduced ownership costs and decreased cost per flight hour over multiple

Boeing Showcases Services Capability for India at Defexpo 2014

Boeing's services and support capabilities are being demonstrated during Defexpo 2014 through presentations and discussions on lifecycle support tools, training, performance based logistics, planning and forecast, and spares management.

During the Show, products from Boeing subsidiaries Tapestry Solutions and Miro Technologies are on display in the Boeing booth and available for demos.

The Virtual Mission Board is a deployable multi-touch display system that improves operations and training by immersing the viewer in a virtual representation of one's operating environment. The Virtual Mission Board provides full visualisation of situational awareness and enables centralised mission command.

GOLDesp™ is Miro's military-grade, enterprise software that manages maintenance, supply, repair and performance performance based logistics for complex assets operating in air, space, sea and ground environment.

platforms. More than 7,000 Boeing 737s are in active service all over the globe enabling all derivative aircraft, including the P-8A Poseidon, to benefit from this uncommon economy of scale for sustainment and support needs. By leveraging its unique 'One Boeing' capabilities, GS&S is deploying a sustainment solution for the Indian Navy's P-8I that draws on synergies from Commercial Airplane Services, including its subsidiary, Aviall, while leveraging the economy of scale unique to commercial derivative aircraft, specifically the 737, the world's most prolific commercial aircraft, in service and in production.

Boeing is aware of the budgetary challenges faced by operators, including the Indian Navy and is committed to helping fill gaps and leverage the decades of platform expertise to maximise sustainment efficiencies. Boeing is investing in P-8 global support capabilities including spares, modeling and simulation forecasting, operations center support, engineering services and site activation stand-up.

As for the C-17 Globemaster III, initial qualification training of Indian Air Force crews was conducted by the US Air Force at Joint Base Charleston in South Carolina. A total of 100 Indian Air Force airmen received instruction from the 373rd Training Squadron Detachment 5, the training including classroom time as well as simulator training. The first group graduated in November 2012, which included aircrew and loadmasters as also power plant technical personnel.

Indian Navy aircrew received conversion on the P-8I which included pilots, mission system operators and maintenance technicians, which was concluded in Seattle last year. The programme included a combination of flight, classroom and lab training as well as 'real-world' simulation experiences that can reduce total ownership costs. Between February and September of 2013, Boeing trained more than 110 Indian Navy personnel including five pilot crews, five mission crews and a number of flight signallers and observers.





Boeing's comprehensive training provides a full range of equipment, software, courseware, personnel and logistics, and the company is currently providing P-8 aircrew and mission crew simulators for the US Navy. The benefits of these simulator-based training include a reduced number of training flights, lower cost of operation (less fuel and maintenance required for live aircraft), and reduced use of limited aircraft.

Boeing anticipates other training opportunities for aircrew and maintenance courseware development for platforms such as the AH-64 Apache and CH-47 Chinook, opportunities which being pursued.

Boeing's GS&S Division

The Global Services & Support (GS&S) Division of Boeing Defense, Space & Security supports both military and commercial products and services, having established itself as the US Department of Defence's largest performance based logistics contractor. The Division is also a provider of sustainment solutions for Boeing and select non-Boeing platforms in addition to providing logistics command and control and training systems.

Headquartered in St. Louis, Missouri, GS&S comprises three Divisions: Integrated Logistics; Maintenance, Modification & Upgrades; and Training Systems and Government Services. Combined, these organisations provide focused logistics and services to meet the current and future needs of Boeing's customers around the world.

Integrated Logistics

The Integrated Logistics division of Boeing GS&S offers coordinated logistics services that address the life cycle of aircraft and weapon systems. Online, real-time,

integrated information systems provide reliability and demand forecasting, total asset visibility, maintenance information and field data to improve aircraft availability and reduce costs. This approach offers a single point of accountability during the service life of a product. As a result, mission effectiveness and readiness are improved while the total cost of ownership is reduced. Integrated Logistics programs provide a full spectrum of fleet support to such aircraft as the P-8 Poseidon, AH-64 Apache, CH-47 Chinook, AV-8B, V-22-Osprey, and F/A-18 Hornet.

Maintenance, Modification and Upgrades

The Maintenance, Modifications & Upgrades Division operates at centres strategically located throughout the United States, providing high-quality, rapid and affordable aircraft services for military customers. The Boeing philosophy is to work in close partnership with existing military depots, providing complementary capabilities for the nation's support infrastructure. In addition, Boeing partners

with indigenous suppliers in-country to establish these capabilities.

Maintenance, modification, and upgrade services include the following elements and are applied to aircraft of all types, including tactical fighters, transports, support aircraft, and rotor-craft:

- Modification engineering
- Fleet support
- Component and structural upgrades
- Depot- and intermediate-level maintenance
- Corrosion control
- Additional services specific to each aircraft type

Training Systems and Government Services

The Training Systems and Government Services (TSGS) Division provides domestic and international customers with a full range of training capabilities, in addition to logistics and asset management solutions. TSGS designs and develops more than 350 trainers for 24 aircraft platforms using the latest technologies to ensure students have relevant and realistic learning experiences. Boeing provides a full range of training capabilities and customer-focused solutions to directly enable mission readiness including:

- Aircrew and maintenance training devices
- Mission planning systems
- Fully integrated training systems
- Training management services
- Classroom instruction, courseware and logistics support
- Infrastructure and range services
- Logistics Information Management System



First international exposition for the new Airbus Group

VAYU Interview with

**Vayu Aerospace & Defence Review's
Yves Guillaume,
President India, Airbus Group**



VAYU : Please update us on the new structure of the Airbus Group !

YG: We took off into the New Year with the rebranding and reorganisation of EADS to the Airbus Group. The Group is now home to three Divisions: Airbus, Airbus Defence and Space, and Airbus Helicopters. With Airbus, the Group remains a leader in the commercial aircraft market and will further strengthen its position through innovation, services and a more global approach. Airbus Helicopters (previously Eurocopter) comprises all commercial and military helicopter business. With Airbus Defence and Space we have brought together our defence and space businesses previously spread across Airbus Military, Cassidian and Astrium under one roof. The focus and core identity of the Group will remain aeronautics and space adding up to more than 95% of its activities.

VAYU : What was the need for reorganisation and why adopt Airbus as the overall brand?

YG: We need to improve our competitiveness in the defence and aerospace business. With our traditional 'home markets' sliding

downward, we urgently need to improve access to international customers and to growth markets. For that to work, we need to cut costs, eliminate product and resource overlaps, create synergies in our operations and product portfolio and better focus our research and development efforts. Hence, the restructuring and integration plan for our defence and space business. We adopted the Airbus brand because for years, it has been a globally renowned synonym for technological breakthrough as well as aeronautics passion and pride. Joining forces under the strong Airbus brand gives all our operations and employees the thrust and lift to capture global markets.

VAYU : What is your view of the prevalent situation in the Indian defence sector?

YG: The potential of Indian defence market is huge. It is still one of the few large and growing economies in the world which is committed to modernising its armed forces. We are enthusiastic about our presence here not because we see India simply as a big market for our products. We are investing in a long-term partnership with India

because we believe that we have much to offer each other for mutual growth. This is the reason why we have two captive engineering centres, with one focused on civil and the other on defence activities, and a R&D centre in Bengaluru. This is why we have close collaborations in terms of joint development and production with institutions like DRDO, ISRO and Antrix (ISRO's commercial arm). We are also working with local companies, both public and private be it for sourcing or manufacturing. India has the potential to emerge as a global production hub for defence equipment and it is our endeavour to support this for mutual benefit by increasing our own industrial footprint here.

VAYU : How do you support your claim of supporting India's efforts at holistic indigenisation in defence?

YG: There are many examples I could give you. Let's start with our division Airbus Defence and Space. It has successfully cooperated with India's Defence Research and Development Organisation (DRDO) to develop a missile approach warning sensor (MILDS). The sensor has been certified as 'indigenous' by Indian authorities and is produced locally for fitment in Indian Army's Cheetah and Chetak helicopter fleet. The division is also consulting on the Naval-Light Combat Aircraft. In addition, both sides are jointly reviewing an indigenous Airborne Early Warning & Control System. In terms of cooperation with the Indian industry, Airbus Defence and Space has a joint venture with Larsen & Toubro in the field of defence electronics, while in the aerospace arena, Airbus Defence and Space and ISRO have jointly designed, produced and marketed two communication satellites: Eutelsat W2M in December 2008 and HYLAS 1 in 2010. In September 2012, Indian launcher PSLV launched the SPOT



The C295: Contender for the IAF's 'Avro replacement' programme.

6 Earth Observation Satellite and will soon launch SPOT 7. Talking about Airbus Helicopters, it has offered the EC725 along with transfer of technology for India's requirement of 120 Naval Multi-Role Helicopters. In addition, MBDA, a missile manufacturer in which Airbus Group is a shareholder, is holding discussions with the DRDO to jointly develop a brand new short range surface to air missile (SR-SAM) which will be produced in India by Bharat Dynamics Limited.

VAYU: Which are the new products under development at Airbus Group that you think will keep you ahead of the competition?

YG: Instead of listing products in development, I prefer to dwell upon how Airbus Group is investing in its future as since the year 2000 : the Group has invested over €30 billion in R&D. We are one of the world's leading innovators in aerospace and defence. In 2012, the Group invested over €3 billion in R&D. Today, Airbus Group has a portfolio of more than 37,000 patents and close to 1000 new patents are filed each year.

VAYU: What are your expectations at Defexpo 2014 and what are you showcasing?

YG: We always look forward to participating in Defexpo as it is a premier defence exhibition. This edition of the show is particularly significant for us as this is the first time we are exhibiting in any international show under the new brand. We will have a broad range of products from Airbus Defence and Space and Airbus Helicopters on display at the stand (no.19

in Hall 11). This will include scale models of the C295, helicopters (EC725, AS565 MBe Panther and AS550 C3 Fennec), missile approach warning sensor MILDS, helicopter collision avoidance system SferiSense 300, AESA technology based coastal surveillance radar Spexer 2000 and diesel powered tactical vertical takeoff and landing unmanned aerial system Tanan 300.



Sagem's MOST day-night surveillance system

Sagem, a Safran group company, has expanded its product range with the addition of a new system that makes its debut at DefExpo 2014. This is MOST (*MâtOptronique de Surveillance Terrestre* oprotronic land surveillance mast).

The heart of this new system consists of Sagem's JIM LR long-range multifunction infrared binoculars. Building on the high-performance JIM LR, Sagem has added other advanced functions on MOST, including day-night image fusion, panoramic display, and automatic threat detection. MOST is operated from a shelter-mounted tactical terminal and features the latest image processing software, and is offered in several configurations: vehicle mounted, fixed station or telescopic mast, among others. Covering a full 360 degrees, the JIM LR sensor incorporates a thermal imager, daytime channel, GPS, and a north seeker enabling the detection and position

determination of a target at a range of several kilometers, for protection, intelligence and attack missions. With adequate power supply, it can operate round-the-clock. Featuring a highly modular design, the MOST system uses a quick release bracket that allows the JIM LR binoculars to be easily removed from the system for use by dismounted troops. JIM LR can be used standalone by forward observers in close-air-support loop, involving artillery, attack helicopters, or fighter-bombers.

This new system intends to capitalise on the global success of Sagem's JIM family of thermal binoculars: more than 6,000 JIM LR units are either on order or in service across some 30 countries, including the USA, UK, Poland, Denmark and France

Sagem will be showcasing its products at the Safran stand during DefExpo 2014 in four main areas: portable optronics, navigation systems, Patroller UAV and AASM missile systems.

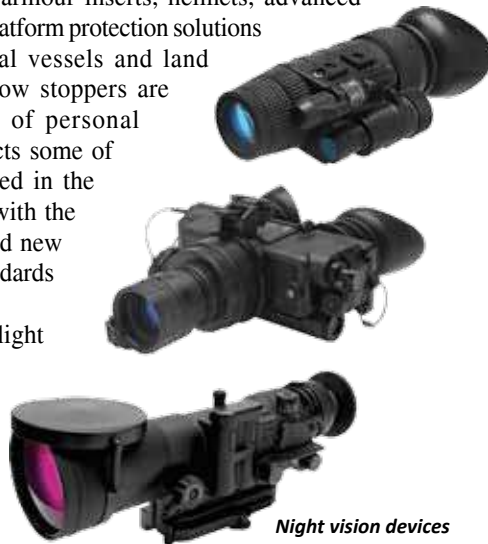


Gaining the edge—it's MKU!



MKU, a leading manufacturer of ballistic protection equipment and night vision devices, with over 25 years of domain experience is participating yet again at Defexpo and is taking the opportunity to display some of their latest solutions. The protection solutions on display at the MKU booth include ballistic jackets, armour inserts, helmets, advanced protection gear, platform protection solutions for aircraft, naval vessels and land vehicles. The show stoppers are the latest range of personal protection products some of which are patented in the US and comply with the most stringent and new International Standards like NIJ 0101.06.

Another highlight



Night vision devices



Bullet proof jacket, plate and helmet



Soldier with black Ergo vest



Helmet with night vision device

Return of the Amphibian !



Commodore Sujeet Samaddar, NM formerly with the Indian Navy, examines the case for acquiring such unique capability

The Chief Guest at India's Republic Day celebrations in January 2014 was Japanese Prime Minister Shinzo Abe, and the import of this fact goes far beyond the Rajpath parade in New Delhi. There are significant working group discussions taking place between the two countries impacting on security and economic issues, matters of great significance considering that China, which neighbours both nations, has of late been flexing its muscles on issues of 'dispute' at sea and the high mountains.

One of the major areas of cooperation between India and Japan concerns maritime security and as an example, the Coast Guards of both countries have recently carried out combined exercises. There was a far reaching Memorandum of Cooperation (MoC), signed between the two Coast Guards, which encompasses issues of maritime search and rescue, combating marine pollution, technical assistance for responding to natural disasters and exchange of information regarding crimes at sea, including smuggling and illicit trafficking.



Comde Sujeet Samaddar, Director and CEO, ShinMaywa Industries India Pvt. Ltd

Under this broad based umbrella, Coast Guards of India and Japan have just carried out exercises off the Kochi coast in mid-January 2014, with ships and aircraft of both countries taking part. However taking part were conventional patrol vessels, light helicopters plus fixed wing aircraft, and the unique capability of amphibious aircraft remained obviously as on the 'wish list'.

Modern amphibious aircraft are capable of a variety of missions other than SAR. Under Article 98 of the United Nations Conventions on the Law of the Seas (UNCLOS) "Every coastal State shall promote the establishment, operation and maintenance of an adequate and effective search and rescue service regarding safety on and over the sea and, where circumstances so require, by way of mutual regional arrangements cooperate with neighbouring States for this purpose." Amphibious aircraft fit this purpose completely, combining the capabilities of rapid surveillance and prompt response, whether for relief or arrest, in a single platform, not available otherwise. Unlike helicopters and land-based aircraft, amphibious aircraft can land at the location and enforce both the will and the law of the country and thus are a platform of choice for benign and constabulary missions of navies. Unlike ships, amphibious aircraft can reach the location far faster than ships can preventing destruction or dumping of contraband.

The recent SAR conducted by the US-2 of the JMSDF in extreme weather conditions proves how modern amphibious aircraft can dramatically change the scenario. The US-2 carried out a successful SAR of stranded Japanese on yacht in June 2013, some 1,200 kms South East of Miyagi Kinkasan. The SAR was conducted by the US-2 in typhoon conditions over the Pacific Ocean. The recorded sea state was 5 with 4m wave height. The wind velocity was about 40 kts during the rescue. Approaching sunset and the inclement weather made the mission even more hazardous. However, ultra-modern aviation technology on board the US-2 coupled with superior flying skills of the crew made the SAR a successful mission.

As has been reported, India and Japan have been discussing the suitability of ShinMaywa's US-2i amphibian aircraft in this context and according to a Senior official in the Ministry of External Affairs in New Delhi, a joint working group has been formed to discuss the aircraft programme, meetings to continue after the visit to India of the Japanese Prime Minister.

VAYU Interview with

Ian Walsh

Textron Systems



Ian Walsh is Senior Vice President and General Manager of Textron Defence Systems, a member of the Textron Systems Executive Leadership Team, and David Sylvestre, Textron's Director of Corporate Communications

VAYU: What are the key technologies and products that Textron Systems is showcasing at DefExpo 2014?

Walsh: Featured at this year's exhibition will be Textron Systems' end-to-end solutions addressing the border security and intelligence requirements faced by regional customers. Among these are capabilities including:

Shadow M2 Tactical Unmanned Aircraft System: Designed based on lessons learned during hundreds of thousands of combat operational hours, the Shadow M2 offers increased range, endurance and reliability, as well as higher-altitude flight for a greater variety of mission profiles.

MicroObserver Unattended Ground Sensor System: These ground sensors are part of a scalable, effective solution for both tactical and non-military applications covering a variety of terrains and targets.

Motor Lifeboat (MLB): The 47-foot, all-aluminum MLB delivers outstanding performance in a wide variety of roles, including search-and-rescue, border patrol, law enforcement and natural disaster relief operations.

Our flagship geospatial intelligence analysis software products, Remote View and ELT, provide a comprehensive range of capabilities, from high-powered exploitation and mapping for geospatial analysts to valuable image analysis tools for tactical users.

VAYU: The past year or two have seen dramatic changes in India's military acquisitions processes. Given Textron Systems' interests in India, have you partnered with any PSUs or private sector companies?

Walsh: Textron Systems is first and foremost a solutions provider. This focus means identifying the best business model for

our customer, as well as the best products and services. Co-development and co-manufacturing are priorities for Indian customers, and we are actively exploring industry partnerships that benefit all parties.

VAYU: At Aero India last year, you had stated Textron Systems' interest in providing MicroObserver unattended ground sensors (UGS) to the Indian Border Security Force – what is the status of this proposal at present?

Walsh: There are a number of valuable applications for unattended ground sensors along India's vast borders. Our proven and reliable MicroObserver UGS system features long mission life and highly covert sensors to provide customers, including the Indian Border Security Force, effective detection, classification and tracking of people and vehicles. We are confident this award-winning system is well suited to help meet India's border security requirements.

VAYU: The Indian Navy has a requirement for over fifty shipboard light utility helicopters and RFPs have been issued for the same. Has Textron subsidiary Bell Helicopter submitted a response to this RFP, and if so, what rotorcraft is on offer?

Sylvestre: Bell Helicopter did not bid on the light utility helicopter program because we did not have an aircraft that met the specific requirements outlined by the Navy.

VAYU: In December 2013, Textron confirmed plans to purchase Beechcraft Corporation (formerly Hawker Beechcraft). This major acquisition marks a significant change in the global aviation landscape – what are your short- and long-term plans following the acquisition?

Sylvestre: Textron's acquisition of Beech Holdings is proceeding on schedule, with

the transaction expected to close by mid-year 2014. Textron will continue to globally market the Beechcraft line, which is very complementary to Cessna's product line. For example, the Beechcraft King Air fits in very well with the Cessna Caravan and the Cessna Citation lineup. As part of the acquisition, Textron will also gain approximately 90 customer service centers that will help to grow Cessna's ability to service customers who fly Cessna, Beechcraft, Hawker and other types of aircraft. Though the Hawker jet line will not re-start production, Textron is committed to servicing the existing Hawker fleet through the service network, including certified Hawker parts and maintenance services. Longer term plans include growing both the Cessna and Beechcraft brands, though the specific strategies for doing so will be determined by the recently formed transition team, represented by leaders of Textron, Cessna and Beechcraft.

VAYU: Textron recently achieved a milestone with the first flight of the Scorpion light attack jet. Is this now close to the final production configuration or are significant changes still foreseen before a final standard can be committed to? Also, what markets are you hoping to serve with this aircraft?

Sylvestre: The Scorpion jet had a successful first flight on December 12th and has continued with additional flights. The development team expects to conduct about 400 hours of test flights in 2014. The final design details of the Scorpion may be refined as testing proceeds, though no major design changes are anticipated. The goal remains to secure the initial customer contracts and then proceed to low-rate production in 2015. The Scorpion is designed as an affordable, U.S.-built, twin-jet tactical aircraft, with high interior payload capacity to support today's intelligence, reconnaissance and surveillance (ISR). Attachment points on the wings support a wide range of precision munitions. Since the jet's introduction in September 2013, there has been active interest from branches of the US military and a number of US partner nations. Scorpion is an ideal platform for air forces requiring an affordable solution for multiple missions such as irregular warfare, counter narcotics, disaster aid, border security and maritime surveillance. The jet provides the speed to get on location quickly, along with the long loiter time and low speed often needed for sustained reconnaissance. With flight per hour targeted at under \$3,000 dollars, it offers an economical alternative to far more costly aircraft.

**Lars-Olof Lindgren,
Chairman Saab India
Technologies Pvt Ltd
on eve of Defexpo 2014**



VAYU : What brings you to Defexpo 2014? Why is Defexpo 2014 important for you?

LOL : Defexpo 2014 is a very important date in Saab's calendar both because of the market potential and our collaboration in partnerships and investments for the global markets. We have made a long term commitment to India's national security goals by being a partner in developing an indigenous, global scale, self-sustaining industry. We fully support India's ambitions and we are willing to partner and share our own experience to expedite the leap frog we expect to see in India in this area.

Defexpo 2014 will be an opportunity to meet Indian stakeholders from the government, defence forces, homeland security, research (science and technology) and both the public and private sector industry.

Consequently, this exhibition is a great opportunity for us to showcase our capabilities, success of current Saab programmes, partnerships and achievements and set the stage for the future.

VAYU: What is the message you wish to communicate through your participation at Defexpo 2014?

LOL : The main theme for Saab for this Defexpo is 'Teaming up with India'. Saab believes in partnerships, by combining our thinking edge with Indian Industry, we enrich relationships and encourage development of smarter products. Through industrial cooperation, we collaborate with

Indian companies to achieve the long-term goal of creating an indigenous, self-sufficient defence industry on the global scale. This, combined with our willingness to transfer cutting-edge technology, has resulted in rewarding partnerships. There are a number of partnerships between Saab and Indian companies, including those with Tech Mahindra, Pipavav, HAL, QuEST, among others. DefExpo 2014 offers the opportunity to reinforce our determination to continue to form partnerships with India.

VAYU: What opportunities do you see for Saab in India, both in the short term and the medium term, across services?

LOL : We have participated in a number of programmes with various arms of the defence forces and are quite pleased with the progress of different programmes. Saab has a wide portfolio of products and we are in dialogue with the armed forces and homeland security for a whole range of sophisticated equipment, including camouflage, battle management systems, air defence systems, ground combat systems, advanced surveillance and foliage penetrating radars, naval and coast guard systems, electronic warfare systems, communication equipment and avionics among others.

Saab is currently pursuing many individual opportunities in the requirements of the Indian defence forces. All of Saab's Business Areas are active in India offering high-tech solutions and products such as the C4I, EW (Self Protection Systems),

Signature Management, Missile & Weapon Systems, Aeronautical Platforms, Sensors (Radars), Maritime Security and Civil Security, LPI Radars and the Sea Giraffe.

VAYU: Can you elaborate on the recent successes that Saab has had with the Indian armed forces, across domains?

LOL : Saab has received two orders from Hindustan Aeronautics Limited (HAL), for serial production of an integrated electronic warfare self-protection system for installation on the Indian Army's and Air Force's Advanced Light Helicopter. These orders follow initial serial production orders received in 2008 and further establish Saab as a local partner to the Indian Industry and provider of high tech products and systems to the Indian Armed Forces. With these orders we continue to build on our very successful partnership with HAL. The fact that HAL and the Armed Forces have continued to show faith in the IDAS system is a testimony of the effectiveness and reliability of the solution.

VAYU: Many multinational companies operating in India are forging partnerships or joint ventures with Indian companies. Does this appeal to Saab?

LOL : Given the right market situation, prospect or realisation of a mature order, Saab will certainly consider investing in joint ventures in India. Saab has invested in Indian companies, particularly Pipavav and Quest. These are irrespective of the equity levels allowed currently.

Modernisation is 'Mantra' for BAE Systems at Defexpo 2014



M777 Ultra Light Howitzer

BAE Systems' participation at the eighth edition of DefExpo, is anchored in a single mantra – the Company's continued commitment to partner with the Government of India in its planned modernisation of the military, through technology and capability-sharing with the domestic defence industrial base.

At Defexpo 2014, the Company's showcases its broad span of state-of-the-art capabilities in towed and self-propelled Artillery and its Fire Control Systems, Naval Gun Systems, Ammunitions, Military Communications Systems, Geospatial Exploitation Products, Wheeled and Light Armoured Vehicles, and Helmet Mounted Displays.

Leading the Company's participation in this biennial show are John Brosnan, Managing Director, South East Asia & India and Mark Simpkins, Vice President and General Manager for India.

John Brosnan, Managing Director, South East Asia & India has said that "DefExpo is a signature event for our Company and we are encouraged by the keen interest our displays receive. The platform is also significant in presenting us an excellent opportunity to progress discussions with partners for domestic co-development and co-production to fulfill our shared goal of indigenisation."

Centre stage at the BAE Systems Stand are the M777 ultra-light field howitzer and Mk45 Naval Gun system. The Company

has been supporting discussions between the Governments of India and the United States for a potential Foreign Military Sale of this howitzer that is highly portable by land, sea and air and features a minimal logistical footprint alongside maximum reliability. The Mk45 is the most compact 5-inch (127-mm) fully automated naval gun in the world with a successful and proven track record of service in the naval fleets of Australia, Denmark, Greece, New Zealand, Spain, Thailand and Turkey and is co-produced indigenously in South Korea and Japan.

Demonstrating the strength and expanse of their portfolio in artillery, the BAE stand will display the Archer 155 mm FH 77 BW L52 self-propelled field howitzer that can operate autonomously in tandem with today's command and control systems. Adding fire power will be

the LEMUR Remotely-Controlled Weapon Systems (RCWS) and electro-optical sight for land and sea application. A wide range of munitions is on display including 120mm Tk HESH L31A7 and 120mm Tk Charge Propelling L3A2 amongst others.

The stand also displays the Hawk Mk.132 Advanced Jet Trainer, of which India is the largest operator with 123 aircraft ordered to date by the Indian Air Force (106) and the Indian Navy (17). The Indian Navy recently inducted the first batch of Hawk Advanced Jet Trainers, becoming the third naval operator of the Hawk along with the US Navy and the Royal Navy. BAeHAL, the engineering and business solutions services Joint Venture with Hindustan Aeronautics Limited, will also be present.

Also on-stand is the new Q-Warrior helmet-mounted display (HMD) for the dismounted soldier and Q-Sight HMD for the new-age pilot, both providing mission-critical situational awareness. Adding muscle will be the Striker Helmet for both fixed- and rotary-wing platforms. Display of the RG32 LTV and RG34 exhibits underlines BAE Systems' flagship capabilities and technology in Light Armoured Vehicles for potential partnerships with the Indian industry.

Headquartered in New Delhi, BAE Systems has a six-decade long history in India. The Company has worked closely with the Government to establish an indigenous production capability at Hindustan Aeronautics Limited for the Hawk Advanced Jet Trainer, which is in service with the Indian Air Force and the Indian Navy. In addition, the Company is developing a range of opportunities across the land, naval and the C4ISR sectors in collaboration with domestic industrial partners.



Mk45 Naval Gun System

OIS at DEFEXPO 2014

The OIS family of companies, spearheaded by OIS-AT is taking part in Defexpo 2014 with the aim of showcasing its competitive and extensive range of advanced technology products and capabilities including R&D, manufacturing and Systems Integration capabilities.

OIS-AT's ability to innovate advanced products is best exemplified by the industry's first true 3D Avian (Bird) Detection Radar that is under the spotlight at Defexpo 2014. This product has been entirely developed, designed and manufactured by OIS-AT, which also owns the Intellectual Property rights of the product. The significance of this product derives from its technological and environmentally sensitive value to air-space security and as such would be of interest globally. This unique product has been proven in operation as part of recent trials. This along with several other products in OIS' portfolio, further exemplify its ability to absorb and integrate complex technologies, provide complex solutions, systems integration and support to a host of companies in India and globally.

As participants of DefExpo 2014, OIS-AT will be also demonstrating its capabilities as Systems Integrators of complex solutions related to Homeland Security. It's focus on dual use technologies, allows the company to

offer an ideal technology and services platform to serve the Indian market. In this context, OIS-AT is showcasing capabilities and highlighting its strategy for onshoring advanced technologies either through System Integration or via local manufacturing, so that they are available as indigenously developed products and solutions to customers.

OIS companies will also be highlighting the range of capabilities including R&D and manufacturing to international companies who are expected to fulfill an Offset obligation. OIS companies are eligible Offset partners (IOPs) with appropriate certification. In addition to this, for those technologies and products that they do not manufacture in-house, OIS-AT has created a robust ecosystem of partnerships with SMEs who have proven manufacturing capabilities and whose products are made available to OIS-AT, who in turn acts as the 'Prime' for global customers.

By virtue of OIS's multi-faceted portfolio and commitment to innovation the company believes that the unique range of products and technology capabilities showcased at Defexpo 2014 will not only further the interest of the industry in India, but also address requirements of the Indian Government and international clients.



3-D solid state Avian (Bird) Detection Radar system

Chinese J-20 stealth fighter testing progresses

In January 2014, the third prototype of the Chengdu J-20 stealth fighter bearing serial number '2011' was spotted undergoing testing in China. This aircraft features a number of significant changes from earlier prototypes, indicating that the design and development of the airframe is still being refined.



Most noticeably, the engine air intakes have been heavily reshaped and now feature prominent diverterless supersonic intake (DSI) 'bumps' on the inboard edge, making them very similar to the smaller Shenyang J-31, which itself mimics the intake configuration of the F-35 JSF. DSI designs are both lighter and less complex than conventional means of regulating airflow, such as intake ramps or inlet cones. As an added benefit, DSIs are stealthier than conventional variable intakes, although less so than stealth-optimised variable intakes such as those on the F-22 Raptor.

Another less prominent but arguably more significant change is the addition of an electro-optical targeting system (EOTS) under the nose. The EOTS provides capabilities in line with contemporary dedicated targeting pods andIRST sensors, but in a conformal (and stealthy) housing.

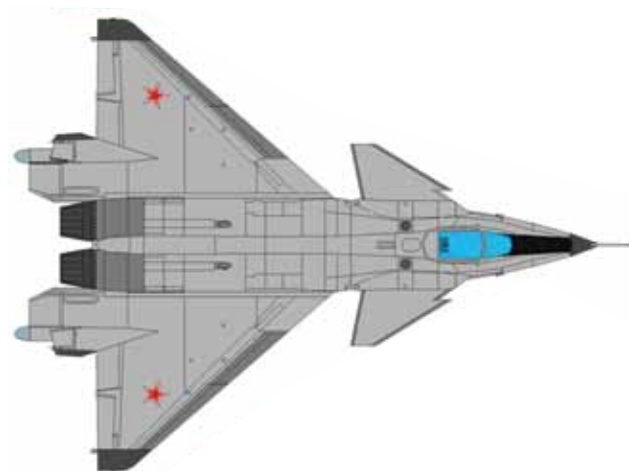
The canopy has received an embedded detonating cord for low-level/low-speed ejection and has also been internally braced, although it remains a single-piece bubble. Small intakes, likely for cooling, have been incorporated at base of each vertical fin and fairings for the wing-mounted control surface actuators have been made more compact.

The aircraft is reportedly still using a variant of the Russian AL-31 engine, as the Xian WS-15 afterburning turbofan is still not ready for integration with the airframe although it has been spotted being flight-tested on an Il-76 testbed operated by the China Flight Test Establishment (CFTE).

It is not entirely clear why the aircraft carries the serial number '2011.' Considering the two preceding aircraft were '2001' and '2002,' the third aircraft should have carried the number '2003.' However, a likely theory is that 2001 and 2002 belong to the first (0) batch of prototypes, whereas 2011 begins the next (1) batch. This second lot of prototypes incorporates design changes that have resulted from programme development as well as flight-testing results from the first batch.

New Russian light fighter ?

The Russian Air Force has traditionally operated a mix of heavy and light fighters, and is currently acquiring 'heavy' Sukhoi Su-30SM and Su-35S fighters for its forces and plans to introduce Sukhoi's T-50 stealth fighter, to replace early variant Su-27s. While there are a limited number of the 'lighter' MiG-29SMT fighters on order, it has until now had no apparent replacement plan for the approximately 250 examples of this type in air force service.



The MiG Article 1.44 was in competition with the Sukhoi PAK-FA to meet the Russian (and Indian) requirement for a fifth generation fighter aircraft (FGFA)

RAC MiG has not had a clearly identified successor for the MiG-29 since the closure of its twin-engined Article 1.44 demonstrator programme in the mid 1990s. It subsequently revived the concept for such a light tactical fighter after receiving initial interest from India but later opted to participate on the developmental T-50 instead.

According to Russian deputy prime minister Dmitry Rogozin, "There is already the task of creating a future light fighter, and it will be built. Light fighters are always in demand from the point of view of export potential".

Brazilian government selects Gripen

In dramatic manner, on 18 December 2013, the Brazilian government announced selection of the Gripen NG to meet its long stated requirement for a new generation multi-role combat aircraft. Negotiations will now begin, with the Brazilian Air Force aiming at a procurement of 36 Gripen NGs to be followed by additional aircraft, not yet defined. The offer presented to the Brazilian Government by Saab includes the Gripen NG, sub-systems, an extensive technology transfer package, a financing package as well as long term bi-lateral collaboration between the Brazilian and Swedish Governments.

"I am extremely proud of the confidence that the Brazilian government has placed in the Gripen NG. Saab regards the announcement as a strong commitment of the Brazilian Government



Depiction of the Gripen painted in Brazilian colours

and are looking forward to provide the Brazilian Air Force with the world's leading and most affordable fighter. Furthermore, this announcement is very significant for the collaboration between Brazil and Sweden. We stand prepared to start the industrial collaboration as planned, with its positive effects for Brazilian industry", stated Saab CEO Håkan Buskhe.

Iraq orders T-50

On 12 December 2013, in a major breakthrough for the Korean AJT, the Government of Iraq signed a \$1.1 billion contract for 24 Korea Aerospace Industries T-50 advanced jet trainers, the second international customer for the type. The first aircraft will be delivered in April 2016, with all 24 to be transferred within a 12-month period. The contract also covers training for Iraqi pilots, while KAI will provide follow-on support for the fleet for 20 years, bringing the entire value of the contract to over \$2 billion. The trainer will be designated as the T-50IQ in Iraqi service and be based on the most advanced version of the T-50, the FA-50, which can serve both as an advanced jet trainer and light attack aircraft.



The FA-50 is powered by the GE F.404 engine and is equipped with an Israeli built Elta Systems EL/M-2032 radar, Link 16 tactical data link, radar warning receivers and a night vision imaging system. It is capable of carrying up to 4,500 kg of weapons on external hardpoints, has a 20mm internal cannon and can carry air-to-air missiles. The T-50 is also to compete in the US Air Force's future T-X competition to replace the Northrop T-38, with the model to be offered in conjunction with development partner Lockheed.

40 F-35s for S Korea

South Korea is to procure 40 Lockheed Martin F-35A Joint Strike Fighters to meet its F-X III requirement, following a decision by the Joint Chiefs of Staff (JCS) on 22 November. Deliveries will begin in 2018, with the programme to be conducted through the US government's Foreign Military Sales mechanism. South Korea will also have an option to buy 20 more of the aircraft later. The original F-X III requirement was for 60 fighters, but following a competition also involving the Eurofighter Typhoon, the only type to come in below its US \$7.7 billion budget was Boeing's proposed F-15SE.



USAF F-35s

In September 2013, the government decided to re-tender the deal, following the air force's reiteration that it wants to introduce a 'stealthy aircraft'.

Meanwhile, the ROK Air Force plans to advance upgrade of its Lockheed Martin F-16C/D fighters. Worth an estimated \$200 million, and to be conducted via the US government's Foreign Military Sales mechanism, the proposed phase one contract includes elements such as new computers, displays, sensors and weapons, and also some software development.

Tranche 3 Typhoon first flight

First Tranche 3 production of the Eurofighter Typhoon made its maiden flight on 2 December from Warton in the UK. Flown by BAE test pilot Nat Makepeace, the aircraft (BS 116) is one of the 40 Tranche 3 aircraft being produced for the Royal Air Force



and equipped with a series of enhancements over previous examples. Germany, Italy and Spain will receive combined a further 72 Tranche 3 Eurofighters. "Work has been carried out on power, cooling and electronics so that a new E-scan (active electronically scanned array) radar could be accommodated," according to BAE Systems. The Euroradar consortium and Selex ES are working on candidate systems, with BAE having already performed a trial installation with the UK's Typhoon instrument production aircraft 5. Another design change introduced for the Tranche 3 standard is the option of installing conformal fuel tanks.

Wind tunnel work has been performed on the design change, which will be the subject of future flight-testing. "These would give the aircraft greater range, and make available hardpoints under the aircraft for larger or additional weapons." Partner company Alenia Aermacchi conducted the first flight test of a Eurofighter in late November 2013 carrying two MBDA Storm Shadow cruise missiles, a stand-off-range type which will be employed with the Typhoon by Italy and the UK.

According to BAE, the Tranche 3 enhancements will "future-proof the aircraft and make it more attractive to current and potential export customers."

50th JF-17 Thunder inducted by PAF



JF-17 Thunder of the PAF's No 16 Squadron ('Black Panthers') at the Dubai Air Show 2013

During a ceremony at Kamra, site of the Pakistan Aeronautical Complex, the 50th JF-17 Thunder of Block I series was inducted by the Pakistan Air Force, on 26 December 2013. The PAF now have two fully operational squadrons with the type (Nos 16 and 26), which are now forward based at Peshawar. Formation of additional squadrons with the JF-17 will reportedly follow after new base preparations are completed.

PAC launches production of JF-17 Block II

On 18 December 2013, Pakistan Aeronautical Complex (PAC) formally launched production of the JF-17 Thunder Block II, a variant of the Block I featuring upgraded avionics, radar and weapon systems. Confirmed orders by the Pakistan Air Force are for 50 of these additional JF-17s, which will continue to be powered by the Russian-origin RD93 turbofan engine, which also equips the earlier JF-17 Block I.



Prime Minister Nawaz Sharif being presented scale model of the JF-17 by Air Chief Marshal Tahir Rafique Butt

The JF-17 Thunder has been co-developed and co-produced by PAC with the China National Aero-technology Import and Export Corporation. "The indigenous manufacturing of JF-17s will not only lead to self-reliance and industrialisation but will also further strengthen Pakistan's friendship with China," Prime Minister Nawaz Sharif said at the ceremony. "The first Block-II JF-17 will be ready by June 2014," according to chief project director Air Vice Marshal Javaid Ahmad.

The Block-II will have improved avionics, air-to-air refuelling capability, additional weapons carriage and some extra operational capabilities. Ahmad said that several countries in Central Asia, South America and Africa had shown interest in buying the new fighter. The Pakistan Aeronautical Complex, which overhauls and rebuilds the air force's range of combat aircraft, has the capacity to produce 16-25 aircraft per year. In addition to the present range of armament, the JF-17 is to be equipped with the Chinese origin H-4 Joint Standoff Weapon.

Series production of Gripen E begins

Saab has, within the framework of a previously signed agreement with the Swedish Defence Materiel Administration (FMV) for the new generation of Gripen E, received a serial production order for completion during 2013-2026. The order includes modification of 60 Gripen C to Gripen E for Sweden with initial deliveries in 2018. "The order from FMV is further proof of the Swedish Parliament's confidence in Gripen, its development potential and defence capacity. Furthermore, this is confirmation that the programme is proceeding according to plan," said Saab's president and CEO Håkan Buskhe.



This is the third order under the agreement with FMV for Gripen E that was made public on 15 February 2013. Other orders within the agreement include development of Gripen E to Sweden during 2013-2023, mission-specific equipment and support and maintenance for Gripen E delivery of 22 new Gripen E, plus related equipment to Switzerland. During August and September 2013 both chambers of the Swiss Parliament voted 'yes' to the procurement of Gripen E and a referendum on the procurement is expected in 2014.

Meteor integration on Gripen E

Saab has meanwhile received an order from Swedish Defence Materiel Administration (FMV) for integration of the Meteor weapon system on the Gripen E. The total order value amounts to approx. SEK 186 million and will be achieved during 2013-2023. Meteor is a Beyond Visual Range Air-to-Air Missile (BVRAAM) developed to enable engagement of airborne targets at long distances, the missile being the result of a European collaborative project involving Sweden, France, Italy, Spain, Germany and Great Britain. At the end of June 2013 Saab in cooperation with FMV conducted the first test firing of the serial production configuration of the Meteor. Gripen is the first combat fighter system in the world with the capability to fire this version of Meteor which has been developed for Gripen, Eurofighter and Rafale.

400th Eurofighter Typhoon delivered



The German Air Force took delivery of the 400th Typhoon built, on 4 December 2013 during a special ceremony at Cassidian's Military Air Systems Centre in Manching, Southern Germany. State Secretary of the German Ministry of Defence, Christian Schmidt, received the aircraft with the markings '31+06'.

Eurofighter Typhoon's flight tests with Storm Shadow

Eurofighter's partner company Alenia Aermacchi has announced that the first in a major series of flight tests to integrate the MBDA Storm Shadow missile onto Eurofighter Typhoon, have commenced. Initial flight trials to demonstrate that the missile can be safely carried started on 27 November, at the Alenia Aermacchi Flight Test Centre Decimomannu Air Base, in Sardinia, Italy, with the support of Eurofighter Partner Companies, BAE Systems and Cassidian.



The intensive flight test programme began with flutter tests and an air data system large store interference assessment, using Instrumented Production Aircraft 2 (IPA2) updated to the Phase 1 Enhancement standard. The Storm Shadow, already in service with the Italian Air Force and Royal Air Force Tornados, is a

conventionally armed, stealthy, long-range stand-off precision weapon designed to neutralise high value targets. The new weapons systems will add the capability to strike by day or night in all-weather conditions, against well-defended infrastructure targets such as port facilities, control centres, bunkers, missile sites, airfields and bridges that would otherwise require several aircraft and missions.

A400M in-flight refueling trials

The Airbus Military A400M has received fuel in-flight for the first time, with one of the programme's three development aircraft having achieved the milestone, being mid-air refuelled by a French Air Force C160 Transall over Seville, Spain. This successfully validates a new set of air-to-air refueling (AAR) flight control laws referred to as 'D6R-P', according to project pilot Tony Flynn. Cockpit video footage of the second dry contact made behind the now-retired Royal Air Force VC-10 shows the A400M pitching up and down, before climbing violently towards the tanker's T-tail as the crew abandoned the connection.



"We are confident the flight control law will be acceptable, but will have to test it further to be completely sure," and this process will involve making contacts behind an RAF A330 Voyager tanker/transport from February 2014 at higher altitudes and faster speeds. Software modifications will be made if required, before Airbus Military starts the AAR receiver certification process later in 2014. Work to also prove the A400M's ability to transfer fuel to the fixed-wing aircraft and helicopters using under-wing hose and drogue refueling pods will be conducted this year.

More UAVs for Russia

The Russian Government has contracted with Kazan-based Eniks for delivery of 34 short-range unmanned air vehicles Eleron-ZSV to be used in a surveillance role. The UAVs are a modernised variant of earlier Eleron systems and will be delivered in 2014. The 5.3kg (12lb) Eleron carries a 1kg imaging payload, with a top speed of 70kt (130km/h) and ceiling of 13,000ft (4000m).

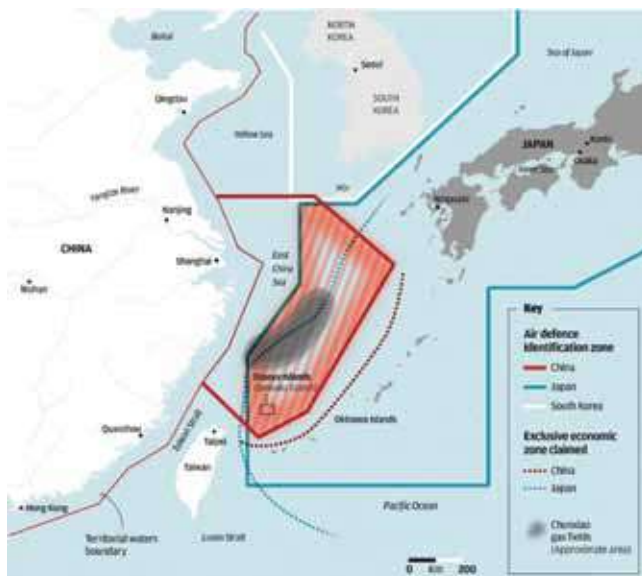


In an interesting development, UAE-based Adcom Systems is to deliver its 1,500 kg United 40 medium-altitude long-endurance UAV to the Russian defence ministry for trials in February 2014. The United 40 platform can be configured for a number of missions, including an armed guise fitted with air-to-surface missiles.

China's new air defence zone

Japan's defence minister has called on the international community "to oppose China's recently declared maritime air defence zone over the East China Sea and possibly over the disputed South China Sea". Defence Minister Itsunori Onodera had discussed Japan's concern over China's action separately with Philippines Defence Secretary Voltaire Gazmin and Australian Foreign Minister Julia Bishop during his recent visit to the Philippines.

In his meeting with Bishop, Onodera said he mentioned that the international community "should meet to deal with this matter together" and that any unilateral action by coercive means should be opposed. "If any country would establish a similar air zone in



the South China Sea, that would bring up tension in the region and that should be stopped,” and added that “the issue should be resolved by dialogue”.

The United States, Australia, South Korea and other countries have also expressed alarm over China’s new air identification zone. The Chinese have directed that all aircraft entering the vast area must identify themselves and follow Chinese instructions. China’s ambassador to the Philippines, Ma Keqing, said that it was Beijing’s right to decide “where and when to set up” an air identification zone. She was asked about a possibility that China might set up a similar zone over the South China Sea, but Ma did not say if China would do so.

New Chinese aircraft carriers

China will construct two conventionally-powered aircraft carriers in Dalian and Shanghai between 2014 and 2015, according to a source from China’s Central Military Commission.



J-15 takes off from the ski ramp of the aircraft carrier Liaoning

Under the Commission’s ‘Project 048’, China aims to establish three carrier battle groups by 2020 so that all three major fleets of the PLA Navy will be able to carry out missions with the full support of an aircraft carrier. The two new Type 001A indigenous carriers will be updated versions of China’s first aircraft carrier, the *Liaoning*, which was originally the Soviet-era *Admiral Kuznetsov* aircraft carrier purchased from Ukraine in 1998 and will be designed with a ski-jump ramp.

Sources said that the General Equipment Department of the PLA has already signed a contract with the Beijing-based China Shipbuilding Industry Corporation to build the two carriers. The price of the two vessels is estimated to be worth \$9 billion. It is uncertain whether the Chinese J-31 stealth fighter will supplant the J-15 to become the country’s next generation carrier-based fighter. Sources said that a decision will only be made after the construction of the nation’s second and third aircraft carriers is completed, which will give the PLA more time to think about the type of carrier-based fighter it will need in the future.

Japan and South Korea joint exercises

Japan and South Korea have conducted a joint naval exercise in the area covered by China’s ‘air defence identification zone’, a move seen as sending “a firm message to Beijing.” Under Chinese rules, all aircraft are required to report flight plans in advance. However, the two countries are divided over compliance by commercial flights. Korean Air and Asiana Airlines said they would start to notify the Chinese authorities, while Japan has told its commercial operators not to comply.

Analysts state the Asian neighbours were sending a strong signal to China by choosing to carry out the exercise near Suyan Rock, the tiny, submerged rock which has become the focus of renewed disputes between Beijing and Seoul since the air zone was declared on 23 November 2013.

A South Korean military official stated that two destroyers and two helicopters from each side took part and a Japanese naval spokesman confirmed the drill was conducted within China’s air zone, but added, “The drill had been planned for a long time, since before China’s announcement [of the air defence identification zone]. It was not organised in reaction [to the zone].” The UN maritime law states that a state cannot claim territorial sovereignty over a Maritime region. The Chinese did not immediately respond to this joint exercise.

Boeing/Saab to compete for T-X programme

Boeing and Saab are to develop a new advanced jet trainer to compete for the USAF T-X requirement to replace the current Northrop T-38 Talons. Under their joint development agreement, Boeing is to act as prime contractor and Saab as primary partner. The collaboration will cover design, development, production, support, sales and marketing activities.

Boeing’s pact with Saab seeks to draw on the Swedish company’s proven experience in developing affordable systems, such as the in-service Gripen and developmental E-model version. For Saab,



Two-seat Gripen D operational trainer

the partnering agreement is the latest step in a strategy to expand globally and particularly in the Americas. Saab's growth strategy in the US market has emphasised partnering with domestic companies. By 2009, the Swedish firm had built a US business with annual sales of \$200 million spread among three, largely independent businesses: Saab Barracuda, Saab Training and Saab Support Services.

South Korean President raises MCMV delays during India visit

On 16 January, during a state visit, South Korean President Park Geun-Hye pushed for the signing of a major bilateral defence deal that has been hanging fire for almost three years after being virtually finalised – the project to equip the Indian Navy with new mine countermeasures vessels (MCMVs). The programme plans for India to acquire two MCMVs and transfer of technology for Rs 2,700 crore from South Korean shipbuilder Kangnam Corporation, with Goa Shipyard to build another six vessels valued at over Rs 6,000 crore.



The specialised MCMVs are made of non-magnetic fibre-reinforced plastics (FRP) to avoid generating the electro-magnetic signatures that typically activate naval mines. The vessels are used to clear harbours as well as offshore installations for shipping activity, and perform a vital role in protecting the Navy's warships.

President Park Geun-Hye stated that she had raised the pending export of Korean minesweepers to India with Prime Minister Manmohan Singh as part of discussions on the emerging strategic partnership between India and the Republic of Korea.

The MCMV acquisition has been stuck in the Indian MoD due to typical bureaucratic delays and complaints of irregularities by rival bidders. This is despite the Navy having unequivocally stated that new minesweepers are an "urgent" requirement and approval for acquisition of eight MCMVs having been granted over eight years ago, in July 2005. The contract price negotiations with Kangnam were reportedly concluded as far back as October 2011, making this the third year that the MoD has delayed the contract without explanation.

Mi-28N Night Hunter in service

On 27 December 2013, the Mi-28N Night Hunter combat helicopter, made by Russian Helicopters officially entered service with the Russian Defence Ministry, which had tested it in various conditions and developed a dedicated training and support base. "The fact that the Defence Ministry has officially accepted the Mi-28N testifies to the fact that the Night Hunter meets the requirements for a combat helicopter, has passed all the necessary tests, and is ready to enter into service with the Russian Air Force," stated Alexander Mikheev, CEO Russian Helicopters.



The Mi-28N Night Hunter "meets all current combat helicopter requirements, and has roused interest among potential customers". The export model is known as the Mi-28NE Night Hunter and has "superior flight capabilities," allowing it to perform aerobatic manoeuvres. The legendary Golden Eagles (*Berkuty*) helicopter aerobatics team have flown Mi-28N Night Hunter helicopters since 2012.

Canadian-Chinese twinjet airliners

Canada's Bombardier and China's Comac have been continuously evaluating progress of their collaboration on their respective CSeries and C919 development programmes. Their meeting in December 2013 summarised progress of the second phase of the collaboration in areas such as supply chain services, flight training, flight test support as well as sales and marketing. Both companies also reportedly discussed the next phase of their collaboration to explore commonalities between the C919 and CSeries twinjets.

C919's chief designer Wu Guanghui stated that "a great deal has been achieved since it began working with Bombardier in March 2012". Comac looks to deepen the partnership in future to realise mutual benefits. Bombardier and Comac began working together to examine similarities between the C919 and the CSeries family in supply chain services, human interface and cockpit design.

The Canadian company is also acting as an advisor to Comac on the latter's ARJ21 regional jet programme. As part of this effort, Comac will be involved in the "non-flying tasks" related to the CSeries flight-test activities, a move that is expected to help

the inexperienced Chinese airframer with the certification process on the C919. Bombardier and Comac will also work together on sales and marketing activities, and jointly promote the aircraft to customers worldwide.

Comac C919 development progress

Meanwhile, design and development of the Comac C919 airliner continues with a number of initial components now complete. On 28 November 2013, the Chinese company announced that Shenyang Aircraft had manufactured first engine pylon for the airliner. The pylon will be transferred to the engine manufacturer CFM International for later installation on the latter's flying testbed for flight trials of the Leap-1C engine.



Completion of this part enables the twinjet to maintain its first-flight target of 2015. Comac has also released images showing a completed mid-fuselage section with the outer wingbox installed. Production and assembly of the fuselage section has been conducted by AVIC's Xian Aircraft, and points to breakthroughs in indigenous manufacturing capabilities, which include manufacture and utilisation of aluminium-lithium alloy material for the fuselage skin and the use of laser-shaped parts for the centre-wing chords. Aircraft structural data has also been distributed, while parts and components manufacturing is currently moving at a good pace across five different Chinese cities.

Avia Consortium and Exolus Group co-operation on Frigate Ecojet

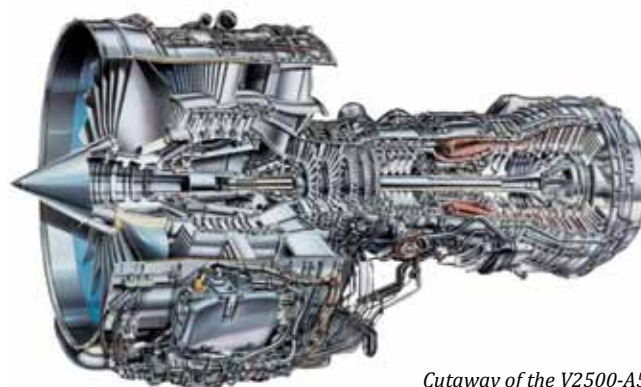
Russian Avia Consortium and the Exolus Group will expand their 2011 'Strategic Cooperation' in development of optimal global operating platforms for the Frigate Ecojet programme, which involves the development of a new wide-body short/medium haul civil aircraft using a brand new aerodynamic and design configuration in accordance with the requirements made for the next generation wide-body short/medium haul aircraft Frigate Ecojet based on a fundamentally new, innovative aerodynamic and structural design.

The Exolus Group has supported RAC in defining the evolution and transformation in the range of the world's major system integrators' global operating platforms, focusing on production logistics, airframe production, and vendor selection, while assessing the underpinning risk sharing partnerships, industrial offset agreements, subsidies, and others. RAC and Exolus will

move forward with a sequencing of the implementation in the development of "a truly unique and best-in-class global operating platform tailored to a new generation of aircraft".

MTU plans "substantial" investments for new programmes

The German company MTU projects significant growth for its civil aero engine production and maintenance activities in 2014, and aims to fund future programme investment through considerable cost-savings. The commercial engine subassembly manufacturing business is set to show the highest growth rate, with revenues expected to increase 15% year-on-year.



Cutaway of the V2500-A5

In 2012, the division generated a turnover of around €1.6 billion, or some half the group's total €3.3 billion revenue. MTU's civil maintenance business is expected to expand at a high single-digit rate, after the unit's revenue increased by nearly 17% to €1.3 billion in 2012, including contribution to Pratt & Whitney's PW1000G family of geared turbofans for the Airbus A320neo and other in-development aircraft and the General Electric GENx on the Boeing 787, for which "substantial upfront investments into development and production will be required." Greater focus is being placed on low-cost manufacturing, with the group planning to concentrate all low-pressure turbine assembly work at its Polish production plant.

Northrop Grumman's System for RN Astute submarines

Northrop Grumman Corporation has supplied the final batch of Platform Management System (PMS) hardware for the Royal Navy's *Astute*-class series' boat 5 submarine. Under a performance partnering arrangement, Northrop Grumman's Sperry Marine business unit supplied the PMS to BAE Systems Maritime-Submarines for installation on *Astute* Boat 5, HMS *Anson*, at its shipyard in Barrow-in-Furness, UK. The PMS equipment controls and monitors the submarine's platform machinery and onboard systems. Additionally, Northrop Grumman is currently under



Image courtesy BAE Systems Maritime-Submarines

contract to supply PMS hardware and software for *Astute* Boat 4 (*Audacious*) and the forthcoming *Astute* boats 6 and 7, which will be the Royal Navy's newest nuclear-powered submarines.

BAE next-generation guided projectile for US Navy

BAE Systems has received a \$33.6 million contract from the Office of Naval Research (ONR) to develop and demonstrate a Hyper Velocity Projectile (HVP), designed to provide lethality and performance enhancements to current and future gun systems. The objective of the first phase is to produce a concept design and development roadmap towards fully guided flight demonstrations.

BAE Systems, along with United Technologies and Custom Analytical Engineering Systems (CAES), will develop and demonstrate a modular, low drag HVP. The modular design will allow the HVP to be configured for multiple gun systems and to address different missions. BAE Systems will build on its recent Long Range Land Attack Projectile and Multi-Service Standard Guided Projectile development and demonstration successes to apply innovative and proven designs to the next-generation projectile.



BAE Systems and DCNS cooperation on Astute-class submarine programme

DCNS has signed a contract with BAE Systems to supply four high-efficiency heat exchangers for boats 6 and 7 of the Royal Navy's *Astute*-class nuclear-powered attack submarine programme. The Royal Navy took delivery of the second *Astute*-class boat earlier in 2013. DCNS has been a preferred supplier of BAE Systems on the *Astute* programme since 2001 and this latest contract makes the Group sole supplier of heat exchangers for the United Kingdom's latest generation of nuclear-powered submarines. The design and construction of these heat exchangers is based on advanced technologies and expertise acquired through the Group's involvement in a number of conventional and nuclear-powered submarine programmes. Over the years, the Group has delivered more than 500 heat exchangers, including 170 for conventional and nuclear-powered submarines operated by 10 navies, developing specific expertise in the relevant areas of mechanical and thermal engineering.

Next generation RN nuclear submarines

Funds have been allocated for investment in the next generation of Royal Navy submarines, the *Successor* submarines, which will carry the UK's strategic nuclear deterrent, to be the largest and most advanced boats operated by the Navy and their design and construction will be the most technologically complex in history of the UK. Two contracts worth £47 million and £32 million have been awarded to BAE Systems Maritime-Submarines, based in Barrow-in-Furness, Cumbria, who are leading the design of the vessels.

The investment will allow BAES, to begin work on some initial items for the submarines that are due to replace the *Vanguard*-class from 2028. The submarines are being designed as stealthiest in the world and are expected to see operational service from the late 2020s to the 2060s. The *Successor* design and build programme is amongst the most complex ever undertaken by British industry. Over 850 potential UK suppliers have so far been identified as benefiting from investment in the programme and as many as 6,000 people will be involved by the time that the construction reaches a peak (courtesy: Richard Gardner, UK).



The MoD has released this image which shows how early designs of 'Successor' are taking shape

Patriot Missiles test fired



Raytheon Patriot Air and Missile Defence System have test fired nine Patriot missiles at McGregor Range, N.M., during its annual Field Surveillance Programme (FSP), successfully engaging inbound and outbound unmanned air breathing targets. This was the first FSP conducted with the PAC-2 missiles, using recently launched Post Deployment Build-7 (PDB-7) software and the modernised radar with radar digital processor. This test comes on the heels of the successful PAC-3 FSP test conducted on 20 November. In 2013, missiles from the US and several foreign military sales customers have been test fired under the FSP.

Patriot Air and Missile defence system test fired

The Japan Air Self-Defence Force (JASDF) has successfully completed another series of test firings of Raytheon Patriot Air and Missile Defence System at McGregor Range, N.M. The Annual Service Practice included target engagement and firings of Patriot in stressing tactical mission scenarios. JASDF's Annual Service Practice was held from 21 September to 2 November 2013, with approximately 380 JASDF personnel participating, including a VIP visit and viewing by Japan Vice Commander of the Air Defence Command.



Intercept success for MEADS

The Medium Extended Air Defence System (MEADS) intercepted and destroyed two simultaneous targets attacking from opposite directions during a stressing demonstration of its 360-degree air and missile defence (AMD) capabilities at White Sands Missile Range, N.M., achieving all criteria for success. All elements of the MEADS system were tested, including the 360-degree MEADS Surveillance Radar, a networked MEADS battle manager, two lightweight launchers firing PAC-3 Missile Segment Enhancement (MSE) Missiles and a 360-degree MEADS Multifunction Fire Control Radar (MFCR).



MEADS is a next-generation, ground-mobile AMD system that incorporates 360-degree radars, netted and distributed battle management, easily transportable launchers and the hit-to-kill PAC-3 MSE Missile.

Fourth Mi-38 prototype

Russian Helicopters' Kazan have produced the fourth prototype of their Mil-38 helicopter for completion of flight testing before entering series production. The company intends to certificate the design for the Russian market and start assembly from 2015. The Mi-38 is designed to undertake a variety of roles including VIP charter and offshore transportation.

The fourth prototype differs from earlier airframes in having a French-made Acrucizer crash-resistant fuel system and enlarged windows. The Company is focusing its efforts for the Mi-38 on



markets where it traditionally has a strong presence, such as Russia and other CIS countries, South East Asia, Africa and Latin America. However, it will consider obtaining a local certification “if a foreign customer shows sufficient interest” in the design.

Mi-171 to Airfast Indonesia

Russian Helicopters, a subsidiary of Oboronprom, part of Rostec State Corporation, has delivered a second commercial multirole Mi-171 helicopter built by Ulan-Ude Aviation Plant to Airfast Indonesia.



Airfast Indonesia, one of the country’s biggest providers of aviation services to the oil, mining and construction industries took delivery of its first commercial Mi-171 in 2013. The Mi-171’s successful operational history was a key factor in the Indonesian company’s decision to add these helicopters to its fleet. In 2012 and 2013, the parties signed contracts for the delivery of two more Mi-171s.

Bell 429s for Turkish National Police

Bell Helicopter has delivered the first seven of 15 Bell 429s to the Turkish National Police on or ahead of schedule. The aircraft will be used for a wide array of law enforcement missions,



including surveillance, personnel transport and air support of ground operations. The first seven of 15 Bell 429s ordered by the Turkish National Police last year were accepted between September and October 2013, with remaining deliveries expected to occur on or ahead of schedule through 2014. The National Police began operating the aircraft as soon as they were delivered, flying surveillance and transport missions nearly every day and night. Each aircraft is equipped with multi-sensor cameras, the latest microwave downlink technology and a state-of-the-art video management system that allows the flow of information between air and ground operations.

Philippine Air Force order AW109 Power



The Philippine Air Force has signed a contract for eight AW109 Power light twin-engine helicopters, which will be used to perform a range of duties including homeland security, armed reconnaissance and close support, with deliveries to start in 2014. The contract also includes initial logistics support and training for aircrew and maintenance personnel.

This contract further expands the presence of AgustaWestland in the Philippine, helicopter market and adds one more military customer for the AW109 Power model in this country, following an order for three aircraft by the Philippine Navy earlier in 2013

to enhance the service's maritime operational capability. The Philippine Air Force's AW109 Power configuration will feature a dedicated mission and equipment package including a range of weapon systems.

AW189s for Gulf Helicopters

Gulf Helicopters of Qatar has signed firm orders for fifteen AgustaWestland AW189 helicopters, the first two aircraft planned to be delivered in 2014 with all helicopters to achieve operational readiness by 2017. Assembly and flight testing of the first batch of offshore-configured AW189 production aircraft is on-going at the Vergiate plant (Italy) with the start of delivery by end-2014. Meanwhile, a range maintenance and flight training devices is already being made available to customers to rapidly start familiarisation with the type and speed up operational readiness once the aircraft are delivered to service, offering "unprecedented advantages" to AW189 operators.



Mi-171E helicopters for China

Russian Helicopters have delivered four Mi-171E transport helicopters to Poly Technologies under a contract signed in 2012 by the Chinese company and Rosoboronexport. Russian Helicopters will supply 52 Mi-171E transport helicopters to China. The latest consignment brings the number of helicopters delivered to date to 32, with the final batch expected to be transferred in 2014.

Russian Helicopters has worked with Poly Technologies since 2009, when the companies signed a contract for 32 Mi-171Es. The contract was completed in 2011 and formed a firm foundation



for continued cooperation. China is one of the biggest operators of Russian-made helicopters, most popular of which are of the Mi-8/17 series, the country having a fleet of about 150 Mi-171 s; also operated in China are the heavy Mi-26TS and the multirole Ka-32A11BC. China plans to expand its fleet of Russian-built helicopters and Russian Helicopters is offering its Chinese partners the latest models including the multirole Ka-226T and Mi-171A2.

Norwegian contract for 16 AW101s

AgustaWestland has been awarded a contract for 16 AW101 helicopters plus support and training to meet the Norwegian All Weather SAR Helicopter (NAWSARH) requirement. The contract also includes an option for six further aircraft.



Aircraft deliveries to the Royal Norwegian Air Force, who will operate the helicopters, will start in 2017 and continue through to 2020, the aircraft to be assembled at AgustaWestland's Yeovil facility in the UK. The aircraft will be equipped with an advanced SAR equipment package including a multi-panel AESA surveillance radar system from Selex ES that provides 360° coverage, 4-axis digital Automatic Flight Control System (AFCS), two rescue hoists, searchlight, electro optical device and a fully integrated avionics and mission system.

1,500th R-R engine to LM for C-130J

Rolls-Royce has completed its 1,500th AE 2100 engine for installation on a Lockheed Martin C-130J aircraft, scheduled for delivery to the US Air Force in 2014. More than 300 of the four-



engine transports have been delivered or are on order to customers in 15 countries, across 16 different mission types. The 1,500th engine was delivered to Lockheed Martin's Marietta, GA, facility following a celebration event at Rolls-Royce in Indianapolis, IN, where AE 2100 engines are manufactured, assembled and tested.

Rolls-Royce support of T-45 Adour engines

Rolls-Royce has been awarded a \$50.7 million MissionCare(tm) contract extension by the US Department of Defence to provide continued support for the F405 (Adour) engines that power the US Navy's T-45 training aircraft. The contract extension will continue the successful MissionCare support which has provided the US Navy's training fleet with guaranteed availability over the past ten years.

In addition to powering the T-45 Goshawk and other military aircraft, the Adour engine will also power the Hawk AJTS aircraft, which is a contender for the US Air Force T-X trainer programme. Under the terms of the agreement, which is administered by the Naval Air Systems Command (NAVAIR), Rolls-Royce will provide total inventory control, as well as integrated logistics support and required engineering elements for both the F405 engine and the

aircraft gas turbine starting system. This includes support ranging from on-wing through intermediate and depot level maintenance. The contract will run through March 2014.

GE testing new GE9X Fan Blades

GE Aviation has begun testing new composite fan blades for the GE9X, the next-generation GE90 engine that will power Boeing's 777X aircraft, this validation test being the first of several testing programmes GE has planned for the GE9X fan module. The first round of fan blade tests occurred in June 2013 at the ITP Engine testing facility in the United Kingdom and focused on validating the new composite material for the fan blades. The results were very positive. GE plans a second round of tests at ITP to further validate the new fan blade composite material and a new metal material for the fan blade leading edge.

The GE9X engine will have 16 fan blades, which is fewer than the GENx and the GE90-115B engines. This fan blade reduction is possible as a result of advancements in three-dimensional (3D) swept design that enables engineers to create a more swept design and large fan chord. The new high-strength carbon fibre material allows the blades to be thinner than blades made from current carbon fibre material, but with the same strength and durability. These improvements will drive fuel efficiency improvements and

Russian Helicopters' strong production and financial growth in 2013

In 2013, Russian Helicopters, a subsidiary of Oboronprom, part of State Corporation Rostec, produced 303 helicopters for Russian and international customers, with an anticipated consolidated profit in excess of 140 billion roubles. Preliminary results were shared at the Russian Helicopters board meeting which reviewed performance in the helicopter sector over the past year and outlined its main priorities for 2014.

"In 2013 Russian Helicopters continued to develop as a modern, highly efficient and dynamic Russian company," Russian Helicopters CEO Alexander Mikheev said. "We completed the state defence order in full, supplied combat helicopters to export and produced dozens of batches of safe, reliable commercial helicopters for Russian and international customers. We continued to modernise production over the past year. Over 800 news pieces of machinery were installed in our facilities, and more than 100 events designed to make us more eco-friendly and improve safety were held. Implementing investment projects delivered significant results: retooling the processing, plating, and composite industries was concluded. Output per employee increased by 12.4% to 3.4 million roubles per staff member.

The portfolio of confirmed orders, as on 11 December 2013, stood at 772 helicopters worth over 370 billion roubles. Russian Helicopters' order book is 100% full for 2014, 73% full for 2015 and 25% full for 2016.

Russian Helicopters' priorities for 2014 have also been set. Notably, the vector of work on major projects in the light, medium and heavy classes of helicopters has been defined. One of the key priorities for 2014 will be slashing the timeframe for bringing the new multi-role Ka-62, Mi-38, and Mi-171A2 helicopters to the market. An agreement with the company AgustaWestland was signed, creating a new light helicopter with a weight of 2.5 tons, in a joint venture. Russian Helicopters and Turbomeca signed an agreement on opening service centres to support the commissioning of the Ka-226T and Ka-62, equipped with French engines.

In 2014, work on developments and the creation of new helicopter models will continue at the innovation cluster at the company's National Helicopter Manufacturing Centre in the Moscow region town of Tomilino, where Russian Helicopters' key intellectual assets, the Mil Moscow Helicopter Plant and Kamov Design Bureau, are based.

In servicing, Russian Helicopters will continue to follow its strategy of developing a global system for post-sales services, which will allow it to move to "full life-cycle" helicopter sales, ensuring helicopter sold receive immediate support throughout their service life.

In terms of corporate development, Russian Helicopters will continue to optimise its management systems to ensure a smooth transfer from financial to operational management models. The main goal will be bringing to a close the restructuring and optimisation of the key production and specialised enterprises that have come together to form Russian Helicopters.

major weight reduction from fan blades and the structure needed to support them.

The GE9X engine for Boeing's 777X aircraft will be in the 100,000 pounds thrust class with a 10 percent improvement in fuel burn over today's GE90-115B. Key features include a 132" fan diameter; composite fan case and fourth-generation composite fan blades; next-generation 27:1 pressure ratio high-pressure compressor; a third-generation TAPS (twin annular pre-swirl) combustor for greater efficiency and low emissions; and ceramic matrix composite (CMC) material in the combustor and turbine.

Chinese MBT-2000 export successes

The Chinese MBT-2000 tank, a variant of which, (the Al Khalid), was co-developed with Pakistan, has seen significant export success over the past few years, entering service with several nations in Africa and Asia. After the joint development of a variant customised for Pakistan Army requirements, the first export order for the type was placed in 2010 by the Moroccan Army, which has already received over 50 tanks of a total of 150 contracted for. This marked the first time Morocco had procured battle tanks from China, and was a major boost for Chinese MBT sales on the foreign market.



Pakistan Army Al Khalid MBT at IDEAS, Karachi

The second export success was with Bangladesh procuring 44 MBT-2000s for around \$162 million in 2011, with first deliveries taking place in December 2012. Bangladesh already operates a few hundred Chinese-made tanks but these are decades-old types that remain in service thanks to a series of Chinese upgrades. The MBT-2000 purchase marks the first time that Bangladesh has selected new-build contemporary-generation tanks for its Army.

In May 2012, reports of an unknown number of MBT-2000s in Myanmar Army service began to emerge, although official details regarding a contract remain elusive. Like Bangladesh, the Myanmar Army also operates older-generation Chinese tanks.

At present, plans are in progress to upgrade the MBT-2000/Al-Khalid with a redesigned turret, upgraded modular armour package and sensors, improved ammunition and a new powerpack. The upgrade tank also incorporates a new Integrated Battle Management System (IBMS) and an active threat-protection system.

First Archer systems delivered in Sweden



BAE Systems delivered the first four Archer artillery systems to the Swedish Defence Materiel Administration, FMV, during a handover ceremony at the company's Karlskoga, Sweden facility. BAE Systems employees and representatives from FMV and the Norwegian Defence Logistics Organisation, FLO, attended the ceremony where FMV's Director General Lena Erixon received the four systems from Lena Gillström managing director at BAE Systems' Weapon Systems business in Sweden.

"Archer is an important programme for both the Swedish and Norwegian Armed Forces, an important milestone in our partnership and very encouraging for us deliver the first systems to our Swedish customer," said Gillström. It's an immensely proud moment for everyone at BAE Systems and we now look forward to continuing our partnership with the Swedish and Norwegian customer in working on the delivery of all systems," added Gillström.

In total, 48 systems will be delivered to the Swedish and Norwegian Armed Forces.

GD contracted for additional Foxhound vehicles

General Dynamics Land Systems-Force Protection Europe has received a \$36.3 million (€23 million) contract for an additional 24 Foxhound light tactical blast-protected vehicles from



the UK Ministry of Defence (MoD). (Parent company of General Dynamics Land Systems - Force Protection Europe, is a business unit of General Dynamics). The order will expand the MoD's fleet to 400 vehicles. Production of the first Foxhound vehicles began in 2011 and since June 2012, the vehicles have been deployed in Afghanistan for use by British troops operating in mentoring and partnering roles with the Afghan National Security Forces. Production was extended in 2012 for an additional 150 vehicles, helping to preserve the jobs created across the UK in fabrication, manufacture and support.

Refurbished Stryker Double-V Hull vehicles



General Dynamics Land Systems has been awarded a \$118 million contract by the US Army Tacom Life Cycle Management Command to convert 66 flat-bottom Stryker infantry combat vehicles to a newer, more survivable double-V hull (DVH) design. Deliveries of the vehicles will begin in July 2014 and be completed by February 2015. The Army partnered with General Dynamics in 2012 and launched a Stryker DVH-exchange pilot programme to validate that components from traditional Stryker flat-bottom variants can be quickly refurbished and installed on a new, more survivable double-V hull variant, at less cost than producing a new vehicle. General Dynamics and the Anniston Army Depot in Anniston, Ala., successfully completed the DVH pilot programme in April 2013 and delivered 52 Stryker vehicles on time and under budget.

Diehl Defence tests new guided missile

With two direct hits, Diehl Defence has demonstrated the IRIS-T SL (Surface Launched) surface-to-air guided missile's operational capability and performance. The two firings were conducted within a test campaign from 4 to 8 November 2013 at the Overberg Test Range in South Africa and are part of the development programme for the new guided missile plus launcher, contracted by the Federal Office of Equipment, Information Technology and Utilisation of the *Bundeswehr* (BAAINBW). Realistic air defence scenarios were displayed by employing low-flying target drones of the type DO DT-25. Both missiles destroyed their targets with direct hits, confirming the guided missile system's expected precision. In one case the maximum distance lay far beyond 20 kilometres.

IRIS-T SL is planned as an effector for the German Armed Forces' future ground-based air defence architecture and designed for easy integration in this architecture, accomplished by seamless connection to fire control systems via standardised interfaces.

Based on IRIS-T SL, Diehl Defence is offering armed forces a modern, cost-effective solution of entire air defence systems. The mobile, medium-range systems provide comprehensive 360 degree protection against air attacks by aircraft, helicopters, cruise missiles and guided weapons and allow simultaneous engagement of several targets even at very short distances thanks to extremely short reaction times.



Hexacopters for Amazon

Online retailer Amazon has taken an unusual initiative to deliver goods using 'hexacopters' but this is likely to face technological and regulatory barriers. Amazon's plan to deliver packages using such small unmanned aircraft, also highlights potential "tangible benefits" offered by UAVs, which have suffered from association with larger unmanned military aircraft.

According to Amazon chief executive Jeff Bezos, such UAVs could eventually carry small packages up to 10 miles (18.5km), allowing the company to deliver goods in areas within 30 minutes of ordering. Bezos concedes the technology is still in development and that regulatory hurdles will not allow Amazon's unmanned aircraft to operate until at least 2015.

A commercial operator needs a special airworthiness certificate for experimental aircraft from the US Federal Aviation to fly such systems in US airspace and so far, the FAA has permitted only one company to operate UAVs, in the Arctic airspace in Alaska. Technological challenges such as a weight and navigation systems may still make Amazon's plan impractical, according to Nickolas Macciarella, chair of the aeronautical science programme at Embry-Riddle Aeronautical University in Florida. "Also, the transportation cost would be higher than (the value) of the product concerned"!



CFM milestones in 2013

CFM International marked three major production milestones in 2013 with the ubiquitous CFM56 fleet: the company delivered its 25,000th CFM56 engine in May; in October, it delivered the 10,000th CFM56-7B engine for the Boeing Next-Generation 737; and in December, the 8,500th CFM56-5 engine was delivered for Airbus programmes.

"The continued success of the CFM56 programme is phenomenal, but so are the people behind the product," said Jean-Paul Ebanga, president and CEO of CFM International. "In nearly 32 years of service - more than 25,000 CFM56 engines - we have never once delayed an aircraft delivery. It is an incredible record and we are very proud of what we have accomplished."

"However, we know that none of this means anything without the continued confidence airlines around the globe have shown in our products, selecting CFM56 engines to power more Airbus and Boeing single-aisle aircraft than any other engine in history. It is our greatest asset, and represents our greatest challenge. Each day, it is our job to assure each of these airlines that they have made the right choice."

CFM continues to maintain the highest production rate in the industry. The company is on track to deliver approximately 1,500 CFM56 engines each year in both 2013 and 2014. Over the next few years, it will continue to ramp CFM56 production while simultaneously transitioning to the new LEAP engine family introduced in 2008.

There is a current backlog of more than 10,000 undelivered CFM56 and LEAP engines. By 2019, CFM anticipates a production rate of 1,700 engines per year. The company will continue to build both installed and spare CFM56-5B and CFM56-7B engines to meet demand as it moves to full LEAP production. Based on the size of the current CFM56 commercial fleet in services (18,000 engines), CFM expects to manufacture CFM56 spare parts at least until the year 2040.

CFM56 engines power the Airbus A318/A319/A320/A321, the A318 Elite and A319CJ, A320CJ, and A321CJ corporate jets and A340-200/-300 models and the Boeing Next-Generation 737-600/-700/-800/-900/-900ER and BBJ airplanes. LEAP engines power the Airbus A320neo, Boeing 737 MAX, and COMAC C919 aircraft families.



CFM completes ground testing first LEAP engine

CFM International has completed testing of the first full LEAP engine "with outstanding results". The LEAP-1A engine fired for the first time on 4 September 2013, two days ahead of the schedule set in early 2010.

The engine, which was operating smoothly at full take-off thrust in a matter of hours, logged a total of 310 hours and more than 400 cycles during approximately five weeks of testing.

During 2014, a total of 15 LEAP engines (a combination of all three models) are scheduled to be on test. Among the tests planned for next year, CFM will complete early icing tests at GE facilities in Winnipeg, Canada, as well as early endurance testing. Both the LEAP-1A and -1C configurations are on schedule for flight tests in 2014, as well. "We still have a lot of testing ahead of us, and problems may turn up in future engines," said Chaker Chahrouh, executive vice president for CFM. "However, the point of these tests is to push the engine as hard as we can. We got a ton of great data that has given us real insight into this engine, and we are right where we want to be".

The first engine test launched an extensive ground and flight test certification programme that will encompass 60 engine builds over the next three years and will accumulate approximately 40,000 cycles before entry into service.

The foundation of the LEAP engine is heavily rooted in advanced aerodynamics, environmental, and materials technology development programs. It will provide 15 percent better fuel consumption and an equivalent reduction in CO2 emissions compared to today's best CFM engine, along with dramatic reductions in engine noise and emissions. All this technology brings with it CFM's legendary reliability and low maintenance costs.

CFM56 and LEAP engine orders soar

2013 was another stellar year for CFM International (CFM), with the company logging orders for more than 1,255 LEAP engines, as well as 1,172 orders for CFM56 engines through October. These orders for a total of 2,427 total engines have a combined value of



\$25.7 billion, including commercial, military, and spare engines.

By comparison, CFM booked a total of 1,998 CFM56 and LEAP engine orders in 2012 for a combined value of \$23 billion. Overall, CFM has logged total orders for 5,607 LEAP engines, while total CFM56 engine orders stand at more than 30,360 engines.

As the company logs record commitments, CFM is also achieving historic production rates for the CFM56 product line. The company delivered approximately 1,420 CFM56 engines in 2012 and is on track to build more than 1,500 engines in 2013. 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.

Lufthansa places orders for CFM56-5B engines



Deutsche Lufthansa has selected CFM International's CFM56-5B engine to power 30 firm Airbus A320neo (current engine option) aircraft.

Lufthansa, which is part of the Lufthansa Aviation Group, currently operates a fleet 350 CFM56 engines powering Airbus A319/A320, long-range, four-engine A340-300, and Boeing 737 Classic aircraft. Overall, Lufthansa Aviation Group, which includes Germanwings, Austrian, and Swiss, operates more than 560 CFM56 engines.

"This is a fantastic vote of confidence for the entire CFM Team," said Jean-Paul Ebanga, president and CEO of CFM. "Lufthansa is a long-time CFM customer and we are proud to continue this long relationship with them."

Since its foundation, Lufthansa has been a driving force behind commercial aviation. In recent years, the airline has been one of the industry's strongest proponents of environmental technology adoption to help reduce the impact of aviation on the environment, particularly noise and emissions.

All of Lufthansa's new engines will be the CFM56-5B Performance Improvement Package (PIP) configuration. The PIP became the new production configuration for the CFM56-5B in 2011. The improvements, which is providing a 0.5% improvement in fuel burn, include hardware changes to the core, including new high-pressure turbine blade, as well as manufacturing changes the fan and compressor blades and vanes to improve performance

retention. The engine maintains the same noise signature as the current production engine and meets current International Civil Aviation Organisation (ICAO) Committee of Aviation Environmental Protection standards (CAEP/6) requirements.

Pegasus seals \$4.3 billion deal with CFM

Pegasus Airlines has finalised its order for CFM International's advanced LEAP-1A engine to power 100 Airbus A320neo/A321neo aircraft. The agreement is valued at approximately \$4.3 billion, including the long-term service agreement.

Under the terms of the 20-year Rate per Flight Hour (RPFH) maintenance agreement,

CFM will guarantee maintenance costs on a dollar per engine flight hour basis. The engine selection was announced in July 2013 and the airline is schedule to begin taking delivery of its new aircraft in 2016.

The Istanbul-based low cost airline has been a CFM customer since it began operations in 1990 and currently, the airline operates a fleet of 45 CFM-powered Boeing 737 aircraft on scheduled routes to 76 domestic and international destinations throughout Europe, Russia, Central Asia, Caucasus, the Middle East, and Africa.

The first LEAP-1A engine to test started for the first time on 4 September 2013, two days ahead of the schedule set in early 2010. The engine performed flawlessly and logged more than 300 hours and 400 cycles before coming off the test stand. The next major milestone is the icing tests that will take place in 2014. CFM is performing the test early, more than one year ahead of the engine certification timeline, to ensure that any potential issues are identified well in advance. The foundation of the LEAP engine is heavily rooted in advanced aerodynamics, environmental, and materials technology development programmes. It will provide 15 percent better fuel consumption and an equivalent reduction in CO2 emissions compared to today's best CFM engine, along with a 50 percent reduction in oxides of nitrogen emissions, and up to a 15 decibel reduction in noise. All this technology brings with it CFM's legendary reliability and low maintenance costs.



Sertac Haybat, CEO of Pegasus Airlines (right), and Pierre Fabre, president and CEO of CFM parent company Snecma (Safran), signed the final agreement for the airlines purchase of 200 LEAP-1A engines

AIR POLICING MACEDONIA



After the independence of the Republic of Macedonia in 1991, under the Ministry of Interior, the Special Task Unit (STU) became an elite part of the Ministry of Internal Affairs (MOI). The STU operates together with Macedonian Police Aviation Unit deploying their members in various ways

The Balkan Hawks

Macedonia, officially the Republic of Macedonia, is located in the central Balkan Peninsula in Southeast Europe. It is one of the states of former Yugoslavia, from which it declared independence in 1991 and became a member of the United Nations in 1993. The Republic of Macedonia is bordered by Kosovo to the northwest, Serbia to the north, Bulgaria to the east, Greece to the south and Albania to the west.

Since December 2005 it has also been a candidate for joining the European Union and has applied for NATO membership. Law enforcement in the Former Yugoslav Republic of Macedonia is the responsibility of the Ministry of Internal Affairs (MOI). Headquartered in Skopje and headed by

a Government-appointed Director for a four-year mandate, the Ministry's Bureau for Public Security runs the national Police Force, which is playing a vital role in the country's security; an important role is played by the Macedonian Police Aviation Unit which has a long history in the region.

The Macedonian Police aviation unit 'Hawks' (*Helikopterska Edinica "Jastrebi"*) currently operates a small fleet of helicopters out of Petrovec Airport and Indrizovo, the latter being the main Macedonian Police station, located about 15 kilometres to the east of Petrovec airport. Various types currently in use range from the AB.206, AB.212, AB.412 to the Mi-17V5 (2) and Mi-171 (2) heavy transport helicopters. The Macedonian Police acquired these

helicopters to support their tasks and expand capabilities especially night operations and support of the Special Task Unit (STU).

The official name of the Macedonian Police Aviation Unit is *Oddel za vazduhoplovni edinici*, which translates as 'Aircraft Unit of the Macedonian Police'. Macedonian Police helicopters are used by the Ministry of Internal Affairs (MOI) for various tasks: VIP transport, transport of cargo and the special police units (STU/ Special Task Unit), Border monitoring, Search and Rescue (SAR) missions, Medevac and traffic surveillance. The 'Hawks' unit was formed in 1969 and for 40 years has been operating Bell-designed helicopters. The addition of the four Mi-17 helicopters came as a surprise



Members of the Special Training Unit (STU) exercise a tactical deployment from the sole Bell 412EP in use by the Macedonian Police

in both Macedonia and abroad, especially considering the experience the MOI has with its limited western-origin fleet and at the same time, the logistical problems the Macedonian Air Brigade is currently having with its Mi-17 and Mi-24V helicopters in terms of spare parts.

The Mi-171 helicopters are currently part of an extensive upgrade under the so-called 'Balkan programme'. Elbit Systems is involved in the upgrade which seems similar to the 'Alexander' upgrade to both Mi-17 and Mi-24s of the Macedonian Air Brigade though detailed information remains scarce

at the moment. As Dragi Micev, Head of the Aviation Department, states "The first stage of the upgrade consists of adding Night Vision Capabilities and has been implemented by now. Stage 2 comprises of a moving map, upgraded Radio and GPS amongst others. Both Police Mi-171 helicopters should be upgraded by the end of 2013". Further details were not revealed during the author's visit.

The Hawks are currently working with limited personnel which puts much pressure on pilots and technicians. "Our pilots and mechanics are mainly ex-Air Force" Dragi Micev continues. "We have experienced and senior personnel; however there is a continuous pressure as we work with a team of around 30 people in total. Maintenance of our helicopters is done on base by the Unit. After 600 hours of flight the helicopters are overhauled abroad. There is always a challenge to allow for holidays, but also keep a 24x7 alert in case of emergency". Currently three student pilots are being trained within the unit with the senior pilots also acting as examiners. "We could easily double our headcount in order to achieve all our activities and put



The sole AB.212 of the Macedonian Police was registered as YU-HBP. After declaration of Macedonian independence during 1991 Macedonian Civil Aviation was established and this Macedonian police helicopter became part of the Macedonian register



The Macedonian Ministry of Internal Affairs is operating two Mi-171s and two Mi-17V-5s out of Petrovec-Skopje.

less pressure on the current team”. Dragi Micev continues “Our main challenge is to expand the number of pilots and work with the budget we are provided by the MOI. In the most optimal scenario we would like to have forty-eight pilots”. The Macedonian Police student examiners consist of the Head of the Aviation Department Dragi Micev and the former Head of the unit. It takes up to 135 flight hours to complete the training phase.

As of 2014 it is expected the first student class of Police pilots will be trained by the newly established Pilot Training Centre (PTC) at Petrovec Air Base. The PTC is a joint venture between Elbit Systems of Israel and Macedonian Ministry of Defence dating back to May 2011. Currently the PTC trains two classes for the Air Brigade utilizing Zlin 142s and a sole AB.206, to allow for smooth transition on the Mi-17 and Mi-24 helicopters. “The main difference in requirements for the Police pilots is that we do not require an academic background” Dragi Micev added.

The Augusta Bell AB.206 and Augusta-Bell AB.212 have been in the Macedonian inventory since the early 1970s. During



After operating a small fleet of Bell helicopters for thirty-five years the Macedonian Police Aviation unit acquired two Mi-171 and two Mi-17V5s. All four helicopters are now operational within the Ministry's Helicopter Hawks unit located at Petrovec airport

2000, Taiwan announced it would donate one Bell UH-1H utility helicopter to the Macedonian Air Force and Air Defence Forces, but this was later changed, due to objections of the United States. Taiwan decided instead to donate US 5 million to the Macedonian Government for procurement of one new helicopter from Bell Helicopter. The Macedonian Government acquired one Bell 412EP which was delivered to the Macedonian Police Aviation Unit on 22 November 2000.

The main roles for the Macedonian Police Aviation Unit since its establishment in 1969 has been monitoring the borders of Yugoslavia with Bulgaria, Greece and Albania, humanitarian missions and other activities to preserve and protect the interests of Macedonia. The full Border Patrol role, with all the responsibilities, was taken over from the Air Brigade some years ago. One of the new roles that came up as a new task for the Police is conducting Commercial flights. In practice everybody can hire one of the Police helicopters for travel in Macedonia, “The drug enforcement role has become more important, the harbor of Thessaloniki, Greece is very nearby and Macedonia is being used as one of the transit countries” according to Dragi Micev. “Of course general crime fighting and prostitution problems from the neighboring country Albania is a continuous attention area”. The Macedonian Police is working together with other European Police Forces. Tasks



The official name of the Macedonian Police Aviation Unit is 'Oddel za vazduhoplovni edinici', which translates as 'Aircraft Unit of the Macedonian Police'

Affairs (MOI). In the past the STU has been engaged in supporting major events to support the regular police, to execute arrests of criminals, assist in case of natural disasters. Nowadays, following the world trends in the fight against crime, particularly in combatting terrorism the STU performs the following tasks: hostage negotiation, counterterrorism activities, arrest of high risk targets, VIP protection, coordinating actions with other organisational units of the MOI in providing escorts for high ranking foreign delegations, secure shipments of money, support transport of weapons and ammunition, search and rescue, and imparting advanced training to the other members of the STU.

***Carlo Kuit & Paul Kievit/
Bronco Aviation***

are becoming more intensive and more complicated” the Head of the Aviation Department concluded.

After operating a small fleet of Bell helicopters for thirty-five years the Macedonian Police Aviation unit acquired two Mi-171 and two Mi-17V5s late in 2008. The helicopters were not procured directly from the Russian helicopter production plants Ulan-Ude Aviation Plant (UUAZ) and Kazan Helicopter Plant (KVZ). Instead, they were purchased on the European market in order to answer urgent needs for helicopters that could perform a wide range of demanding missions, disaster relief and civil affairs operations under the Ministry of Internal Affairs responsibility.

All four helicopters are now operational within the Ministry’s Helicopter Hawks unit located at Petrovec airport. “These new helicopters brought us challenges” as Dragi Micev outlines “The heavy Mi-17 helicopters have been acquired for new tasks previously not in scope of our work. Besides SAR, VIP transport standard police tasks we are now also involved in border patrol activities and work closely together with the Special Task Unit (STU). Also the crew of Mi-17 consists of a crew of three where we normally work with a crew of two pilots operating the Bell helicopters” concludes Dragi Micev.

The Mi-171s and Mi-17V5s all display the Macedonian national flag and Macedonian Police emblem. The new Macedonian Mi-171 helicopters are recognisable by the fact that they have an Iraqi Air Force colour scheme, the two helicopters were part of a group that the Iraqi Ministry of Defence refused to take from the Polish company Bumar before being acquired by Macedonian Ministry of Internal Affairs.

The history of the Special Task Unit (STU) dates back to 1980 following a decision made by the State Secretary of Interior to form a new unit for specialized tasks. After the independence of the Republic of Macedonia in 1991, under the Ministry of Interior, the Militia became a Special task unit (STU) as an elite part of the Ministry of Internal



25 Years Back

More Dornier 228s for Vayudoot

Vayudoot is seeking additional capacity through the acquisition of two Dornier 228s from the Indian Air Force. This unusual proposal has been taken up at the Ministerial level and the IAF reportedly pressured to examine the proposal for two of its five aircraft to be given to Vayudoot with its own requirement being made up by HAL a little later.

The IAF which has contracted for 45 aircraft has received five with further additions expected, the Coast Guard has received three with nine more ready to be delivered and further additions to take place in the coming year.

Sea King Mk.42Bs accepted

After extensive delays owing to a number of factors, the first of a batch of 20 Westland SeaKing Mk.42B ASW helicopters was formally accepted by the Indian Navy at Yeovil in West England in mid-January 1989. The prime reason for delays is attributed to the performance of the helicopter's mission system avionics, involving GEC Avionics AQS-902B acoustics processor, integrated with the MEL Super Searcher radar, Hermes ESM and Thomson-Sintra Hs 12 dipping sonar.

LCA developments

The first prototype of the light combat aircraft (LCA) will fly in 1992 and its production version will be ready in 1996, according to Dr Kota Harinarayana, LCA programme director, Aeronautical Development Agency.

Describing the LCA project as a national programme, he said that it would be the smallest fighter on the drawing board and belonging to the same generation as the French Rafale, the European Fighter Aircraft (EFA) and the Swedish Gripen.

Dr Harinarayana said that the futuristic fighter would fulfill its role as an advanced tactical fighter in air combat and offensive air support operations. It would be highly agile at subsonic speed and would have supersonic maneuverability. The LCA would be light in weight and could be exported, he said, "It should be better than the F-16", he added.

The director of the Aeronautical Development Establishment Dr KG Narayanan, said that the simulator for solving some of the issues connected with the design of the LCA was already in existence and another simulator for air-to-air combat would be ready in two to three years.

Resource crunch stalls Defence Plan

It is reported that the Cabinet Committee on Political Affairs has recently approved the Seventh Five Year Defence Plan, four

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years after the Plan period began in March 1985. Even the formal approval is ambiguous since it has been passed minus its financial implications.

In a recent communication to the three wings of the Armed Forces, the Defence Ministry views that since just one year remains for the completion of the Plan period, the approval was merely a "formality" and that the Service, cases for various projects and demands pending for the past three or four years would be considered on the usual case-by-case basis.

Indo-French aerospace technologies

India and France may expand their cooperation in the area of aerospace technologies on the basis of some fresh proposals that were considered during the recent visit of the French President, Mr Francois Mitterrand to India.

New MD, HAL Bangalore Complex

Dr CG Krishnadas Nair took over as Managing Director Hindustan Aeronautics Limited, Bangalore Complex on 14 December 1988. During the past 17 years, Dr Nair has worked in Research & Development, Quality Control and Manufacturing in various capacities as Manager, Senior Manager and Deputy General Manager. As General Manager, he was the Chief Executive of the two manufacturing Divisions viz. Foundry & Forge and Engine Divisions and very recently as the Executive Director of HAL before assuming the present position as Managing Director.

Indian concern on F-16s for PAF

The Indian Ambassador to the United States met the US Under-Secretary of State for Political Affairs, Michael Armacost to convey India's concern at Pakistan's request to the US Government for a further supply of F-16 fighter aircraft to augment its fleet. It has been reported that Pakistan, which already has about 40 F-16s is now seeking to add 60 more, raising the overall number to 100.

Mr Armacost is understood to have confirmed that Pakistan had asked for additional F-16s and said the request was being kept in view, but so far no action has been initiated.

Indian Army : new equipment displayed

Two recent acquisitions of the Indian Army were displayed to the public for the first time on 26 January 1989, during the Republic Day parade in New Delhi. These were the 'Kartik' Bridge Laying Tank (BLT), developed indigenously by the DR&DO and the Osa-AK surface-to-air-missile system recently acquired by the Indian Army for air defence of field formations.

The Indian Army's Regiment of Artillery, responsible for battle-field air defence, also deploys the ZSU-23-4 'Shilka' multibarrel radar-directed 23mm cannon, the 'Kvadrat' (SA-6 'Gainful') mobile SAMs and SA-7 'Grail' shoulder-fired SAMs, apart from Regiments with the Bofors L 40/70 40mm and ZU-23 twin-barrel 23mm cannon.

Learning from nature

Researchers have it that birds fly in a distinctive V-formation to arrange themselves in 'aerodynamically optimum positions' while precisely timing the flapping of their wings. This helps each bird take advantage of 'good air' (upwash) thrown up by the wings of the flier in front while avoiding detrimental 'bad air' (downwash).



Seen above are the 'Russian Knights' formation aerobatic team flying Su-27s (inset : migratory birds head away from Russia to warmer climes during winters).

UFO over Heathrow



The terrified pilot of an airliner reported a near miss in which a rugby ball-shaped UFO passed with a short distance from his aircraft while flying near Heathrow Airport, London. The captain spotted the object travelling rapidly, apparently heading directly towards him, was certain the object was going to crash into his aircraft - and ducked in terror !

Subsequent investigation has been unable to establish any earthly identity for the mysterious craft, which left the aircrew with no time to take evasive action. But, all ended well as the IFO (his A320) airliner landed safely thereafter.

Panagarh Redux

A small town in West Bengal, 150km from Calcutta, Panagarh is in the news, with the Indian Army's new XVII Corps to be located here along with a new tactical airlift squadron at the expanded and modernised airfield. Built during World War II, Panagarh was used by the USAAF's 10th Air Force and Maintenance Depot for B-24 Liberator heavy bombers of the 7th Bombardment Group.



USAAF B-24 Liberator after heavy landing at Panagarh, 1944-45.

So, soon enough Super Hercules of the IAF will operate from Panagarh but one hopes that the numerous wartime relics, priceless in history, are not bulldozed into oblivion !

Monkey Business - I

*Two little monkeys launching into space
One fell off and bumped his face
Rouhani called Obama,
And Obama said
No more monkeys launching into space*

News : Iran has successfully sent a monkey into space for a second time, part of its ambitious programme aimed at manned space flight launch of the rocket dubbed 'Pajohesh', or Research in Farsi, which was Iran's first use of liquid fuel. This reached a height of 120 kilometers (72 miles). The monkey, named 'Fargam' or Auspicious, which was strapped snugly into a seat, parachuted safely to earth after the capsule detached from the rocket in a mission that lasted 15 minutes.



Monkey Business - II

Perhaps exhausted after their 8,000km voyage from freezing northern Russia to balmy southern India, a large number of Russian sailors and technicians accompanying the new aircraft carrier INS *Vikramaditya* went out on a spree in Karwar, shedding their inhibitions (and clothes) as they went skinny swimming along the beach.

The police had to intervene and convinced the Russians that 'this' was not allowed on the beaches in Karnataka. The Russians left soon after that. But perhaps the Indian Navy should have oriented them on Swadeshi *dos and don'ts*.

Charmed !

Air India are going in for a makeover of sorts. The airline's airhostesses could soon sport *kurtis*, *churidars* and trousers as the national carrier plans a more contemporary look for its cabin crew in a competitive market that has seen its Maharaja charm wearing off. AI plans to offer a choice between sari and *churidar kurti* on the domestic routes to its airhostesses and *kurti* and trousers on the international sector. As of now, on international routes cabin crew have had the option of wearing *churidar kurti*.

Passengers will be charmed !



Afterburner

Saab

Shinmaywa