

VAYU

VI/2013

Aerospace & Defence Review



**INS Vikramaditya (R33)
commissioned**

India's Maritime Options

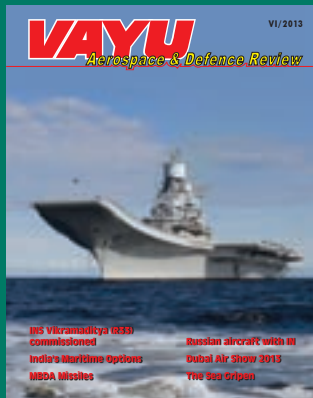
MBDA Missiles

Russian aircraft with IN

Dubai Air Show 2013

The Sea Gripen

CFM



INS Vikramaditya during sea trials in Russian waters (photo : Sevmarsh)

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Printed at Aegean Offset Printers

The opinions expressed in the articles published in the Vayu Aerospace and Defence Review do not necessarily reflect the views or policies of The Society for Aerospace Studies.

VAYU

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42 'The Carrier that came in from the Cold'

Vayu was the only trade journal represented at Severodvinsk when the Indian Naval Ensign was hoisted on stern of INS Vikramaditya, and is therefore able to bring this exclusive, comprehensive report on commissioning of Indian Navy's new aircraft carrier. This account is supported with other 'exclusives' including an informal interaction with Defence Minister AK Antony and a tour of vital sections of the ship.



34 Interview with DCNS, interaction with CNS

On the eve of Navy Day, Admiral DK Joshi addressed the nation during a media briefing, the theme being 'Indian Navy – Maritime Security through Self Reliance'. Earlier, in an exclusive interview with the Vayu Vice Admiral Pradeep K Chatterjee, DCNS articulated on several issues that are critical to the future prowess of the Indian Navy.



56 India's Maritime Options

Admiral Arun Prakash invokes the 'Mahanian solution', alongside maritime doctrine of the famous Naval geo-strategist Sir Julian Corbett, in his review of the Indian Navy today. In asking the question whether we are "putting the cart before the horse", the former CNS



endorses the view that "a well-funded navy can become both a provider of security and an expression of India's willingness to shoulder great-power responsibilities."

68 NAMEXPO 2013

India's first Naval and Maritime Expo was held at Cochin, which included conferences involving the Indian Navy, Coast Guard, Ministry of MSME and NSIC. There was both international and domestic participation, with timely papers presented by several speakers including that by Tony Ogilvy head of the Sea Gripen programme. A relevant piece examines the LCA Navy project and focuses on critical challenges of aircraft operating from a carrier at sea.



76 DCNS : 'Sea' the Future

The French naval defence company (DCNS) have expanded their expertise beyond designing & building submarines and surface combatants, to now include associated systems and infrastructure. In this review of the company's performance in 2013, the CEO Patrick Boissier, confirms their growth potential even as we look at "The Water World of DCNS".



91 Things that go 'Bang' !

Angad Singh of 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. In this first article of a two-part series on the trip, are covered MBDA's maritime products, in keeping with the Navy-centric theme of this Issue.



102 An Enduring Story

As Part II of the article on Indo-Russian co-operation in military aviation, the ongoing extent of Russian aircraft in service with India's Naval Air Arm is reviewed by Pushpinder Singh. The Indian Navy's inventory today includes Russian-origin long range maritime patrol aircraft, AEW and ASW helicopters, supersonic multi-role fighters - an enduring story in its sixth decade.



116 Air Show on the Gulf

The Vayu editorial team were at the Dubai World Centre and the brand new Al Maktoum International Airport to cover the Dubai Air Show 2013. The Show witnessed mega orders by mega carriers, with formal announcements on orders for Boeing and Airbus airliners exceeding US \$ 160 billion. The Sino-Pakistani JF-17 Thunder fighter also made its mark, both on static and flying display.



Also :

Affordable Air Power;
Mangalyaan to Mars;
Gathering of (Grey) Eagles;
EMALS; Aircraft and their Carriers; More wings for ICG;
Dornier 228 in India – 30 years on; DSEI 2013; ESPS 'Cantabria'; Tomahawk for Precision Strikes; Bear versus Dragon; Guardians of the Golden Gate; End of An Era; Interviews with Mr Kanji Ishimaru (ShinMaywa); Mr Khalil Rahman (Atlas Elektronik India); AVM Arvind Walia (Sikorsky); Rainer Farid (Eurocopter); Sebastien Remy (EADS Innovation Works).

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Commentary, Opinion, Viewpoint, Aviation & Defence in India, World Aviation & Defence News, Ancient Aviator Anecdotes, Vayu 25 years back, Tale Spin.

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The Promise of INS Vikramaditya

India's naval doctrine professes a three-carrier force: one each on either flank, with a third one remaining on periodic maintenance at any given time. Having envisaged a naval force built around a carrier battle group to retain control over the expansive seas under its sphere of geostrategic interest, India acquired its first carrier, INS *Vikrant*, as early as 1961 and operated it till the late 1990s alongside another British-origin carrier, INS *Viraat*, which was inducted in 1987. Aircraft carrier *Vikramaditya* has now been inducted into the Indian Navy as a work-in-progress. It is meant to bridge the operational gap between the retirement of *Viraat*, already a spent force and on its last lap, and the induction of the indigenous carrier, *Vikrant*, to be ready hopefully by 2018. During the interregnum, the Navy could not have afforded to waste its five-decade experience and skills in operating carriers. The strategic value of an aircraft carrier is apparent also from China's acquisition of a resurrected Soviet carrier.

The debate may continue on the strategic utility of sea control when stealthy underwater platforms are part of the strategic deterrence. Yet, the significance of carriers in implementing India's quest to exert a benign influence over the volatile Indo-Pacific cannot be overstated. Strengthening its expensive carrier-centric surface fleet should not of course be at the expense of critical sea denial capability achieved through a strategic submarine force. The two can indeed be complementary. Carriers demonstrate 'intent', but a potent undersea fleet, which is less costly to build and maintain and relatively less vulnerable to attacks, would be increasingly vital to attaining credible strategic deterrence.

The induction of INS *Vikramaditya* has hopefully ended any debates over its usefulness. The age of the hull, the quality of work done at the Russian submarine yard of Sevmas where it was rebuilt, and price renegotiations, were part of this debate in the past. The Navy should now focus its energies on integrating it into the fleet. It should train and qualify its fighter pilots on the *Vikramaditya*'s deck. It should negotiate with Russia on the maintenance of the platform so as to operate the systems smoothly and efficiently through its life-cycle of 25 years. Concurrently, an Indian yard should be qualified to carry out minor refits. Weaponising the carrier will pose the next major challenge. It will be in the interest of the Indian Navy to zero in on and integrate without delay effective and key defence systems such as surface-to-air missiles on the platform to fast-track its operationalisation. After inducting the *Vikramaditya*, the Navy would be looking to commissioning the indigenous aircraft carrier, INS *Vikrant*.

From The Hindu

IAF Blues

The Indian Air Force (IAF), which came into being 81 years ago, has come a long way from the time it was raised by the British as an auxiliary air force in 1932

with initially just four Westland Wapiti IIA single-engine biplanes.

Post-Independence, the IAF has been among with the world's busiest: it has participated in wars with Pakistan, been involved in military engagements overseas (Sri Lanka) and in UN peace support operations, continues to be engaged in air maintenance operations in some of the world's most treacherous terrains setting new records as a matter of routine and exercises with some of the world's most advanced air forces, including the US Air Force.

The IAF, which is currently in the midst of unprecedented modernisation and capability enhancement, has in the last decade-and-a-half inducted long-range Su-30MKI multi-role fighters, flight refuelling aircraft, Airborne Warning and Control Systems and the US-made C-17 and C-130J Hercules transport aircraft. The transport aircraft, however, are essentially replacements for the ageing Soviet-origin Il-76 and An-32 fleet. But despite these new inductions and capabilities, the IAF seems to be fighting a losing battle — both quantitative and qualitative — when it comes to its fighter squadrons. Numerically, the IAF is depleted to 33 fighter squadrons (a 34th squadron is currently under raising) against its sanctioned strength of 42.

The much delayed indigenously developed Light Combat Aircraft is still some time away from induction, which means the IAF will need to continue to fly its museum piece MiG-21s that have a dubious flight safety record. Equally serious is the recent statement of the Chief of Air Staff, Air Chief Marshal Norman Anil Kumar Browne, that the IAF has no backup plan in case India does not make a timely purchase of the shortlisted French-made Rafale medium multi-role combat aircraft which are meant to replace the ageing Jaguars and the other MiG series aircraft — the MiG-23s, MiG-27s and MiG-29s. There could then be a rapid decline in the number of fighter aircraft fleet between 2017-2022, making the IAF worse off than now. The government, which would be aware of all this, needs to take timely measures so that the country's air power capabilities do not deteriorate further.

From The Tribune

In a tailspin

Union Civil Aviation Minister Ajit Singh caused great turbulence with his statement that privatising Air India may be the only realistic option now. Air India had been reeling under losses of Rs 35,000 crore, accumulated over four years, but had been bailed out by the government with a cash infusion of Rs 30,000 crore over nine years, starting 2012-13, but that generosity is jarring, given the fiscal deficit. While it had managed to control the bleeding somewhat, the airline continues to lose money to the tune of Rs 11 crore a day, translating into a total drain of over Rs 4,000 crore. These losses are despite the government infusing Rs 16,300 crore in the last four years. How much, then, will the proposed infusion till 2020-21 change the situation at Air India? This is a crisis of credibility as much as of finances and operations.

BAE Systems

Singh said that while the airline management and employees are aware of the crisis, the decision to privatise would require political consensus and the cabinet's initiative. That's easier said than done, because the last time Singh ventured to speak on similar lines, after a debilitating strike by Air India pilots, political parties united in outrage at the hint of privatisation, threatening a privilege motion against him for speaking of civil aviation policy outside Parliament. But Singh is right, an organisation as moribund as Air India, with no incentive to compete with the rest of the sector, demoralised employees and inefficient practices, needs a fundamental rewiring to survive.

While many are irrationally attached to the idea of national carriers, and see them as embassies with wings, there is no reason why private money and enterprise would deter that project. Examples around the world confirm the wisdom of privatising national carriers, from Alitalia to British Airways or Lufthansa. The government has little justification for sinking money into an airline that has an unfair advantage over the competition and serves no public interest. Till recently, all lucrative routes were reserved for Air India, which had first right of refusal on bilateral air services rights, but only a fraction of seat capacity was actually used. If the question is about the willingness of private airlines to serve "unviable" locations, there are ways to incentivise those routes with public funds, without devoting a whole airline to it, with 221 employees per aircraft. Air India has lost the opportunity to professionalise, and privatisation, after all, should be more palatable than closure.

From The Indian Express

Defence Blueprint

Two subjects highlighted by Prime Minister Manmohan Singh in his address to the Combined Commanders' Conference require serious deliberation. First, Singh pointed out the need for comprehensive national power to tackle the challenges posed by the shift in global strategic focus to the Asia-Pacific region. This is exemplified by the US pivot towards Asia and the rise of China and its attendant security and economic consequences. Second, Singh urged the military brass to exercise prudence in defence acquisitions in light of the economic slowdown. Both issues require the armed forces to calibrate strategies accordingly.

There's little doubt that India cannot match China's defence spending in the near future. In fact, India should learn from the mistakes of the erstwhile Soviet Union's arms race with the US and refrain from a similar situation with China. Instead, it should focus on strengthening its nuclear deterrence and second-strike capabilities. Simultaneously, it should concentrate on raising elite forces to undertake special operations - be they to strike at terrorist camps or protect national boundaries. And to help shift the focus from quantity to quality it is imperative that the private sector is made a substantial stakeholder in the defence industry,

creating a US-style military-industrial complex and cutting down defence import bills.

Having said that, in this era of globalisation no security strategy can triumph without appropriate foreign policy. Pakistan has successfully leveraged its relations with China and the US to shore up its defence capabilities. However, India's leadership continues to be influenced by the legacy of the non-aligned movement. But with the international community now concerned about global terrorism and China's growing military might, there's no reason why India shouldn't cultivate a defence cooperation understanding with a broad group including the US, Japan, Vietnam, Australia and Indonesia. Combining this with appropriate bilateral and multilateral economic initiatives is key to the security strategy India needs to adopt.

From The Times of India

See the Stars

India's Mars mission has begun successfully, although it will take all of 10 more months for the satellite that scientists at the Indian Space Research Organisation (ISRO) have packed with five different kinds of testing equipment to transfer to its planned elliptical orbit around the red planet. So far, the lift-off of the launch vehicle, its traverse across the designated trajectory shedding spent sections of the multi-stage propulsion system and final release of the satellite into an earth orbit have all proceeded exactly as planned. This is good news and the scientists at ISRO deserve congratulations, including their chief, albeit his penchant for assigning credit for India's space successes to assorted gods.

If the Mars orbiter does finally reach its orbit, India's would be the fourth space agency to manage this feat, after the US, Russia and Europe. Japanese and Chinese attempts have joined intergalactical flotsam. Another US probe to Mars is slated for the end of the month. India's mission costs just about a tenth of the USA. This should make us proud of ISRO's frugal engineering, its ability to rely extensively on simulation and produce just one physical model. Except that Indian space scientists' frugality is achieved at the cost of original research.

Indians adapt and innovate new uses for extant technologies and tools, while at America's NASA, they allow competing teams to work on the same problem, producing new research, all of which might not find immediate application in the project at hand. So, India spends less to achieve the specified mission but produces a limited range of collateral benefits, while the US spends more but ends up producing new materials, technologies and processes that give American industry world-beating capabilities. It is time India began to focus, en route to Mars, on beating earthlings on earth. For that, Indian industry, too, must move on from a perpetual scramble for short-term profits to a more holistic approach to creating long-term competitive advantage. And ISRO must take steps to reach out to industry, to forge partnerships.

From The Economic Times

Pilatus

Renewal of a Sacred Trust



Of late the Indian armed forces have more often than not been in the news for reasons that appear to reflect a lowering of both personal and institutional moral and ethical standards. The reasons are many, not least the rising demand from the public at large for accountability and a round-the-clock electronic media hungry for sensational news.

But beyond these fairly legitimate aspects of a vibrant democracy lie the general societal expectations — that members of our armed forces are expected to be a cut above the rest and, whilst society may be somewhat tolerant of the shenanigans of our administrators and politicians, it draws the line when the decay spreads to our armed forces. In a way, members

of society bind members of the armed forces to an unwritten professional contract — that of mutual trust whereby they authorise the armed forces to use their awesome military power to ensure the people's security, but within the bounds of moral and ethical codes of conduct and behaviour. A contract neither articulated nor legal, yet that has the sanction of a moral binding force, for what is a nation's military without the moral support of its people?

Unfortunately, an open debate on the subject has been lacking in India, thus depriving all the stakeholders, namely the armed forces, the institutions of democracy, of governance and, most crucially, society at large to understand the complexities that drive the modern-day profession of arms and the necessity of a mutually supportive relationship among all the stakeholders. All this in a changing world where individualism and the pursuit of personal advancement, wealth and pleasure have come to take on greater relevance than human values of selflessness, service and sacrifice and where human rights and other pacifist movements look upon the profession of arms with a certain degree of disdain.

It is vital that even war, with all the death and destruction that it brings, must be conducted ethically and within the moral value system endorsed by society. Indeed, the professionalism of the military is judged not just by the achievement of various mission objectives, but also by whether these were achieved through fighting a moral and ethical

Boeing 1

battle. It is by means of articulating the Hague and Geneva Conventions and the United Nations Charter that the international community has been able to differentiate conduct in what is called a 'just war' from the wanton killing of human beings.

Judgments about going to war fall in the political domain and the political executive must bear the moral responsibility for these actions and be able to persuade the society to which it is answerable. On the other hand, the just conduct of war covers the operational aspects that are the moral responsibility of the military, which in turn will be judged on its ethical and moral conduct, not just by political leadership and society at large, but the international community as well.

There is always a moral dilemma that confronts military leaders. Not only do they have to cope with the stresses of professional decision-making, they must do so under the benign eye of their political executives who, at the end of the day, must answer to the people who elect them. This relationship can at times be problematic, considering that the working environments of the two — military and civil — systems are often poles apart. Any effort to intercept this line of communication by the bureaucracy acting as interlocutors or the media in the garb of public opinion would be contrary to the spirit of this relationship.

The State lets the profession of arms develop its own codes, ethics, professional expertise and skills provided they conform to moral values of society, whilst upholding the laws of the land. In fulfillment of this abiding trust between the society and himself, every professional military person is honour bound to protect the sovereignty and integrity of the nation even at the peril of one's life. This is the oath that one takes, making the profession of arms unique. The foundations of this contract of unlimited liability on the part of the uniformed fraternity for the larger good of society are based neither on laws of the land nor rules of governance, but on mutual trust and moral and ethical conduct on the part of both parties.

And finally, whilst military professionals must aspire and strive to

build for themselves a successful career, this must not be at the cost of professional integrity where careerism results in either not standing up for what is right, or for those under one's command nor, indeed, to further one's career prospects by indulging in unethical professional or personal conduct.

The rising number of suicides in the armed forces is one of the symptoms of the prolonged use of the forces (more specifically the Army) in countering insurgencies and the low-intensity conflict in Jammu Kashmir. When the suicide of a soldier serving in Jammu Kashmir was raised in Parliament, the Prime Minister urged members not to have a discussion, stating, "[T]his is a very small incident, which is being blown out of proportion. It is not good for the morale of our armed forces." That the people's representatives accepted this view speaks of the trust deficit between the representatives of society, the government and the armed forces, when discussions on such vital issues are considered inconsequential and are avoided under the hollow pretence of protecting the morale of the forces.

The response to the recent desecration of our soldiers' bodies points again to serious fault lines in the mutual trust between society, the executive and its soldiers. It is for the first time in Indian history that families of such martyrs have gone public with their angst. A society that reacts indifferently to the dishonouring of its armed forces not only risks losing the respect of its armed forces but demonstrates that the so-called spirit of mutual trust and sacred contract of unlimited liability have become one-sided to the detriment of the armed forces. In today's connected world, the armed forces are not insensitive to this state of affairs. This augurs ill for the morale of the armed forces of India.

The moral questions that society must ask of itself are what obligations does it have to its armed forces professionals, its veterans, martyrs' widows and those wounded and maimed for life, in return for their unlimited liability? The larger question is why is Parliament, which is the voice of the people, not doing its moral duty towards society, the government that it selects and the armed forces in enforcing moral and ethical accountability?

It is a reflection of the lack of trust that prevails today between the civil-military domains that the country has recently been witness to an ugly confrontation between a then serving chief and the government in the Supreme Court. Veterans have been holding protest marches and returning their hard-earned medals to their supreme commander, who no doubt under advice of his bureaucracy, chooses not to meet them. When our soldiers' bodies are desecrated, society and civil leaders fail to fathom the deep shame that every uniformed and veteran feels. Between the extremes of baying for blood or plain silence, the uniformed community expected to share their wounded honour and sorrow. Not one leader of consequence measured up to this moral moment whilst the electronic media whipped up sentiment to further its own interest. This is proof, if it were needed, that the sacred trust lies in tatters. Institutional actions rather than individual promises are needed to recover our moral and ethical bearings.

Wars, democracies, societies and social norms are all moving with the changing times. In this dynamic situation there remains forlorn hope that morals and ethics that formed the basis on which the armed forces live and die would remain unchanged.

Unfortunately, we do not live in an ideal world. It is up to pragmatic societies and leaderships both civil and military to measure up to the changing security dynamics and to determine what will drive the new relationship between society, its representatives, the government and its armed forces so that there is both stability in the relationship and abiding faith in the moral and ethical values that they bring to both this relationship and in facing new security challenges. This writer believes that it is still not too late to set up a blue ribbon commission that will look at every facet of this fascinating and challenging relationship and come out with a blueprint for the nation and Parliament to discuss, debate and adopt. If the nation has the political vision and moral sagacity, the largest democracy in the world may also be the first to tread a new path — for strengthening the moral and ethical foundations of security institutions for itself and for other modern democracies to emulate.

Air Marshal Brijesh D. Jayal (retd.)

Lockheed Martin

Indian Generals in Politics

The public hand-holding between a former general with an opposition political leader earned swift retribution from an indignant ruling party. While the propriety of both actions may be debatable, far more significantly, the leakage of a ministry of defence (MoD) report following this episode has, once more, dragged the office of the service chiefs and the respected institution of the armed forces into sordid media debate and condemnation by insinuation.

In recent times we, as Indians, have shown a penchant for publicly denigrating and undermining institutions that are respected and protected by every nation because they are the defenders and faithful servants of the state: parliament, the military and the intelligence services. In a young and boisterous democracy, such as ours, the elected representatives can be forgiven many trespasses, but lemming-like behaviour is not one of them.

As we brace ourselves for the forthcoming general elections, there is countrywide apprehension that difficult times lie ahead in terms of political volatility, economic instability and social unrest. The recent grim events in Western UP could presage worse to come.

Externally, the display of belligerence by the Chinese and Pakistani armies, while catching us on the wrong foot, has conveyed the ominous warning that we need to prepare for collusive action by them. To exacerbate our security predicament, the Pak army-ISI combine is waiting for the last GI to depart Afghanistan before unleashing its 'strategic reserve' of Taliban on India.

In such a daunting scenario, Indians would wish their powerful military to be at the peak of combat-readiness, morale and motivation, ready to react swiftly to orders of the political leadership to meet every national crisis, whether internal disorder or external threats.

Let us pause to consider if such a response can be expected from a military which suffers low self-esteem because its leadership is publicly excoriated and humiliated with regularity and snidely accused of disloyalty, by proxy through the media. Let us also pay heed to the words of Winston Churchill, an experienced soldier as well as astute politician: "The army is not an inanimate thing, like a house, to be pulled down or structurally altered at the caprice of the tenant or owner; it is a living thing. If it is bullied, it sulks; if it is unhappy, it pines; if it is harried, it gets feverish."

If there is unanimity amongst the citizenry and the politicians regarding the armed forces, it is that everyone wants them to be completely 'apolitical'. We are extremely fortunate that in a region full of praetorian militaries, the Indian armed forces have remained completely untainted by political stain or ambition; and it is in the nation's interest that they continue to be so.

Regrettably, the same is no longer true of the military veterans, and since the 25-30 lakh former soldiers retain a close umbilical link with the serving personnel there is real danger of the armed forces, too, becoming politicised by osmosis.

A pertinent question that arises at this juncture is how and when did the veterans become politicised? The short answer is they have actually been driven to politics over the past five to six years by the indifference of politicians and the hostile manner in which the MoD bureaucracy has handled problems relating to pensions and allowances of aging veterans, war widows and battle casualties. Forced to go to courts, they were stunned to find a litigious MoD fighting them at every step through appeals to higher courts. In a bizarre development, the MoD has perversely refused to implement even Supreme Court judgments favourable to the veterans.

In April 2008, the frustrated veterans decided to resort to public

demonstrations, in Delhi and elsewhere, to press their demands, and ever since their protest movement has gathered mass, momentum and political flavour. Cautionary advice rendered by senior veterans, including retired chiefs, has been consistently disregarded at the highest levels of the government and MoD. The 'Rewari moment' was, therefore, waiting to happen.

If forcing the veterans to take to the streets was a grave mistake, it has been compounded by serial mishandling, driving a patriotic, disciplined and politically-neutral segment of society into the maw of party politics. Retrieval may be possible even at this late stage if the government initiates urgent action to assuage disquiet among veterans and send a message of reassurance to troops in the field.

First, alleged misdemeanours by the senior military leadership must be investigated under the vast powers available to the government and due process of law followed thereafter. Interests of national security demand the utmost discretion and confidentiality in such cases. Media leaks of military matters and trial-by-TV bring comfort only to our enemies.

Secondly, the so-called department of ex-servicemen's welfare must be recast (as in other democracies) with a retired service officer as its head and with adequate veterans on its staff. The bureaucracy should be made to desist from initiating mindless litigation against the nation's veterans. The defence minister has adequate powers to decide most issues.

Finally, military headquarters, worldwide, are part of government; only in India are they seen as 'submitting' reports/matters for the government's consideration. It is time to eliminate such bureaucratic subterfuge, by amending the government business rules to subsume the three service HQs within its edifice.

Admiral Arun Prakash (retd)

“Limited resource availability”

Speaking to Chiefs of the Indian Army, Navy and Air Force and other PSOs at the Combined Commanders’ Conference in New Delhi on 22 November 2013, Prime Minister Dr Manmohan Singh has indicated that the country might have to trim its defence budget due to the economic slowdown over the last two years. The armed forces will have to exercise greater “prudence” and “cut our coat according to our cloth” in their defence acquisition plans.



Prime Minister Dr Manmohan Singh, Defence Minister AK Antony with the three Service Chiefs

“While we must take into account the capabilities of our adversaries, we have to plan our long-term acquisitions on the assumption of limited resource availability. This is an exercise that has to be done with a high degree of priority and urgency,” he said.

Air Marshal Arup Raha is next CAS



The Government has appointed Air Marshal Arup Raha, presently Vice Chief of the Air Staff, as the next Air Chief on retirement of the present incumbent on 31 December 2013. Air Marshal Raha was commissioned into the IAF on 14 December 1974 in the Fighter Stream of the Flying Branch. During a career

spanning nearly 39 years, he has held various command, staff and instructional appointments.

He was one of the first IAF pilots to convert on the MiG-29 fighter in the then Soviet Union during 1986, thereafter being a pioneer with No.47 Squadron of which he later became Commodore Commandant. Before taking over as Vice Chief of Air Staff in July 2013, he was AOC-in-C Central Air Command and later, Western Air Command.

INS Vikramaditya (R33) commissioned

On 16 November 2013, the Indian Navy’s largest warship, the long awaited INS *Vikramaditya* (pennant number R33), formerly the Russian ship *Admiral Gorshkov*, was ceremonially handed over to India and commissioned by the visiting Defence Minister AK Antony at the Arctic port of Severodvinsk (see article ‘The Carrier that came in from the Cold’ in this issue).



“What happened today is a demonstration of the readiness and restored ability of our country to build warships of such a class,” said Russian Deputy Prime Minister Dmitry Rogozin. The ship’s captain, Commodore Suraj Berry and the deputy director of Russia’s arms export agency, Igor Sevastyanov then signed the final papers for handing over the ship. The ship will set sail on 30 November and following a predetermined route, is scheduled to arrive in India in January 2014. Five IN warships will escort the INS *Vikramaditya* into home waters, where she will eventually embark her complement of MiG-29K/KUBs, Ka-31AEW and Ka-28 ASW helicopters, as also HAL Chetaks as ‘plane guards’.

First MiG-29K launched from SBTF

Earlier, on 29-30 October 2013, the Indian Navy conducted the first aircraft launches from the ski-ramp of the Shore-Based Test Facility at INS *Hansa*, Goa, using MiG-29KUB fighters from INAS 303 ‘Black Panthers.’ While the entire



facility, with land-based arresting wires is not yet complete, the ski-jump portion, which is an exact replica of the flight deck on INS *Vikramaditya*, has been functional since early this year (see *Vayu* III/2013).

The first test was a series of 3 launches made on 29 October, in which the aircraft (IN 672) took off with no stores attached (clean configuration). The second test, on 30 October, involved two launches of armed MiG-29Ks (combat configuration). The launches were conducted in daytime as well as at dusk, and were all flown by RAC-MiG test pilot Mikhail Belyaev.



MiG-29KUB on launch from the STBF at INS Hansa, Goa.

EMALS on offer for next generation aircraft carrier

One of the landmark matters discussed during US Deputy Secretary of Defence Ashton Carter's visit to New Delhi in September 2013, was the possibility of EMALS being offered to India for its next generation aircraft carrier (IAC-2). The US-



A US Navy F/A-18E Super Hornet launches during a land-based EMALS test (US Navy photo)

origin Electro-Magnetic Aircraft Launch System (EMALS), has been developed by General Atomics for equipping US Navy super carriers using a linear motor drive instead of conventional steam pistons. This reduces stress on airframes because they can be accelerated from the deck of aircraft carriers more gradually to takeoff speed than with steam-powered catapults.

The Indian Navy currently relies on ski-jump flight decks for the Sea Harriers aboard INS *Viraat* and the MiG-29Ks on INS *Vikramaditya*. These limit the Navy to the operation of only light and medium weight aircraft, precluding the use of shipborne AEW&C, transport and tanker aircraft. With the design of IAC-2 yet to be frozen, the US is keen to integrate EMALS on the forthcoming carrier under the 'Defence Technology Initiative.'

Third Boeing P-8I for IN

The third Boeing P-8I long-range maritime reconnaissance and anti-submarine warfare aircraft for the Indian Navy arrived at INS *Rajali* its base in India on 23 November 2013, where it joined two earlier P-8Is currently undergoing flight trials and testing. This P-8I is one of eight aircraft that Boeing is building for the Indian Navy as part of a contract awarded in 2009. Based on the company's Next-Generation 737 commercial airplane, the P-8I is the Indian Navy variant of the P-8A Poseidon developed for the US Navy. The P-8I incorporates not only Indian-unique design features, but also India-built subsystems that are tailored to the country's maritime patrol requirements.



Photo credit: Boeing

25 years of Tu-142M LRMR with Indian Navy

On 18 November 2013, Indian Naval Air Squadron 312 'Albatross', marked the Silver Jubilee of its operation with the Tupolev Tu-142M ('Bear-Foxtrot') Long Range Maritime Reconnaissance aircraft, based at INS *Rajali*, Arakkonam in Tamil Nadu. The celebrations included a seminar on maritime operations with Vice Admiral (retd) Dilip Deshpande delivering the key note address at the Seminar. Vice Admiral Anil Chopra FOC-in-C Eastern Naval Command was Chief Guest at the

Irkut

Anniversary, which included a flypast of various aircraft types comprising Chetak helicopters, Dornier 228s, Il-38SD, P-8I and the Tu-142M.



Tu-142M of INAS 312 takes off from INS Rajali

INAS 312 has been awarded a 'Unit Citation', 'Best Frontline Squadron' Trophy twice, the 'CNS Flight Safety' Trophy four times, and was runners up for the 'Best Frontline Squadron' twice. Over the last 25 years of operations, the Squadron has flown over 28,000 hours of incident and accident-free flying on the Tu-142M aircraft. The Squadron is presently commanded by commander P Mahesh Raju.

First flight of upgraded IAF Mirage 2000

The Indian Air Force's first upgraded Mirage 2000 made its debut flight at Istres-Le Tubé air base in France on 5 October 2013. The aircraft was a two-seat Mirage 2000TH (KT201) which incorporates a new avionics suite, self-protection suite and Thales RDY-2 multimode radar among several new systems, effectively bringing it up to the Mirage 2000-5 Mk2 standard.

The upgraded aircraft will supplant the earlier designation Mirage 2000H/TH (single/twin seat respectively) and will be referred to as Mirage 2000 I/TI. KT201 currently has no tail number stencilled on its fin, but has the old number still painted under the wings. The most visible change to the upgraded aircraft



KT201 making its maiden flight (photo: Dassault Aviation - V. Almansa)

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is the new gray radome replacing the distinctive black radome sported by present IAF Mirages.

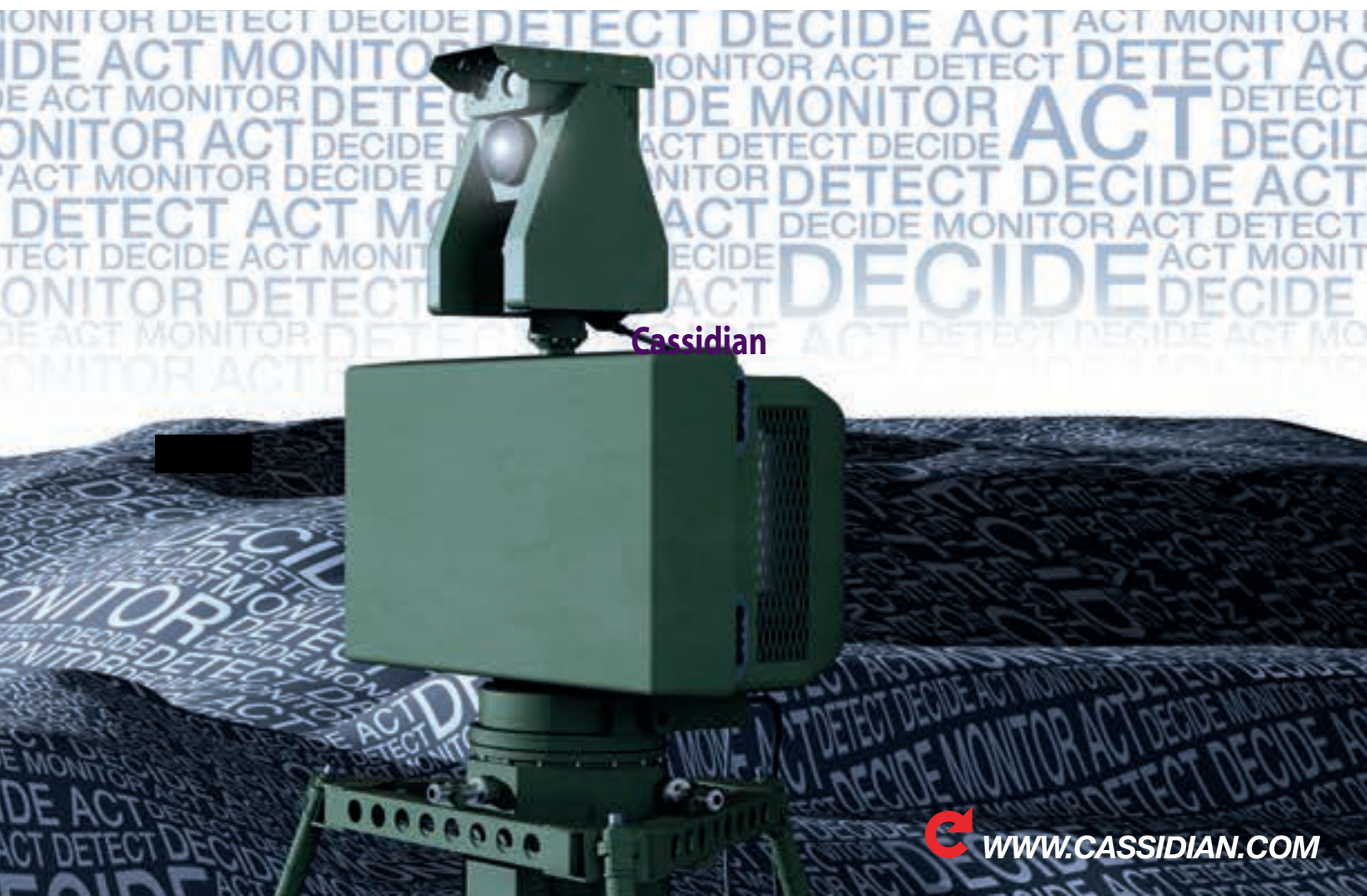
KT201 is the first of 2 aircraft that will be upgraded in France, with the remainder of the fleet (47 aircraft) to be upgraded in India by HAL over the next seven years, at a reported cost of around €1.8 billion. Earlier this year, the MoD also signed a €950 million contract to replace the Mirage fleet's older Magic-II and Super 530D missiles with new MBDA MICA air-to-air missiles.

Indian Navy inducts Hawk Mk.132s

On 6 November 2013, the Indian Navy inducted the first three of 17 HAL-built BAE Systems Hawk Mk.132 advanced jet trainers, at Naval Air Station INS Dega (Vishakhapatnam). The ceremony was attended by various Flag Officers and

senior officers of the Navy, including Admiral DK Joshi, Chief of the Naval Staff, Vice Admiral Anil Chopra, Flag Officer Commanding-in-Chief, Eastern Naval Command as well as senior management from HAL and representatives of BAE Systems and Rolls Royce.

The Hawk Mk.132 will initially be operated by an Intensive Flying Training Unit. "The induction of this highly capable aircraft will bridge the gap for flying and weapons training of naval fighter pilots and also provide the *ab initio* naval pilots with an ideal platform to hone their skills before they graduate to flying high performance aircraft and carrier-based fighter jets." The Hawk induction at INS Dega also changes the status of this major Naval Air Station on the Eastern seaboard, which presently houses Dornier 228 MPAs of INAS 318.



Exercise 'Malabar 2013'

The Indian Navy-US Navy bilateral exercise, *Malabar 2013* was held from 5 to 11 November 2013 in the Bay of Bengal and is the latest in a continuing series of bilateral naval training exercises conducted "to advance multinational maritime relationships and mutual security issues."



USN carrier and support ship during Exercise Malabar 2011

The exercise featured both ashore and at-sea training. The at-sea portions were conducted in the Bay of Bengal and were designed to advance participating nations mil-to-mil coordination and capacity to plan and execute tactical operations in a multinational environment. Events planned during the at-sea portions included professional exchanges and embarkations; communications exercises; Surface Action Group operations; helicopter cross-deck evolutions; gunnery exercises; visit board search and seizure and anti-submarine warfare.

Participation from the US Navy included the *Arleigh-Burke* class guided-missile destroyer USS *McCampbell* (DDG 85) and P-3Cs, while Indian Navy participants included the indigenously built frigate *Shivalik*, guided missile destroyer *Ranvijay* and Tu-142M long range maritime reconnaissance aircraft.

9th 'Naseem Al Bahr' Naval Exercise

The ninth edition of the bilateral Indian Navy-Royal Omani Navy biennial exercise 'Naseem Al Bahr' 2013, was held off Oman in the northern Arabian Sea. Indian Naval Ships *Mysore* (guided missile destroyer), *Tarkash* and *Tabar* (stealth frigates) and *Aditya* (fleet tanker) participated under command of the FOC



RNOV Al Muazzar

Western Fleet, Rear Admiral Anil Kumar Chawla. The Royal Omani Navy was represented by Royal Navy of Oman Vessels, *Al Muazzar*, *Al Mussandam*, *Al Naja* and a landing ship RNOV *Temsah*, along with Royal Air Force of Oman F-16s, Hawks and Jaguars.

This year marked 20 years of Indian Navy-Royal Navy of Oman exercises and a "good measure of interoperability has been achieved over the years". The scope and content of exercise have also increased progressively, focus of the exercise this year was on Surface Warfare, Visit Board Search and Seizure (VBSS), Anti-Air Warfare, Air Operation, Advanced Helo Operations and Maritime Interdiction Operations (MIO).

Navy Commissions first ALH Squadron



On 12 November 2013, the Navy's first HAL Dhruv Advanced Light Helicopter Squadron (INAS 322) was commissioned at Kochi by Vice Admiral Shekhar Sinha, Flag Officer Commanding-in-Chief Western Naval Command. Addressing the commissioning ceremony parade, with Vice Admiral Satish Soni, FOC-in-C, Southern Naval Command present, Vice Admiral Sinha said that the ALH will be operated as an advanced search and rescue (SAR) helicopter, as also used for missions like heliborne operations and armed patrol with night vision devices. This role has become imperative for the Navy in the context of low intensity maritime operations (LIMO) and coastal security construct, stated the Admiral.



Earlier, Mrs Mona Sinha unveiled the commissioning plaque of INAS 322 while Commander Ravi Sivasankar, CO of the Squadron recited the invocation and read out the commissioning warrant. The squadron has the appellation *Guardians* with the credo 'Search Fearlessly, Rescue Valiantly' signifying their primary role of SAR.

HAL Dhruv ALH completes 100,000 flying hours

An Advanced Light Helicopter (IA 3104) of the Indian Army's 301 Army Aviation Sqn (Spl Ops) achieved the milestone of completing 100,000 flying hours on 9 October 2013. "One lakh hours flown by the machine is an awesome feat to achieve. It is a dream machine for any pilot", enthused Lt Col Kapil Agarwal who flew this ALH.



Dhruv of 301 Army Aviation Sqn (special operations), which completed one lakh flying hours on 9 October 2013.

The Dhruv ALH is operated by the Indian Army, Indian Navy, Coast Guard, Indian Air Force, BSF and state governments, with currently more than 132 Dhruvs in service. HAL has also built 12 civil variant Dhruv helicopters, while six Dhruv ALHs were exported to the Ecuador Air Force (FAE).

"MMRCA deal to be finalised within this Financial Year"

Speaking at 'Brochure Release' of the 8th International Conference on 'Energising Indian Aerospace, Air Marshal S Sukumar, Deputy Chief of Air Staff has said that "the MMRCA deal will be inked within this financial year". This was on 17 October 2013 and the DCAS also said that response to the 'Avro' replacement RFP has been extended by two months (*further extended to March 2014 : Ed*).

Air Marshal Vinod Patney, Director, Centre for Air Power Studies opined that "we want Indian aerospace industry to flourish however, all stakeholders should sit together to discuss priorities to arrive at a common blue print. We should also look into the R&D and technology which impacts all the fields".

CAS: "no problem" with AW101

On the sidelines of a ceremony at Halwara, Air Chief Marshal NAK Browne addressed questions regarding the controversial AgustaWestland AW101 helicopter deal, stating, unequivocally, that there was no problem with the helicopters themselves and that they were "absolutely what the Air Force wanted".



Commenting on the status of contract and possible arbitration, Browne said that any decision lies in the hands of the government. AgustaWestland has denied any wrongdoing in securing the contract, whilst the Defence Ministry alleges that the Italian firm is in violation of a pre-contract integrity pact, which allows the government to take action against the company. Browne expressed certainty that the MoD would come to a decision that would be "good for the country."

CGAS 700 inducts fourth Do 228

To enhance its maritime surveillance capability over the coastal region in West Bengal and Odisha, the Indian Coast Guard (ICG) North East Region has inducted a fourth Dornier 228 MPA aircraft at its operational air enclave at Dum Dum Airport (Kolkata). CGAS 700 was the first fixed wing air squadron of the Coast Guard, initially operating a pair of ex-Indian Airlines F.27 Friendships, and later re-equipped with HAL-Dornier 228s. With this the total strength of this aircraft type with the Indian Coast Guard goes upto 38 numbers operated by CGAS 700, 744, 745 and 750 (*see article in this issue*).



Fourth C-17 Globemaster III for IAF

The Indian Air Force's fourth Boeing C-17 Globemaster III departed for India from Long Beach on 19 October 2013, keeping the company on track to deliver a total of five advanced airlifters to the IAF this year. Boeing will deliver five more C-17s to India in 2014 to complete the contract.

Most recently, the IAF used its C-17s to transport relief supplies to eastern India after Cyclone *Phailin* (Thai for 'sapphire'), the very severe cyclonic storm which caused substantial damage in Andhra Pradesh and Odisha.



Boeing will complete production of the C-17 Globemaster III in the fourth quarter of 2015. In addition to the remaining C-17s for India, the company will build 15 more for other operators outside the United States. Boeing will continue after-delivery support of the worldwide C-17 fleet as part of the C-17 Globemaster III *Integrated Sustainment Programme Performance-Based Logistics* agreement.

IAF C-130J on humanitarian aid mission to the Philippines

The Government of India has sent relief supplies comprising medicines, hygiene material and chemicals, tentage, blankets, tarpaulins and pre-prepared meals to the Philippines after that island nation was ravaged by a devastating hurricane *Haiyan*. These were flown in an Indian Air Force C-130J aircraft (KC-3801) to Mactan to assist in rehabilitation where over 10,000 people are feared dead and about 4 million people affected. Plans are underway to further supplement the effort and provide



additional relief material through an Indian naval ship that will set sail "at the earliest".

BEL and Pilatus in offset project

Bharat Electronics Ltd (BEL) and Pilatus Aircraft of Switzerland, have launched an offset project to establish electrical harness manufacturing capability at BEL's Bangalore Complex. The project will enable BEL to manufacture electrical harnesses for the Pilatus global supply chain.



Pilatus Aircraft Ltd had entered into a contract with the Government of India in 2012 for the supply of 75 PC-7 MkII turboprop basic trainer aircraft for the Indian Air Force which includes an integrated ground based training system, a comprehensive logistics support package and a 30 per cent offset obligation. "Pilatus has taken the offset obligation as a major opportunity to expand its footprint in India".

The project includes transfer of technology in the form of tooling, jigs and training of BEL's personnel at Pilatus in Switzerland and India. The first phase of training in Switzerland was successfully completed in June 2013. The training at BEL's facilities in Bangalore is scheduled to be completed by this year end. Pilatus will continue to provide support as and when required until the capability is established at BEL.

Rusavia

Mahindra Aerospace inaugurate aerostructures facility

Mahindra Aerospace inaugurated its modern 25,000 sq.m. aerostructures manufacturing facility at the Narsapura Industrial Estate near Bangalore on 21 October 2013. This service-oriented facility has the ability to accurately craft large, complex sheet metal parts using CNC routing, stretch-forming, bladder press, heat treatment and other specialised equipment.

Simultaneously, Mahindra Aerospace also announced the signing of a technology partnership with the Aernnova Group, a leading aerostructures Tier 1 supplier that is headquartered in Spain with facilities around the globe. Aernnova specialises in the design and manufacture of major airframe assemblies and is a key supplier on numerous civil and military aircraft programmes for several global aircraft OEMs. This technology partnership is Aernnova's first with an Indian aerostructures manufacturer. "Aernnova and Mahindra Aerospace will work together to develop capabilities and meet market demand for mutual benefit."



Left to right: Arvind Mehra, Executive Director and Global CEO, Mahindra Aerospace, Anand Mahindra, Chairman, Mahindra Group, Hemant Luthra, President - Mahindra Systech and Pedro Fuente COO Aernnova Group, at the inauguration of Mahindra Aerospace's new Aerostructures facility

'EADS-CEFIPRA Aerospace Programme' to fund research in Indian universities

EADS have signed a letter of intent (LoI) with CEFIPRA (Indo-French Centre for the Promotion of Advanced Research) for creating a new innovation initiative called the 'EADS-CEFIPRA Aerospace Programme.' Under this programme, calls will be given to leading Indian universities and institutes to propose research projects for funding. The programme aims to foster research in India in the field of aerospace, particularly related to topics such as avionics, composite materials, high performance computing, nanotechnology and



Dr Debapriya Dutta, Director CEFIPRA with Arnaud Marfurt, Vice-President, Innovation Works (International Operations)

applied mathematics. In addition, the letter of intent envisages the launch of 'EADS Postdoctoral Fellowship' in India.

EADS had earlier set up a research Chair in the field of 'Mathematics of Complex Systems' in partnership with the Tata Institute of Fundamental Research (TIFR) in Bengaluru. Held by Prof. Mythily Ramaswamy, professor and researcher at the Centre for Applicable Mathematics, TIFR and Prof. Spenta Wadia, distinguished professor and Director, International Centre for Theoretical Sciences, at TIFR, the Chair's lead objective is to develop innovative research involving theoretical and computational work in general mathematics of complex systems including control theory and data assimilation.

Tata-Sikorsky JV delivers 50th S-92 helicopter cabin

The Hyderabad facility of Tata-Sikorsky India JV have produced their 50th S-92 helicopter cabin, the TASL facility now having the capacity to produce up to four cabins a month and are also responsible for future design modifications. On 24 October 2013, the organisation announced that its S-92 helicopter cabin production in India has become "100 percent indigenous". The India operation is not only assembling cabins but also



Shane Eddy Senior VP, Sikorsky and S Ramadorai, at unveiling of the 100% indigenously made Sikorsky S-92 cabin

producing all parts needed for the assembly, before shipping the cabins to the US for aircraft completion and customer delivery. The S-92 helicopter cabin and more than 5,000 associated precision components are made at Hyderabad through a strategic collaboration between Sikorsky and Tata Advanced Systems Ltd (TASL).

In June 2009, Sikorsky and TASL entered into an agreement for production of S-92 helicopter cabins in India, and in November 2009, they entered into a joint-venture for production of more than 5,000 detailed aerospace components in India, thereby establishing two manufacturing facilities in Hyderabad. Both facilities commenced production within two years of signing the agreements and today constitute an important part of Sikorsky's global supply chain. The S-92 helicopter cabins from India are shipped to the US for final assembly, and the completed helicopters delivered to customers globally.

Saab SA self-protection system for HAL Dhruv

Swedish/South African defence and security company Saab Grintek Defence (SGD) has received orders from Hindustan Aeronautics Limited for serial production of an integrated electronic warfare self-protection system, which will be developed and produced at Saab South Africa's headquarters, in Centurion (Saab Grintek Defence). The Saab's Integrated Defensive Aids Suite (IDAS) protects crew and aircraft and enhances survivability in sophisticated, diverse and dense threat environments. The system provides a timely warning against different types of threats, including radar, laser and missile approach warning and automatically deploys appropriate countermeasures.

These orders follow initial serial production orders received in 2008 and further establish Saab as a local partner to the Indian industry as provider of hi-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," observed Lars-Olof Lindgren, head of Market Area Saab India.

Saab agreement with Indianeye

Meanwhile, Saab have signed distribution agreement with the Indian company Indianeye Security Pvt Ltd for marketing and distribution of Agile Tactical Engagement Simulation (ATES) equipment to the Indian Armed Forces, Paramilitary, Special Forces and Police.

Indianeye Security Pvt Ltd, was set up with the objective of assisting the challenges being faced by government departments, companies and individuals in the current security environment of India. Their tie-ups and collaboration with overseas companies bring together over three decades of in-depth and vast experiences in the field of security across a wide spectrum of activities.

InterGlobe and CAE inaugurate pilot training facility

InterGlobe Enterprises and CAE have inaugurated their modern pilot training facility in Greater Noida, National Capital Region (NCR). CAE Simulation Training Private Limited (CSTPL), is a joint venture between InterGlobe Enterprises and CAE, with an investment of over \$ 25 million. The Centre already provides training to IndiGo pilots and starting from December 2013, GoAir's A320 pilots will also get trained at the facility.

With its six simulator bays, the Centre will have the capacity to train over 5,000 aviation professionals per year, and will be the largest such facility in India. The facility provides 'wet' and 'dry' type-rating, recurrent, conversion and jet indoctrination training for commercial aircraft pilots. Currently, it features two CAE Series 5000 A320 full-flight simulators certified level D. Pilots and students can benefit from advanced training technology such as CAE Simfinity multimedia classrooms, computer-based training and brief/debrief facilities. This will also be the first centre in India to impart Airbus certified training.

Rs. 2,000 Cr Jet-Etihad deal finally cleared

On 20 November, Jet Airways and Etihad Airways finally cleared a deal valued at over Rs. 2,069 crore that saw the Abu Dhabi-based airline acquire 24% equity in Jet Airways, marking the first FDI infusion in civil aviation since the FDI regulations in civil aviation were relaxed in September 2012. The agreement now paves the way for both airlines to implement complementary global expansion plans.



In a filing with the Bombay Stock Exchange, Jet Airways disclosed that it had allotted 27.26 million preferential shares to Etihad for Rs 2,057.67 crore. The shares, equal to a 24% stake in the Indian carrier, were allotted at a premium of Rs 744.74 on a face value of Rs 10 per share. Etihad CEO James Hogan and CFO James Rigney have now joined the board of Jet Airways, with Hogan stating that “Etihad Airways and Jet Airways will both be strengthened” as a result of the investment, “along with the economies of India and the UAE.”



Sita's Airport Management System at 10 more airports in India

The Airports Authority of India (AAI) has chosen Sita's next generation Airport Management System to transform operations at ten airports across India. The seven-year, multi-million dollar deal contract is part of a \$130 billion airport modernisation project which prepares for annual passenger numbers in India to triple to 450 million by 2020. Sita has partnered with NIIT Technologies Ltd. for this first multi-airport project in Asia to implement Airport Operations Control Centres (AOCC).

VP Agrawal, Chairman, AAI stated that the Authority is integrating and automating airport operations at 10 of its airports including Chennai and Kolkata in technology partnership with NIIT Technologies Ltd, who will in turn implement Sita's solution for central AODB and AMS. Once implemented successfully, it will help to execute Airport Collaborative Decision Making (ACDM) which will greatly enhance both capacity and efficiency of the airport operations thereby making them more cost effective.

Atos engineering contract with Airbus

Airbus has selected Atos, the international IT services company to develop, maintain and transform almost all of its

Enterprise Content Management system. This five-year contract will be implemented by Atos teams in Toulouse, Hamburg, Madrid, Seville and Pune. The contract between Airbus and Atos involves a significant component of the aircraft manufacturer's information system, which is core to a large number of key internal and external business processes (both customers and suppliers). The management of business needs and issues, the consolidation of the requirements of a wide range of users and the technical complexity associated with diverse content management components, “are the main challenges for Atos.”

Dassault deliver first 2000S business jet to India

Dassault Aviation are to shortly deliver the first Falcon 2000S business jet to an Indian operator following certification by the DGCA. The 2000S was certified on 1 November continuing a process that began in the spring of 2013 with the receipt of FAA and EASA approvals. The aircraft has already been certified in Brazil, Mexico and Turkey, and Dassault expects approval from the Canadian authorities shortly. The 2000S also recently received EASA and FAA steep approach approval, paving the way for its operations at London City Airport in the heart of London.



Dassault has delivered 10 Falcon 2000S business jets since aircraft deliveries started in April 2013. The 3,250 nm / 6,300 km Falcon 2000S is equipped with winglets and full inboard slats that enable it to land and takeoff at steep angles and low speed, even at high altitudes and high temperature conditions and can operate at marginal and challenging airports such as Kulu-Manali, as also Leh.

TATA-SIA Airline launched

The Tata Group and Singapore Airlines (SIA) are to launch a new full-service carrier in a joint venture, the new airline to be based in New Delhi, but details of its planned fleet and route network have yet to be announced. Tata will own 51% of the new airline, and SIA the remaining 49%.

DRDO

Foreign carriers are permitted to own upto 49% of an Indian airline after the national regulator, the Directorate General of Civil Aviation, authorised foreign direct investment in Indian carriers in 2012. SIA and Tata have applied to India's Foreign Investment Promotion Board for approval to establish the new airline. A Tata spokesman said the two companies would invest \$100 million in the joint venture, split in line with their respective stakes.

The nominated Chairman is Prasad R Menon, currently Chairman of Tata Quality Management Services, who said that the joint venture would be a "world-class full-service airline" and that it would "exploit the predicted growth in Indian air travel."

First Cessna Citation Mustang for India

Cessna Aircraft Company, a Textron Inc. company, have delivered the first Citation Mustang for service in India to IRM Limited, one of the largest integrated travel and travel-related financial services company in India. This first Mustang in India will be based at the company's facility in Ahmedabad, providing IRM Limited with high-speed executive and corporate travel, plus charter opportunities.

The Mustang is equipped with the Garmin G1000 avionics suite and weather avoidance radar. Also part of the avionics are a terrain-avoidance warning system (TAWS), traffic information system, dual altitude heading reference system and dual air data computers. The Mustang has a maximum operating altitude of 41,000 ft (12,497 m) and can accommodate two pilots and four passengers.



GKN Aerospace's new Bangalore engineering centre

GKN Aerospace has officially inaugurated its advanced engineering centre in Bangalore, with a highly skilled engineering team which extends the company's one thousand-

strong global engineering strength already contributing design engineering expertise to the company's international aero-engine activities. Over the next eighteen months, a local recruitment campaign will increase the workforce in Bangalore to over 100 individuals.



GKN Aerospace composite spar assembly of rear trailing edge

David Orth, newly appointed General Manager at the Bangalore engineering centre explains: "GKN Aerospace is known for the strength of its engineering expertise and through this new Centre, the company is adding India's and specifically, Bangalore's impressive engineering skills base to that expertise. We look forward to playing our part in creating effective design and engineering solutions that will help GKN Aerospace extend the performance of future aircraft and aero-engines."

Eurocopter AS350 B3 helicopter maps groundwater

The Ministry of Water Resources, in tandem with Eurocopter India, has initiated a Rs. 41 Crore project to map aquifers in India in order to find clean drinking water in remote areas within the country. Danish technology developed at Aarhus University has the SkyTEM instrument investigating groundwater beneath the soil surface from beneath a deployed Eurocopter AS350 B3, which is hooked with a 30-m long probe having a huge frame of 300 square metres. With a higher under-slung load capacity and the ability to transport heavy load the AS350 B3 is the considered as the optimal helicopter for this task.

Selected on the basis of soil types and topography, six areas have been identified for this project, being Chandrabhaga in Nagpur (Deccan basaltic traps), Tumkur in Karnataka (granite), Cuddalore in Tamil Nadu (coastal area), Ramgadh in Jaisalmer (desert environment), Patna (alluvial soil) and Dausa in Jaipur (hard rock with alluvium).

Indian mission to Mars



5 November 2013 heralded what is surely the Indian Space Research Organisation's most prestigious programme, launch of the Mangalyaan Mars Orbiter Mission (MOM) on board the Polar Satellite Launch Vehicle (PSLV C-25). 44 minutes after launch from the Indian space port at Sriharikota, the Mars orbiter went into its initial earth-elliptical orbit with a predicted perigee of 250 km and an apogee of 23, 500 km. On 15 November, the ISRO manoeuvred the Mangalyaan for the fifth orbit raising operation before the crucial trans-Mars injection on 1 December 2013 for the spacecraft to move out of the sphere of influence of earth towards Mars (*see article in this issue*).

Infantry Day Celebrations

The Indian Army marked its annual Infantry Day on 27 October 2013, which 67 years earlier was the date when troops of the 1st Battalion Sikh Regiment were flown into Srinagar airfield when Kashmir was under invasion by tribal raiders from Pakistan.



General Bikram Singh, COAS, at India Gate

Formation of a Mountain Strike Corps

The Government has issued a "sanction letter" to the Indian Army for raising of a new Mountain Strike Corps along with two independent Infantry and two independent Armoured Brigades, totalling some 80,000 personnel. Identified as 17 Corps, its headquarters are initially to be at Panagarh in Bengal, the operational task being "rapid reaction force capability in the mountains" in the defence of Arunachal Pradesh, which the Chinese claim as being part of 'southern Tibet'.



It is reported that one of the existing Mountain Divisions (23rd) in Eastern Command will form part of the new 17 Corps, which will be fully operational after infrastructure is in place in the years ahead.

BrahMos Block III test fired

The Block III variant of the BrahMos supersonic cruise missile was successfully test fired by the Indian Army at the Pokhran test range in Rajasthan on 18 November 2013.

This was test launched from a Mobile Autonomous Launcher (MAL) deployed in full configuration with Mobile command Post (MCP), the missile after launch following the predetermined trajectory and successfully impacting on target "The launch has successfully validated the deep penetration capability of the supersonic cruise missile system against hardened targets," a company official said. Corps Commander Lt. General Amit Sharma witnessed the launch along with other Indian Army senior officers.

India and US to co-develop Javelin missile?

As part of a push to secure a mammoth Rs. 15,000 Cr Indian Army order for 8,000 anti-tank guided missiles (ATGMs) and 300 man-portable launchers, the USA is offering significant incentives to the Indian defence industry. Apart from a full

transfer of technology agreement for the current third-generation Javelin ATGM on offer, including crucial seeker technology and software, the US government has signalled its readiness to develop a future fourth-generation Javelin in cooperation with Indian agencies.



File photo of US troops firing the Javelin

The Javelin is a fire-and-forget ATGM developed by Raytheon and Lockheed-Martin. The system features lock-on before launch and automatic self-guidance, and executes a top-attack flight profile against armoured vehicles. It is equipped with an imaging infrared seeker and a tandem warhead designed specifically to defeat explosive reactive armour.

Indo-Russian joint military training exercise



Indian Special Forces at the Exercise

Exercise 'Indra 2013', the joint Indo-Russian military exercise, commenced on 19 October 2013 at Mahajan Field Firing Ranges in Rajasthan. "The aim of the exercise is to enhance the ability of both the armies to operate as an integrated force for Peace Keeping Operations within the framework of United Nations". Both the armies employed mechanised forces as also advanced equipment for surveillance and target acquisition,

medical treatment. Special Forces teams were deployed from assault helicopters supported by attack helicopters in the exercises which included 'Vindhural' and 'Gangneva'.



Russian troops at the closing ceremony

Indian and Chinese Armies in joint training exercise



Troops slithering from Chinese Mi-17 V5 during the exercise

In early November 2013, select units of the Indian Army and the People's Liberation Army (PLA) carried out a weeklong joint training exercise, termed 'Hand-in-Hand', at Chengdu, the capital of Sichuan province in Southwest China. The senior Chinese and Indian commanders involved were Lieutenant General Zhou Xiaozhou and Lieutenant General Anil Kumar Ahuja, while the Indian Army contingent consisted of some 160 soldiers from the 16th Sikh Light Infantry, flown to Kunming province in southern China for the exercise, which has been held twice earlier, in Kunming in 2007 and in Belgaum in 2008.

"After several days of endurance training, obstacle crossing and tactical drills together, a joint unit involving Indian and Chinese soldiers raided a simulated terrorist group. The 100 highly trained terrorists were depicted as taking refuge on the Sino-Indian border, waiting for an opportunity to strike. But the



Sikh LI troops using Chinese QBZ-95 rifles at firing practice

PLA-Indian Army joint force, operating under joint command, planned and executed an attack in which they approached, cordoned off, and destroyed the terrorist camp with live fire”.



IAF Ilyushin Il-76MD landing at Chengdu with the Indian troops

Coast Guard Commanders Conference

The 32nd Annual Coast Guard Commanders Conference took place in the first week of October for introspecting myriad challenges confronting the service in the maritime



domain. Speaking at the inauguration, the Defence Secretary acknowledged contribution of the Service towards the security of the nation and complimented the rank and file of the Coast Guard “for exhibiting tremendous zeal and tenacity whilst discharging their mandated charters.” The Defence Secretary also expressed satisfaction with the progress and expansion of the service which includes induction of modern ships and aircraft and exhorted the concerned officials to work towards timely culmination of important projects including the Coastal Security Network.

Director General Indian Coast Guard Vice Admiral AG Thapliyal, in his inaugural address highlighted the progress made by the Service across the entire spectrum of activities and also thanked the MOD for all the valuable support and guidance.

Fast Patrol Vessel for Indian Coast Guard

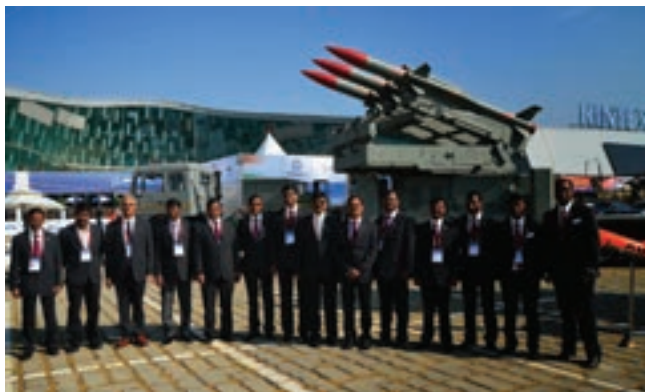


Cochin Shipyard Limited (CSL) launched the fourth Fast Patrol Vessel (FPV) being built for the Indian Coast Guard (ICG) on 30 September 2013, bearing yard Hull No. BY 504. The vessel is the fourth in a series of 20 FPVs contracted by CSL for the ICG under a contract, with delivery of the last vessel slated for 2017. The vessels are being built under the dual classification requirements of ABS and IRS, with a designed speed of 33 knots, propelled by water jets. The primary role of the vessel includes fisheries protection and monitoring, patrol within the exclusive economic zone (EEZ) and coastal patrol, anti smuggling, search and rescue operations and for anti piracy operations. The vessels have a secondary role of providing communication link and escort convoys during hostilities and war time.

DRDO at ADEX 2013

DRDO, along with a number of PSUs took part at the International Aerospace and Defence Exhibition ADEX-2013, held at Kintex, Seoul, South Korea from 29 October to 3 November 2013, where more than 30 countries participated. The DRDO's pavilion at ADEX was inaugurated by RRM Jitendra

Singh on 29 October 2013. The DRDO team was led by Avinash Chander, Scientific Advisor to Defence Minister, Secretary Deptt of Defence R&D and DG DRDO.



Systems on display included models of the Akash Air Defence System, Tejas Light Combat Aircraft and its variants, expandable high speed aerial target Abhyas, Airborne Early Warning and Control System, advanced radars, sonar and communication systems among others. A large number of products developed by DRDO and produced by Indian Industry including those being displayed at ADEX-2013, "have immense export potential." Recently, in August 2013, the Explosive Detection Kit (EDK) developed by DRDO and already being produced in India, was launched in USA after the technology for its manufacture was transferred to a US firm. "DRDO's participation in the event will go a long way in promoting international collaboration and generating fruitful interactions with leading global leaders from industry and Defence R&D institution especially those from South Korea, according to a MoD spokesman."

DMRL Celebrates Golden Jubilee

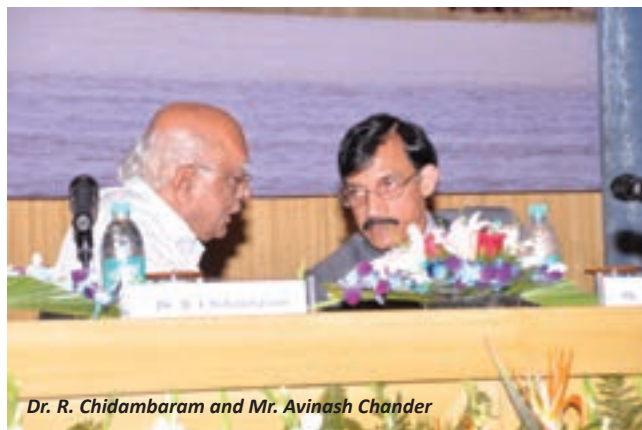


Defence Metallurgical Research Laboratory (DMRL) marked its Golden Jubilee which had Avinash Chander, Scientific Adviser to Raksha Mantri, Secretary, Defence R&D and Chairman, DRDO as the Chief Guest with Dr. V. Bhujanga Rao, Director General (Naval Systems and Materials) as the Guest of Honour. A two-day seminar

entitled 'Materials Technologies for Defence: Success Stories and Road Ahead' was organised on 25- 26 October, in order to bring together all the stakeholders in the development of materials technologies for defence i.e. Services, Systems Laboratories of DRDO, Laboratories from Materials Cluster of DRDO, Defence PSUs, Ordnance factories, Industry and Academia. The seminar not only highlighted the success stories, both past and present, but also focussed on the challenges ahead to meet the materials requirements for next generation defence systems.

Engineers' Conclave 2013

Formulation of an aerospace policy, Government investments for selective infrastructure required for aerospace manufacturing, setting up an 'Aviation University' and enhanced budget for R&D in Government as well as in private industries, were amongst salient recommendations which emerged from the recent 'Engineers Conclave-2013' in New Delhi. There were panel discussions and brain storming to evolve solutions for myriad problems related to production and manufacturing in aerospace sector on one hand and those associated with the development of the Sunderbans region on the other hand.



Dr. R. Chidambaram and Mr. Avinash Chander

The conclave concluded with a valedictory function chaired by Dr. R Chidambaram, Principal Scientific Advisor to Govt. of India in the presence of Avinash Chander, Conclave Chair, SA to RM and Secy Dept. of Def R&D, GC Pati, Secy, Dept. of Defence Production, Dr. Baldev Raj, President, INAE besides scientists from DRDO, Dept. of Atomic Energy, Indian Space Research Organisation, Ministry of Earth Sciences, INAE fellows and leaders from the industry.

P. Srikumar is new Director of Aeronautical Development Establishment (ADE)



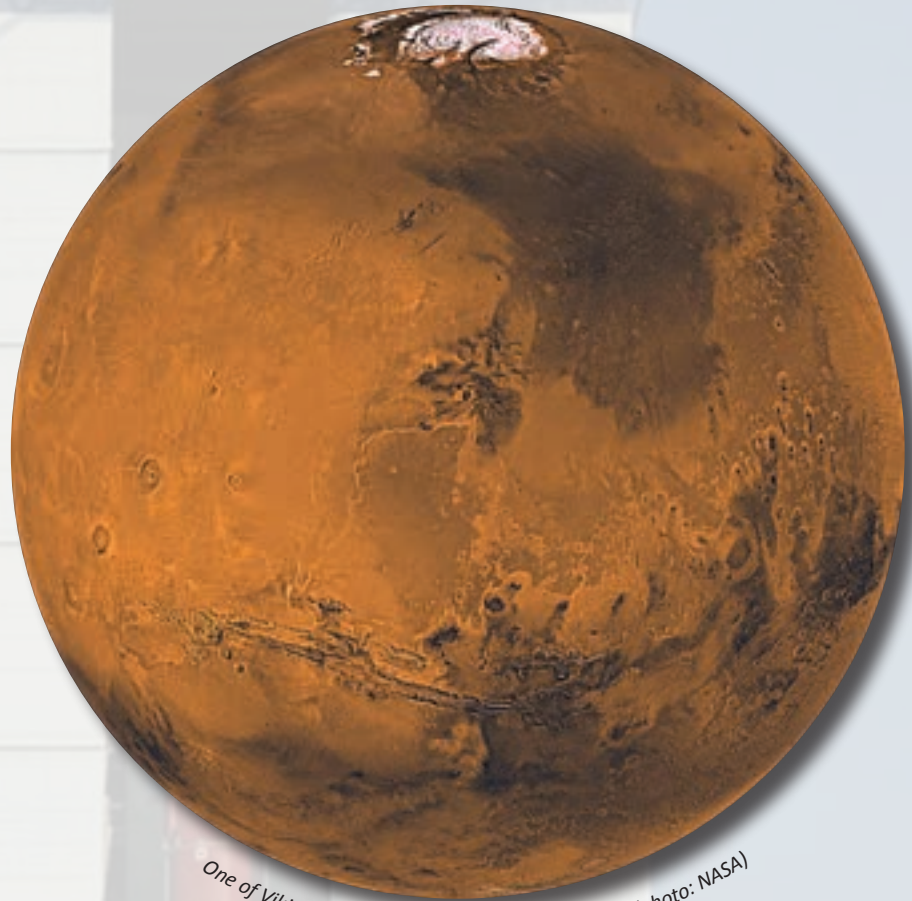
P Srikumar has been appointed as the new Director of Aeronautical Development Establishment (ADE) Bangalore, succeeding PS Krishnan. Srikumar is recipient of the DRDO Performance Excellence Award in 2004 for his contributions to the Flight Control, Guidance & Navigation System of the UAV 'Nishant'.

Mangalyaan to Mars

India's Mars Orbiter launched by PSLV C-25

India's first interplanetary mission, ISRO's Mars Orbiter named as Mangalyaan successfully lifted off towards Mars from the Satish Dhawan Space Centre on 5 November 2013 "to carry out experiments and search for evidence of life on the red planet."

"It is a historic moment for all of us. We have successfully put the Mars Orbiter Spacecraft into an elliptical orbit



One of Viking spacecraft's global mosaics of Mars. (photo: NASA)



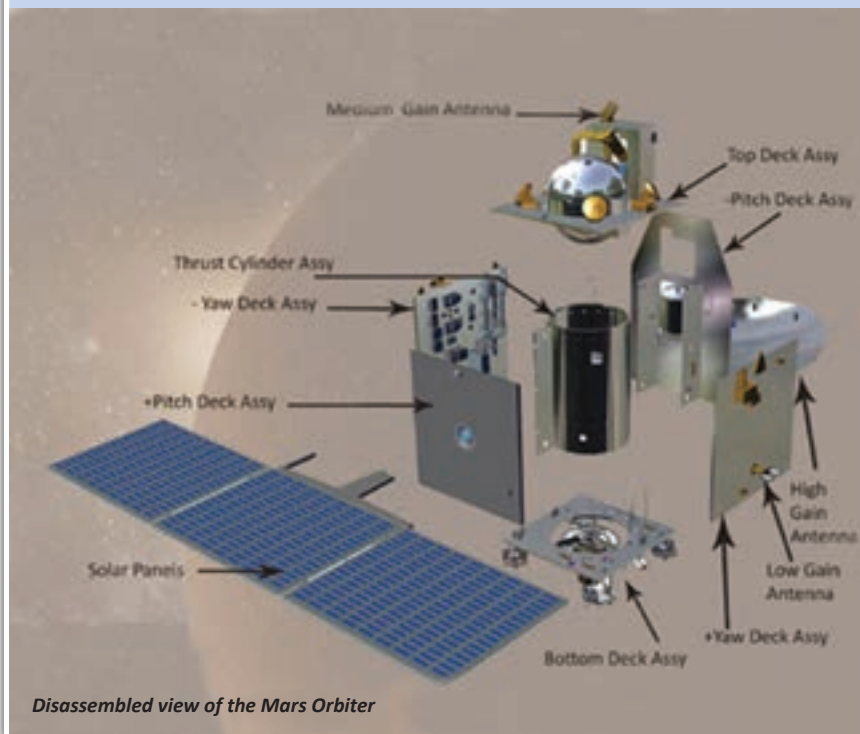
PSLV-C5 on launch

as had been intended," K Radhakrishnan, Chairperson of the Indian Space Research Organisation (ISRO), exulted from the control room. "I feel delighted to announce that the spacecraft is in a good health," he continued. SK Shivakumar, Director, ISRO Satellite Centre, summed up the Indian scientific community's pride at the flight of the Mars Orbiter Mission (MOM). "Our baby is up in space looking for scientific objects. We have a long way to go," he said amidst loud applause.

Only the US, Europe, and Russia have sent probes that have orbited or landed on Mars. Probes to Mars have a high failure rate and success will be a boost for national pride, especially after a similar mission by China failed to leave Earth's orbit in 2011. China has keenly followed Mangalyaan's successful launch, which will also aid

Mars Orbiter Spacecraft

The Mangalyaan carries five scientific payloads to observe the Martian surface, atmosphere and exosphere extending up to 80,000 km for a detailed understanding of that planet, especially the related geologic and the possible biogenic processes. These payloads consist of a camera, two spectrometers, a radiometer and a photometer. Together, they have a weight of about 15 kg. The spacecraft configuration is a balanced mix of design from the proven IRS/INSAT/Chandrayaan-1. Modifications required for Mars mission were in the areas of communication, power, propulsion systems (mainly related to liquid engine restart after nearly 10 months) and on-board autonomy.



Disassembled view of the Mars Orbiter

India's efforts to capture more of the \$304 billion global space market with its low-cost technology. Praise came too from the US scientific community. "We didn't believe they'd be able to launch this early," project scientist for the NASA Mars probe, Joe Grebowsky, admitted.

ISRO is now looking forward to two key dates : 1 December, when the MOM spacecraft leaves Earth's sphere of influence and 24 September 2014, when it is 'captured' by the Martian orbit.

Launch vehicle PSLV-C25 was the twenty fifth edition of the PSLV that launched the Mars Orbiter Mission Spacecraft. The challenging PSLV-C25 mission was optimised for the launch of Mars Orbiter Mission spacecraft into a highly elliptical Earth orbit with a perigee (nearest point to Earth) of 250 km and an apogee (farthest point to

Earth) of 23,500 km with an inclination of 19.2 ± 0.2 degree with respect to the equator. One of the main objectives of this first Indian mission to Mars is to gain the technologies required for design, planning, management and operations of an interplanetary mission.

The objectives of the mission include design and realisation of a Mars orbiter with capability to survive and perform Earth bound manoeuvres, cruise phase of 300 days, Mars orbit insertion / capture, and on-orbit phase around Mars. Also involved is deep space communication, navigation, mission planning and management; incorporation of autonomous features to handle contingency situations and exploration of Mars surface features, morphology, mineralogy and Martian atmosphere by indigenous scientific instruments.

Mission plan

The Launch Vehicle - (PSLV-C25) is to inject the Spacecraft into an Elliptical Parking Orbit with a perigee of 250 km and an apogee of 23,500 km. With six liquid engines firing, the spacecraft gradually manoeuvred into a hyperbolic trajectory with which it escapes from the Earth's Sphere of Influence (SOI) and arrives at Mars Sphere of Influence. When the spacecraft reaches nearest point of Mars (Peri-apsis), it will be manoeuvred in to an elliptical orbit around Mars by firing the liquid engine. The spacecraft then moves around Mars in an orbit with Peri-apsis of 366 km and Apo-apsis of about 80000 km.

HAL's contribution

Hindustan Aeronautics Limited contributed to the Mars Orbiter Mission spacecraft. "We delivered seven types of riveted structural assemblies and four types of welded propellant tankages for the Polar Satellite Launch Vehicle (PSLV-C25)", said Dr. R.K. Tyagi, Chairman HAL. The Company had also delivered bare satellite structure and deck panel to ISRO. The satellite structure is an assembly of composite and metallic honeycomb sandwich panels with a central composite cylinder. The honeycomb panels and the composite cylinder were supplied by HAL's Composite Manufacturing Division and the structural assembly work was carried out at HAL's Aerospace Division. The payload, propellant systems, solar panels and other items were integrated into the structure by ISRO.



The Mars Orbiter Mission Satellite Structure (Bare structure supplied by HAL)



Planets of a common Sun: Earth and Mars.

Three mission phases

Geo Centric Phase: The spacecraft is injected into an Elliptic Parking Orbit by the launcher. With six main engine burns, the spacecraft is gradually maneuvered into a departure hyperbolic trajectory with which it escapes from the Earth's Sphere of Influence (SOI) with Earth's orbital velocity + V boost. The SOI of Earth ends at 9,18,347 km from surface of the planet beyond which the perturbing force on the orbiter is mainly owed to the Sun. One primary concern is to get the spacecraft to Mars with the least of fuel. ISRO uses a method of travel called a Hohmann Transfer Orbit – or a Minimum Energy Transfer Orbit – to send a spacecraft from Earth to Mars with the least amount of fuel possible.

Helio Centric Phase: The spacecraft leaves Earth in a direction tangential to Earth's orbit and encounters Mars tangentially to its orbit. The flight path is roughly one half of an ellipse around the sun, and will eventually intersect the orbit of Mars at the exact moment when Mars is in place. This trajectory becomes possible with certain allowances when the relative position of Earth, Mars and Sun form an angle of approximately 44°. Such an arrangement recurs periodically at intervals of about 780 days. Minimum energy opportunities for Earth-Mars will occur in November 2013, January 2016, May 2018 etc.

Martian Phase: The spacecraft arrives at the Mars Sphere of Influence (around 573,473 km from the surface of Mars) in a hyperbolic trajectory. At the time the spacecraft reaches the closest approach to Mars (Periapsis), it is captured into planned orbit around Mars by imparting moves which is called the Mars Orbit Insertion (MOI) manoeuvre. ISRO has launched the Mars Orbiter Mission during the November 2013 window, utilising the minimum energy transfer opportunity.



PSLV-5 before launch



Air Marshal Brijesh Jayal (retired) chairing the first Session on 'Deciding the Optimum Force Mix'. Speakers were Air Marshal M Matheswaran, Deputy Chief of Integrated Defence Staff (Force Development, Perspective Planning) and Mr Manohar Thyagaraj, of ORF.

Affordable Air Power

Jointly organised by the Observer Research Foundation and The Society for Aerospace Studies (publishers of the *Vayu*) was a focussed conference in New Delhi on 'Affordable Air Power'. This was a most timely initiative considering the challenges posed by an economic slowdown in the country and dwindling combat aircraft fleet of the Indian Air Force.

On 30 October, 2013, the ORF office in New Delhi had key Air Force, Defence Research and Aeronautical Industrial delegates engage in focussed discussions on *Affordable Air Power*. The theme was the current shift in defence expenditures around the world, with defence budgets falling in Europe and North America, and rising in the Asia-Pacific region. From 2009 to 2013, the defence expenditure in India had been almost of the order of Rs 300 thousand crores. In this context, would India need new business models and alliances to cope with its future defence needs ?

The first session of the conference was on 'Deciding the Optimum Force Mix' and it was noted that the term 'air power' denotes more than just the air force's capabilities but also implies national capability as a whole, which includes R&D, industry and the civil aviation sector, which makes it a very capital intensive task indeed. The need for an integrated plan to coordinate all the three services' procurement needs to decide the optimum force mix was stressed upon.

It was also noted that the strategic environment is an increasingly technological one and ultimately, 'affordability' is directly embedded with a strategy of control over critical technologies. Therefore, any review needs to fundamentally address the national aerospace policy to develop an industrial ecosystem. Most importantly, there is the



At the Conference : Air Marshal Vinod Patney (retired) Director Centre for Air Power Studies with (to his right) Air Marshal S Sukumar, (Deputy Chief of Air Staff), Air Marshal S Deo (DG Air Ops), Air Vice Marshal B Suresh (ACAS–Air Defence) and Air Vice Marshal RKS Bhaduri (ACAS–Projects)

pressing need for accountability in projects and it is necessary close down unviable projects at the earliest.

However, some participants viewed that given that affordability and air power are both functions of different variables, picking an affordable aircraft mix is an 'inexact science'. As an example, the US Air Force have sought to replace the older A-10 close air-support aircraft which costs around \$13 million with the F-35 fifth generation aircraft which costs upwards of \$120 million. It is important to consider whether spending on a specific type of role match has place in the overall numbers of aircraft required. Similarly, can one define affordability by the cost of the platform itself, or the costs of its weapons and sensors? Is it more affordable to have aircraft that are role-specific or have multi-role capabilities? How is affordability related to life cycle costs in long term planning?

The second session of the conference was titled 'Rationalisation of Weapon Systems & Fleet'. The issue of quality improvement was focused upon and it was asserted that if quality is improved per se, this would lead to an increase in fleet availability. In contrast with civil aviation where airlines work towards 99 percent-plus fleet availability, air forces struggle to get upto 60 percent in their fleets. Thus, there is great potential for improving on this situation. Availability is also dependant on manufacturing and production processes. Some of the problematic areas currently in India includes the ability to absorb specific technology, absence of fundamental test facilities, lack of proper tooling and design facilities, product support and human resource development.

The most suitable manner for deploying available resources in order to get "the best value for money" was reviewed and it was felt that with the non-linear relationship between capability and cost and spiralling cost of equipment skyrocketing, there has also been a subsequent increase in capability. The inevitable high costs can be offset to a large extent by enhancing maintainability, reducing downtime, and reducing the periodicity of inspection and need for recalibration. Overall, the Indian experience of complete reliance on Government institutions for defence production has not been positive and the private sector must be increasingly involved with the government institutions focussing on strategic planning, laying the guidelines and monitoring.



Dr Manoj Joshi chaired the Seminar on 'Cost Effective Solutions & New Partnership Models' with speakers including Commodore Sujeet Samaddar of Shinmaywa, and Major Karun Khanna of Alpha Technologies. To his right is Mr Pushpinder Singh, who chaired the Session on 'Rationalising Weapons Systems & The Fleet'. Speakers in this Session were Dr K Tamilmani, Director-General, Aeronautic Systems from DRDO and Air Marshal Nirdosh Tyagi (retd) former Deputy Chief of Air Staff (IAF).

The last session was on 'Cost Effective Solutions & New Partnership Models'. The need for new business models was questioned. It was argued that the hitherto licence production approach has given the desired results and has not encouraged indigenisation. In the near future, there will be a huge demand for civil and military aircraft in the Asia-Pacific region, but Indian Industry is not geared to take advantage of this market which is still dominated by the large western industries. It was suggested that the Indian aerospace industry factor this opportunities and be allowed an increase in Foreign Direct Investment.

The partnership model followed in the USA, the so-called mentor-protégé system was reviewed. Large companies have a

host of protégé companies whom they guide through the process of eventually becoming tier 1 suppliers. To encourage this approach, high-technology centres of excellence should be nominated, whereby defence PSUs 'adopt' protégés to work in collaboration with them. Presently, there is no formal, government mandated policy with regards to this vital need and without such a policy, and a pragmatic one, India's aerospace industry will find it difficult to move resolutely into the future.

Criticism of the present state of Indian DPSUs was a recurrent theme. The problem is in the basics, a refinement of processes in conducting business and procurement would go a long way.

Arjun Chatterjee, ORF



Presentation by Dr K Tamilmani when delivering his talk

Indian Navy – Maritime Security through Self Reliance

VAYU Interview with

Vice Admiral Pradeep K Chatterjee, Deputy Chief of Naval Staff

VAYU: In an interview with *Vayu* in 2012, the CNS had stated that the first of six Project 75 (*Scorpene*-class) submarines would be delivered in 2015. Has this deadline changed, given the record of delays that have plagued this programme? Also, at a press conference in December 2012, the CNS had stated that the RFPs for the follow-on Project 75-I were to be issued “soon”, yet a year has passed with no movement on that programme. Your comments, please!

DCNS: There has been a delay in the Project 75 due to non-availability of a few items of ‘import nature’ required for submarine construction, which has resulted in revision of delivery schedule of submarines. This equipment would now be available as per the contracted schedule. Hence the first submarine (of Project 75) is likely to be delivered by the later part of 2016.

Coming to the other submarine project, P-75(I), this is a high value case with multiple complexities. The level of scrutiny in such situations is higher and therefore time consuming. Necessary approval from CCS is being processed by the MoD and the RFP is expected to be issued within a reasonably short time post accord of CCS sanction.

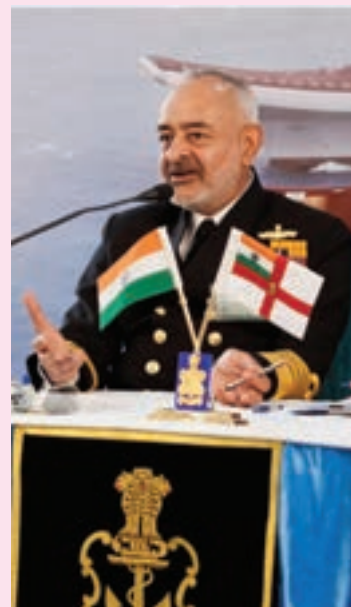


*Kilo-class submarine during President's Review of the Fleet
(photo : Major S.D. Rokade, MoD)*



“Indian Navy in Fine Fettle” : Chief of Naval Staff

Addressing the nation through the media on the eve of the Indian Navy Day, Admiral DK Joshi, Chief of the Naval Staff, said that given the Indian Navy's vast maritime domain, far-flung island territories, national interests, and the extremely dynamic geo-strategic environment, recent commissioning of the INS *Vikramaditya* has further bolstered the Navy's carrier-centric ‘blue-water’ capability. Her complement of MiG-29K fighters are undertaking intensive training at Goa and will commence deck flying, thus integrating the *Vikramaditya* into our operational architecture. INS *Vikramaditya* bridges the time gap between Indian Navy's existing capability and our indigenous aircraft carrier project. INS *Vikrant*, launched recently, is expected to be commissioned around 2017. Recent induction of Boeing P-8Is has ushered in a new era for Navy's air surveillance and standoff attack capabilities, and with recent introduction of Hawk AJTs, naval aviation is undergoing a qualitative transformation.



IAI

VAYU : With several long-awaited capital ship inductions such as the INS *Vikramaditya*, INS *Vikrant* (IAC-1) and INS *Arihant* now imminent, the Indian Navy appears on the cusp of becoming a true 'blue-water' force. Additionally, in a recent speech the CNS had mentioned that changing geopolitics on a regional as well as global scale make maritime power "vital" in securing national interests. How have the tactical and strategic doctrines of the Navy evolved to reflect this transformation?

DCNS : Maritime power is the ability of a nation to use the seas to safeguard and progress its national interests. As such, it is one of the pillars of national security and is a key enabler in the formulation and implementation of viable national and military strategies.

The Navy is the prime instrument and manifestation of the maritime power of a nation-state. The *raison d'être* of a Navy is to safeguard the nation's use of seas for its legitimate sovereign purposes, whilst concurrently guarding against inimical use of the sea by others. Strategic maritime doctrine therefore focuses on that dimension of maritime power, which enables use of the seas by all stakeholders.

With the above issues in mind, the Indian Navy is developing a capable and balanced force that would counter emerging maritime challenges across the entire operational spectrum, from low intensity operations to armed conflict with nuclear overtones. Keeping pace with the new acquisitions and capabilities as brought out by you, we are continuously revisiting our strategic and tactical doctrines to redefine and refine the Navy's operating, planning, organisational and training philosophies. There has also been a conscious effort to move forward from the commonalities of maritime thought applicable to most sea faring nations, to address specific maritime concepts and developments applicable to India and the Indian Navy.

VAYU : The Indian Navy's 'reach' has been dramatically extended over the past few years and is poised for another leap once INS *Vikramaditya* begins to operate with MiG-29Ks on board. Considering that there are more aircraft carriers on order, is the Indian Navy planning to acquire its own mid-air refueling assets for extending air operations at sea?



MiG-29K of INAS 303 off Goa

DCNS: IN fighter aircraft are currently being worked up regularly with the IAF for air-to-air refueling and would be operationalised with buddy refueling pods for carrier operations. Therefore, currently there is no requirement of a dedicated shore-based FRA exclusively for the IN.

VAYU : It has been widely reported that INS *Vikramaditya* will be delivered without a close-in weapon system (CIWS) for protection against airborne threats including anti-ship missiles. Could you kindly comment on the reason for this, as well as how this could affect operational deployment of the vessel?

DCNS: It is to be understood that the integral air element of the carrier is by itself a good deterrent for any airborne threat including the launch platform. Having said that, I must add that the fitment of weapon systems i.e. Anti-Missile Defence (AMD) including a Close-in-Weapon System (CIWS) is planned on arrival of the ship in India.

VAYU: The construction of INS *Vikrant* was delayed owing to a number of issues – not least of which included belated indigenous production of warship-grade steel and problems with the main gearboxes. Now with the LR-SAM air defence system also reportedly delayed, are we facing further slippages in the schedule to operationalise the vessel?

DCNS: The sheer size and complexity of building aircraft carriers inhibited many nations in scaling their ability to do so and therefore has been the preserve of an elitist few. Therefore, evolution of such first time development was bound to pose its unique set of challenges. Whether it was evolution of indigenous steel or unique equipment, these challenges have been addressed and give us the requisite optimism and confidence for the next critical phase

Indigenisation

The theme for this year's Navy Week, 'Indian Navy – Maritime Security Through Self Reliance', the CNS said "encapsulates our commitment to indigenisation in quest for strategic autonomy for the nation. We are proud of the fact that all 45 ships and submarines, which are currently on order for Indian Navy, are being constructed in India in both public as well as private shipyards".

Enumerating on achievements of the Indian Navy, the Chief of Naval Staff referred to launch of the INS *Vikrant*, attainment of criticality of INS *Arihant*'s nuclear reactor and its impending sea trials, induction of *Shivalik*-class stealth frigates, and the ongoing trials of INS *Kolkata*, lead ship of Project 15A stealth destroyers. These progressive steps have demonstrated the strength of our R&D, Naval Design and Industry. The synergy between Navy, DRDO and Industry has enhanced the pace, quantum and quality of indigenisation. Considering that globally very few select countries construct their own ships, aircraft carriers and submarines, including nuclear ones, and this achievement is a matter of national pride. The launch of GSAT-7 in collaboration with ISRO, a dedicated satellite for Navy under project *Rukmani*, is a landmark achievement in enhancement of our blue-water networked operations. The Indian Navy is also supporting ISRO in the Mars Mission through Naval Teams embarked on SCI ships currently in the South Pacific.

Boeing 2

of outfitting to be followed by trials. Specifically with regard to LR-SAM air defence system for the carrier, a system has been identified and the procurement process of the same are on schedule. It is expected that the ship would commence trials in 2016 and be commissioned by 2018.

VAYU: As pointed out in a recent CAG report, operational availability of IN submarines is as low as 40% owing to the ageing fleet and prolonged refit and life-extension programmes. What measures are afoot to improve operational availability of the submarines? Also causing concern are the rudimentary rescue facilities currently at the Navy's disposal. What are the plans to acquire deep submergence rescue vessels (DSRVs)?

DCNS: (a) I would not like to comment on the CAG report. However, concerted efforts have always been made at every level to expedite procurement of spares and modernise equipment to keep our submarines role worthy. It is always a challenging to support the legacy equipment fitted on older submarines. The Indian Navy is also firmly committed to indigenisation and therefore difficulties are being surmounted by replacing foreign equipment with equivalent indigenously developed products.

(b) Regarding DSRV procurement, the Navy is steering a case for acquisition of two DSRVs with associated rescue kit. The DSRVs are envisaged to be based 'one each' on the West and East coast of India. They will be transportable by road/rail/air to enable quick deployment and do not require a dedicated 'mother ship.' Instead, the DSRV can be rigged on a suitable vessel of opportunity such as large OSVs, MSVs etc to widen the possibility of choice of mother ship. It is anticipated that the contract would be concluded by 2014 with delivery in 2016-17.

VAYU: Piracy in the Indian Ocean Region (IOR) is a continuing problem. Is the Indian Navy revisiting this issue, especially in terms of future engagement with foreign navies? In this context, please outline your view on the efficacy of bilateral or multinational exercises with foreign navies.

DCNS: The Indian Navy has been at the forefront in anti-piracy efforts and

has taken robust measures to combat this scourge. We have been coordinating with international efforts, as a result of which piracy has declined over the last year. The IN commenced anti-piracy patrols in the Gulf of Aden (GoA) in Oct 2008 and to date, a total of 40 Indian Navy ships have been deployed to escort merchant ships along the Internationally Recognised Transit Corridor (IRTC). We have provided escorts to over 2,660 vessels and more than 19,500 Indian seafarers till date. Our escort operations have been effective and no merchant ship under our escort has been attacked. On separate occasions, while on patrol, the Indian Navy has intervened and foiled 40 piracy attempts, neutralised four pirate mother ships, apprehended 120 pirates, and rescued 74 foreign fishermen from pirate vessels.

India is an active member of Contact Group on Piracy off Coast of Somalia (CGPCS), the forum dealing with piracy issues emanating from Somalia. This grouping makes recommendations to IMO on the matter. The IN also regularly participates in the SHADE (Shared Awareness and De-confliction) meetings to improve coordination between various Navies deployed in the GoA for anti-piracy.

India, China, Japan and Republic of Korea deploy ships independently in the GoA. In order to avoid duplication of efforts and prevent mutual interference in anti-piracy operations, coordination of the convoys for anti-piracy escort operations is undertaken and the arrangements have proved successful.

In regard to our exercises with foreign navies, these are not specifically aimed at anti-piracy. The exercises are part of building maritime relations and improving interoperability with friendly navies. They assist in case of a need to coordinate naval actions in various scenarios, including anti-piracy operations. The exercises, like any other deployment, help in 'showing presence' and carrying out surveillance for building Maritime Domain Awareness, apart from improving inter-operability.

VAYU: There has been increasing reference to long-range search and rescue amphibian aircraft to be operated by the Indian Navy and this also came up during the PM's recent

visit to Japan. Is the Navy considering this as part of its near future force structure?

DCNS: The perspective plans of the Indian Navy include procurement of amphibious aircraft. The IN is currently drawing up the 'Qualitative Requirements' for an amphibious aircraft based on the capability required by the IN. The envisaged roles of the aircraft include rapid maritime interdiction by embarking special forces, operational logistics support to in ships and units at sea, long range search and rescue (LR-SAR), casualty evacuation (CASEVAC), support of anti-piracy operations, humanitarian aid & disaster relief (HADR) and also for maritime patrol. The aircraft are planned for induction into the Indian Navy in the 12th Plan (2012-17) and 13th Plan (2017-22) periods.

VAYU: There has been little information over the past year on the Naval LCA programme. There is still only one prototype of the N-LCA and the Shore-Based Test Facility (SBTF) in Goa remains incomplete. Could you kindly update us on both programmes as they stand today?

DCNS: The first LCA (Navy) prototype NP-1 undertook its maiden

Coastal Security

Coastal security remains a key focus area. With regular exercises and setting up of Joint Operations Centres, coordination between various agencies has improved considerably. Situational awareness has also improved with phased implementation of National AIS Network and Coastal Radar Chains. The Indian Navy is constantly upgrading the military infrastructure and facilities in our island territories to improve surveillance and operations. While downstream activities are being progressed, the Navy is concurrently working towards further augmentation of assets and infrastructure under Coastal Security Phase II. A Coastal Security Bill to further improve multiple agency and Centre-State interface has also been drafted.

Atlas Elektronik



Shivalik-class stealth frigate INS Satpura

flight on 27 April 2012. A large number of modifications were affected to improve the performance during the first phase of the flights, which attributed to some delays. Currently, preparations are in progress for the second phase of trials.

Construction and equipment installation work on SBTf is likely to be completed within a few months. This would include necessary tests and certification of the facility.

VAYU : Commencement of design-cum-construction programme for seven Project 17A stealth frigates, as follow on to the successful *Shivalik*-class, was approved by the Cabinet Committee on Security (CCS) in September 2012, yet the first of these vessels is yet to be laid down. Please elaborate on the intended in-service date for the first of these ships.

DCNS: P-17A ships will be 'multi-mission' frigates, capable of operating in a blue-water multi-threat environment. These ships would be a derivative of

Project 17 class (*Shivalik*) stealth frigates and built using 'integrated construction' techniques with extensive pre-outfitting at the block stage. This is expected to result in reduced build periods and enhanced quality of workmanship. With enhanced stealth features, these ships would also be fitted with more advanced weapons & sensors suite.

Four ships of Project 17A class are to be constructed at Mazagon Dock Limited (MDL) in Mumbai and three ships at Garden Reach Shipbuilders & Engineers (GRSE) in Kolkata. The functional design of the vessel is at an advanced stage of completion. The shipbuilding contract with the shipyards would be concluded after completion of requisite government approvals. The construction of the vessels is expected to commence by late 2015 or early 2016 and the first ship is likely to be delivered in 2021, with the remainder coming in around 2024-2025.

VAYU : The Indian Navy has recently received its first Hawk advanced jet

trainer, which will provide a major boost to flight training. Could you elaborate on the Navy's future plans for flying training, including continued reliance on the IAF for basic flying training, at a time when that service has yet to receive its full complement of such aircraft?

DCNS: The ongoing induction of the Hawk Advanced Jet Trainer (AJT) aircraft would essentially cater for naval orientation training of fighter stream pilots. It is planned to commence training in-house by 2014. Towards this, a Hawk AJT Intensive Flying Training Unit (IFTU) has been set-up to formulate SOPs and training curriculum. As regards the basic flying training, the Navy would continue to utilise the available vacancies with the IAF. However, to meet additional requirement of Pilots for new induction aircraft, few officers are undergoing training at Indira Gandhi Rashtriya Udan Academy (IGRUA), Rae Bareilly. A long-term training agreement with the institution could be an option, based on the assessment of the quality of training imparted to the first batch. It may also be noted that MoD has approved fighter training of 24 pilots with US Navy in the next three years after a review of constraints in training infrastructure at IAF Flying Training Establishments (FTEs). As a long-term measure, the IN is also examining the feasibility to develop an integral flying training infrastructure for ab-initio trainees.

VAYU : The Navy has been interested in acquiring additional amphibious capability, namely four LPDs (Landing Platform Dock), since the entry into service of INS *Jalashwa* in 2007. RFIs for the same were issued in 2011. Where does this acquisition programme stand today?

DCNS: The Landing Platform Dock (LPD) project is a first ship acquisition case which is being steered under the Buy and Make (Indian) category. This project will be another major leap towards in the indigenous shipbuilding wherein these ships will be built by the Indian shipyards. The Request for Proposal (RFP) has been issued recently and as per the envisaged induction plan, LPDs are likely to be inducted into service by 2022.

DCNS

'The Carrier that came

INS Vikramaditya : end of an epic and beginning of a new chapter

On 16 November 2013, the 9-year wait for India's largest warship finally came to an end. Vayu Aerospace & Defence Review was the only trade journal represented at Severodvinsk when the Indian Naval Ensign was hoisted on the stern of INS Vikramaditya, and is therefore able to bring this exclusive, comprehensive report on commissioning of the Indian Navy's new aircraft carrier.

Entering the White Sea town of Severodvinsk is like taking a journey back in time. Consisting almost entirely of typical Soviet-era slab-sided concrete buildings that exude a sense of brutal utilitarianism, little has changed here in the decades following the dissolution of the Soviet Union. The November snow only adds to the dramatic aura of the place, making the town seem like the setting of a Cold War era spy movie.

Against this backdrop, quietly moored amidst Russian nuclear submarines and mammoth battlecruisers, we had our first glimpse of the completed INS *Vikramaditya*, abuzz with activity as sailors and civilians alike prepared for the culmination of a 9-year saga that will catapult the Indian Navy into the 'big league' of heavyweight naval aviation.

The History

Vikramaditya has had a chequered past : originally commissioned as *Baku* for the Soviet Navy, she was the last of the *Kiev* class of "heavy aircraft-carrying cruisers" designed by the Nevskoye Design Bureau and built at Nikolayev South Shipyard in what is now Ukraine. *Baku* was equipped with twelve P-500 *Bazalt* cruise missiles in addition to an air wing of 12 Yak-38 'Forger' V/STOL combat aircraft and 12-16 helicopters (Kamov

Vikramaditya sailing the frigid waters of the White Sea (photo: Sevmash)

in from the Cold'



INS Vikramaditya's pennant number – R33 – along with the ship's crest and crests of the Naval Air Squadrons that will operate from the carrier (photo: Angad Singh)

Ka-25/27). The angled flight deck extended around two-thirds the length of the ship, and was designed exclusively for VTOL operations, being devoid of a ski-jump or catapults. She was different in many aspects from the preceding *Kiev*-class vessels; being used to trial some of the technologies that would be used on the larger *Kuznetsov*-class aircraft carrier.

After the dissolution of the USSR, *Baku* was renamed as *Admiral Flota Sovetskogo Soyuza Gorshkov* in 1991, and continued to serve in the Northern Fleet. A boiler room explosion in 1994 necessitated a year of repairs, and she returned to service in 1995. The following year, *Gorshkov* was decommissioned and offered for sale. India was immediately interested in the purchase but negotiations were drawn out and an agreement to buy the ship was only reached in January 2004. Under the terms of this initial agreement, the ship would be “free,” but the overhaul, upgrade and modifications would cost around \$800 million, with an additional \$1 billion to be spent on the aircraft and weapons systems. The aircraft carrier was to be named *INS Vikramaditya* in Indian Navy service.

The entirety of the overhaul and modernisation of *Admiral Gorshkov* was undertaken at the Sevmash shipyard in Severodvinsk as *Project 11430*.

This included the removal of the P-500 cruise missile launchers and the four 3K95 *Kinzhal* surface-to-air missile launchers fitted on the bow, to make room for a 14.3° bow ski-jump. Two aircraft restraining stands are also fitted, allowing combat aircraft to reach full power before making a ski jump-assisted takeoff.

A historic aircraft aboard INS *Vikramaditya* – the original MiG-29K prototype



The MiG-29K project was initiated in the late 1970s as *Product 9.31* when the Soviet Navy developed a requirement for a supersonic carrier-based fighter. To meet this requirement, the Mikoyan design bureau designed a navalised version of the land-based MiG-29B, fitted with a stronger undercarriage and a reinforced tail section with an arrestor hook, along with a new folding wing of larger surface area. The first prototype of *Product 9.31*, numbered '311 Blue' first flew in 1988, and was subject to extensive trials on shore and then off the carrier *Tbilisi* (now *Kuznetsov*).

311 Blue is unique, as it retains the old-style bubble canopy of the MiG-29B and looks largely similar to the land-based variant. By contrast, the current production MiG-29K/KUB (*Product 9.41*) is based on the later MiG-29M, with a new wing and almost completely redesigned fuselage and canopy.

311 Blue was last seen active in 2004, following which it was not seen in public for years. However, in 2010, the aircraft was stripped of engines and avionics and delivered aboard INS *Vikramaditya* as a “dummy” MiG-29K to test certain equipment and train the crew in aircraft handling.

On 16 November, this historic airframe stood proud within the hangar of the ship it helped commission, which will operate the aircraft it helped develop.

The 20-ton capacity aircraft elevator beside the ship's island superstructure remains mostly unchanged, but the aft lift has been enlarged and its capacity increased to 30 tons. Three 30 m wide arresting cables are fitted on the aft part of the angled deck and navigation and carrier-landing aids have been refitted to support fixed-wing STOBAR (Short Take-Off But Arrested Recovery) operations. Crucially, the old flight control centre has been converted to a visitors' gallery and replaced with an all-new, elevated and expanded control centre offering a better view of the flight deck and all aircraft operations.

The eight boilers have been converted to take low-sulphur high-speed diesel fuel instead of heavy furnace fuel oil, and modern oil-water separators as well as a sewage treatment plant are incorporated to meet international standards. She is also fitted with six new Italian-made Wärtsilä 1.5 MW diesel generators, an all-new combat management system, Global Marine communications system, Sperry Bridgmaster navigation radar, a new telephone exchange, new data link and an IFF Mk XI system. 'Hotel services' are vastly improved, incorporating new reverse osmosis water-producing plants capable of supplying up to 400

tonnes of fresh water per day. York International has provided refrigeration and air conditioning, and a new galley is being installed together with improved domestic services and, interestingly, accommodation for 10 female officers.

For Sevmash, it was important to maintain the hull strength, particularly because of the large number of openings in hull (over 500). Old equipment had to be removed from the ship in drydock, after which the shipyard conducted what was effectively a 'rebuilding' of the ship. This process was incredibly extensive, requiring the replacement of over 4,000 tonnes of metal ! Whilst a lot of the fresh steel – over 900 tonnes of it – was used toward the construction of the ski-jump, no effort was spared in refurbishment of the structure either : 1,750 of 2,500 compartments were completely rebuilt, and 234 new hull sections fabricated, resulting in a ship that is virtually 'new' today.

In the years following the initial agreement, construction delays and cost escalations strained the deal and threatened derailment. Issues were raised by both sides – Sevmash and Rosoboronexport had grossly underestimated the scope of work required to bring *Gorshkov* up to modern standards, most (in)famously realising well into the refit that nearly all the cabling in the ship – totalling a mammoth 2300 km – needed replacement. Additionally, over 300km of new piping was installed, along with all-new electronics, fans pumps and similar equipment.

However, Sevmash Chief Delivery Commissioner, Igor Leonov, noted prior to the delivery that the Indian side had also added to complications by changing a number of specifications and requesting a number of things that had not initially been contracted for. But Leonov also admitted that the increased scale of modernisation had its benefits, and that the Indian Navy, which had maintained its engineers and technicians on the vessel throughout the refit process, “took the right decision to change many aggregates, components and entire cabling, instead of opting for repairs. Almost everything on the *Vikramaditya* is new.”

A stalemate was reached in 2008, with Russia stating that owing to the severely deteriorated condition of the ship, final delivery cost would be in the region of \$3

On the sidelines with the Defence Minister



Vayu had an interesting, if brief, interaction with Defence Minister AK Antony on the sidelines of the commissioning of INS *Vikramaditya*. Antony, not in the best of health, having recently undergone two surgeries, was exuberant following the ceremony and displayed an unusual, albeit welcome candour as he talked about the past and future of Indo-Russian military ties.

With a wry smile, he remarked “now that the ship is ours, I can confide in you – the whole programme very nearly failed !”

He did not specify exactly when, but said that there was a period during the programme when he honestly felt that the incredible amount of issues facing both sides would stymie the entire deal. However, he noted appreciatively that all involved parties, from the Russian and Indian navies to the design bureau, shipyard and diplomats, eventually came together, found solutions and pushed through to success.

After a detailed tour of the ship, he stressed that he was very impressed with the work done by Sevmash and extended his congratulations and thanks to the yard as well as the Russian Navy “for a job well done.”

With the 13th meeting of the India-Russia Inter-Governmental Commission on Military Technical Cooperation (IRIGC-MTC) planned for 18 November in Moscow, two days after the commissioning of INS *Vikramaditya*, Antony shared some views on the future of Indo-Russian military activities. Although *Project 11430* is doubtless an important programme in the long history of cooperation between the two nations, he was keen to point out that the vessel is only one of the many key systems that Russia has supplied to India. Russia, he noted, has helped India substantially strengthen its defence capabilities, and he hoped this time-tested relation would only strengthen in the years to come.

On being asked about plans to lease a second nuclear-powered attack submarine,

Antony declined to mention specific details, but did admit that the matter was likely to come up at the MTC meeting. The possibility for a second leased nuclear submarine has been mooted multiple times since INS *Chakra*, a Project 971 (NATO: *Akula-II*) submarine was received on a ten-year lease at a cost of nearly \$1 billion in April 2012. However, recent information suggests that it is unlikely that India would opt for another leased submarine unless the commercial terms were “very favourable.” With INS *Chakra* already fulfilling her role of developing naval nuclear-powered subsurface doctrines and training of crews in nuclear submarine operation, and additional *Arihant*-class vessels already under construction, the MoD does not believe another lease offers good value for money if executed under similar terms to the first. That may change, however, if Russia can offer much more competitive commercial terms.

AS

billion. Following months of high-level talks, in March 2009, the final delivery price was agreed upon at \$2.3 billion, still nearly three times higher than the original contract. Since then, work continued apace, and the aircraft carrier looked on track for a late-2012 delivery date.

In June 2010, a MiG-29K prototype was tested for use aboard the *Vikramaditya*, this type being the primary fixed wing fighter to be operated off the carrier by the Indian Navy. The first of these aircraft had already been delivered to India in 2009, with a total of 45 to be operated by the Navy in the coming years. Meanwhile, the Navy's MiG-29K/KUB fleet is fully operational and is based at INS Hansa,

Goa under INAS 303 'Black Panthers' (see *Vayu* IV/2013).

Project 11430 dock trials began in March 2011. The focus of these trials was on the main power generation units and the radio-electronic armament systems, manufactured in India. Additionally, Indian Navy personnel began training on INS *Vikramaditya* in April 2011. A year later, in April 2012, it was announced that all internal systems were functioning, and the ship was entirely self-contained. Measurement of the ship's magnetic field and centre of gravity were performed before sea trials were undertaken.

INS *Vikramaditya* sailed for the first time under own power on 10 June 2012,

after almost 17 years spent inactive. The ship departed for the crucial pre-delivery trials from Severodvinsk in June itself, with projected handover on 4 December, 2012, celebrated as 'Navy Day' in India.

However, it was during this final set of trials lasting 120 days that the programme was struck its most recent and widely-publicised blow. During full-power testing in September 2012, seven of the ship's eight boilers failed and had to be shut down. The Russian contractors insinuated that the failure was a result of India's insistence to replace the engines' asbestos insulation. Asbestos is a known carcinogen, and India had sought to replace the material based on health and safety concerns.

Boiler insulation is composed of two fire-resistant layers – an inner layer of asbestos clad with a second layer of firebricks. As per Indian requirements, the carcinogenic asbestos layer was replaced with another material, unproven as an insulator. During trials, it was this inner layer that failed first, causing the outer layer to collapse as well.

During post-trials discussions between the India and Russia, the asbestos issue was examined in great detail. The Russians highlighted the fact that since asbestos comprises the inner layer of insulation and is therefore not subject to environmental degradation, it is not a health hazard. The Indian side found this position acceptable and the asbestos was installed anew. Andrey Dyachkov, Director General of JSC Northern Shipbuilding Centre, parent organisation of Sevmash, placed on record his appreciation for the "understanding and acceptance" shown by India during the negotiations on this issue.

However, despite the boiler issue gaining the most publicity, most of the other systems that were to be tested during the sea trials, including the crucial aviation-related elements such as the ski jump, arrestor wires and aircraft guidance systems, performed flawlessly. Regardless, the boiler issues in 2012, pushed the delivery date of *Vikramaditya* back by a year, and the ship returned to Severodvinsk to undergo further work.

The Final Stretch

In July 2013, following the boiler repairs and other work conducted over the 9-odd months since the decision to defer delivery, INS *Vikramaditya* headed into

Spy games in the White Sea

Despite the Cold War being a tale of the past, in 2012, during INS *Vikramaditya*'s sea trials in the White Sea, this vessel was spied upon by a pair of NATO surveillance assets: a Norwegian P-3C Orion maritime surveillance aircraft and the Norwegian electronic intelligence (ELINT) ship F/S *Marjata*.

The P-3C circled low over *Vikramaditya* in an attempt to harvest classified electronic data from the vessel and also dropped two sensor buoys into *Vikramaditya*'s path in order to record acoustic signatures. Presence of the surveillance aircraft created so much consternation aboard the carrier that a Russian Navy MiG-29K had to be vectored in from a shore base to chase away the Norwegian aircraft.

Shortly after the P-3C was seen off, the F/S *Marjata* 'intercepted' *Vikramaditya* in a further attempt to gather electronic data. The vessel, operated by the Norwegian Intelligence Service, is considered to be one of the most advanced ships of her kind in the world, with specialised equipment on board that allows it to record acoustics as well as electromagnetic emissions of submarines as well as surface vessels.

However, it was reported that by the time *Marjata* intercepted *Vikramaditya*, her electronic equipment had been shut down and the ship had gone 'silent' in order to avoid compromising classified data.

There are few details of how much data, if any, may have been compromised by the NATO intrusion but the incidents were taken up diplomatically by both Russia and India. The Russian government sent photographic evidence of the intrusion to the US Embassy in Moscow and NATO headquarters, but has received no reply yet.



File photo of Norwegian Air Force P-3C Orion



Comde Suraj Berry, then CO-designate, on the bridge of INS Vikramaditya during sea trials (photo: Sevmash)

the White Sea where speed and manoeuvring trials were conducted, along with testing of the electronic warfare (EW) systems. All systems were put under full load and during this phase of trials, the carrier achieved a top speed of 29.2 knots. The ship operated well throughout, and the (Russian) delivery crew expressed their satisfaction with performance of the vessel. The boilers were of particular concern but the propulsion plant worked flawlessly.

After the White Sea trials in July, the ship proceeded to the Barents Sea, and on 5 August 2013 commenced the second stage of trials. This stage also involved flight operations of MiG-29K/KUB from the ship, including night flying trials. Rear Adm Hari Kumar headed the delivery team aboard the ship at this time, and Vice Admiral Shekhar Sinha, FoC-in-C WNC, was on board during the flight-testing and even flew in the rear seat of a MiG-29KUB. Over 2,500 people were on board



A Russian Navy MiG-29K conducts a low pass over the flight deck during trials (photo: Sevmash)



A Kamov Ka-27 hovers over the flight deck during trials (photo: Sevmash)

Vikramaditya during the Barents Sea trials, including specialists from all subcontractors involved in the project, and some 1000 Indian Navy personnel.

The carrier controlled 778 flights during trials. There were 88 landings, all piloted by Russians. The carrier's EW capability was demonstrated when the Sukhoi Su-33s, Ka-31s, MiG-29s and A-50 AEW aircraft all failed to paint it on their radars. The carrier's radar, however, had no difficulty tracking incoming aircraft from a distance of 350-400 km. All personnel aboard the vessel were reportedly very impressed by the performance of the vessel during EW trials.

Out of the 8,600 miles covered during the 2013 trials, 1,700 miles were sailed under command of Commodore Suraj Berry, CO-designate of the vessel, while Commander (Air) is Captain Janak Bevli, who had earlier commanded INAS 300 'White Tigers' with Sea Harriers.



Test pilots prepare Russian Navy MiG-29Ks for flight trials as a Ka-27 SAR helicopter hovers overhead (photo: Sevmash)



Dramatic shot of a Ka-27 SAR helicopter taking off from INS Vikramaditya during trials (photo: Sevmash)



Twilight operations of MiG-29K during trials (photo: Sevmash)



Andrey Dyachkov, DG Northern Shipbuilding Centre, reported that the Indian crew was very impressive, learned a lot in a short time and displayed great professional competence. He noted that the Russian and Indian crews became “like family during the time spent at sea.” There were more than 80 interpreters on the ship during trials, in order to facilitate communication, but by the end they were barely needed! However, Indian



MiG-29KUB taking off with air-to-air missiles (photo: Sevmash)

reports differ somewhat, with certain Navy officers noting the Russians' autonomy in conducting of the trials and the comparatively short amount of time the ship spent being crewed and commanded by Indian personnel.

After the Barents Sea trials, INS *Vikramaditya* returned to the White Sea for a second round of speed and manoeuvring trials, recording a 29.5 knot maximum forward speed during this test,

and a full reverse speed of 15.9 knots. There was no question by this time that after refit and modernisation, the ship had maintained high performance characteristics and met Indian Navy requirements. Particularly, the trials validated the performance of the steam turbines after the disaster of the previous year: the eight boilers produce 100 TPH at a very high pressure of 64 bar, generating a total turbine output power of 180,000 shp, driving four enormous propellers.

On 20 September 2013, the trials were declared successfully completed and *Vikramaditya* was once again docked at Severodvinsk.



The Commissioning

16 November began as it always does in Severodvinsk – with darkness and snow. First light was not expected until 10:30am, and we arrived at the Sevmash dock in twilight conditions accompanied by ferociously icy winds and a light snowfall.

Indian and Russian sailors stood in ranks in front of the jetty, impressively composed given the atrocious conditions, symbolising perhaps the time-tested defence relationship between the two countries. They gave a rousing welcome to arriving dignitaries from both India and Russia even as the rest of the attendees huddled together against the weather.

As the unrelenting snowfall intensified, we moved up to the aft flight deck for the ceremony proper.

Indian Defence Minister AK Antony stated that “the carrier would add a whole new dimension to the operational capabilities of the Navy and that





Lt Cdr HS Mehta leads the colour guard on the flight deck (photo: Angad Singh)

the ceremony realised the vision of the Navy's capability-based transformation conceived over a decade ago, and heralded the beginning of a new era for Indian maritime power." He noted appreciatively the Russian contribution to the Indian Navy, and stated that Indo-Russian defence relations remained a matter of highest priority for mutual benefits and as a factor of global peace and stability.

"India's economic development is dependent on the seas, and safeguarding the nation's maritime interests is central to our national policy. Aircraft carriers have been part of the Indian Navy's force structure since our independence and have effectively served the country over the past five decades or so," he recalled.

Admiral DK Joshi, Chief of Naval Staff, said that the induction would catalyse Indo-Russian strategic partnership to greater heights. On the need for a three-carrier Navy, he said that given India's vast seascape, far-flung islands, regional geopolitics and the dynamic maritime security environment, aircraft carriers were necessary to implement India's strategic interests in the region. The transformation of a Heavy Aircraft Carrier Cruiser into a modern short-take off but arrested recovery (STOBAR) air defence platform was challenging for both nations, he said.

INS Vikramaditya – some vital statistics

Displacement: 45,400 tonnes
Length: 284 m
Beam: 60 m
Draught: 10 m
Propulsion: 8 boilers, 4 steam turbines
Power: 180,000 shp driving four propellers
Speed: 29.5 knots
Range: 7,000 nautical miles (13,000 km)
Endurance: 45 days without replenishment
Crew: over 1,600



Air group:

INS *Vikramaditya* is equipped with state of the art launch and recovery systems to enable smooth and efficient operation of ship borne aircraft. These systems include the LUNA landing system for MiG-29Ks, DAPS landing system for Sea Harriers and flight deck lighting systems.

The ship has the ability to carry over 30 aircraft including MiG-29K/KUB fighters as well as Ka-31, Ka-28, Sea King, Dhruv and Chetak helicopters. Interestingly, it has been confirmed that Sea Harriers can indeed be operated from the carrier, albeit with "limited support" as the carrier is equipped to handle mostly Russian-origin aircraft.

After mercifully brief speeches from Defence Minister AK Antony, Admiral DK Joshi, and Russian Deputy Prime Minister Dmitry Rogozin, Captain (Commodore) Suraj Berry, commissioning CO of INS *Vikramaditya*, read out the commissioning order. The Russian flag at the stern of the ship was then hauled down and ceremonially handed over to the Russian Chief of Naval Staff, Admiral Victor Chirkov. In its place, the Indian Naval Ensign was slowly raised to the tune of the Indian national anthem, and in a moment worthy of a Bollywood epic, as the stiff wind whipped the ship's new ensign about the flagpole, the snow stopped !

INS *Vikramaditya* (R33) – her motto *Strike Far, Strike Sure* – was now formally part of the Indian Navy!

The ship, which currently does not have any aircraft embarked on board, is scheduled to set sail for India by the end of November. It will be met in the



The flight control centre – heart of the carrier's air operations (photo: Angad Singh)

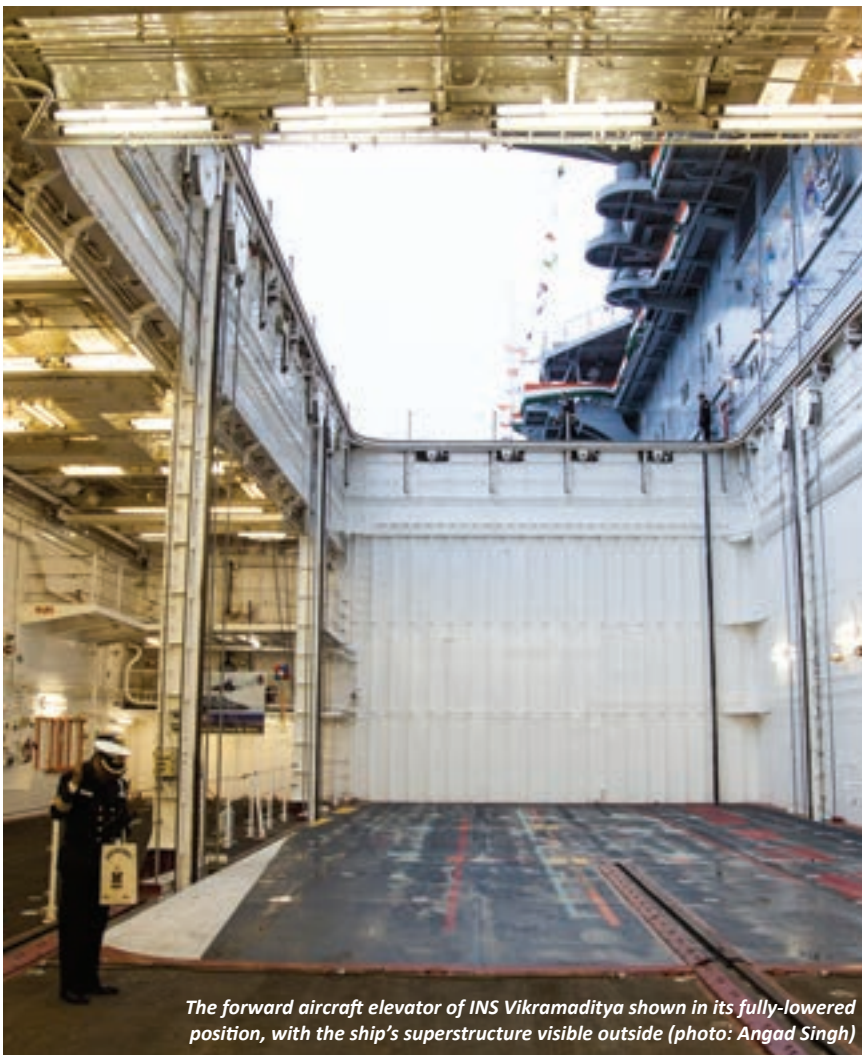
White Sea by *Talwar*-class frigate INS *Trikand* and fleet tanker INS *Deepak*, and will be joined by more Indian Navy vessels as it journeys towards its home port of Karwar. Paperwork to transit the Suez Canal has been submitted by Indian authorities, and it is anticipated that

clearance for the transit will be granted, allowing the INS *Vikramaditya* to take the short route home. If, for whatever reason, the Suez administration fails to grant transit clearance, the flotilla will sail around the cape of Africa instead, taking a few weeks longer to complete their homeward journey. During this trip, certain additional systems such as the all-important air conditioning, will be tested when *Vikramaditya* enters warmer waters, as the White Sea and Barents Sea were too cold to effectively evaluate these during pre-delivery trials. On board *Vikramaditya* will be over 1,600 personnel, including a 183-member Russian team led by Sevmarsh Chief Delivery Commissioner Igor Leonov, who will assist in training as well as operating the vessel, and will act as a guarantee team for one year after their arrival in India.

Once INS *Vikramaditya* reaches India in January 2014, the Navy will rapidly conduct the last remaining work at Karwar and then move toward operationalising the carrier. Indian MiG-29K pilots are fully qualified “on type” but are yet to actually operate their aircraft from any aircraft carrier. It is anticipated that the bulk of time following the vessel's arrival will be spent in qualifying men and machines to operate off its deck.

While a tremendous amount of work lies ahead of the Indian Navy before INS *Vikramaditya* finally sails the Indian Ocean as an operational warship, the commissioning of the vessel is a major boost to force morale and, come 2015, will be a game changer not only for the subcontinent, but indeed the world.

Angad Singh



The forward aircraft elevator of INS Vikramaditya shown in its fully-lowered position, with the ship's superstructure visible outside (photo: Angad Singh)

Admiral Arun Prakash on



Metamorphosis

of the Admiral Gorshkov ...

It was in October 2000 that the Russian aircraft-carrying cruiser, *Admiral Flota Sovetskogo Soyuza Gorshkov*, was “gifted” to India under an inter-governmental agreement. The Indian government finally gave its approval for repair and modernisation of the ship in January 2004. Designated as “Project 11430”, according to Russian custom, the ship was handed over to the Sevmash shipyard in Severodvinsk in April 2004, so that the process could start.

The ship had essentially to be converted from an aviation-cruiser used for vertical take-off and landing to an aircraft carrier capable of launching and recovering supersonic fighters in the short take-off but arrested recovery mode.

... to the INS Vikramaditya

Culmination of the 13-year saga was formal handing over and commissioning of the INS *Vikramaditya* on 16 November 2013, but now the Indian Navy faces two immediate challenges : the smooth integration of this huge warship, with its

new systems, in terms of shore-support and maintenance, and the evolution of new doctrines to exploit the immense operational capabilities that this ship offers.

Carrying a mix of supersonic, fourth-generation MiG-29K fighters, Kamov Ka-28 anti-submarine and Ka-31 airborne early-warning helicopters, the *Vikramaditya* promises to transform the maritime balance of power in the Indian Ocean. The 44,500-tonne behemoth, with its formidable air group, will be able to exercise sea-control over a three-dimensional bubble of 400-450 mile radius. Any hostile ship, aircraft or submarine enters this zone of control at its peril !

The ship has the capability of ‘projecting power’ over a hostile shore, using the MiG-29K to deliver kinetic strikes with guns, rockets or stand-off missiles. Or it could project power by heli-borne deployment of special forces and troops.

In disaster-relief situations, The *Vikramaditya*’s massive decks, hangars and domestic services could accommodate and feed thousands of refugees. Its electricity generation and water

purification plants and medical facilities could provide for a small town.

Contrary to the misconception that carriers require a large escort force, a ship like the INS *Vikramaditya* actually affords protection to other units or merchant convoys in its vicinity. Calling the ship a “game-changer” is not mere hyperbole. Unlike its smaller predecessors, the *Vikramaditya*-MiG-29K combination could confront any shore-based air force - and expect to prevail.

Inevitably, there will be comparisons between the manner in which two emerging powers, India and China, have managed their aircraft carrier projects. There are remarkable similarities: acquisition of a decommissioned Soviet-era aviation ship, its repair, modernisation and induction into service.

While China undertook the *Varyag/Liaoning* project in-house, India had to outsource *Gorshkov/Vikramaditya* to Russia. The success of the *Liaoning* project cannot be attributed only to China’s sound defence-industrial base and vibrant shipbuilding industry. The long-term strategic vision and foresight of the Chinese leadership and a corresponding deficit in India must be recognised.

When they are put out to sea as operational aircraft-carriers, both the *Liaoning* and the *Vikramaditya* will be observed with great interest by maritime professionals. The Chinese navy, with the bigger ship, but an untried aircraft and with no background of carrier operations, will be stepping out cautiously. In contrast, the Indian Navy, with an experienced naval aircrew and half a century of carrier operations behind it, should be deploying the *Vikramaditya* with confidence and panache.





VAYU Interview with

Mr Kanji Ishimaru, Managing Director ShinMaywa Industries India Pvt Ltd and Director ShinMaywa Industries Ltd, Japan

VAYU: Since the issuance of RFI in Jan 2011, what has been the progress of the case and what has been ShinMaywa's experience during this period? How many aircraft are to be inducted according to the RFI?

KI: Since the RFI was issued and we responded, ShinMaywa has commenced the process of IOP surveillance to finalise our potential IOP partner. We have also had many meetings with Government of India officials, Indian Navy, Indian Air Force and the Indian Coast Guard. Our experience has been very good till now. The RFI indicates acquisition of nine amphibious aircraft for Indian Navy.

VAYU: The PMs of India and Japan, in a joint declaration in May 2013, had established a JWG "to explore the potential for cooperation between the defense and aviation industries between the two countries, as well as to figure out the mechanism and modalities for the acquisition of the US-2 by the

Indian Navy." Has the JWG been set up already? When is it scheduled to meet?

KI: The Prime Ministers of India and Japan had declared to form a JWG to explore modality for the cooperation on the US-2 amphibious aircraft. ShinMaywa (Japan) is also part of the JWG. First meeting of JWG is scheduled by the end of the year. However, no firm dates are known to us so far. We expect that the progress of JWG would be discussed as part of the agenda during the next summit meeting. Of course, in between the Japanese Defence Minister will visit India soon and then we expect there may be further progress also.

VAYU: In case the contract is awarded to your company, would you be bound by offset obligations? This question is in light of the fact that with the setting up of JWG, the amphibious aircraft deal could in all probability be an intergovernmental agreement between the two countries.



KI: As far as we know, the case would be steered following the DPP process. In that, we are bound to honour the offset requirements. We will respect and follow the laid down procedure and the agreements between our governments.

VAYU: If you are bound by the offset clause then how much progress in finding a suitable offset partner? Have you shortlisted any company as yet?

KI: We have a very comprehensive offset plan. The idea is to develop the private Indian aircraft manufacturing industry in the best possible manner that we can. Ultimately we have to select a company with goodwill and passion for this kind of job. They have to love this aircraft and understand that such cooperation

would not only contribute to Indian economy, but would also form an important part of the regional security initiative. We also understand that the present order quantity may not be an interesting proposition for any potential IOP to make an investment decision. We have to find alternate business opportunities for our IOP partner from our existing clients to make his investment sustainable and justifiable. The process of selection of IOP and our other partners has commenced. Hopefully we would be able to finalise shortly.

complicated as the US-2, it might take us a little while and the process has to be graduated but we are fully confident that if we have a chance we can help to transform the Indian aircraft industry. We are also looking at maintenance, repair and overhaul for the aircraft in India, Foreign Direct Investment and sourcing from a number of SMEs and in addition, we also have an extremely interesting plan towards creating an impact towards genuine capability building in the country in aeronautical engineering. Discussions

and A340 fairing and Gulfstream etc. We also partner with MHI and KHI for military programs of Japan Self Defence Force.

VAYU : What about your thoughts on bringing in ShinMaywa's other business interests such as passenger boarding bridges, parking systems and so on to India ? Any success so far?

KI: We have held very preliminary discussions with some potential customers regarding our other business interests like PBB, pumps, parking systems etc. The



VAYU : What kind of ToT are you envisaging to accomplish with this contract? would it help build the Indian aviation industry bring in capabilities that the nation does not have as yet ?

KI: The private sector doesn't have enough capability and experience at the present moment. So we have to really partner with Indian industry to build the required capability, develop the right skill sets, imbibe highest quality and work ethics and provide mentoring to our IOP to become a world class company. Especially for an aircraft as

are on with certain institutions regarding the same.

VAYU : Can you tell us about your involvement with Boeing and Airbus (and other smaller aircraft manufacturers) as far as civil airliners are concerned?

KI: ShinMaywa is part of Boeing's 777 and 787 programme. We are also involved in the process of major medium components like wing to body fairing; ShinMaywa is very good at the composite structures. We provide entire composite parts for the Boeing 787 wing spar. Our other clients are Airbus for the A380, A330

process will be very graduated and based on global demands of our products.

VAYU : Finally, how do you find the working in Indian Defence sector with all the regulations imposed by DPP?

KI: Since this is ShinMaywa's first chance to export the US-2, we cannot compare the situations with any other country. We do realise that the DPP 2013 is a very comprehensive document but a reasonable one to be followed. The only thing we can say is that we have to do our best work so as to finalise everything as per customer's satisfaction.




MAHAN , CORBETT - OR COMMON SENSE ?

India's Maritime Options

Admiral Arun Prakash (retd) asks: are we putting the cart before the horse?

As the Indian Navy (IN) prepares to celebrate the 42nd anniversary of its devastating attack on the Pakistani naval bastion of Karachi on 4 December 1971, its leadership can take tremendous satisfaction from the knowledge that there are few sea services, world-wide, which can boast of such a comprehensive force-accretion plan. In an environment that is fraught with economic uncertainty and demands a cautious approach, the Government of India has committed funds to a capability acquisition plan which will place the IN amongst the front ranks of maritime forces within the next two decades or so.

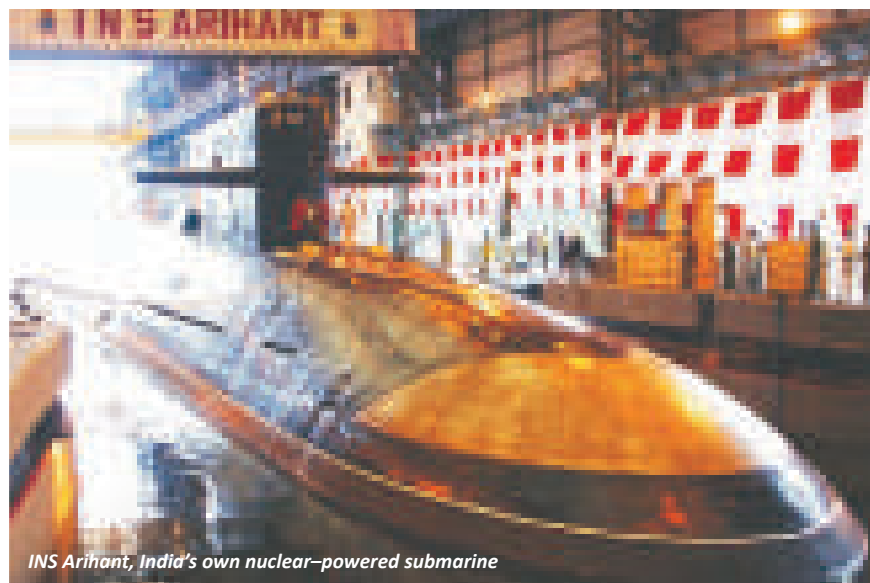
The accident on board submarine INS *Sindhurakshak* in August 2013, and the distressing loss of life, must have come as an unkind blow to the Indian Navy, just as nation-wide applause for the near-simultaneous launch of an aircraft-carrier and operationalisation of a nuclear ballistic-missile submarine (SSBN) was subsiding. However, the Service could draw some solace from the impending delivery of six new *Scorpene*-class submarines due to start in 2016. There is much



Kilo-class conventional submarine

else happening too: the *Arihant*'s reactor having gone critical, the focus will now shift to follow-on SSBNs, hopefully, with longer range ballistic-missiles. A Russian nuclear-powered attack submarine or SSN (on a 10-year lease) was commissioned as the *INS Chakra* in 2012, and there are plans to construct some more in India. The first indigenous aircraft carrier having been launched in Kochi, a second such ship is on the drawing board. The long-awaited arrival of refurbished Russian aircraft-carrier *Admiral Gorshkov* is due by early-2014. On order are seven stealth frigates, eight P-8I maritime patrol aircraft, 45 MiG-29K fighters and 30 other warships.

Hardware acquisition, even allowing for India's 'Kafkaesque bureaucracy', seems to be the simplest element of national security. It is the formulation of policy, based on India's vision of its place in the world and clearly enunciated national aims and objectives that must guide the force-planning and acquisition processes. Since India's national-security decision-making mechanism remains



INS Arihant, India's own nuclear-powered submarine

nebulous and, in any case, excludes the armed forces from its ambit, the two remain quite separate. It is, therefore, not surprising that we have collected all the trappings of power, without a clear notion about their purpose. While the committed expenditure of about US \$ 25-30 billion, mentioned above, may be good news for the IN, the question that needs to be, asked bluntly is : are we putting the cart before the horse? Perhaps policy vacuum is an issue that should engage the minds of our Naval Commanders when they meet in the run-up to Navy Day 2014.

A Policy Vacuum

21st century wars will be fought essentially for the same fundamental reasons the Greek historian Thucydides identified nearly 2,500 years ago: 'honour, interest and fear'. India's record of learning from history or even from its own recent conflicts is rather poor, as is the ability of its politicians and national-security elite to define or articulate the limits of national 'honour' or 'interest'. From India's cautious diplomatic approach and timorous policies it would seem that 'fear' is the driving impulse – in spite of the fact



The lone aircraft carrier, INS Viraat, still sails on, well beyond its original life span.



IN warships on exercise



we have one of the world's largest standing armed forces and a nuclear arsenal, both maintained at colossal expense.

If not fear, then it is certainly ignorance and indifference. Otherwise, what explains the Indian politician's view of defence and national security issues as tedious and time-consuming, best left to the bureaucracy to handle? While this does enable him to devote time to party,

parliament and political survival, it also places national security in the hands of itinerant, generalist MoD bureaucrats who can barely begin to comprehend complex defence-related issues before they move on to another ministry. In such an environment it is not surprising that India's massive defence budget is rarely debated in Parliament, and that India has never issued a defence white paper, a

national security doctrine, nor undertaken a strategic defence review. Worst of all, the armed forces have, for decades, been compelled to extemporise as far as planning, strategy and force-accretion are concerned, but this does not seem to bother anyone.

The current tensions with Pakistan, and the repeated provocations offered by China, portend difficult times ahead.



INS Viraat, with various aircraft types embarked, and escort ships at sea



Missile boat launches surface-to-surface missile

The US withdrawal from Afghanistan, coinciding with our own general election, will be a major window of vulnerability for the Indian state. While the military-balance on our northern and western borders remains precarious, India's geophysical advantages in the Indian Ocean offer a far more favourable prospect. The question that hangs in the air, then, is: does the ability of our navy to dominate sea-lanes,

and interdict shipping, provide India a 'maritime card' which could be played to redress the asymmetry on land?

Continentalists vs Navalists

A few straws in the wind were visible, recently, when the columns of *The Hindu* saw an unusual exchange between India's (for want of a better term), continentalists and navalists. Triggered by reports that the

Government of India (GoI) had, at long last, accorded approval for the raising of a new mountain strike corps to counter the Chinese PLA build-up in our north-east, the short-lived debate revolved around the question whether the (estimated) Rs. 60,000 crores, or US\$ 10 bn, sought for manpower and hardware of the projected army formation would be better spent on acquiring maritime capabilities which



Kashin-class guided missile destroyer

could be deployed to apply pressure from seawards.

The navalist viewpoint held that the rugged and restrictive Himalayan terrain, combined with the PLA's logistic and overall superiority on the Tibetan plateau, would severely hamstring the mobility of infantry formations and reduce the term 'mountain strike-corps' to an oxymoron. On the other hand, well-equipped naval forces could enable India to exercise a stranglehold on China's economic 'jugular' represented by its sea lanes of communication (SLOCs) carrying trade and energy past India's doorstep.

The counter-view rejected such a facile 'Mahanian solution' owing to

the impracticality and complexity of trade-warfare or even a naval-blockade in the contemporary environment. It went on to argue that basing a strategy on China's 'maritime vulnerabilities' could be foolhardy since India, too, had similar vulnerabilities. Moreover, China was actively engaged in mitigating them by reducing SLOC dependency through creation of strategic fuel-reserves and building land-linkages through Central Asia.

While Mahan has been invoked by both parties, and the ghost of Halford Mackinder looms in the background, it is 19th century naval historian and geo-strategist Sir Julian Corbett whose

thoughts have greater relevance to the circumstances under discussion. Well ahead of his times in his vision of sea-land warfare, Corbett's interesting observations about the relative importance of maritime and land-based power lend a different nuance to this discussion.

Corbett and the Maritime Doctrine

Corbett proclaims that "since men live upon land and not upon the sea, great issues between nations have always been decided... by what the army can do against your enemy's territory and national life; and by what the fleet makes it possible for the army to do." Having allocated a subaltern role to maritime power, he draws a distinction between 'naval strategy' and 'maritime strategy' by characterising the former as "that part of maritime strategy which determines the movements of the fleet when it has been determined what part it must play in relation to the action of land forces."

The IN has taken serious note of Corbett's conviction about the impossibility of "a war being decided by naval action alone", and of his advice that, "the paramount concern of maritime strategy is to determine the mutual relations of your army and navy in a plan of war." Consequently, the Indian Maritime Doctrine 2009 states, "...the nation's political objectives – and thus military objectives – are inextricably linked to events on land....therefore, whatever concepts the maritime forces adopt must directly or indirectly impact affairs on land." This offers an interesting contrast to the views of air-power enthusiasts who cite Giulio Douhet's 90-year old prophesies, to insist that air power, having achieved 'air-dominance', can win quick military victories from the air; rendering surface forces obsolete.

When the Maritime Doctrine points out that 'military objectives' must emerge from 'national objectives' it is merely reiterating the Clausewitzian dictums that "war is a continuation of policy by other means", and that "military action must never supercede policy; the policy is always the object." Therefore, on being ordered to prepare for war, the vital questions that the armed forces planning staff need to ask the MEA and/or MoD are: ★ what will the war be about ★ what



Army MBT launched from LST during amphibious exercises



For even greater reach out at sea: MiG-29KUB in mid-air refuelling

objectives is our diplomacy pursuing, and ★ why do we expect diplomacy to break down and force a resort to arms? Since war is a form of political intercourse in which we fight battles instead of sending ‘demarches’, there needs to be a sound interface between the politician and the soldier – with as little bureaucratic intervention as possible. Such an interface has rarely existed in India, except for short spells when *ad-hoc* bodies have seen us through crises situations.

Politico-Military Interface

That such an interface is badly needed in war and in peace, is highlighted by debates such as the one referred to earlier. For

procurement procedure for routine processing of hardware demands, there is no forum with the professional competence or the authority to question these demands, or to weigh the relative merit of all capability options available, and then select the best one. In the absence of such a process it is possible for any of the Services to pressurise an ignorant MoD into sanctioning scarce resources for acquisition of capabilities which may be redundant, superfluous or duplicated elsewhere. In instances where two or more Services genuinely need the same or similar capability, there must be an underlying doctrine to ensure the synergistic use of such capabilities.

security outlook and a higher defence structure that lacks in synergy, the crafting of a cohesive strategy seems 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 maritime reconnaissance and anti-submarine warfare capabilities. The expected advent of the PLA Navy, especially its nuclear submarines, into the Indian Ocean will lend urgency to the



The first Boeing P-8I of INAS 312 at INS Rajahmundry

example, the proposal for acquisition of a capability must not only be justified by the sponsoring Service, it must also stand in the face of competing claims from other Services. Military modernisation, especially in an era of financial stringency, must be viewed as a continuum in which hardware acquisition choices are exercised across the full spectrum of land, maritime and aerospace warfare capabilities, rather than as decisions taken to meet the aspirations or enhance the prestige of one Service or the other.

Such a process would need to be rooted in a national security doctrine and strategy; which, unfortunately, do not exist. While we do have a Defence Acquisition Council and an elaborate

Maritime Game-changers

Against this background, India’s maritime rise is being viewed, by foreign observers, with a mixture of curiosity and apprehension. It has been described as ‘rapid’ or even ‘dramatic’ and, contrary to our own perceptions, there are suggestions that a growing IN may ‘jeopardise regional stability’ or ‘trigger an arms race’. Comparisons are inevitably made between the IN and the PLA Navy, with specific reference to their respective progress in the fields of submarine construction and carrier aviation.

Within the country, there is a vague expectation that the IN could, somehow, tilt the balance in the South Asian power-game. But given India’s current national

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 the ex-Russian carrier, to be re-named INS *Vikramaditya*, with its complement of MiG-29K fighters and Kamov-Ka28/31 helicopters, will boost the navy’s capability to exercise sea-control and to project power over the shore. Current plans



The IN's conventional submarine force needs major augmentation, a plan long delayed.

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 *vis-a-vis* adversaries; China and Pakistan. As the Service responsible for safe and efficient conduct of SSBN operations, the IN will be custodian of their nuclear-tipped ballistic missiles, thus enhancing its status and importance in the national security totem-pole. Deterrence related command & control functions, however, will be retained by the Strategic Forces Command.

★ The induction of the nuclear-powered attack-submarine (SSN) *INS Chakra* has placed a powerful weapon of offence 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.

China's pursuit of a, so called, 'string of pearls' strategy tends to draw considerable attention in political and 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 Indian Ocean region (IOR). Apart from activities such as exercises, joint-patrolling, port calls and flag-showing deployments, the navy's outreach also includes provision of maritime security on request by neighbours, either through direct naval presence, but more often through training assistance and material aid. Agreements exist with almost all IOR countries that permit IN ships, submarines and aircraft to avail of refueling and turn-around facilities at very short notice.

The recent stand-offs on our northern borders have only re-emphasised concerns of long-standing. China has wrought dramatic improvements in communications on the Tibetan plateau to enhance military mobility. These include the Qingdao-Tibet railway, a network of heavy-duty highways and a number of airfields. The location of missile sites, army formations and air-bases in Tibet tilts the military balance heavily in China's

favour. The possibility, of 'all-weather allies', Pakistan and China colluding to threaten India from two fronts worsens the odds for our forces.

The maritime dimension is a relatively new factor in the Sino-Indian strategic equation. The rapid growth of both economies has led to increasing reliance on energy and raw materials, sourced from all over the world, and transported by sea. As the Somali pirates have demonstrated, any serious disruption in the supply of energy or commodities could destabilise markets and economies. In such a scenario, the fortuitous location of the Indian peninsula jutting a thousand kilometers into the ocean provides a huge natural leverage to the Indian Navy.

The 5th April 2013 issue of *The Economist* magazine, focused on India in its cover story and analysed the factors that constrain India's global aspirations. While exhorting India to "start shaping its own destiny and the fate of its region, by taking strategy more seriously", it recommended three instrumentalities: a capable foreign service, a professional MoD and unified defence staff, and last but not the least, "...a well-funded navy that can become both a provider of security and an expression of India's willingness to shoulder great-power responsibilities."

This writer could not have put it better.

Meeting the Indian Navy's future helicopter requirements

VAYU Interview with

AVM (retd) Arvind Walia,
Regional Executive,
India & South Asia, Sikorsky



VAYU : What is the status on the long-delayed Indian Navy tender for 16 MRH? Could you share some reasons for the delay?

Walia: The MoD has asked Sikorsky to give further extension until March 2014. We are currently reviewing our decision on the extension.

It is indeed a challenging situation at this point, with delays causing

technological obsolescence issues, cost overruns and also in absence of any firm timeline for concluding the project, it becomes increasingly difficult to hold the prices as per the offer in its current commercial state.

VAYU : Which helicopter type is being offered to meet the tendered requirements for 120 NMRH for the Indian Navy? What level of

customisation is Sikorsky prepared to offer to meet the customer's needs?

Walia: We have a range of naval products that we could offer. The actual offering would depend on the RFP, which will lay down the exact specifications. We have the MH-60R, MH-60S, S-70B or MH-148 that could be offered. Sikorsky is willing to partner with local companies to bring in the best and the most advanced





technologies to India, should we win the competition for the NMRH.

VAYU: Is the S-76 being proposed to meet the Indian Navy's requirement for 56 Naval Utility Helicopter (NUH)? What is the status of Sikorsky's proposal for this programme?

Walia: S-76 does not meet the NUH specifications, as the Navy requires a helicopter weighing less than 4,500 kg; therefore we are unable to participate in this programme.

VAYU: Overall, these requirements are enormous, both in terms of number of rotorcraft involved, as well as in their monetary value. Could you share some information on the offset obligations for these tenders, and how Sikorsky intends to meet them?

Walia: As per the DPP, any project more than Rs. 300 crore has an offset obligation. I assume most or all of the rotorcraft programmes of MOD are

greater than Rs. 300 crore, so would entail offsets. Sikorsky is prepared to meet the offset obligation for all those projects where we are participating. We have tie

ups with leading aerospace and defence companies in India to meet the offset obligations. Sikorsky will align itself with the requirements of DPP and honour them.



MH-60R: changing the game

MH-60R and Littoral
Combat Ship USS Freedom

in the maritime domain

To combat the most advanced threats at-sea and in coastal waters, the MH-60R submarine hunter and anti-surface warfare helicopter provides “unparalleled maritime security for United States and international navies.”

The MH-60R anti-submarine (ASW) and anti-surface warfare (ASuW) weapons system shifts the advantage from the submarine to the helicopter. Deployed on carriers, cruisers, destroyers, frigates, logistics support ships and the new littoral combat ship, the complete package of sensors and weapons aboard the helicopter were chosen and certified to address today’s maritime defense needs.

Manufactured by Sikorsky Aircraft Corp and provided with advanced mission systems and sensors by Lockheed Martin, the MH-60R is already operational and deployed as the primary U.S. Navy ASW and ASuW system for both open-ocean and littoral zones.

The MH-60R’s capabilities are provided by its advanced mission sensor suite that hosts the proven ASW ‘kill chain’. The suite presents a complete package featuring a multi-mode radar that includes Inverse Synthetic Aperture Radar; an Airborne Low Frequency

Dipping Sonar (ALFS) subsystem and sonobuoys; electronic support measures with an integrated helo threat warning capability; a forward looking infrared electro-optical device; integrated self-defense, and a weapons suite including MK.46 or MK.54 torpedoes, anti-ship missiles and crew served weapons. Advances in “fully integrated” mission systems coupled with Lockheed Martin’s dominance in combat systems integration have proven to be the most sophisticated capabilities across maritime operations worldwide.

Lockheed Martin and Tata Advanced Systems have formed a joint venture company in India, Tata Lockheed Martin Aerostructures, for manufacturing airframe components for the C-130J. A partnership on the MH-60R would bring jobs and technology to the country. In accordance with the Defence Procurement Policy, the Indian Navy would receive advanced MH-60R capabilities with the ability to sustain the platforms indigenously throughout the life of the platform.

Aboard the MH-60R, sensor data is integrated into actionable information for the three-member crew. The mission systems compile data from onboard and

offboard sensors to create an integrated picture that allows the helicopter to identify, locate, track and prosecute threats.

With its modular design, the MH-60R can adapt its weapon systems to match specific mission requirements. It possesses the agility to provide greater surveillance and flexibility capabilities, as well as more options for multiple mission requirements. While ASW and ASuW are the MH-60R’s primary missions, it also has the capability for secondary missions such as search and rescue, vertical replenishment, naval surface fire support, logistics support, personnel transport, medical evacuation, and VHF/UHF/link communication relay.

The first international MH-60R partner is the Royal Australian Navy. By the end of 2013, two MH-60R helicopters will be delivered to the Royal Australian Navy as first delivery in the partnership between the United States and Australia. “International MH-60R partners can share in the U.S. Navy’s ongoing technical insertion roadmap, mitigating obsolescence and keeping pace and ahead of the maritime threats for the next 30 years.”

(courtesy: LM)

Meeting the Indian Navy's future helicopter requirements

VAYU Interview with

Rainer Farid,

VP for Sales & CR – South Asia, Eurocopter



VAYU : In the Indian Navy tender for 16 MRH, is Eurocopter taking the lead on the NH90 proposal? Is there an option for additional units?

Farid: This tender is led by our Italian partners from AgustaWestland, hence we are unable to provide any information on the proposal.

VAYU : What about Eurocopter's offer of the EC725 Caracal to meet the tendered requirement for 120 NMRH for the Indian Navy? Will there be any India-centric modifications to the helicopter?

Farid: The EC725 is the latest version of this medium lift (11-ton class) helicopter, 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 in Lebanon, Afghanistan and recently Africa.

The EC725 has operated from both ships and ashore, 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 capabilities and is thus perfectly adapted to the Indian Navy requirements.

The EC725 solution for the Indian Navy is based on a multi-role helicopter. The proposed multi-role configuration provides maximum flexibility and utility



EC725 Caracal

for operations in the following mission scenarios: Anti-Surface Unit Warfare (ASuW), Special Operations, Commando Operations, Amphibious Assault, Troop Carrier, ELINT, SAR, External Cargo Carrying, Casualty Evacuation, Communication duties and Combat SAR.

This programme is under the 'Buy & Make' category requiring a massive Transfer of Technology package leading to the indigenous manufacturing of the NMRH by HAL.

VAYU: We understand that the AS565 MBe Panther is being proposed to meet the Indian Navy's requirement for 56 Naval Utility Helicopters (NUH). Could you provide some details on the helicopter and any potential for customisation to Indian needs?

Farid: Yes, we will be proposing the AS565 MBe Naval Panther, which is

at a lower cost and with increased safety.

AS565/365 Panther/Dauphin helicopters are operational around the world in naval and coast guard service in countries such as the United States of America, France, Spain, China, Saudi Arabia, Korea and Malaysia, among others. The mission equipment and systems integrated on these rotorcraft include anti-ship missiles, search torpedoes, surveillance and weather radars, Electro Optical System (EOS) with FLIR & TV sensors associated with laser rangefinders, glass cockpits with night vision goggle compatibility, a Link II data link that couples the helicopters' sensors to shipboard mission systems, as well as countermeasures suites with missile/radar/laser warning receivers and chaff and flare dispensers.

terrorism / anti-piracy with weapons including as torpedos, guns, rockets.

A huge training and support package, including simulators located in India, is also required.

VAYU: Specifically, could you share some information on the offset obligations for these tenders, and how Eurocopter intends to meet them?

Farid: Eurocopter has been very successful in developing and implementing co-operation packages worldwide. Similarly, licensed production, technology transfer and sourcing have been key elements of Eurocopter's contribution in India for over 50 years and will remain the core of our strategy.

Being the owner of its technology, Eurocopter has the ability to deliver unique knowledge transfer and high quality activities in the frame of the co-operation



AS565 MBe Panther

an upgraded version of the Panther MB, for this competition. Field Evaluation Trials in India are planned in 2014. The helicopter must be able to operate from ASW / missile corvette class and larger ships (up to aircraft carrier) in adverse weather and by day and night. The AS565 MBe offers even better performance levels than the AS565 MB, particularly in 'hot and high' conditions,

In Indian service, the Panther is envisioned to execute the following roles: Search and rescue, Casualty Evacuation (CASEVAC), Logistics and Communication duties including under slung cargo, Limited Observation and Surveillance, Limited ELINT gathering, ASW attack with light weight torpedo / depth charge, provide dynamic response during aid to civil authorities, Anti-

proposal associated with the Indian naval helicopter acquisition programmes. Eurocopter has already developed a sound industrial co-operation on previous licensed programmes and is therefore confident to be in the best position to become a privileged contributor to the development of the Indian aeronautical industry, and Indian naval rotorcraft programmes.

VAYU reports on **NAMEXPO 2013**

India's first Naval and Maritime Expo



The traditional start! Vice Admiral Satish Soni lights the lamp alongside K. Babu

The first Naval and Maritime Exposition (NAMEXPO) took place between 23 and 27 September 2013, which saw the port city of Cochin play host to thousands of exhibitors and visitors as they descended upon Willingdon Island. The event was organised by the Confederation of Indian Industry (CII) in association with the Indian Navy, Government of Kerala, Ministry of Micro, Small and Medium Enterprises, Ministry of Shipping, and the Ministry of Earth Sciences. The event was geared towards allowing foreign companies and militaries to interact and discuss business with Indian firms in defence and maritime sectors, as well as to interact with the Indian Navy, Coast Guard and research and development laboratories. With the first iteration seeing strong participation from around the world, NAMEXPO is slated to become a biennial event, much like Aero India and DefExpo.

The five-day exposition was preceded by a 'curtain raiser' in New Delhi, where Vice Admiral RK Dhowan, Vice Chief of Naval Staff spoke at length on indigenous naval technology and the global shipbuilding standards that are in place in India today. Stressing on the fact that 46 of the 47 warships and submarines on order for the Navy today are being constructed in Indian shipyards, Vice Admiral Dhowan stressed that the Navy is poised to grow and modernise over the coming years, providing an ideal opportunity to the Indian naval industry to meet challenges in the maritime domain.

Satish Kaura, co-Chairman of CII's National Committee on Defence and Aerospace and Chairman of the Samtel Group said that NAMEXPO was aimed at projecting Indian industry's technological and manufacturing prowess and to support the government's efforts towards self-reliance and indigenisation.

In Cochin, the event itself was inaugurated by K Babu, Minister for Fisheries and Ports, at the Cochin Port Trust on Willingdon Island. Vice Admiral Satish Soni, Flag Officer Commanding-in-Chief, Southern Naval Command, KKN Kutty, former chairman, CII (Southern Region), A Sivathanu Pillai, CMD, Brahmos Corporation, and Jose Dominic, former chairman, CII (Kerala), were present. The inauguration ceremony was followed by a breath-taking demonstration by Indian Navy marine commandos, who conducted operations from a HAL Dhruv hovering mere inches above the water in front of the exposition venue.

Events during the exposition included conferences with the Indian Navy, Coast Guard, Ministry of MSME and NSIC. Several senior Navy and Coast Guard officers contributed to the deliberations and former Minister of State for Defence, S Krishnakumar was among the key panellists. On the exhibition side, a range of products were on display, from ships (models as well as operational IN vessels) and submarines to underwater unmanned vehicles, helicopters and seaplanes, along with a range of naval and maritime subsystems, components, radars, missiles, surveillance and reconnaissance solutions, sonars and torpedoes. With the exhibition spanning a total indoor and outdoor area of over 7000 sq metres, visitors were able to access a wide variety of products from vendors across the globe. Amongst Indian Navy ships docked alongside were the INS *Satpura*, a *Shivalik*-class stealth frigate, INS *Kabra*, a *Car Nicobar*-class patrol vessel, and INS *Sudarshini*, the Indian Navy's iconic sail training ship.

Over the course of five days, NAMEXPO witnessed participation from fifty exhibitors both international and domestic, along with 2,000 business visitors, 15 official delegations and 6,500 general visitors. Besides Indian Navy and Coast Guard officers and personnel, Naval officers from more than 25 countries also visited the Exposition and interacted with exhibitors and participants.

Saab presents diverse portfolio

Saab presented a diverse portfolio of naval products and was the chief sponsor for the event. Saab speakers also addressed various conferences during the five-day event. The company, located at stands E58 and E57, displayed a spectrum of naval products covering the air, surface, underwater and coastal security domains. Some of the products presented included the Sea Gripen, 9LV SAT/CMS/FCS, AUV 62 MR SPURT, Sea Giraffe and Saab 340 MSA.

Saab India Country Chairperson Lars-Olof Lindgren said, “Saab is delighted to participate in India’s first premier Naval and Maritime Expo. This event is a good forum for us to meet with the relevant stakeholders in the naval domain. NAMEXPO 2013 will be an opportunity to meet Indian stakeholders from government, defence forces and the Coast Guard and to initiate discussions. The main theme for Saab for this NAMEXPO is

“Teaming Up With India on Naval Systems.” We believe that partnership is the way forward to work in India and to be able to fully support the market. We already have entered into partnerships with Indian industry to address the naval domain and we are looking forward to further strengthening our engagement with the Indian naval forces and industry.”



The Saab 340 has been adopted for medium maritime surveillance

ShinMaywa and its US-2i

ShinMaywa participated at NAMEXPO 2013 and showcased the US-2i amphibian aircraft with the intent to increase awareness about the aircraft and the numerous roles and missions that it can accomplish making it a force multiplier and game changer in the IOR (Indian Ocean Region).

The US-2i, is unique among amphibian aircraft, being capable of operating in sea state 5 conditions on the high seas. It is also the only amphibious aircraft in the world fitted with a state of the art ‘Boundary Layer Control System’ (BLCS) for lift augmentation, allowing it to combine high payload, long range and short take-off and landing distances. “The aircraft is ideally suited to carry out long range logistics support, casualty

evacuation, humanitarian assistance, disaster relief, long range search and rescue and EEZ surveillance.”

ShinMaywa attracted the attention of senior officials of the Indian Navy and the Coast Guard, including Vice Admiral Satish Soni, FOC-inC, Southern Naval Command, and Vice Admiral NN Kumar, Chief of Materiel. The stall also generated interest from local visitors, who were keen to learn about the unique aircraft.

During the Expo, a Naval Seminar, inaugurated by Vice Admiral Satish Soni was conducted on 23–24 September and Cmde (R) Sujeet Samaddar, Director and CEO was a speaker during the session ‘Development of Advanced Naval Aviation Systems and Sustainable Repair Support’ and presented his views on leveraging acquisitions for technology infusion in the aerospace sector.



Cmde Sujeet Samaddar and executives from ShinMaywa, Japan with senior Indian Navy officers and CII official, at NAMEXPO 2013

The Sea Gripen AHOY !



Swedish Air Force Gripens on Baltic Sea patrol.

Force Multiplication at Sea

Tony Ogilvy, Head of Sea Gripen Programme for Saab in the UK, spoke at the NAMEXPO 2013 at Cochin on the Sea Gripen as a future carrier-borne fighter. Excerpts of his paper :

The Swedish company Saab in partnership with a customer nation, will develop and establish the Sea Gripen as a new-generation carrier-based fighter option for the future, having all the capabilities of the Gripen E/F and assuredly the most technologically advanced fighter aircraft in the world in its category. The Sea Gripen will be highly agile, have super-cruise capability, extended reach, netcentric capability, carefree manoeuvring, advanced data link and an extensive electronic warfare suite that can be adapted to meet specific national user requirements

The Sea Gripen will also have superior sensor fusion abilities, incorporating as it will the Selex Raven AESA radar, Infra-Red Search and Track, plus a revolutionary avionics architecture including ultra-fast databuses and Ethernet. As with the land based version, the Gripen platform offers for easy integration of advanced weapon systems and growth potential.

All the sensors, avionics and weapons and the power plant (GE 414G) of the Gripen E/F will be available with the Sea Gripen, whose small logistic footprint, high availability and a smaller, lighter airframe results in significant gains from a maintainability point of view. The Gripen spares inventory is therefore lighter, smaller and adds less to the load of the carrier and it takes fewer personnel to maintain the aircraft.

In fact, the Gripen platform absolutely meets, in fact exceeds, the exacting requirements, being able to operate in varied environment world wide. Potential operators place exceptional demands on such fighters' ability to operate in high humidity conditions but the challenge at sea adds the extreme corrosive effect of salt water ingress when operating in the maritime environment. The very exacting Gripen design tolerances are inbuilt to produce a watertight outer skin on the airframe, which protects against salt

water ingress and the very hostile climatic conditions encountered in the maritime environment.

Vitality, the Sea Gripen packs a considerable punch, being equipped with 10 weapon stations, on which wide spectrum of weapon systems can be integrated, while the Mauser cannon is retained. The Sea Gripen for naval operators will have the same weapons configuration as the Gripen E/F, but will be customised to meet the exact requirements of the customer.

Key support cost parameters such as aircraft reliability, maintainability and testability have received equal priority to the operational and technical design goals during design of the Gripen. As a result, the Gripen operator will experience few failures, low maintenance downtimes, a very short turnaround time and at exceptionally low life support costs. The aircraft design is influenced to maximise its inherent availability which ensures



Artist's depiction of Sea Gripen in disruptive camouflage.

outstanding reliability, at sea, the support system design optimising all key functions such as maintenance, training, supply and support resources. This support system is extremely flexible and well meets the specific customer's individual requirements and priorities so as to enable Sea Gripen operators to re-evaluate the aircraft carrier support and maintenance concept of operations, so as to make fullest use of the exceptional simplicity of Gripen support requirements, thus saving costs and dramatically increase availability.

That operational costs are critical is a given. Based on open statistics from the Swedish Air Force, the calculated cost per flying hour of the Gripen is some US \$ 4,500 including fuel, which, by an order of magnitude, makes the New Generation Gripen the lowest cost operational fighter in service extant.

Sea Gripen has been designed to operate from both CATOBAR and STOBAR aircraft carriers. For ease of reference, the former being catapult launched, will allow the Sea Gripen to get airborne at its maximum take-off weight of 16,500 kg. The result will be an aircraft with an empty weight just below 8,000 kg, with a total fuel and weapon load of approximately 8,500 kg. Combat radius is estimated at approximately 1,250 km/780 nm in a maritime strike profile or 1,400 km/875nm in an offensive counter-air profile.

STOBAR operations however, would be conducted at a reduced maximum take-off weight compared to catapult launched. However, this reduction is mitigated by the use of a hold-back

mechanism allowing the fighter to achieve 100% installed thrust before release for its launch run. Additionally, optimisation of the aircraft lift devices to match the ramp exit conditions will assist the launch weight capability. The most important element, however, is the thrust available on take-off, and the new GE414G engine with enhanced thrust will deliver up to 25,000lb. static thrust to improve MTOW. Overall it is anticipated that, from a 240 metre run, with holdback and the GE414 EPE engine, a MTOW

STOBAR launch of circa 14.5 tons can be achieved.

For all arrested landings, the maximum recovery weight into the wires is 11.5 tons, which will allow a very significant bring-back of 3.5 tons. This will enable the recovery of very expensive unexpended ordnance such as the new generation Meteor missile.

For carrier operations, the Sea Gripen will have a service life of 6,000 flight hours based on a 2:1 ratio distribution between landbased and shipborne operations.



Artist's depiction of Sea Gripen before carrier touch down.

Ship interface and compatibility : ideal sizing

The most obvious factor that influences the design of a ship-based aircraft is geometric compatibility. Quite simply the aircraft must be of an acceptable size and shape to fit within the constrained operating spaces aboard the ship. Sea Gripen's dimensions approximate to that of the highly successful previous generation sea-based fighter aircraft, the Sea Harrier, which the Indian Navy has optimally operated for over three decades. The Sea Gripen also benefits from an extremely acute turning circle owing to its exacting design requirements, as previous and present Gripen variants have been



required to operate from remote, short and narrow road strips.

Geometric constraints are an obvious factor. Aircraft at sea are stored in hangar bays for the performance of maintenance activity. The aircraft must thus be compatible with the deck elevators and the Sea Gripen fits on all current, and by definition all future, aircraft carrier lifts worldwide. The Sea Gripen has great advantage on board the aircraft carrier owing to its minimal maintenance footprint and less consideration needs to be given to the amount of space required per Gripen in terms of associated maintenance and support equipment.

Concerning the electromagnetic environment, the Gripen and its mission and flight critical systems are designed to operate in high intensity radiated fields in close proximity to radio and radar transmitters, accentuated onboard carriers.

The aircraft is designed to withstand more severe levels than the HIRF (High Intensity Radiation Fields) levels for shipborne operations as described in MIL-STD464.

We are sanguine that the Sea Gripen can operate safely from current and future Indian Navy carriers, both in STOBAR and CATOBAR configuration :-

INS <i>Viraat</i>	STOBAR
INS <i>Vikramaditya</i>	STOBAR
INS <i>Vikrant</i>	STOBAR
INS <i>Vishal</i>	CATOBAR

In summary, we believe that the Sea Gripen offers a full multi-role capability in all roles, day and night. It is the perfect work-horse for the carrier environment, with low supportability and high availability offering the marine command maximum levels of fire power over protracted operational periods afloat and ashore, and the ability to surge to very high tempo operations when required. The Sea Gripen will be assuredly the most cost effective naval fighter in the world !



How it might well look : INS Viraat with Sea Gripens embarked, with one on ski ramp.

Key structural changes introduced in the Sea Gripen will be:

- Stronger and longer nose gear (with larger tyres and new shock absorber)
- Stronger main undercarriage (capable of absorbing a 6.3 m/sec sink rate)
- Undercarriage shock absorbers changed from alloy to steel construction for strength
- Arrestor hook
- Minor structural reinforcements
- Removal of corrosion risks from the airframe using new manufacturing techniques/materials
- Hydraulic launch stop mechanism operated in tandem with the nose gear raise/lower



Tony Ogilvy speaking at NAMEXPO 2013

Quo Vadis LCA Navy ?



LCA-Navy (NP-1) before flight at HAL Bangalore.

The Naval Light Combat Aircraft project

Derived from the LCA Mk.I (Air Force version), first prototype of the LCA Navy (NP-1) was 'rolled out' from the prototype hanger at HAL's Bangalore Complex on 10 July 2010, but only made its first flight some 21 months later, on 27 April 2012, flown by Commodore JA Maolankar, Chief Test Pilot with the NFTC. Thereafter, NP-1 aircraft made another four flights before being grounded for major modifications of its landing gear and is presently, 18 months on, being readied for flight again.

Formal sanction for the LCA Navy had been accorded in 2003, involving initial design, development and fabrication of a trainer (NP-1) and fighter (NP-2) along with a Shore Based Test Facility (SBTF) at INS *Hansa*, Goa. A complete airframe – Structural Test Specimen (STS) - was also part of the development programme.

The LCA (Navy) essentially differs from its Air Force counterpart in having the front fuselage with drooped nose for improved pilot vision, a stronger and longer landing gear, arrestor hook to engage deck landing wires, the aircraft having to assume longitudinal deceleration of nearly 4.5' g'. An additional control surface to reduce landing speed is the Levcon (leading edge vortex controller) which is close to the forward root of the wing in the apex region. Like the Air Force Mk.I, the naval LCA is powered by the GEF404-IN20 engine but the Mk.II variant would be powered by General Electric's F414-GE-INS6 engine with 98kN of thrust and refined aerodynamics.

The Indian Navy has been very supportive of the programme, expressing a requirement for 46 LCA Mk.IIs and in the interim, placing orders for 8 Navy LCA Mk.Is to be employed for 'familiarisation' and conversion training. According to initial plans, the LCA Navy Mk.II would have its first flight in 2015-16

and begin with take off / landing trials from the aircraft carrier in 2017. Plans have been made for the LCA Navy to supplant the Sea Harriers of INAS 300 'White Tigers' and operate from the new INS *Vikrant* which is being designed with a separate aircraft lift and maintenance facilities for both the LCA Navy, in addition to those for the MiG-29K.

In many ways, the trials and travails of the LCA-Navy mirror those of the Air Force LCA but perhaps more so in terms of key concerns and high stakes. As Admiral Arun Prakash, former Chief of Naval Staff and Test Pilot wrote in his article on the *LCA Navy: Is it Ready for Sea* (see *Vayu* Issue IV/2012), "considering the unique venture of qualifying an unstable, FBW, delta-wing prototype for STOBAR operations, the road ahead promises to be exciting – but complex".

The Admiral then gets to the point as "the real unexplored territory for the trials team will be the ski-jump launch, which requires investigation of aircraft performance and behavior in many areas. Some of these are : relationship of all-up weight to deck run, engine thrust and relative wind, undercarriage oleo compression of the ramp and sudden extension on exit controllability at ski-jump exit and acceleration thereafter. A crucial factor in this phase will be accurate estimation of engine thrust available under given ambient conditions of temperature and pressure. The test team is hopeful that it will be possible to indicate the maximum thrust available from the aircraft powerplant as a number on the cockpit head-up display".

The Aeronautical Development Agency has since sought assistance in critical areas of the LCA Navy's development : while RAC-MiG have provided consultancy of the tail hook design and installation, the US Navy has been approached for assistance as aspect of carrier-deck operations, NFTC personal visiting the US



Paper tiger ? LCA taxis past the venerable Sea Harriers of INAS 300 'White Tigers' (photo : Simon Watson)

Navy's Naval Air Station at Oceania, in Virginia, again as recently in October 2013.

As an aside, the US Naval Air Station Oceania is perhaps the largest USN base on the eastern coast, housing 17 strike fighter squadrons (F/A-18 Hornets) and conducting advanced training. It is also the Centre for Naval Aviation technical and maintenance training, and has a landing signal officer school for training specialists to guide approaching aircraft. Back home, however, future of the LCA Navy is inexorably linked with successful development of the Air Forces LCA Mk.II, with its higher thrust F414 engine but there are disquieting reports on the feasibility of this programme which would even more dramatically impact on the IAF's long term re-equipment planning.

The N-LCA programme – challenges abound

With the Indian Navy having ordered 8 LSP-standard Naval Tejas Light Combat Aircraft, one might be forgiven for thinking that all is well on the maritime side of the troubled LCA programme. In reality, the deficiencies in the basic land-based Tejas are only amplified when considering the naval operating environment and the naval Tejas as currently configured is a barely-capable machine with limited operational use even in the most forgiving scenarios. While construction of the Navy's LSP aircraft has not yet begun and first delivery is years away, it is important to note that these aircraft are effectively production variants of the first (and so far only) Naval Tejas prototype, NP-1, which is itself a maritime version of the Tejas 'Mk.1' with the GE F404 afterburning turbofan engine, incorporating strengthened undercarriage and fuselage, a tailhook for carrier landings, leading-edge vortex controllers (LEVCONs) for additional lift at low speeds, and extensive usage of corrosion-resistant materials for sea-based operation.

The Navy does not have the luxury as the IAF does of tailoring operations around aircraft capabilities. Any naval aircraft operated in the coming years will have to be able to be launched from the 200-odd metre flight deck of a STOBAR aircraft carrier – either INS *Vikramaditya* or INS *Vikrant* – and naval combat aircraft therefore need sufficient performance to operate with combat payload in very demanding conditions. The LCA, even in its land-based variants, has been plagued with well-documented weight and power issues that rob it of the performance that is required of a naval fighter – where strengthened landing gear, airframe and tailhook add a further weight penalty.

The current N-LCA prototype (NP-1) powered by the GE F404 producing approximately 85-88 kN installed thrust is projected to be able to take off from a carrier with 20 knots relative wind on deck only in a basic air defence configuration, equipped with light short range air-to-air missiles and operating on internal fuel. Even with this minimal load, the aircraft would have low endurance and be able to stay aloft for a very short period of time. The Navy needs this performance envelope to be expanded to allow for longer endurance and higher payload.

The solution to these limitations is more power – to be provided by the already contracted-for GE F414 engine – and weight reduction of the aircraft structure. The LCA in both land-based and naval versions is well above target weight limits set by the respective Services, but an increase in wet thrust from the current GE F404's sub-90 kN to the F414's 98 kN would likely yield sufficient (although still not ideal) levels of performance for a carrier-based fighter. A simultaneous reduction in operating empty weight would only add to the performance provided by a new engine, but given the trouble HAL and ADA have historically had with weight reduction, this is probably not a realistic expectation in the short term, especially given the increased levels of ruggedisation required for carrier aircraft. However, this must be expedited, as it is understood that work on an N-LCA Mk.2 has yet to begin!

In summation, the Navy would be best served by a navalised variant of the LCA Mk.2 currently under development but without operating the naval equivalent of the LCA Mk.1 at all, given the Mk.1's limited operational effectiveness. However, given that 8 aircraft are already on order and Mk.2 development is likely to take yet more time, the first batch of aircraft can be put to use first to validate and test N-LCA operations first at the shore-based test facility (SBTF) at Goa, then aboard INS *Vikrant* (IAC-1), and afterwards be operated as shore-based type conversion aircraft for an eventual Mk.2-equivalent fleet. This would be an acceptable compromise in the interest of fostering indigenous aircraft development and production, whilst maximising combat efficacy in operational service.

AS



Scorpene submarine: six are being built by MDL for the Indian Navy

DCNS: 'Sea' the Future

DCNS fervently believe that the sea is central to our planet's future. As a world leader in naval defence and an innovator in the energy sector, the Group is developing advanced technology and solutions to secure the future and develop the planet's potential in sustained manner. Its specific strategy is built on proven ability to meet an operator's needs by combining "exceptional" know-how with "unique" industrial resources. DCNS designs and builds submarines and surface combatants, develops associated systems and infrastructure, and offers a full range of services to naval bases and shipyards. The Group has also expanded its expertise into civil nuclear engineering and marine renewable energy. "As a responsible corporate citizen, DCNS was one of the first major defence groups to achieve full certification to ISO 14001", state company officials.

The DCNS continues to grow, as recorded in first half of 2013. Patrick Boissier, Chairman and CEO of the DCNS Group, said: "In the course of the first half of 2013, we recorded an increase in revenue, confirming our growth potential. Operating profit did not see the same growth due to the impact of certain operational difficulties and increased investment in R&D."

In the absence of major new contracts, the Group booked orders worth €578 million in the first half of 2013, compared with €813 million in H1 2012. At end June, the order book was worth €13.23 billion, compared with €14.2 billion a year earlier, which, however, represents four years' output. First-half revenue rose to €1.63 billion, compared with €1.4 billion a year earlier, thanks to good progress on industrial programmes for the French Navy (FREMM frigates, *Barracuda* submarines

and through-life support for front-line ships) plus others for international navies (notably Brazil, India and Russia).

Operating profit before impact of PPA (purchase price allocation) for the first half of 2013 amounted to €95 million, or 5.8% of revenue, compared with €98 million, or 7% of revenue, for the same period last year. The Group encountered operational difficulties in certain industrial programmes, primarily in the civil nuclear engineering sector. It also stepped up R&D investment relative to H1 2012 in order to maintain its technological leadership in key markets. An action plan has been launched to increase operating profitability.

From 17 to 23 June, DCNS launched a major exercise campaign off the coast of Toulon in the Mediterranean Sea (see later).

Building on its expertise in the development and integration of complex



data systems dedicated to the naval defence domain, DCNS is applying its know-how in the area of maritime security and state action at sea (coastguard, police, customs...) as is, for example, the case with the recent deployment of its Marilyn system designed to improve the effectiveness of sea search and rescue missions whilst at the same time allowing the coordination of the concerned services. This new system has just been installed in all regional surveillance and rescue operational centres (*CROSS - Centres régionaux opérationnels de surveillance et de sauvetage*) of the Department of Maritime Affairs.

DCNS teams are also coordinating the European research project I2C, supported by the European Union. I2C, which was initiated in October 2010 for a duration of 4 years, is a system designed and developed by DCNS with its partners.

The aim is to detect and identify (in real time) illegal and criminal activities conducted at sea. I2C allows the dynamic analysis of vessel trajectories and activities, database access and automatic alerts as a function of the established

rules in consultation with the operational authorities.

To accomplish these missions, the system correlates and exploits all information gathered from multiple sources: surveillance data from coastal radars, airplanes and vessels (via AIS), observation satellites, etc. The analysis of these data allows the real-time constitution of the most precise synopsis possible of the situation for use by the operational manager. He thus has at his disposal reliable information to make operational decisions and plan the necessary interventions. It is a powerful decision-support tool.

The exercise campaign of July 2013, coordinated by DCNS, deployed significant resources: Zeppelin aerostat, maritime patrol aircraft, surface drone, coastal surveillance stations) and involved around ten experts. This operation aimed to evaluate the I2C system and its vessel surveillance performance in the exclusive economic zone (EEZ), which extends up to 200 nautical miles (about 320 kilometres) out from the coastline. In effect, the system ensured permanent

monitoring of the activities of almost 50,000 vessels of all sizes, under all weather conditions and up to a distance of 200 nautical miles from the coast.

I2C aims to be complementary to existing national surveillance systems and offers the continuous correlation of many other streams of maritime information originating from multiple sources such as weather and sea-state forecasts, vessel identity and history, geographical data, port movements, intelligence, etc. These multiple sources of information are exploited by a powerful algorithmic simulation software tool. For each alert, it provides precise hypotheses concerning the nature of the illegal activity. Furthermore, the operator may himself apply "detection rule" settings to detect any particular type of suspicious situation. This project is supported by the European Union through the Framework Programme for Research of the Maritime Chapter of EUROSUR (EUROPEAN SURveillance). It aims to develop a common (multinational and interoperable) border surveillance system.

The Water World of DCNS

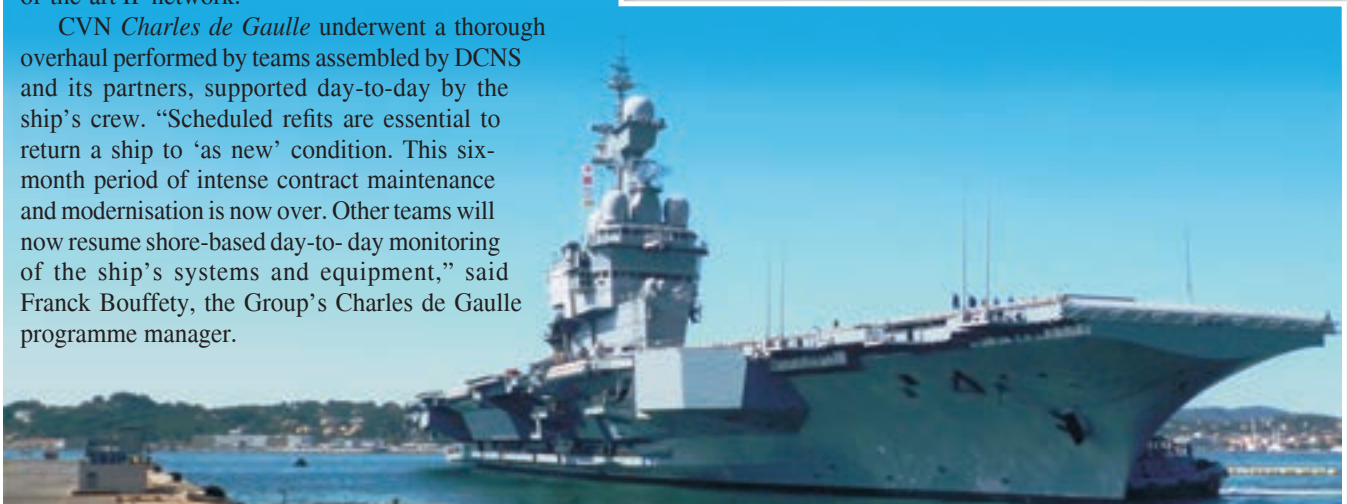
DCNS completes CVN Charles de Gaulle refit

The French Navy's Fleet Support Service (SSF) signed off on completion of the intermediate refit of nuclear-powered aircraft carrier Charles de Gaulle after six months' work by DCNS. From hull to combat system, including compliance tests to the latest environmental standards, communications suite modernisation or the refurbishment of the accommodation and recreation areas, the project involved some 950 people and one million man-hours' work.

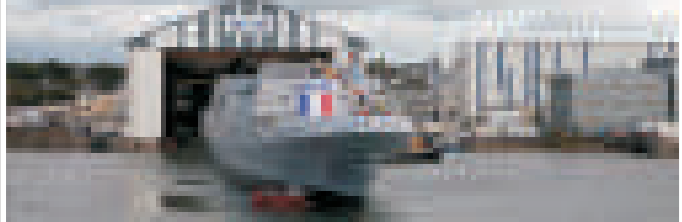


In addition to scheduled maintenance, the refit was used to undertake significant modernisation. The work was performed in the Vauban drydock at the Toulon naval base. The ship was given a complete facelift that included repainting of a total area of 26,000 square metres and the complete refurbishment of one of the main galleys. Other modernisation work included the replacement of the stabilisation computer. The propulsion system and other shipboard systems and equipment were inspected, overhauled and tested to ensure optimal performance in operation. Some 35 kilometres of cabling was also installed with a view to the later installation of a state-of-the-art IP network.

CVN *Charles de Gaulle* underwent a thorough overhaul performed by teams assembled by DCNS and its partners, supported day-to-day by the ship's crew. "Scheduled refits are essential to return a ship to 'as new' condition. This six-month period of intense contract maintenance and modernisation is now over. Other teams will now resume shore-based day-to-day monitoring of the ship's systems and equipment," said Franck Bouffety, the Group's Charles de Gaulle programme manager.



FREMM frigate Provence floated out



On 18 September 2013, FREMM frigate *Provence* was floated out of its building dock at the Lorient shipyard. With five FREMM multi-mission frigates at different stages of assembly and construction, this float-out (or pre-outfitting launch) – always a major milestone – highlights the Group's expertise in concurrent shipbuilding. Eleven of the 12 FREMM frigates on order are for the French Navy.

Operations began with flooding of the building dock. Following a number of other steps, the ship was gently floated out of the building dock. Executing a manoeuvre lasting 15 minutes, tugs then moved the frigate to a nearby outfitting berth.

Over the coming months, DCNS specialists and subcontractor teams will install the ship's systems. The next major milestone will be installation of the *Provence*'s masts and sensors, including her radars, antennas, cameras and jammers.

DCNS began building the *Provence*, the third *Aquitaine*-class FREMM frigate for the French Navy, in December 2010. These highly automated surface combatants require a complement of just 108, or less than half the number required to man earlier generation vessels with similar capabilities. The FREMM multi-mission design concept combines missions including anti-air warfare (AAW), anti-surface warfare (ASuW) and anti-submarine warfare (ASW). On 23 November 2012, following delivery of first-of-class FREMM frigate *Aquitaine* for the French Navy in compliance with the relevant contractual requirements, European Joint Armament Cooperation Organisation OCCAR signed off her acceptance on behalf of French defence procurement agency DGA.

Sea trials of FREMM frigate for Royal Moroccan Navy

The FREMM multimission frigate on order for the Royal Moroccan Navy is pursuing sea trials off the French coast in preparation for delivery end of this year. In June, DCNS successfully completed a third series of trials to test performance of the ship's combat system. The crew and DCNS specialists completed the latest trials off the Brittany coast, this series of tests being designed to check the performance of the combat system's main sensors. Operational scenarios were executed to check the consistency of the data analysed and displayed by the combat system sensors with the results obtained during shore-based simulations. Specific tests included target engagement sequences using Aster anti-air missiles and MM40 anti-ship missiles, fire control tests for the 76-mm main gun and exhaustive testing of the multifunction radar. Other vessel capability tests involved helicopter approach control and the deployment of various towed devices.



DCNS begins sea trials of FREMM frigate 'Normandie'

FREMM frigate *Normandie*, second of the *Aquitaine* class for the French Navy, went to sea for the first time on 25 October. This milestone marks the beginning of the ship's sea trials, which will take place off Brittany and are expected to last till the end of the year. The main aim of these preliminary trials is to test performance of the ship's propulsion and navigation systems.

"This milestone represents the culmination of the combined efforts of many people working towards common goals, including DCNS personnel, teams provided by DCNS partners and suppliers, the French Navy crew and representatives of the French defence procurement agency (DGA) plus the European Joint Armament Cooperation Organisation (OCCAR)," said FREMM programme manager Anne Bianchi. "The construction of this second-of-class FREMM frigate for the French Navy is proceeding on schedule and on budget. FREMM frigates are among the most technologically advanced and competitively priced on the world market. Thanks to their many innovations, FREMM multimission frigates can respond to all types of threats with unparalleled flexibility and availability."

Tests will be conducted at a sustained pace during day and at

night, the first three days devoted to the 'familiarisation' phase during which the crew and other personnel test the ship's safety systems and equipment, including fire-fighting, flood control and emergency response systems and evacuation procedures as well as manoeuvrability and mooring performance. The tests will focus on the propulsion system. The FREMM's high-performance hybrid CODLOG (Combined Diesel eLectric Or Gas) power package combines a gas turbine for mechanical propulsion at speeds exceeding 27 knots and electric motors for quiet, low-speed propulsion. This phase will also include extensive testing of the ship's navigation (log, position, heading) and other basic systems.

On completing these preliminary trials, FREMM frigate *Normandie* will return to DCNS's Lorient shipyard for several weeks of quayside work. In early 2014, the ship will return to sea for a second series of trials, focusing on the combat system.

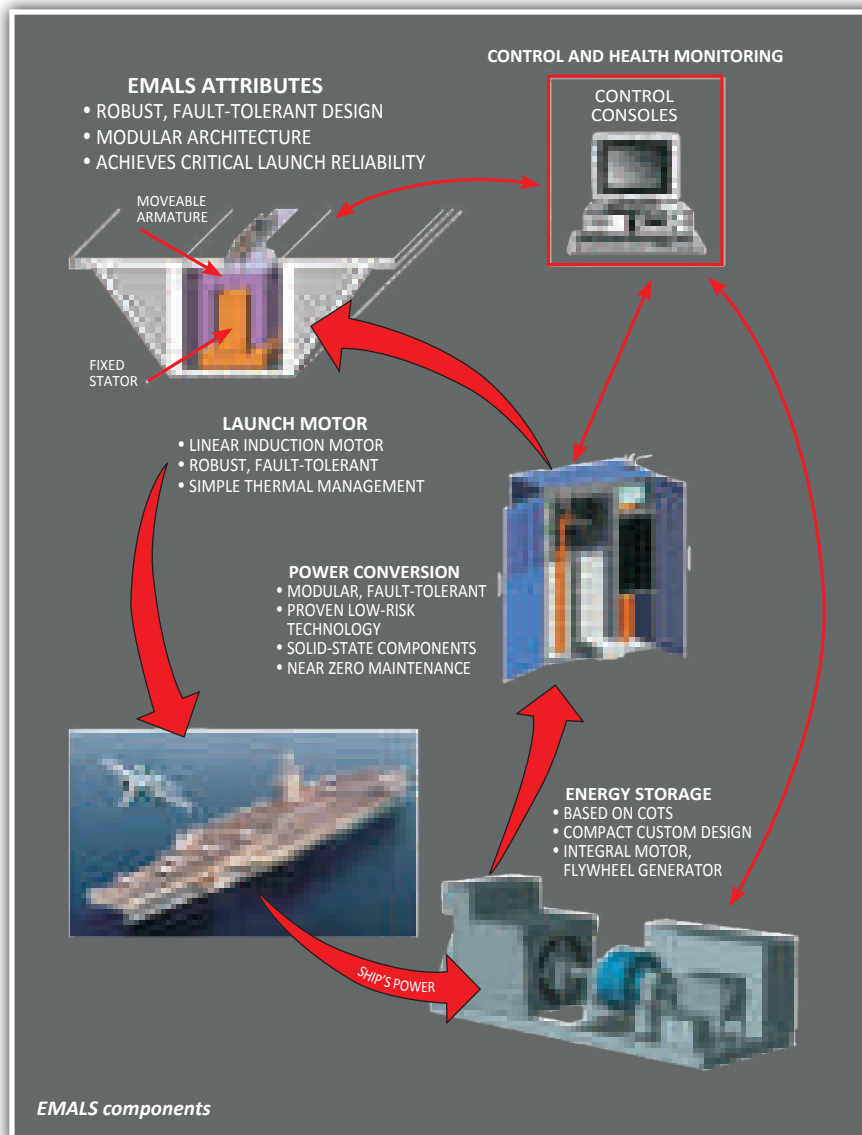


EMALS

Towards a 'Magnetic Bond'

The path-breaking to develop next-generation aircraft carriers, as formally put by United States Deputy Secretary of Defence Ashton Carter, comes at a time when cooperation between United States Navy (USN) and Indian Navy (IN) has reached significant dimensions, encompassing patrol and anti-piracy operations in significant global theatres and progressively moving towards robust Anti-Submarine Warfare (ASW) procedures and doctrines. A common fleet of Boeing P-8 Poseidon Multi-mission Maritime Aircraft (MMA) and possible ship-based rotary wing complement promises excellent interoperability and synergy of operations with cross references of experience. One of the key technologies being formally offered is the futuristic General Atomics Electro-Magnetic Aircraft Launch System (EMALS), capable of launching all types of carrier assets from Airborne Early Warning & Control (AEW&C) platforms through multi-role fighters to Unmanned Aerial Combat Vehicles (UACV).

EMALS uses an approach analogous to an electro-magnetic rail gun, so as to accelerate the shuttle that holds the aircraft. The 91-metre Linear Induction Motor (LIM) will accelerate a fully loaded 45,000-kg aircraft to 130 knots (240 km/h) 'within seconds' so providing a smoother launch, while offering up to 30-percent more launch energy potential to cope with heavier fighters. As apparent, EMALS provides the much necessary



First EMALS launch with the F/A-18E



slower launch speed for UACVs and allows a wider window of wind-over-deck speed required for the launch sequence. It also has far lower space and maintenance requirements, because it dispenses with most of the steam

catapult's cumbersome piping, pumps, motors and control systems. Diagnostic systems can be embedded for ease of maintenance with fewer personnel on board. EMALS motor generator weighs over 80,000-lb, is 13.5-feet long, almost

11-feet wide and almost 7-feet tall and is designed to deliver up to 60-mega joules of electricity, with 60-megawatts at its peak. This motor generator is part of a suite of equipment called the Energy Storage Subsystem (ESS), which includes



The 'Queen Elizabeth'-class carriers were to be fitted with EMALS but have reverted to their original STOBAR configuration.

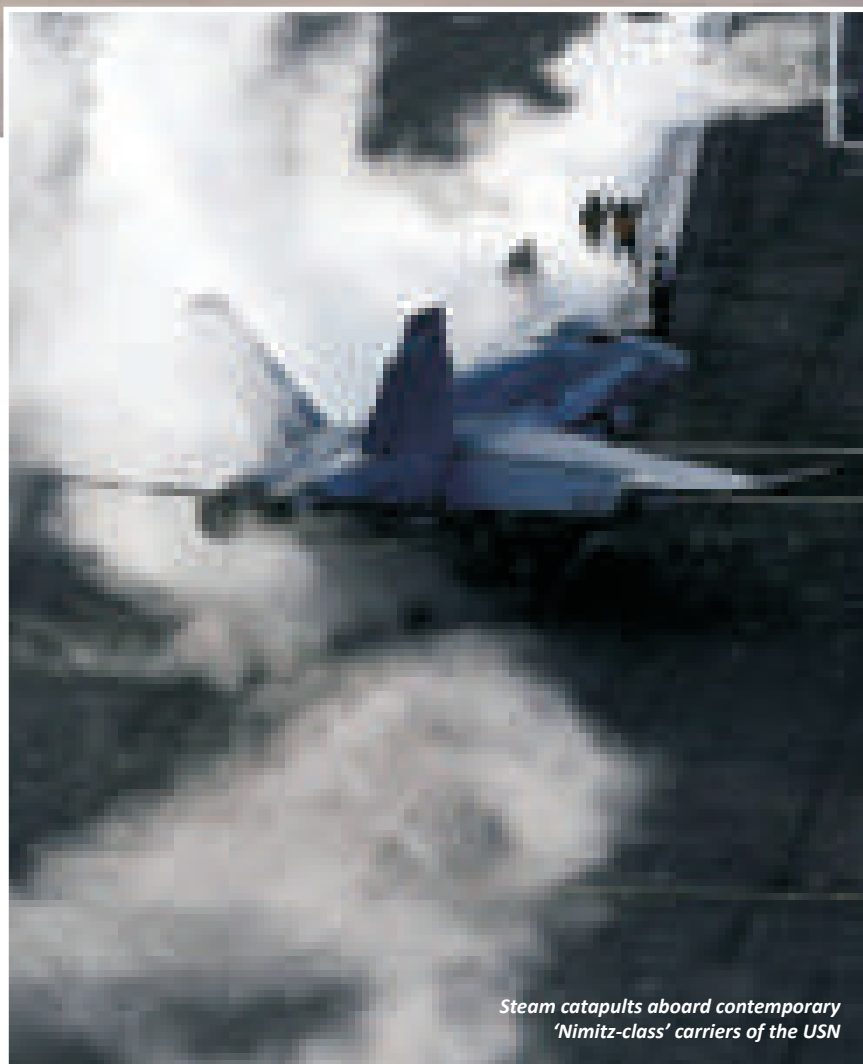


EMALS facilitates easier launching of aircraft such as this E-2D 'Advanced Hawkeye' AEW&C aircraft (photo: NGC)

the motor generator, the generator control tower and the stored energy exciter power supply. The new USN *Gerald R. Ford* -class aircraft carriers will require 12 of each.

The EMALS on IAC-2 will enable IN to operate fixed-wing AEW&C platforms like the United States E-2D 'Advanced Hawkeye' with superior coverage of airspace and, more importantly, have the ability to guide and control shipborne fighters towards their targets, an attribute the AEW helicopter platforms lack. Fortunately India's strategic geographic position also enables her to influence naval operations with land based LRMP platforms like P-8I Poseidon and Tupolev Tu-142 'Bear-F' which provide extended ASW coverage and AEW&C platforms for optimal situational awareness, (although an integral AEW&C asset is always welcome). The point of drama is whether the United States is ready to offer one of her *Nimitz*-class aircraft carriers (few home ported for budgetary constraints) on lease to the IN for familiarisation and training if the "next-generation aircraft carrier" joint venture proceeds on track—and in time.

Sayan Majumdar



Steam catapults aboard contemporary 'Nimitz-class' carriers of the USN



Aircraft and their Carriers

Then and Now

On 18 January 1911, an aviation pioneer from Iowa in America, Eugene Burton Ely, made history when he landed his Curtiss pusher airplane on a platform on the armoured cruiser USS *Pennsylvania* anchored in San Francisco Bay which was the first, successful shipboard landing of an aircraft. This flight was also the first ever using a tailhook system, designed and built by circus performer and aviator Hugh Robinson. As Ely later reminisced, "It was easy enough. I think the trick could be successfully turned nine times out of ten".

As described in the book *Carrier : a century of first-hand accounts of Naval Operations in War & Peace* edited by Jean Hood, "at 10:58 o'clock the lookout on the cruiser sighted Ely through the haze and the ship's siren roared a blast of welcome. He came on at terrific speed and circled around the fleet, dipping in salute to each ship, and then came up in the wind for the stern of the *Pennsylvania*. He was flying low as he neared the ship and touched down, lightly striking the platform about forty feet from the inner end. The hooks of

the aeroplane caught the ropes and stopped the bi-plane within sixty feet, coming to a standstill without damaging any part of his machine. There was a great outburst of cheers and a rush of the officers, visitors and sailors to greet the naval aviator.

Exactly one hour from the time he landed on the cruiser, Ely took his seat in the machine and gave the word to let go. The aeroplane swept down the 130-foot platform at high speed, dropped off the stern with a gentle dip and then rose rapidly over the ships in the harbour. The take off was as perfect as the landing had been. Rising to a height of 2000 feet, Ely circled over San Francisco and then headed for the aviation field and landed without any fuss. Thus history was made by this very first tailhooker."

Ely then got in touch with the United States Navy requesting service but United States naval aviation was not yet organised and Ely was destined to continue flying in exhibitions around the USA.

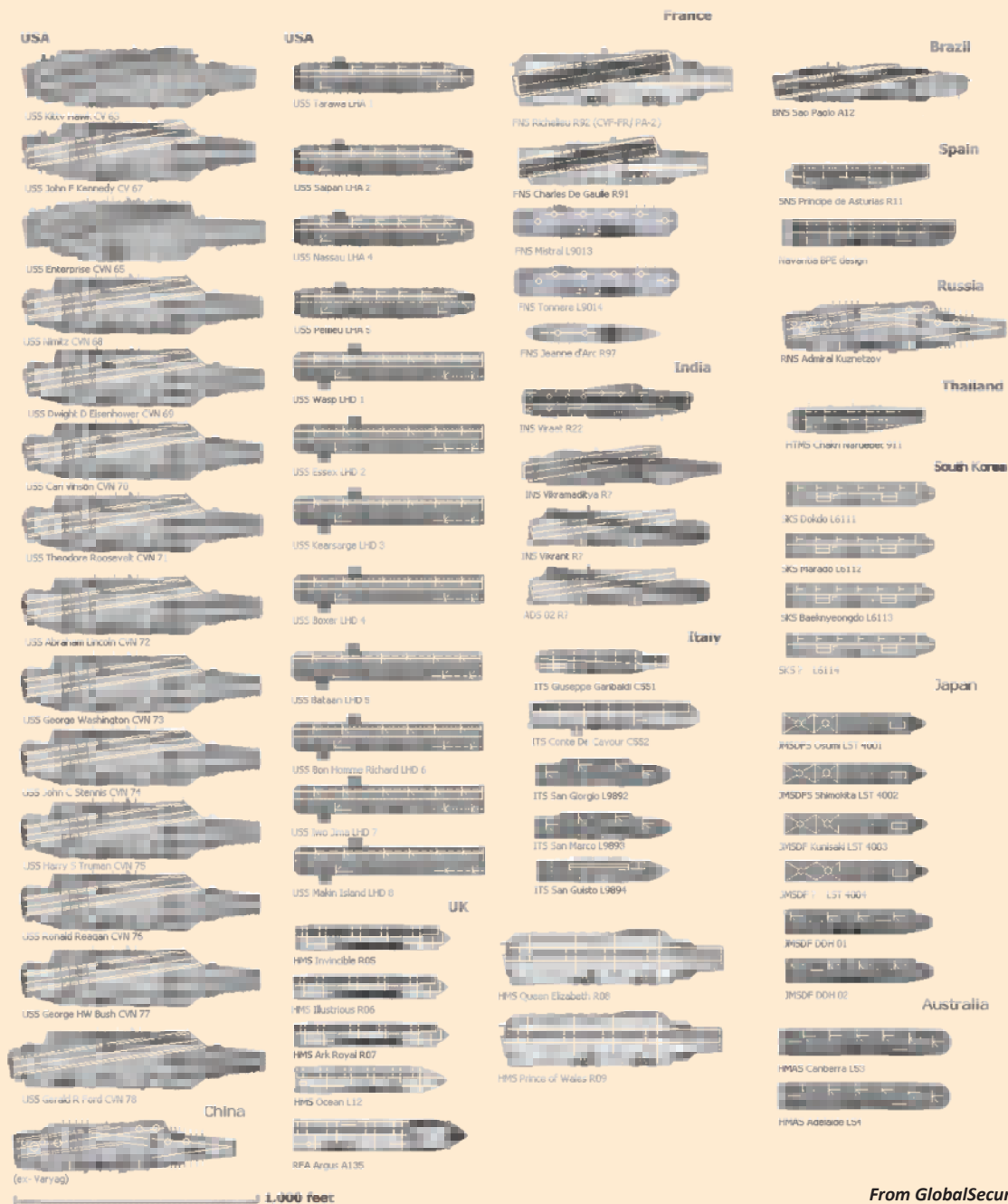
C'est la vie !

100 years after Ely's historic flight, nine Navies of the world today operate aircraft

carriers, led well ahead by the USA, with eleven, Britain awaiting the first of their new carriers while Italy has two. Then, France, Russia, Brazil, Spain and Thailand have one each, while the Indian Navy will augment its single carrier with another two over the next few years. Another ten vessels are under construction or being rebuilt : they comprise China's first three aircraft carriers, a second for Spain, the first of a new *Gerald R. Ford* class for the USN, apart from the HMS *Queen Elizabeth* and *Prince of Wales* for the Royal Navy. Other navies including France and Russia are considering their own medium-term options in a rapidly changing world that has been hit by economic recession and in which nobody can predict with any certainty exactly what kind of military conflicts will have to be resolved in the future or what means will be required.

Aircraft carriers and the aircraft that operate from them are expensive, to state the obvious as are the many highly-skilled personnel aboard them. There is a very long lead time between the signing of a contract and commissioning of the ship

Aircraft Carriers of the World



From GlobalSecurity.org

or the entry into service of a new fighter or helicopter. Critics have argued that too much is invested in them, that the loss of a carrier to enemy action would be a catastrophe for a Navy and so it is hardly surprising that at various times over the past century, various governments have viewed aircraft carriers as 'flag flying luxuries' or irreverently as 'dinosaurs'. Nevertheless, as the past century records, aircraft carriers are arguably the most versatile and potent means of projecting a nation's power overseas.

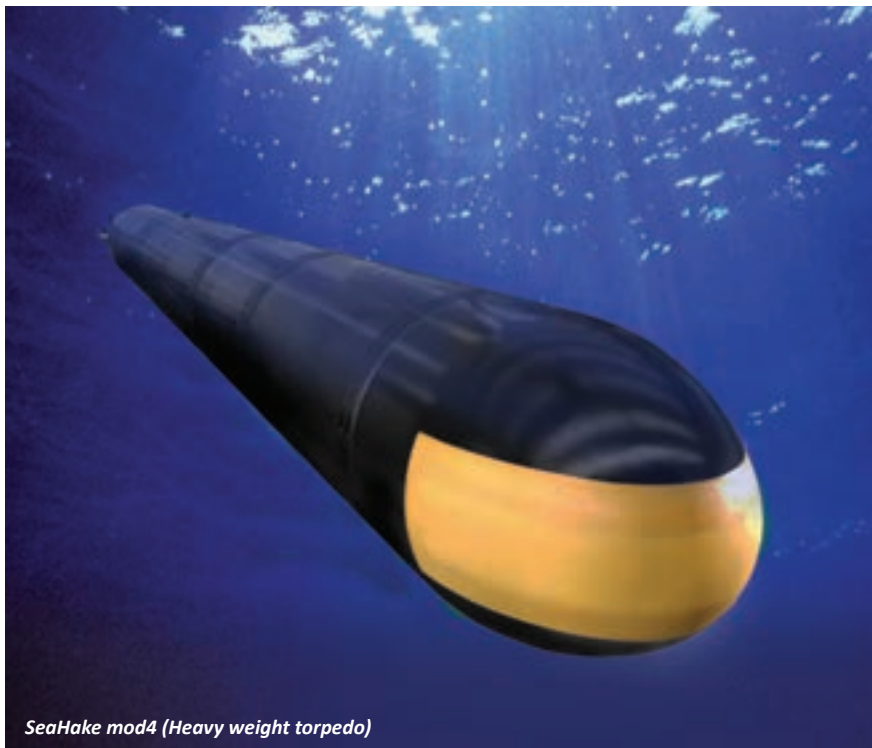
Above all, the aircraft carrier is much more than a powerful warship. Wherever it is sent it remains a sliver of superbly-equipped sovereign territory. In international waters it acts as a self-contained air base independent of the consent of foreign governments. Of course, its traditional adversary, the submarine, has become ever stealthier and potent but modern ASW, along with AEW and anti-missile systems, have correspondingly become more sophisticated. The aircraft carrier and its complement of strike

fighters and air defence aircraft plus helicopters is likely to remain a cornerstone of naval policy for decades to come.

Who can forget the exclamation of then US President Bill Clinton during his visit to *USS Theodore Roosevelt* : 'When word of crisis breaks out in Washington, it's no accident the first question that comes to everyone's lips is: Where is the nearest carrier?'

With converging US and Indian interests in the South China Sea, it could well be the new *INS Vikrant* !

Mr. Khalil Rahman, CEO, Atlas Elektronik India



SeaHake mod4 (Heavy weight torpedo)

VAYU : Atlas Elektronik has set up its Indian subsidiary. What is the purpose of the new subsidiary in India?

KR: Atlas Elektronik founded its subsidiary, Atlas Elektronik India Pvt Ltd with headquarters in New Delhi earlier this year. The Indian subsidiary is acting as the bridge-head for the German company into the country and will provide technical and logistical support to customers and to the German parent company. Atlas India will also act as the main point of contact for developing industrial partnerships with Indian companies.

Atlas Elektronik India is looking forward to a couple of programmes where we have a very good visibility. These include the life extension of the torpedoes and Active Towed Array Sonars. In addition to these two, three major programmes are coming up where

we are going to bid. Then there are long-term programmes, for instance, *Project 75 India*.

Atlas Elektronik sees a large potential in the Indian market and in view of the Indian Navy's fleet expansion plans, we have created a subsidiary in India which will enable us establish a long-term footprint both commercial and technical in the country.

VAYU : Please elaborate on the main programmes Atlas Elektronik is working on in India currently?

KR: Existing projects are focused mainly around the upgrade of the *Shishumar*-class submarines, which are in various stages.

In terms of new projects the company is currently involved in a number of programmes, top among them being the

Active Towed Array Sonar (ACTAS). This will equip the *Delhi* and *Talwar*-class ships initially and subsequently be manufactured in India under cooperation with BEL. Atlas Elektronik GmbH is also looking forward to compete on some of the ambitious Indian navy programmes in the areas of sonars and torpedoes apart from the long term expansion programmes such as *Project 75 India*.

Besides, these other three upcoming major programmes where we are going to bid:

First one is the new torpedo defence suite, which is an anti-submarine warfare (ASW) suite, consisting of a sonar, a decoy and fire control system. The bid is for 12 systems and the RFP has been issued

We are also expecting the bid for 16 shallow water craft. Each of these 16 ships will be equipped with hull-mounted sonar and low frequency variable depth sonar (LFVDS). This is a specialised ASW craft designed to operate in littoral water. This is at the request for information (RFI) stage.

The third bid is for the towed-array sonar for eight *Kilo*-class submarines, which are undergoing upgrade.

VAYU : Can you brief us about your cooperation with Indian industry?

KR: Atlas Elektronik is committed to positive relationship with Indian private industry. We are in talks with BEL to see whether we can integrate them into our global supply chain. As we know, BEL is currently the main company in India, which has sonar transducer manufacturing capability. BEL will also be the recipient of the ToT for the towed array sonars and we would like to build a long-term arrangement with them.

We are in the process of negotiating or having discussions about MOUs and partnerships with key industry players. We have already some on-going partnerships. So, for example on the portable diver detection sonar- we are partnered with Larsen & Toubro. Besides, we have also signed an MoU with Pipavav

The market for torpedoes remains very large in India, both heavy and lightweight. We have some really unique technologies that we are willing to share with India and we are talking to various partners including the DRDO in the area of torpedoes. We are looking at developing partnerships with India in order to allow India to develop an indigenous torpedo that integrates aspects of our technology.

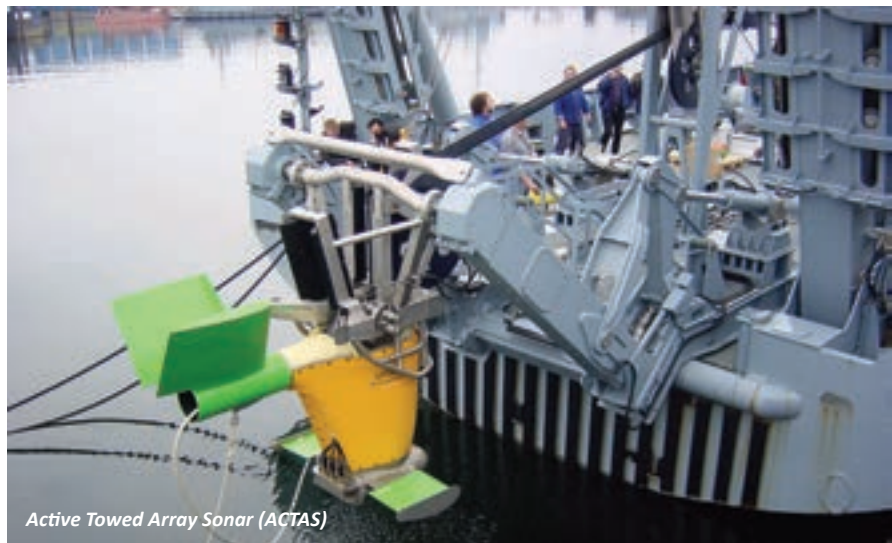
VAYU : The nation witnessed the loss of INS Sindhurakshak recently. How can India, according to you, address the weaknesses in the submarine fleet in the short, medium and long run?

KR: Due to the loss of *Sindhurakshak*, there has been much discussion about the strength of the underwater capabilities and the delays to the various programmes. In the short and medium run, we feel its extremely important for the Indian Navy to focus on the upgrade of its existing submarine fleet since the acquisition and manufacture of new submarines will be a long term solution that cannot solve the short and mid-term issues.

The nation should be looking at reinforcing the ASW capability in the absence of a quick solution to the submarine issue. The Indian Navy should ensure the upgrades of the existing submarines are quickly and efficiently carried out. In the long run, India should focus on new programmes but without losing focus on the continuous upgrade of its existing submarine fleet.

VAYU : What is Atlas doing to help Indian Navy maintain and enhance the submarine capability in the light of recent events?

KR: Atlas is providing upgraded SUT torpedoes, that can also be fired from the P75 submarines. We are also negotiating for upgrades to the ASW sensors (ATAS) for two classes of surface ship. We have provided offers for upgrades of the remaining two *Shishumar*-class submarines.



Active Towed Array Sonar (ACTAS)

Obviously Atlas can only do what it is contracted to by the Indian Navy and we know that the Navy is trying hard to minimise bureaucratic delay.

VAYU : What is status of the SUT upgrade programme and the submarine upgrade programme?

KR: The SUT Life time extension programme has been signed. The fact that Atlas has been contracted for SUT LTE upgrade demonstrates long-term commitment of Atlas to support the Indian Naval heavyweight torpedo arsenal and the confidence of the Navy in Atlas.

VAYU : What opportunities do you see in the long term in India?

KR: The ASW (Anti-Submarine Warfare) market is an area of interest. India wants to project power over the Indian ocean and to counter growing Chinese influence. In order to do this, the

underwater warfare segment is critical and ASW is the flip side of the submarine coin. Atlas has a suite of products in this area such as AMACs and is one of the few global players with a complete ASW solution.

As I mentioned before, the market for torpedoes remains very large in India. The heavy weight torpedoes will be required for the six P-75(I) submarines as and when that platform is built; then there would be a requirement to equip the nuclear submarines and the long term plan of the navy envisages 12 additional conventional submarines, all of which would require torpedoes.

Our plan is to develop an indigenous solution, which enables us to compete in the Indian market. This is only the heavyweight torpedoes from submarines, as in addition torpedoes can be used from other platforms such as surface ships or even land based installations in the context of coastal protection.



SeaHake mod4 ER (extended range)



More wings for Indian Coast Guard

An ICG Dornier patrols over the Bay of Bengal

The Dornier 228 multirole light transport aircraft is virtually synonymous as a sinew of the Indian Coast Guard's prowess. This German-origin, HAL-built aircraft has

served with the air wing of the Indian Coast Guard since 1986, when the first aircraft was flown in from Munich in Germany, to land at Bombay's Santa Cruz Airport. With the receipt of another

batch of Dornier 228s, the first Squadron equipped with the type was CGAS 750 which was commissioned at Daman on the north west coast of the Indian peninsula on 29 October 1987.



Personnel of CGAS 700 with their latest Dornier 228 (CG 789) at Dum Dum Airport, Kolkata



With steady receipt of Dornier 228s built under licence by HAL's Kanpur Division, the Indian Coast Guard thereafter commissioned several new Squadrons including 744 at Meenambakam Airport in Madras, 745 at Port Blair and 747 at Cochin.

However, the very first fixed wing Squadron was CGAS 700 which was commissioned on 30 July 1983 at Dum Dum Airport, Calcutta on 30 July 1983. Its initial complement was two ex-Indian Airlines Fokker F.27s which were operated without role equipment but

provided the Indian Coast Guard with some 'eyes' over the Bay of Bengal even if they were human !

Since 1986, the Indian Coast Guard have received 38 Dornier 228s, equipped with specific role systems and equipment including 360° maritime surveillance radar plus advanced navigation and communication systems. The Dornier 228s have bubble observatory windows in front of the cabin which provide 180° view while the main sliding door on the port side can be opened in flight to permit

airdropping of seven-man life rafts during search and rescue missions.

Coast Guard Dornier 228s can also be fitted with the Micronair pollution prevention system for pollution detection and control, the system allowing spraying of dispersal agent over the designated surface.

To enhance its maritime surveillance capability over the coastal region in West Bengal and Odisha, as also the Bay of Bengal, the Indian Coast Guard, North East Region inducted a fourth Dornier 228 for CGAs 700 on 31 July 2013.

30 Years on



Typical scene at the flight line at Chakeri, with HAL-built Dornier 228s of the Indian Navy, before handing over to the Service

The Dornier 228 programme in India

The contract for licence production of the Dornier 228 Light Transport Aircraft in India was signed 30 years back, on 29 November 1983. Since then, Hindustan Aeronautics Limited at their Transport Aircraft Division at Chakeri (Kanpur) have systematically manufactured several variants of this versatile aircraft for the Indian Coast Guard, Air Force, Navy and the erstwhile Vayudoot. Single examples were also produced for the Airports Authority of India and private operators such as UB Air and Jagsons (remanufactured from

an earlier Druk Air delivery) while a few have been exported to the Mauritius Coast Guard and recently, the Seychelles.

With over 120 aircraft delivered so far and another 35 plus on order, this ensures that production of this ubiquitous light transport aircraft will continue till at least the end of this decade, making it one of the most successful licence production and true transfer-of-technology programmes in Indian aviation history.

However, HAL has not taken advantage of the rights earned by it wherein, the original licensor was to 'buy back' a

minimum of 35 aircraft kits during the initial 10 year period nor indeed market the HAL-built 228 to the 30 countries earmarked as 'exclusive' to it. The original company Dornier was thereafter 'taken over' by a US investor which soon enough closed the programme in Germany and HAL became the only production agency for the 228 in the world and could have, over the past decade, exported at least two score aircraft worldwide.

The Swiss company RUAG, which 'inherited' the Dornier 228 IPR, restarted the programme to the extent that in 2008, it



Historic photograph of the signing ceremony at South Block on 29 November 1983, between Secretary Defence Production Mahesh Sarin and Dr Fritz Mader, Director Dornier GmbH to his right. Further right are Gerd Schoenbuchner and Reinhold Birrenbach of Dornier. Opposite them is (then) Air Marshal Lakshman Katre, Chairman HAL (later Chief of the Air Staff).

ordered 50 odd 228s from HAL in kit form for completion in Germany to the 228NG standard for worldwide sales. However, the very high price reportedly quoted by RUAG have precluded success and the

programme seems to have petered out. A few aircraft have however been sold by RUAG to India's neighbours, particularly the Bangladesh Navy which will operate two 228s in the maritime surveillance

role from Chittagong, covering the Bay of Bengal. Ironically, the same space is being covered by Indian Coast Guard HAL-Dornier 228s operating from Calcutta (*see story in this issue*).



The key sensor on Indian Navy HAL-Dornier 228s is the ELTA EL/M2022 360° Maritime Surveillance Radar

Things that go 'Bang' !

Vayu visits MBDA

A Luftwaffe Tornado in strike configuration launches a Taurus (MBDA photo)

In late October, 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. In this first article of a two-part series on the trip, we cover MBDA's maritime products, in keeping with the Navy-centric theme of this Issue.

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 merger of the leading missile manufacturers of France, Italy and the UK, and reached its present structure with 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.

MBDA's Schrobenhausen facility in Germany, employing over a thousand people, is located about an hour's drive from the heart of Munich, surrounded by verdant Bavarian woodlands. The lush location belies the purpose behind the facility – the design and manufacture of a range of missile products. Schrobenhausen is also one of the few MBDA facilities where high explosives are stored and handled, with a capacity for some 240 tonnes in storage, as well as a testing range.

Here we were briefed upon two key programmes handled by MBDA Germany and its partners: the PARS 3 LR ATGM being produced in collaboration with Diehl BGT Defence and the Taurus

KEPD 350 ALCM in collaboration with Saab Bofors Dynamics. While both products are currently only on offer for Indian Air Force programmes - PARS 3 LR for the HAL Rudra and Taurus for the long-range standoff strike missile requirement – it is important to note that both can well be utilised in the maritime environment. While the PARS 3 LR has already been developed for Indian requirements, with a twin-tube launcher designed by an Indian SME specifically for the Rudra, it is the Taurus that holds special interest for the Navy, and it was explicitly stated that the missile could be optimised for maritime strike.

Taurus KEPD 350

Today, the Taurus KEPD 350 is in service with the German and Spanish Air Forces and has been selected by the South Korean Air Force as well. In its present configuration, the KEPD 350 (Kinetic Energy Penetrator Destroyer) is highly stealthy, accurate and lethal, particularly against hardened targets. This makes it particularly attractive for modification as a long-range strike missile to be carried by the Navy's new MiG-29K multirole fighters or even patrol aircraft such as the Il-38SD and P-8I. With the ability to destroy bunkers and hardened aircraft shelters on land, the KEPD 350 makes for an ideal naval weapon to engage and destroy capital ships whilst keeping launch platforms out of the range of hostile air defences.

MBDA have highlighted their willingness to modify the missile in collaboration with India to suit specific operational

Taurus KEPD 350MR - the missile

Range: 300 km (>500 km for KEPD 350)

Weight: 1400 kg

Length: 5 m

Wingspan: 2 m

Speed: Mach 0.6 – 0.95

Warhead: 480 kg MEPHISTO

Guidance: IBM (Image Based Nav), TRN (Terrain Referenced Nav), INS (Inertial Nav) and MIL-GPS

Platforms: Typhoon, Tornado, Gripen, F/A-18, F-15E



needs. While changes such as India-specific datalinks, mission control and tri-services modifications might be taken for granted, MBDA also mentioned the possibility of working locally to adapt the missile for launch from transport (or similar) aircraft and to add more robust anti-ship capability to the weapon.

From Schrobenhausen, the trip continued across the English Channel to Lostock, a quiet residential district of Bolton, a few miles north of Manchester in England. The MBDA facility in Lostock was originally a propeller factory for De Havilland in 1937, and has been owned by a number of aerospace firms through its history, including Hawker Siddeley and British Aerospace (the latter still has a production facility in nearby Samlesbury). It is now the epicentre for MBDA's activities centring on the ASRAAM, Meteor and Brimstone product lines and their derivatives. MBDA Lostock employs around 300 people, but unlike Schrobenhausen, does not handle any explosives or pyrotechnics (rocket motors). Missiles assembled here are at operational standards save for warheads and propulsion systems, which are integrated either at MBDA's Henlow facility near



ASRAAMs on a RAF Typhoon

London, or UK MoD munitions facilities at Beith, Scotland or Gosport, England.

While the ASRAAM proposal to equip the IAF Jaguar fleet is at an advanced stage and has been widely reported on, representatives from MBDA also discussed in great depth a wide range of maritime products that are of particular relevance to naval operations in the IOR.

The Brimstone Family

The first of these is the Brimstone. Currently operational as the air-launched 'dual-mode Brimstone' that has seen action in Iraq, Afghanistan and Libya, the Brimstone family has its origins from November 1996, when the UK MoD awarded MBDA a development and production contract for the development of a new anti-armour weapon for the Royal Air Force. A lightweight 50 kg missile, Brimstone can be fired in a number of attack profiles: direct or indirect against single targets, a column of targets or against an array of targets. The latter utilises a salvo attack capability for multiple kills per engagement. Once launched the platform is free to manoeuvre away from the target area or engage another target array.

This missile initially provided fire-and-forget attack capability from an effective stand-off range, its millimetre-wave radar seeker ensuring target acquisition and identification in poor visibility and all weather conditions. This 'single-mode' Brimstone entered service with the RAF in March 2005.

Dual-mode Brimstone (DMB) is a refinement of the product, developed by MBDA following an Urgent Operational Requirement (UOR) issued by the RAF for an upgrade to existing Brimstone capability. The UOR called for a precision low collateral damage weapon with man-in-the-loop capability to defeat a wide range of static and fast moving targets whilst operating within restrictive rules of engagement (RoE).

DMB development made maximum re-use of the existing Brimstone missiles, requiring only a modification to the seeker head along with revisions to the missile software. The unique new seeker was developed through a combination of UK MoD and MBDA research funding and combines the original Brimstone millimetre-wave radar seeker with a sensitive Semi-Active Laser Homing (SALH) capability and the ability to operate in single mode or in a dual radar/laser guided mode. DMB fuses the inertial



A Dual-Mode Brimstone showing its large sapphire seeker dome

navigation system, digital autopilot and the seeker RF and new SALH guidance modes simultaneously to guide the missile accurately down to the target specified by the aircraft.

Even more impressive is the fact that the guidance mode is selectable “on the fly” from the cockpit to maximise flexibility on station and enable the missile to engage all types of target in a single sortie.

Dual-mode Brimstone made its combat debut during *Operation Telic*, Iraq, December 2008 and is typically carried on racks of three by RAF Tornado strike fighters. Following *Operation Ellamy* over Libya, data from Brimstone launches were shared with numerous allied air forces, many of who were keenly interested in the accuracy and low collateral damage of the missile. The Indian Air Force Chief of Air Staff, Air Chief Marshal NAK Browne, was reportedly briefed on Brimstone performance in Libya by his British counterpart, following the conclusion of *Operation Ellamy*.

While the precision effects of Brimstone make it highly sought after for any air-launched operator, be they land-based or maritime, MBDA recognised the value of high-precision, low-collateral munitions and has adapted the Brimstone yet again as a lightweight maritime weapon geared toward countering evolving asymmetric threats in increasingly dangerous global environments. Initially dubbed the ‘Sea Spear,’ the shipboard weapon will prevent *USS Cole*-type incidents by being able to counter swarms of small hostile boats, fast attack craft, and other fast-moving asymmetric threats at sea.

The Maritime Brimstone will provide simultaneous engagement of multiple targets by day or night and in any weather conditions in high sea states. With a range of over 6 km, it outranges most light guns and overcomes accuracy issues that come from using guns in rough weather or against fast, small targets. While dual-mode operation similar to its air-launched sibling is possible, the conditions of operating from a ship limit utility of the laser homing portion of the guidance system. Instead, the Maritime Brimstone will be limited to inertial guidance and millimetre-wave radar.

MBDA launched their CWSP (Compact Warfare System Package) combat suite in 2010, so to provide fast patrol boats and similarly-sized ships with an integrated combat system incorporating an automated, twin turret Mistral SIMBAD-RC air defence system and a twin launcher Marte Mk2/N missile system for the anti-ship role. CWSP, also self-funded by MBDA, leverages the company’s experience with air defence C2 systems as well as air defence and anti-ship missiles to create a combat system that combines the firepower of missiles and guns within a modular architecture incorporating radar and EO sensors.

However, in recognition of the growing complexity of littoral operations, MBDA is now offering CWSP with Maritime Brimstone in order to counter agile high-speed craft operating in large numbers and well co-ordinated formations. These fast inshore attack craft (FIAC), when operating together, can overwhelm the defences of naval craft equipped only with medium-calibre gun systems.

The very small system footprint ensures that Maritime Brimstone should be simple to operate and easy to integrate aboard existing ships as well as future designs with a minimum of difficulty; MBDA is offering turn-key CWSP integration



or installation of Brimstone-only packages alongside existing combat management systems. The modular launcher design means that the system can scale to match vessel size, from a 4-tube launcher to 16 tubes, making it able to arm anything from patrol boats to large capital ships.

In May this year, MBDA successfully carried out a surface-to-surface, rapid salvo firing of three Brimstone missiles in a trial scenario representing a FIAC attack. Each of the missiles hit its intended target. This trial added to the tally two previous Brimstone successful tests against FIAC targets.

While Maritime Brimstone is yet to be formally offered to the Indian Navy, MBDA representatives confirmed that clearances for export are in place and the company hopes to so equip the US Navy’s upcoming Littoral Combat Ships while also offering the system to a number of nations in Asia.

Marte missiles

The next system on offer to the Indian Navy is MBDA’s Marte helicopter-launched anti-ship missile (AShM). The Marte family was born in the 1980s and has undergone continuous upgrades and refinements since, culminating in the contemporary product line of 30+ km, rocket-propelled Marte Mk2/S (air-launched) and Mk2/N (ship-launched) as well as the newer Marte ER, which is a heavily modified version featuring a turbojet engine and range in excess of 120 km.

The Marte ER was a natural capability-growth development of the basic Marte family in order to facilitate a stand-off attack capability as well as augment guidance and control. The Marte ER adds GPS guidance, waypoint navigation and variable speed. Multiple missiles can be launched at a target with simultaneous time of impact in order to saturate air defences and increase hit probability against well-defended targets. The new missile leverages commonality with existing Marte Mk2 users and most importantly, maintains similar physical dimensions as the Mk2 whilst dramatically increasing performance. The Marte ER remains a 300 kg missile but almost quadruples the range of the Marte Mk2 while equipping the same warhead. The 300 kg mark is crucial for maintaining performance of airborne platforms such as helicopters. Furthermore, the more flexible design means that the Marte ER warhead is scalable up to 115 kg, trading range

Marte Statistics

Marte Mk2/S (helicopter launched)

Range: 30+ km

Weight: 300 kg

Length: 3.8 m

Speed: high subsonic

Warhead: 74 kg HE

Guidance: Active radar

Platforms: AW101, NH-90

Marte ER

Range: 120+ km

Weight: 300 kg

Length: 3.8 m

Speed: high subsonic

Warhead: 70-115 kg HE

Guidance: Active radar

Platforms: AW101, NH-90



- the Navy has issued an RFI for land-based coastal defence missile systems with similar performance requirements to the MR-AShM RFI, so once again the Marte ER, with modifications for mobile land based use is being suggested.

While the helicopter programmes are experiencing continuous delay, MBDA may find that it is to their benefit to have both a mature weapon (Mk2) and a potential co-development project (ER) to offer the Indian MoD when time comes to make a decision – however, it remains to be seen whether the Indian side will see an opportunity for what it is.



A Marte Mk2/S carried by an Italian Navy NH90 NFH

for increased destructive power, all within the 300 kg limit. The design of the new missile is well underway, with launch platform integration and testing expected in 2015.

Contrary to expectations, the in-development status of the Marte ER has not harmed the programme's sales prospects – quite the opposite! The low cost of development and acquisition makes it attractive to a number of potential customers and indeed to India as well. MBDA had contact with DRDO regarding Marte ER development as early as 2007 and intermittent interactions since then. The possibility to co-develop the missile for present and future Indian requirements remains a distinct possibility.

With three variants of the missile on offer, MBDA has responded to a number of Indian requirements:

- the Marte Mk2/S is on offer for the MRH and NMRH programmes, and has been extensively tested with the NH-90 NFH that is competing to fulfil these requirements. The Marte ER would provide a practical growth path for Indian Navy helicopters capable of operating the Marte Mk2/S.
- the Marte ER has been offered in response to an Indian Navy RFI for a ship-based medium-range anti-ship missile system (MR-AShM) specifying range in excess of 120km, a 100 kg warhead and radar guidance.

The future – Sea Ceptor/CAMM

The final, and perhaps most interesting system under development at MBDA, is the Common Anti-Air Modular Missile (CAMM), a unique missile programme that is designed to be operated from land, sea and air. The maritime air defence system utilising CAMM is scheduled to be first variant in service, and will begin to replace the Sea Wolf point defence systems on the Royal Navy's Type 23 frigates from 2016 onward. Called *Sea Ceptor*, the system has been developed for and funded by the UK MoD, but MBDA has been cognizant of export prospects from outset and the system has been designed to equip a wide variety of present and future warships.

The Royal Navy's initial requirements for Sea Ceptor were rather stringent, entailing 360° coverage, simultaneous multiple target engagement by day or night and in all weather conditions out to around 30 km, along with better performance than current benchmark systems around the world. Additionally, the system was required to be easily retrofitted to older vessels in addition to equipping future ship classes. The system as designed to meet these needs, therefore is highly capable, lethal and flexible, being able to engage a plethora of airborne targets, including helicopters, fixed-wing aircraft, UAVs and anti-ship missiles. Crucially, it is also built to defend against



An artist's rendering of the CAMM in flight

high speed (supersonic) missiles of the future and with a high rate of fire, mid-course guidance via datalink and exceptional manoeuvrability, can counter saturation attacks that are increasingly being adopted to overwhelm contemporary air defence systems.

The missile itself is derived from ASRAAM, sharing many common features, particularly the high speed (Mach 3+), 'lifting body' aerodynamic design and 'skid-to-turn' steering mechanism, but with vastly updated electronic systems and an active radar seeker instead of the ASRAAM's IR seeker. Both missiles share the same diameter, but the CAMM is longer (3.2 m) and heavier (99 kg).

The launcher utilises a 'soft' vertical launch (VLS) mechanism, allowing the missile canisters to be small and lightweight whilst also minimising the wear and tear associated with 'hot' launch systems that ignite the missile's rocket motor within the launch cell. A benefit of the smaller CAMM canisters is that as many as four CAMM units can be fitted into the space occupied by a single cell of current VLS types such as the Mark 41 and SYLVER. Another advantage to the lower size and weight of the system is that it can equip much smaller ships, such as offshore patrol vessels.

With Sea Ceptor scheduled to enter service only 3 years from now, the programme is at an advanced stage, and among other tests, has been validated for soft launch from a Mark 41 VLS cell. With Royal Navy contracts for the Type 26 Global Combat Ship to follow the Type 23 retrofits, and a recent Royal New Zealand Navy decision to equip the upgraded ANZAC frigates with the Sea Ceptor, the Mark 41 integration will serve only to widen the platform's export appeal, including to potential operators in the subcontinent.

With a strong current and future maritime portfolio, MBDA has everything to play for in the Indian defence sector, but only time will tell if the trend of lengthening delays as well as the more recent push toward greater indigenisation will prove to be a hindrance – or an opportunity.

Angad Singh

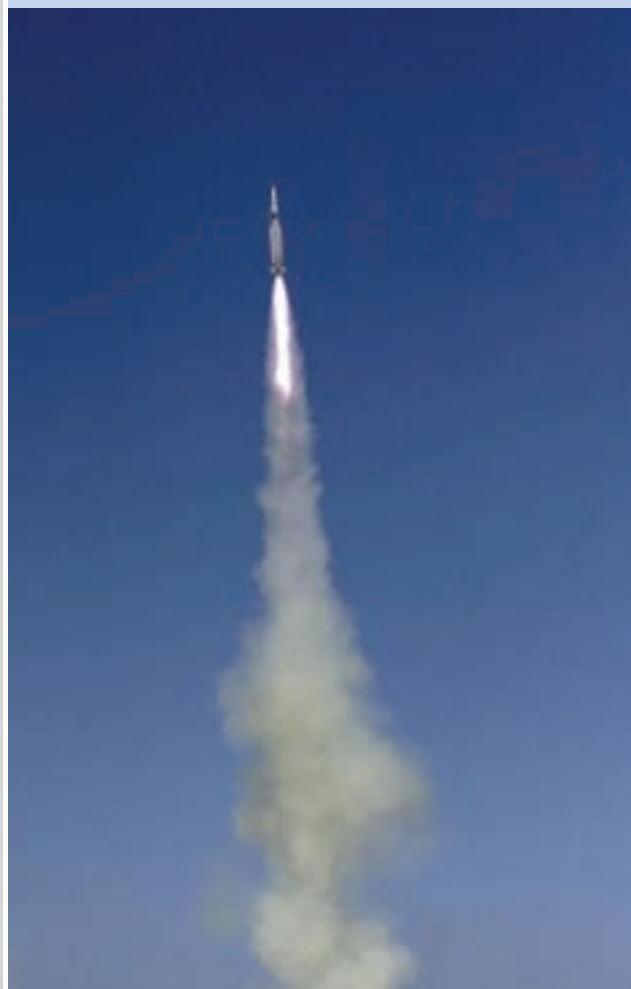
MBDA's VL MICA successfully fired by Oman's Al Shamikh OPV

The Royal Navy of Oman (RNO) has recently conducted an operational naval VL MICA missile firing from the *Al Shamikh* Ocean Patrol Vessel (OPV), a *Khareef*-class ship constructed by BAE Systems. The RNO is one of 12 armed forces worldwide to have selected the MICA missile.

This live firing took place at the French MoD's test range off the coast of the Ile du Levant in the Mediterranean Sea under the supervision and control of the French DGA – EM (*Direction Générale de l'Armement - Essais de Missiles*).

The VL MICA missile successfully intercepted and destroyed a very low altitude target that was simulating a sea skimming anti-ship missile, confirming the operational capability of the RNO with its new vessel and weapon system.

VL MICA is a new-generation air defence system that deploys the MICA missile vertically launched from a canister. In its naval version, VL MICA provides both area air defence as well as self-defence of the host vessel. MICA fire-and-forget missiles can be equipped with either IR or radar seekers and are capable of countering a range of airborne threats as well as saturating attacks.



MBDA's India Focus

At the Paris Air Show 2013, MBDA demonstrated its technology base geared to meet the ever-increasing defence challenges of the future: many of the products on display are of direct interest to India and in particular to the IAF, especially with the planned upgrades of the Mirage and Jaguar in mind and of course the weapons selection for the Rafale. In fact for these three aircraft, MBDA's Le Bourget stand showcased the full complement of weapon systems capable of meeting the IAF's operational needs across an array of missions.

Air Launched Weapons

The MBDA MICA has long been the major air combat weapon with the French Air Force and has also been ordered for the IAF's Mirage 2000 upgrade. Both versions, IR and RF, were on display to highlight the advantages offered by two interoperable seekers which will enable the IAF's Mirages to cover the full air combat spectrum, from short range combat to beyond visual range interception. The IAF is also looking for a weapon to provide its Jaguar strike fighter with the best means of defending itself from attacking aircraft. ASRAAM, with its exceptional speed off the rail and outstanding shoot-up capability is the preferred weapon for the above-wing pylons of the Jaguar.

With Meteor, MBDA demonstrates not only the latest thinking in missile technology but also its capability in leading international cooperative programmes. This beyond visual range air-to-air missile combines throttleable ramjet speed, range and agility to ensure a 'no escape zone' (NEZ) far superior to any current or planned weapon in the BVRAAM category.

Modern multi-role aircraft require not only air combat weapons but also the means to carry out precision strikes against both static and fast moving ground targets. These targets could range from hardened control bunkers to mobile 4x4s and even well concealed snipers. After highly publicised successes in Libya and Afghanistan, Brimstone 2 has been praised not only by the UK's RAF but by other allied air forces as well. With its dual mode seeker (millimetre wave radar and semi-active laser), this versatile 50 kg weapon can neutralise a column of fast moving tanks in fire-and-forget mode and, it can be deployed against a single target during complex urban conditions that call for man-in-the-loop control until impact. Brimstone has also proven its capabilities against fast inshore attack craft (FIACs) which are a growing threat in coastal waters. Displayed for the first time at Le Bourget was MBDA's SPEAR missile which is a development project based on the Brimstone that the company is working on to provide the RAF's future F-35 JSF with an internally carried multi-target, multi-mode seeker equipped stand-off weapon.

The Storm Shadow/SCALP and Taurus KEPD 350 cruise missiles feature extreme stealth and precision at extended ranges and the ability to penetrate hardened bunkers and other high value installations. A number of Storm Shadow/SCALP missiles were fired with "great success" during combat missions in Iraq and Libya.

Weapons for the Battlefield

Seen earlier at Aero India 2013 in Bangalore and displayed again in Paris, was MBDA's PARS 3 LR ATGM. Promoted in India for the HAL Rudra (Dhruv WSI), with PARS 3 LR already in service in Germany on its Tiger helicopters. Recent tests have shown the

system's abilities to strike with precision even in complex urban environments as well as in salvo, fire-and-forget mode in open territory against columns of tanks. Specifically for India, MBDA has already developed a close industrial relationship with an in-country partner to develop a twin-tube launcher for the Rudra.

Ground and Naval Based Air Defence

Maitri or SR-SAM is still a key topic in India with focussed discussions having been concluded recently by the French and Indian Governments. The Indian Army is also currently looking for a weapon system to meet its VSHORAD requirement. MBDA's selection of surface-to-air systems at Le Bourget showcased the firm's experience in this domain and its understanding of a successful multi-layered defence architecture. The Mistral missile system is being proposed for India's VSHORAD needs and at Le Bourget, this highly versatile missile was shown with the MPCV system, a mobile armoured vehicle equipped with twin Mistral turrets. The same Mistral missile was also shown with the remotely-controlled Simbad RC launcher for close-in ship defence.

The Common Anti-air Modular Missile (CAMP) was on display at Le Bourget in its land-based variant but the same soft-launched missile is also part of the UK Royal Navy's planning as a future self-defence system for its current Type 23 and future Type 26 (Global Combat Ship) frigates. To reduce risk and therefore cost, CAMP draws on significant amounts of existing proven technology which will go on to provide technology advances to other MBDA systems in their own future evolution such as with ASRAAM.



MICA on the Mirage 2000



The largely empty space of OFB pavilion at DSEI 2013

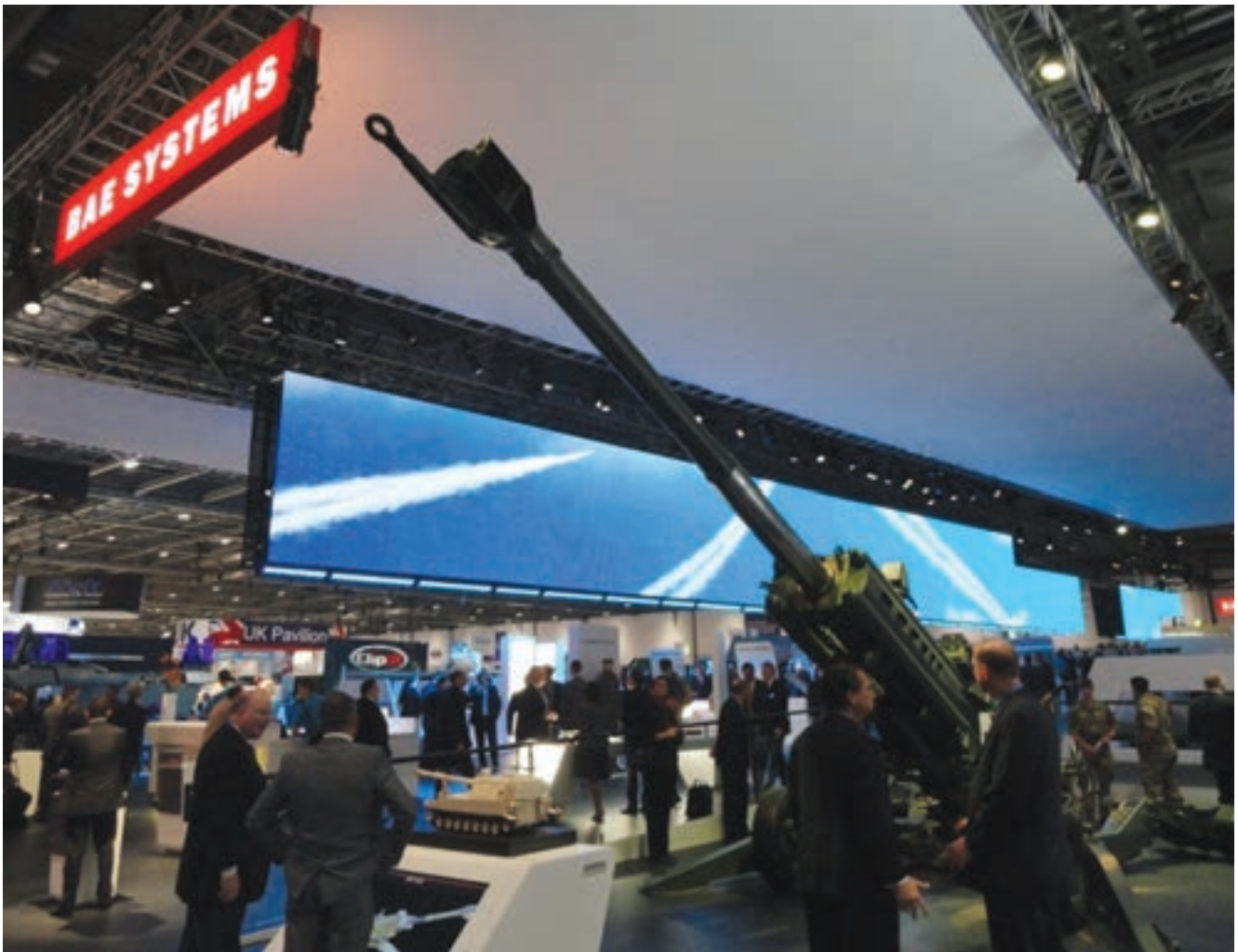
VAYU at DSEI 2013

Considered the world's largest fully integrated defence and security exhibition, this edition of the *Defence Security & Equipment International* (DSEI) was held at ExCeL in London 10-13 September 2013. The Vayu team were there and their detailed analysis will appear in the Journal's special *DefExpo Issue I/2014*.

As a teaser, here are some highlights: British Prime Minister David Cameron announced his backing to a new joint government and industry initiative designed to catalyse growth in the UK defence sector, enshrined in a document 'Securing Prosperity – a strategic vision for the UK Defence Sector'. According to government figures, the UK defence sector is currently worth more than £22 billion a year, and employs well over 100,000 people. The UK is also a leading defence exporter, with overseas sales close to £9 billion last year.



Of interest to India is the Penman 'Metras' armoured vehicle which has been specifically designed for counter insurgency operations.



The M777 155 mm lightweight field howitzer on display : formal orders from India were still awaited during DSEI 2013.



Sailor from the Swedish Navy minesweeper HSwMS Vinga (M75) docked on the Thames

At DSEI 2013, six themed zones made it easier for visitors to meet exhibiting companies and view their associated products, either on static display or in a realistic demonstration scenario. Focus areas included to the Air Zone, Land Zone, Medical & Disaster Relief Zone, Naval Zone, Security & Special Forces Zone; and the Unmanned Systems Showcase.

The India 'zone', in the south hall, was perhaps the largest amongst the International participants and included an array of individual stands highlighting the products and services of the Ordnance Factory Board, the DRDO, Midani, BrahMos Aerospace, BDL, BEL, MDL, HAL, GRSE and last, but not the least, the Defence Exhibitions Organisation which coordinated the entire effort.

There were several Indian participants from the private sector, the largest stand of whose was the of OIS (Offsets India Solutions) with a massive stand in the north hall- watch this space!

Indian Naval Aviation at 60

A gathering of (Grey) Eagles

At INS Hansa, May 2013



Admiral RH Tahiliani, on the left, with Vice Admiral Shekhar Sinha and Commodore Deepak Bajpai (CO INS Hansa) at the Diamond Jubilee Seminar.

Keynote address by Vice Admiral Shekhar Sinha, FOC-in-C Western Naval Command and present 'Grey Eagle'

Admiral RH Tahiliani, our Chief Guest and 'greyest' of the Grey Eagles, former Chiefs of Naval Staff, Commanders-in-Chief of Eastern, Southern and Strategic Force Commands, former Commanders-in-Chief, Flag Officers, war veterans of 1965 and 1971, distinguished guests, delegates, our former naval aviators, men & women in white, Flag Officer Naval Aviation, Ladies & Gentlemen.

It is a long voyage that our Navy has undertaken from the day our first aircraft, a Sealand amphibian touched down on

Cochin backwaters in 1953 to set up what we called the Fleet Requirement Unit. I must be quick to mention that it was on the same day that our Chief Guest, Adm Tahiliani started his flying career somewhere else. In the 60 years since, Indian Naval Aviation has transformed from such humble beginnings to a force capable of baring its fangs in full-fledged maritime conflict, far from our own shores. I am humbled and honoured to stand before you as the Grey Eagle of Indian Naval Aviation, a title not based purely on the colour of one's hair, but on the

trials and tribulations that one experiences during the eventful journey one spends in the most exciting office that God has created - "the cockpit of a naval aviator". It also comes as a reminder that one will soon become "former naval aviator".

The theme of today's symposium is 'Lessons of the Past to Forge a Potent Air Arm for the Future'. We are aware that our flight thus far has taken 60 years and has been possible by each one in the audience adapting to the dynamics of change. And if you truly believe that change is the only constant in the world, it would be



Admiral Arun Prakash, former CNS and *Grey Eagle*, talking with Defence Minister AK Antony after the commissioning of INAS 303 at Goa. At centre is Vice Admiral SPS Cheema, presently Commander-in-Chief Strategic Forces Command.

obvious that no one nation can sit back in the shades of its previous glories but has to continually evolve and keep pace with the rapidly altering geo-political and military environment.

Unrelenting adaptation and therefore 'transformation' is the only option, not just for progress but also for sheer survival in this day and age. This event is structured not to pat ourselves on the back for the years gone by, but to take a hard look at our gaps and chalk out the corridors we need to negotiate for further on. And, at this juncture, I am honoured to welcome Admiral Arun Prakash, former CNS, a naval aviator who has steered transformation first hand from every possible level during his career worth emulating. He has accepted to launch the seminar with his opening talk on the analysis of the years gone by and show us the fairway that we must traverse in the future.

Naval Aviation is a potent and intrinsically intertwined long arm of our navy. The navy's role has been defined as net provider of security, peace and stability in the IOR. The importance of Naval aviation was best described by the former US President Bill Clinton who said,

and I quote, "When a word of crisis breaks out in Washington, the first question that comes to everyone's lips is – where is the nearest carrier?" There is a good reason why the world's foremost military power lays such great emphasis on an expansive and effective naval aviation force. The sooner we find meaning in that thought, better we would be to deal with our charter in the IOR, which could range from encountering conventional military platforms to unseen and dispersed non state actors based anywhere, security of energy lines, HADR and unhindered safe navigation of seafarers as per international norms in this region.

An aircraft carrier has become the naval aviation equivalent of the 'cover picture' of a magazine or the 'poster' of a film banner. While we are poised to integrate our newest afloat airfield INS 'Vikramaditya' into our arsenal, we are ready to commission her integral fighter element, the MiG-29K, as a full fledged squadron tomorrow (see *Vayu Issue IV/2013*). That has been no mean achievement considering that we are the first Navy to operationalise the MiG-29K.

While it is indeed true that only a carrier and its aircraft signified naval aviation in the

early years, it would be myopic to ignore the myriad responsibilities shouldered by naval aviation ever since changes in the *Battle Space Environment* have taken place. These new responsibilities require multifarious platforms, fixed wing and helicopters operating not only from decks – both large and small – but also from bases ashore. Add to this the development of UAVs, UCAVs, satellites and other advances in technology such as stand off autonomous and laser guided weapons and you stand before an aviation force that is truly all encompassing with capabilities well beyond the early concept of just aircraft carriers.

The ability to pack a punch today is decided not by just the size of the teeth or the fist but also the resolution of the eye, the sharpness of hearing and the speed of the nerve. It is only by a graceful choreography of all these organs that one can deliver a powerful punch to the detractor. We have planned induction of the *Vikramaditya* this year and IAC a few years later.

Maritime Domain Awareness is a non negotiable starting point in any naval operation and this can be achieved

only by platforms capable of reach, endurance and electronic capability, best executed by airborne platforms mostly operated from shore or in outer space and in a tactical scenario from afloat units. This requirement brings to fore the importance of a Maritime Patrol Aircraft, operating from bases within the country or otherwise, in the overall scheme of maritime operations. Once the threat is classified, a real time capability towards expeditious prosecution is a must and is afforded by the multitude of aircraft such as AWACS, AEW and helicopters based afloat and in some cases by the MPA itself. Once again, these platforms need to have credible long range and short range capability while staying protected from possible countermeasures. Incidentally, we will be inducting the P-8I aircraft shortly (see *Vayu Issue IV/2013*).

Admiral Arun Prakash will probably provide us a first hand impression of the synergy which needs to be achieved amongst the air, surface and subsurface elements of a carrier group in concert with employment of the potent MPA and possibly UAVs (see *Vayu Issue IV/2013*).

These are just some of the important aspects of the responsibility towards a fleet at sea and its larger role of projecting independent power in the vicinity of hostile areas beyond the reach of a surface force whether the target is an aircraft, ship, submarine, a shore radar, a pirate boat or a terrorist outfit located well inland.

While transformation towards effective operations forms the basic requirement today, it would be impossible to achieve this without taking a hard look at the maintenance and logistic train that allows it to progress unhindered. As a Navy which operates disparate platforms of various origins, the task of 'keeping them on wings' is not an easy one by any measure and requires meticulous support systems in place. While the answer to a smoother transition to efficiency is indigenisation, it is easier said than done and involves lead times that at times prove to be counter productive. This is an issue which all nations confront and forms a very important part of the debate on whether to start a project or shelve it at the drawing board.

We, in the Indian Navy, walk a thin line by using various imported/indigenous platforms/equipment to ensure that we

are able to perform our expected role in the scheme of things. In the midst of this 'apparent chaos', we have also given a certain impetus to indigenisation of our future platforms. The second part of the symposium therefore deals with adapting and synergising our potent forces to meet the next generation operational milieu. We are extremely fortunate to have with us C-in-C East Admiral Anil Chopra and FOCWF Admiral Abhay Karve, both Carrier Captains and exponents of much larger maritime planning and operations, to elaborate on this very subject. I am certain that with their vast experience and innate understanding of the larger picture, they will surely help us see the light through the 'apparent chaos'. They would focus on Operations and Maintenance of air assets and adapting them to the changing world scenario.

I have always believed that you begin with two bags – a full bag of luck and an empty bag of experience and the trick is to fill the bag of experience before the bag of luck runs out! Being a flying instructor myself, there is no doubt in my mind that training as well as grooming are the keys to success and nothing should stop us from this supremely important task of designing and moulding our human resource of the future. At this juncture, I quote Giulio Douhet as he writes in *The Command of the Air* "Victory smiles upon those who anticipate the change in the character of

war, not upon those who wait to adapt themselves after the changes occur". The Indian Navy has constantly striven to be at the forefront of technology and new operational concepts. It has been and will continue to be our endeavour to remain at the leading edge for we firmly believe that "in times of change, learners inherit the earth while the learned find themselves equipped only with a world that has ceased to exist".

Let me leave a thought for all serving friends that please do have a debate for establishment of a *Centre of Maritime Air Warfare* – now that we have very specialised weapons and sensors in all subsections of naval aviation assets. It could be placed under the SNC and be the school which deals with in service and contemporary fighter aircraft tactics, MR and airborne ASW assets application, airborne ESM/ECM systems, the UAV/UCAV, space based sensors integration with a NCO network of the Navy which would sharpen our professionalism in delivering desired weapons on targets anytime anywhere.

Allow me to conclude by saying "it is better to pre-empt and preclude rather than to react and repair" for that is what we shall attempt in this seminar. I would like to thank each one of you in this distinguished audience for joining the diamond jubilee seminar which is an attempted 'quest for excellence'.



The Grey Eagle (Vice Admiral Shekhar Sinha) with Mikhail Belyaev, Chief Test Pilot RAC MiG after flight in a MiG-29KUB from the INS Vikramaditya in the Barents Sea on 6 September 2013 (see Vayu Issue V/2013).

An Enduring Story

Indo-Russian Co-Operation in Military Aviation (part-2)



Russian aircraft with India's Naval Air Arm

The first Russian-origin fixed-wing aircraft with the Indian Naval Aviation is the Ilyushin Il-38, later upgraded to the 'Sea Dragon' standard (photo: Angad Singh)

The Indian Navy (IN) had consistently endeavoured to take over the shore-based long-range maritime patrol task from the Indian Air Force and this finally saw fruition in 1975. Initially, the IN had examined the Beriev Be-12 *Tchaika* high wing amphibian but eventually selected the Ilyushin Il-38 anti-submarine / maritime patrol development of the Il-18 airliner.

In May 1976, selected IN personnel started Russian language courses and preliminary training at INS *Hansa*, and left for Moscow in late September. The training in the Soviet Union (at Riga) was very intensive and in spite of the fact that the pilots had had only single-engine (Alizē) experience, they were cleared for command of the large multi-engined aircraft within five hours of dual

instruction. Other IN personnel received training on maintenance, sensors and armament. On completion of all aspects of training, a hand-over ceremony took place on 24 August 1977 and the first three Il-38s (ex-Soviet Navy) were ferried to India, to arrive at Dabolim (Goa) on 2 September 1977 flying through monsoon conditions. The formal commissioning of INAS 315 'Winged Stallions' took place

on 1 October 1977 at Goa and after an impressive parade led by the Squadron Commander, the crest was unveiled and Squadron thus named. Another two Il-38s were ferried to Goa later to make up the unit's establishment.

The Ilyshin Il-38s soon became cutting edge of the Indian Navy and besides their designated Long Range Maritime Patrol / Anti Submarine Warfare (LRMP/ASW) role, the Il-38s cooperated with the IAF in homing various anti-ship strikes. The Il-38s were employed for over the horizon targeting, anti-submarine cooperation operations, surface and sub-surface search and shadow missions and independent ASV strikes. For search-and-rescue contingencies, INAS 315 provided around

upto the *Sea Dragon* standard, the suite including new generation SAR / ISAR radar, LOFAR sonobuoys, FLIR, ESM, laser rangefinder and TCAS. The first Il-38 was sent to Russia for modernisation and equipped with the state-of-the-art SDMS, was intensively flown on trials from the Barents Sea in Northern Russia to the Black Sea in the south. Extensive work was carried out at Khodynka on the aircraft's sensors and radar installations followed by flight testing at Zhukovsky. The upgrade includes a Leninets *Sea Dragon* mission sensor suite and ten-year airframe service life extension. There are also plans to integrate an air-launched version of the Indo-Russian BrahMos supersonic cruise missile with the aircraft.

aircraft, powered by four turboprops with a rating of 14,795 ehp each and driving eight-blade contra-rotating propellers, was endowed with extremely long range and endurance, and could carry a large number of sonobuoys, torpedoes and depth charges. 'The Mod 3' variant of the Tu-142M, with a MAD boom added to the fin tip, was selected by the Indian Navy and eight aircraft were ordered, in late 1985, to re-equip INAS 312 '*Albatross*'.

The official re-commissioning warrant of INAS 312 took place INS *Hansa* on 16 April 1988, and a further three Tu-142Ms arrived in October 1988, bringing INAS 312 to full strength. The Tu-142Ms bestowed great strategic capability on the service and enabled the Indian Navy to



The largest military aircraft with the Indian defence forces is the Tupolev Tu-142M, operated by INAS 312 of the Indian Navy for long range maritime reconnaissance and anti submarine warfare (photo : Angad Singh)

the clock SAR cover at four hours notice, also capable of carrying the indigenously-designed air droppable dinghy *Rakshak* for rescuing upto 85 survivors at sea upto 1000 nautical miles from base.

However after over two decades of operation it was obvious that the Il-38s needed to be refurbished and upgraded with state-of-the-art avionics and other systems. The Il-38s were to be brought

The Indian Navy was soon to operate the largest military aircraft in Indian service when the erstwhile Soviet Government offered the Tupolev Tu-142M (NATO *Bear-Foxtrot*) the world's largest warplane and derivative of the basic Tu-95 strategic bomber. It was proposed that this type should be adopted to meet the Indian Navy's maritime reconnaissance and anti-submarine warfare needs. This enormous

cover vast areas of the seas. There are ten members of the crew, these comprising the commander, co-pilot, five navigator/observers (weapon-system operators), a flight engineer, flight signaller and a flight gunner, the senior navigator being overall co-ordinator for the ASW phase. The front cabin is divided into three parts, the central tactical area housing the radar and sensor operators. However, there is no



The Kamov Ka-31AEW helicopter is operated from warships by the Indian Navy for airborne early warning

crew rest room and the layout is somewhat Spartan, not unlike Soviet warships ! With a maximum take-off weight of 185 tonnes, the Tu-142M can carry maximum fuel of 87 tonnes, the four NK-12MP engines giving the aircraft excellent take-off and landing performance.

Still to fully exploit the Tu-142M's payload-range potential and it was decided to re deploy these aircraft to the airfield at Arakkonam in Tamil Nadu which after upgradation, has the longest runway in India, and possibly in Asia, at 4500 metres. The Tu-142Ms will continue to operate from INS Rajali, at Arakkonam for the next several years.

Rotorcraft of the Navy

Following the pattern of operating both British and Soviet equipment as an integral part of the overall ship-aircraft system, the Indian Navy also received a sizeable Soviet ASW helicopter component. Five *Kashin*-class guided-missile destroyers were ordered for the Indian Navy in the late seventies, with each embarking an anti-submarine helicopter as an integral



Pair of Kamov Ka-31 AEW helicopters of INAS 339 'Falcons' (photo : Angad Singh)

part of the ship's weapon system. Seven Kamov Ka-25s were on order, all being ex-Soviet Navy and these formed the equipment of the new INAS 333 'Eagles' commissioned in December 1980. Each operated by a two-man crew, the Ka-25s had search radar, dipping sonar in the rear cabin and a canister of sonobuoys externally, and could carry a homing torpedo plus depth bombs. The Ka-25s were essentially for ASW, with secondary surveillance and SAR duties. Endurance was three hours, but limited night and all-weather sonar-dipping capability resulted in the Soviet Navy progressively replacing the Ka-25 by the far more capable Ka-27. The Indian Navy did likewise, ordering the export version of the later Kamov helicopter, the Ka-28, for operation from the latest *Kashin*-class GW destroyers, the INS *Ranvir* and *Ranijay* and also eventually to supplant the Ka-25s aboard other vessels.

The Ka-28 was considered a quantum jump ahead of the Ka-25 in terms of ASW capability and



MiG-29K of the Indian Navy's INAS 303 'Black Panthers' (photo : Angad Singh)



Indian Navy MiG-29K with its weaponry seen on six underwing hardpoints (photo : Angad Singh)



During the commissioning ceremony of INAS 303 at INS Hansa in May 2013.

versatility, with an endurance in the ASW mode for over four hours. There is no commonality between the two types, the Ka-28 representing a 20-year technology leap, being equipped with advanced sensors, search radar, computers, dipping sonar, data-link and MAD equipment. The lower-centre fuselage houses sonobuoys, attack torpedoes and depth charges. The two TV3-117BK engines each of 2.225 shp. Drive contra-rotating blades which have been shortened in length by comparison with those of the Ka-25 for better maneuverability on deck.

INAS 339 'Falcons' which initially operated Sea Kings, were re-equipped with the Kamov Ka-28s in May 1993, moving from INS *Kunjali* to INS *Hansa* thereafter. A total of 13 Ka-28s were ordered, including three equipped for the tuitional task.

In 2004, the first Kamov Ka-31 AEW (Airborne Early Warning) helicopters were received by the Indian Navy and these too were allotted to INS 339 which has a triple role : ASW, AEW and operational

conversion training, the first of these being delivered on 4 April 2003. Considered as the eyes and ears of the fleet at sea, the Ka-31 is deployed on various warships including the INS *Viraat*, the Ka-31 integrates a large rotating radar antenna that is stowed flat against the under fuselage and then deployed downwards before rotating.

Carrier-borne supersonic multirole fighters

Looking into the immediate years ahead, MiG-29Ks of INAS 303 as launched from the carrier INS *Vikramaditya* will rove over the Indian Ocean well beyond the range of shore based combat aircraft operating from the sub-continent and impart a completely new meaning to the concept of organic air power at sea.

The Indian Navy's evaluation of the MiG-29K (for *Korabelny*, meaning 'shipborne' in Russian) began around the time that the MiG Design Bureau had begun work on the MiG-29SMT programme which was a major

upgradation of the earlier the MiG-29s, operated by the Indian Air Force since 1987. The MiG-29SMT was to have new generation avionics and weapons suite, with improved powerplants, with both the MiG-29SMT and MiG-29K having a high degree of commonality.

The MiG-29K/KUB aircraft will be the Indian Navy's prime carrier borne combat aircraft for the next decade. Poised as it is to enter operational service on board the extensively modified *Admiral Gorshkov* as the INS *Vikramaditya*, the MiG-29K has the distinction of having been the first Russian jet-powered aircraft type to take-off from an aircraft-carrier, which was the Russian Navy's *Admiral Kuznetsov* on 1 November 1989.

While externally the MiG-29K is only slightly different from the standard MiG-29, prominent differences are incorporation of leading edge root extensions (LERX), a 'stubby' arrestor hook, special radar absorbent material (RAM) 'under the skin'. The MiG-29K has a unique four-channel digital Fly-by-



Senior pilots of INAS 303 'Black Panthers' with MiG-29KUB at Dabolim

Wire (FBW) Flight Control System (FCS) which, with the 'glass cockpit', enables carefree handling. The MiG-29K features a newly-developed head-up display by the Elektroavtomatika Corporation and the fighter's instrument panel houses two multifunction full-colour liquid crystal displays (LCD). The weapons management is based on the HOTAS (Hands on Throttle And Stick) concept.

On 20 January 2004, in an epoch-marking deal along with the aircraft carrier *Admiral Gorshkov*, the contract for MiG-29Ks had been signed, providing for delivery of 12 single-seat MiG-29Ks and 4 dual-seat MiG-29KUB to the Indian Navy as well as facilities and procedures for training of pilots and technical staff, delivery of the simulator, spare parts and establishment of maintenance facilities in India. Aircraft delivery commenced in 2009 and the first batch was at INS *Hansa*, Dabolim (Goa) by 2012.

An additional order for 29 MiG-29K/KUBs was placed thereafter and these 45 aircraft will be operated from the INS *Vikramaditya* as also from the indigenous aircraft carrier (IAC-1) under construction at the Cochin Shipyard Limited. The first Indian Navy squadron with the MiG-29K is INAS 303 'Black Panthers' which was formally commissioned at Goa on 11 May 2013 by Defence Minister AK Antony.

This enduring story, that of Indo-Russian Military co-operation in the realm of aircraft and their systems, is now in its sixth decade and the future looks even stronger than the past !



Take off into the future : launch of MiG-29K from INS Vikramaditya

ESPS 'Cantabria' : deployment Australia 2013



The excellent relationship and mutual trust which has developed over recent years between the Royal Australian Navy (RAN) and the Spanish Navy (Armada) has allowed development of new initiatives to expand the scope of cooperation between the two Navies.

In this regard, the 'Statement of Intent' signed in July 2012, between the Chiefs of the RAN, Vice Admiral Griggs and Admiral General Rebollo of the Armada set the framework to develop a project to foster the mutual support of each other's capabilities in deployment

and other operational activities. This Statement was not a mere expression of goodwill, but had a practical application almost immediately.

The RAN had showed much interest in the BAC 'Cantabria' and requested the possibility of deploying this ship to Australia during 2013 to support various operational activities.

On 5 November 2012, both Chief's of Navy agreed and signed the 'Project Arrangement', which included information on operations, logistics and personnel and financial support which allowed the *Cantabria* to be deployed

as an integral part of the RAN during 2013.

On 3 January 2013, the Combat Supply Ship *Cantabria* left La Graña Naval Port for a years' deployment to Australia. During the farewell ceremony Admiral Jaime Muñoz-Delgado (Spanish Navy Chief of Staff) and Admiral Santiago Bolibar (Admiral of the Fleet) attended the ceremony, during which Admiral Muñoz-Delgado stressed significance of the deployment and set the course for its conduct, stressing the importance of safety, security and the welfare of the crew.



*Ships Deployment Patch for ESPS
Cantabria in Australia 2013.*

*The SPS Cantabria manoeuvres through Sydney Harbour as she arrives at her temporary home port, Fleet Base East, Sydney.
SPS Cantabria is a modern auxiliary oil replenishment ship, which is capable of supplying fuel, food, stores and ammunition to ships underway.*

In preparation for the long deployment, *Cantabria* conducted a work up period, testing her capabilities in the waters around Ferrol. The ship made the voyage to the Rota naval base, situated in Cadiz, where she was subjected to rigorous certification processes to ensure her systems and equipment were functioning optimally.

Cantabria arrived at Melbourne in Australia, on 13 February in order to participate in the naming ceremony to commemorate induction of the LHD class flagship, HMAS *Canberra*. On 20 February, *Cantabria* navigated her

way to Garden Island Naval Base where she had been based for the nine months whilst on deployment with the Royal Australian Navy.

In support of such a lengthy deployment, ESPS 'Cantabria' had a crew of 145 men and women with specialist trades to meet the supply and replenishment mission of the ship (21 officers, 24 senior sailors and 99 junior sailors). Apart from the crew, a number of RAN officers and sailors embarked on the ship to get some specific training on *Cantabria's* modern systems, and whilst on board, the RAN contingent participated

in all facets of activity and integrated effortlessly with the Armada crew.

The deployment has been a unique and successful initiative which has imparted important training and capability aspects for both the Armada and RAN. Since her departure from Ferrol, the *Cantabria* has sailed more than 34,200 miles and over 167 days at sea. The ship thereafter contributed to training and support of major fleet units of the RAN and other international warships taking part in multinational exercises including *Talisman Saber 13* and *Triton Centenary 13*.



Cantabria at port (photo Clyde Dickens)

In her replenishment role, *Cantabria* completed a total of 61 Replenishment at Sea (RAS) missions. Furthermore, the ship played an important part in *The International Fleet Review* which celebrated 100 years of the Royal Australian Navy. Importantly, as a result of the personnel exchange programme (PIP), there were more than 340 RAN personnel which were onboard, conducting training

and familiarisation with the platform and engineering systems.

During the deployment, *Cantabria* had the opportunity to visit the Australian ports of Melbourne, Adelaide, Darwin and Cairns, during the last port visit, *Cantabria* having had the “immense privilege” to participate alongside other Australian Defence units during the ANZAC Day celebrations.



Other noteworthy events included the SHOL testing for 808 Squadron's MRH-90 and 723 Squadron's AS350B helicopters. The embarkation of 723 Squadron was the first time that an RAN squadron had embarked on a foreign vessel.

History & Traditions

This Combat Replenishment Ship is the first vessel in the Spanish Navy to be named after this region, whose history and sea tradition are closely linked with the Armada. Earlier, there were two other ships carrying the same name during the 19th century, a schooner and a corvette. Both ships, although not officially part of the Spanish Navy, served to connect Spain with its last colonies in South America.

Cantabria's keel was laid on 18 July 2007, two years after being ordered and was launched on 21 July 2008 in Navantia's Shipyards in Cádiz. The wife of Cantabria's President, Aurora Díaz, was the Ship's 'Godmother' during the launching ceremony.

The *Cantabria* was delivered to the Spanish Navy on 29 July 2010 at Rota Naval Base, in a ceremony honoured by the Admiral Chief of Staff of the Navy, Admiral General Manuel Rebollo.



Spanish Navy's Cantabria in Port Phillip Bay sailing past NUSHIP Canberra.



Profile view shows off the immense size of replenishment vessel 'Cantabria' (photo Clyde Dickens)

Then on 25 March 2011, at a ceremony at Santander Harbour presided by the former Minister for Defence, Mrs Carmen Chacón, the ship's Godmother, Mrs Aurora Fernandez presented *Cantabria's* Commanding Officer, Captain Ramon de Leste Contreras, with a special Combat Flag.

On 3 January the Combat Supply Ship *Cantabria* left La Graña Naval Port for a years' deployment to Australia, arriving in Melbourne on 13 February soon participating in the induction of the LHD class flagship, HMAS *Canberra* on 20 February. *Cantabria* had navigated her way to Garden Island Naval Base where she was based whilst on deployment with the RAN.

Mission and capabilities

The *Cantabria's* mission has been to provide operational logistic support to any Naval Task Group (Amphibious Task Group, Transport Group or Landing Force) for sustainability of the naval force over time. Such logistic support allows the Navy to operate in any part of the world where its presence is required. It can also provide its logistic support capabilities for non-combat operations such as environmental protection activities or for delivering humanitarian aid.

For the latter, *Cantabria* has a fully equipped hospital with eight beds, a state-of-the-art operating room rigged with video conference (VTC) assisted medicine, an x-ray room, a dentist consultation room, a sterilisation lab and gas treatment centre. Concerning environmental protection, the ship is equipped to receive liquid fuel from ships specialising in environmental hazard protection, transport and disseminate dispersing anti-contamination agents, as well to transport and deploy a quick deployment inflatable oceanic protection barrier (up to 200m in length, in under 15 minutes).

The design of the ship responds to the concept of a High Value Unit (HVV), counting on the protection of frigates and other escort ships to ensure its own survivability and safety while sailing in high threat environment.

The *Cantabria's* modern combat system, SCOMBA, fully developed and tested in Spain, allows its smooth integration in a Naval Task Force, while its Integrated Platform Control System (SICP), also a product of Spain's R&D, provides a high degree of automation making the crew required to operate the ship more reduced.

The *Cantabria* is equipped with five replenishment stations, (two on each

side and one astern), fuel and liquids transferred with any of the five stations. Solids can however only be transferred using the stations on both sides. The ship is stable and can carry out replenishments at up to and including sea state 5. It also has a large flight deck and a hangar which allows operation of medium and heavy helicopters. The flight deck is equipped with visual landing aids for day and night flight operations including operations with night vision goggles.

The *Cantabria* is designed to operate anywhere in the world, with the exception of Arctic waters. Its principal areas of operation are Spain's sovereign waters in the Atlantic, Pacific and Indian Oceans, the Mediterranean Sea, Latin America, the Sub-Sahara African coast and the Middle East.

The SPS *Cantabria* manoeuvres through Sydney Harbour as she arrives at her temporary home port, Fleet Base East, Sydney. Mid Caption; the Spanish Armada Ship *Cantabria* arrived at her adopted Australian home, Fleet Base East, Sydney. SPS *Cantabria* is a modern auxiliary oil replenishment ship, which is capable of supplying fuel, food, stores and ammunition to ships underway.

Tomahawk for Precision Strikes



On 19 January 1991, during *Operation Desert Storm*, a United States Navy *Los Angeles*-class nuclear powered attack submarine USS *Louisville* (SSN-724), previously deployed as a surveillance platform, in the Red Sea, made the transition from passive surveillance to active combatant, becoming the first submarine in history to launch a Raytheon Tomahawk Land Attack Missile (TLAM) against an enemy target. During the war, conventionally armed Tomahawk Land-Attack Cruise Missiles (LACM) were extensively deployed against fixed, non-hardened targets. Previously it was anticipated that Navy's role to influence battles on land in a high intensity conflict would be somewhat restricted, with Naval land-attack capabilities considered only in the "unthinkable" nuclear warfare scenario with ballistic missile submarines acting as nuclear deterrents and in case of actual nuclear conflict, as the mass retaliator.

Although aircraft carriers are effective in force-projection on enemy homeland in both nuclear and conventional scenario, their ultimate value lies in being survivable dispersed floating airfields during nuclear conflicts. Tomahawk

LACMs made it possible even for attack submarines, cruisers and destroyers to influence the battle on land by fulfilling Suppression of Enemy Air Defence/ Destruction of Enemy Air Defence (SEAD/DEAD) roles, rendering enemy airfields inoperable, plus decimating enemy Communications, Command & Control (C3) nodes, electrical generating facilities, and weapons assembly/storage facilities. *Operation Desert Storm* and subsequent contingency operations, including the September 1996 attacks on Iraqi military installations, demonstrated that long-range missiles can carry out some of the missions of strike aircraft while reducing the risk of pilot losses and aircraft attrition. By then firmly rooted in United States Navy (USN) operational philosophy, when *Operation Iraqi Freedom* commenced in March 2003, yet another *Los Angeles*-class SSN, the USS *Cheyenne* (SSN-773) became the first USN warship to launch Tomahawk cruise missiles against Baghdad.

The Tomahawk is remarkably compact in relation to its performance and destructive capability. The missile is 6.25 m long with a wingspan of 2.67 m and weighs 1,587.6 kg. After launch, an ARC/

CSD solid-fuel booster propels the missile until a small Williams International F107 turbofan engine takes over for the cruise portion of the flight at 880 km/h. The missile is inherently stealthy as radar detection is difficult owing to its small Radar Cross Section (RCS) and low altitude flight. Similarly, infrared (IR) detection is difficult because the turbofan engine emits little heat. Present systems include Global Positioning System (GPS) receiver, an upgrade of the optical Digital Scene Matching Area Correlation (DSMAC) system, time of arrival (TOA) control, and improved F107-WR-402 engines.

The onboard computer manages three guidance systems. The Inertial Navigation System (INS) keeps track of the smallest change in velocity of the missile from its launch. If the warhead is W80 nuclear as in the 2,500 km range TLAM-A to cause wide-area destruction, the degree of accuracy delivered by INS is sufficient. However in case of a conventional payload to achieve greater accuracy and precision, a Terrain Contour Matching (TERCOM) system is used. Stored in the missile's computer memory is a set of digital altitude profiles with strips of landscapes at certain points of

its intended flight path. Manipulating radar signals, TERCOM compares the height of the terrain passing below the missile to the digital altitude profiles stored within. If a 'drift' is noticed course correction is made to put the missile 'back on path.' The process is repeated several times to check the 'drift'. Thus a fair chance of obtaining an accuracy of even 10-metres in certain cases may be expected. Also a flight path can be input into the onboard system to make the missile 'fly around' and thus evade the enemy defences. The United States National Imagery and Mapping Agency (NIMA) provide the necessary databases for planning besides generating targets and maps for TERCOM and DSMAC and threat databases for missile attrition analysis. The database used by TERCOM to maintain its course is based on topographical maps constructed through surveys by reconnaissance satellites.

However, from Block III development onwards jam-resistant GPS is made to complement the navigational data computed by INS. Some deficiencies of TERCOM are also taken care of since TERCOM is somewhat less effective on, for instance, the flat, featureless Iraqi deserts where the average height of terrain does not vary over long stretches.

Block III, with its improved accuracy and stand alone GPS guidance capability, was first used in the September 1995 Bosnia strike (*Deliberate Force*) and again in the September 1996 Iraq strike (*Desert Strike*). GPS is based on an array of low-earth NAVSTAR (Navigation Satellite Targeting & Ranging) satellites. Computers onboard the missile, communicate with the satellites to accurately determine their instantaneous location. Enroute, some missiles may also execute a Precision Strike Tomahawk (PST) Mission transmitting its status back to a ground station via satellite communication. As the missile closes to the target, DSMAC using zoom lens collects images and matches them with the snaps of the approach to the target stored in the memory, and finally leads the missile to the exact target. The missile executes its planned terminal manoeuvre and for TLAM-C hits a single aim point with the conventional WDU-36 1,000lb unitary warhead and for TLAM-D, single or multiple targets with conventional submunitions.



Designed to add flexibility to diverse combat missions, the BGM/UGM-109E Block IV tactical Tomahawk was accepted by the USN on 29 September 2004. Tactical Tomahawk can be reprogrammed (via a two-way satellite link) while in-flight to strike any of 15 pre-programmed alternate targets or redirect the missile to any GPS target coordinates. It is also able to loiter over a target area for some hours, thus very effective against enemy radars, and provides Battle Damage Assessment (BDA) with its on-board TV camera. A potent 1,600 km range anti-ship version of this missile propelled by Williams International F415 turbofan engine may be developed, if sanctioned with an Active Electronically Scanned Array (AESA) millimetre-wave seeker to provide target acquisition and homing and a passive electronic surveillance system for long-range acquisition and identification.

The 1,000 lb blast-fragmentation warhead is replaced by a shaped charge to kill or disable large capital warships in difficult environment such as littoral waters while the two-way data link gets more bandwidth to facilitate networked operations. Targeting data can thus be acquired by manned or unmanned airborne platforms or satellites monitoring the target fleet, and could transmit radar imagery to a shadowing aircraft for final identification of a target prior multiple coordinated missile strikes to overwhelm fleet defences. The saturated strikes interestingly include a prominent feature of Russian anti-ship missile systems over decades, as one scenario has a Tomahawk popping up to image and identify a target and updating missiles below the horizon which remain oblivious to target warships radar.

Sayan Majumdar

Bear versus Dragon

PLAN warships led by Type 052B destroyer
Wuhan (169) at sail during Joint Sea 2013

Love in the water, fear on land

In July 2013, Russia and China held their largest joint naval exercises in the Sea of Japan. Following that, the land armies of the two countries held a joint drill in the Ural Mountains in Russia. In between these two events, Russia staged its biggest yet military manoeuvres in Siberia and the far eastern region along China's borders.

The exercises reflect the dual nature of Russia's relations with its giant neighbour. China is Russia's strategic partner but also a source of profound security fears!

off Russia's Far East on anti-pirate and search-and-rescue operations, escorting ship convoys, ship resupply, and joint anti-aircraft, anti-submarine and anti-surface vessels defences.

The manoeuvres marked a new high in Russian-Chinese defence ties and despite their non-aggressive scenario, they were clearly directed at Japan, which has territorial disputes both with Russia and China, and at the US military pivot to the Asia-Pacific region.

Foreseeing nervous reactions in neighbouring countries, the Russian Defence Ministry announced the surprise war games some hours in advance and separately provided "more detailed information" to China. Briefing foreign military attachés in Moscow, Deputy Defence Minister Anatoly Antonov denied the manoeuvres targeted any country, but admitted that Russia's neighbours were watching them "warily."

Series of drills

Code-named *Joint Sea 2013*, the joint naval drills were the largest in the history of the two countries and saw the Chinese Navy's "single biggest deployment of military force in any joint foreign exercise," according to the Chinese Defence Ministry. For three days, seven Chinese and 16 Russian warships operated

The naval exercises ended on 12 July. The Chinese warships had barely left Russian waters when Russia launched unannounced snap military manoeuvres along the border with China. President Vladimir Putin, who watched part of the war games, said they were the largest ever, involving 160,000 troops, 1,000 tanks, 130 aircraft and 70 ships.

Warmer ties

China and Japan indeed had reason to feel concerned. While the naval part of the Russian war games took place in the Sea of Okhotsk not far from the Kuril Islands claimed by Japan, the land operations involved massive redeployment of troops, weapons and hardware across several time zones closer to the Russian-



Chinese border to repulse a major land attack.

Over the past two decades, Russia and China have dramatically strengthened their ties. They resolved their long-running border disputes, increased bilateral trade from \$5 billion in 2000 to nearly \$90 billion last year, and are in one voice on most global issues. Russia has helped China modernise its military with large-scale supplies of weapons and technologies, and the two countries are forging close military-to-military ties.

Russian Far East

However, behind this happy façade of “overflowing friendship,” Russia harbours ingrained fears of the rising giant next door, fuelled in large measure by its own weaknesses, but also by China’s policies.

The Russian Far East, which constitutes 40 per cent of the country’s territory, has a shrinking population of 6.5 million, whereas three Chinese regions across the border have 140 million people. Demographic pressures and a growing shortage of resources will eventually prompt China to train its sights on its northern neighbour, experts warn, all the more so since China still considers vast territories in the Russian Far East as unfairly annexed from it in the 19th century.

All these territories fall within China’s “strategic borders” that stretch far beyond its geographic border to guarantee “living space” for the country.

Far East and much of Siberia within just a few weeks.

Whatever China’s intentions, it is capabilities that count, according to military experts. They are concerned that China’s two military regions bordering Russia, Shenyang and Beijing, have more troops and firepower than all Russian land forces and have conducted several large-scale manoeuvres of land forces in recent years that involved the relocation of troops across 2,000 km. Such operations are only possible against Russia and Kazakhstan, experts feel.

“The Chinese threat, while being highly hypothetical, is one of the main factors defining Russia’s foreign policy and military build-up,” said Vasily Kashin, a China expert with the Moscow-based Centre for Analysis of Strategies and Technologies.

Under a sweeping military reform currently underway in Russia, the Defence Ministry has taken extra efforts to beef up its forces in the East. When Russia’s seven military districts were pared down to four commands in 2010, the Eastern District was redrawn so as to hand it responsibility for the entire 4,300 km border with China. Today it is the largest military command and is being rearmed on a priority basis.

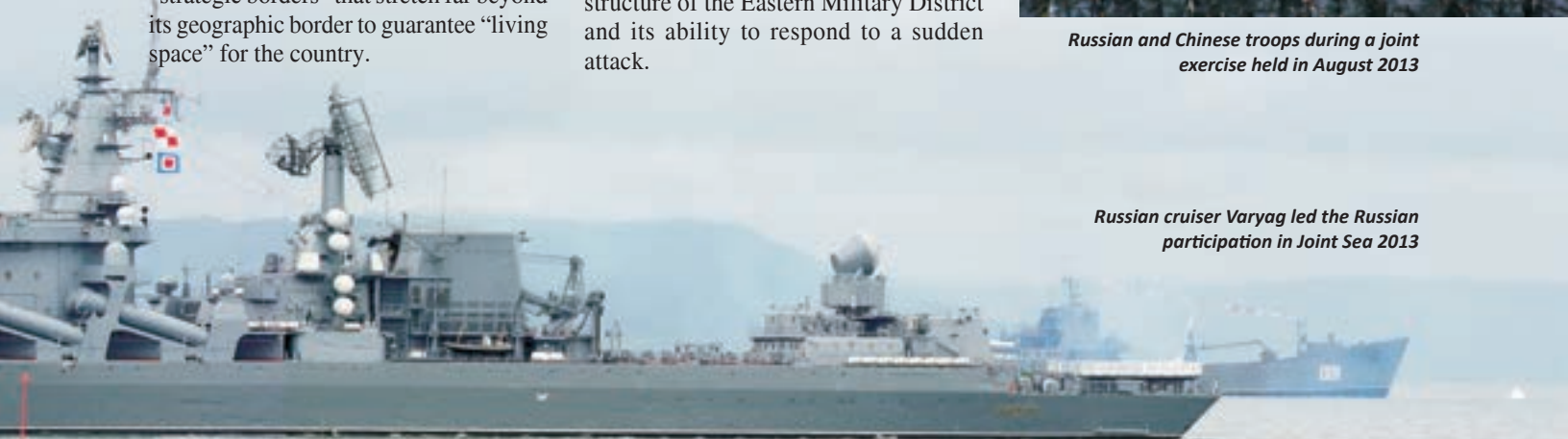
The July manoeuvres put to test the overhauled command and control structure of the Eastern Military District and its ability to respond to a sudden attack.

lies outside the military sphere. Judo black belt Putin is trying to lock China in a tight friendly embrace of economic, political and strategic interdependence that would make conflict inconceivable. Russia is on the way to become an indispensable source of oil, gas and other resources for China’s economic powerhouse; it is cementing close defence ties and is engaging China in multilateral cooperative arrangements, such as the Shanghai Cooperation Organisation.

When China’s new President Xi Jinping paid his first visit abroad to Moscow earlier this year, Mr. Putin said that relations between Russia and China are “the best in their centuries-long history,” while the Chinese leader



Russian and Chinese troops during a joint exercise held in August 2013



Russian cruiser Varyag led the Russian participation in Joint Sea 2013

Most Russian experts think that China will pursue peaceful economic and demographic expansion, but some do not rule out the military option. Military analyst Alexander Khrushchihin has recently published a highly provocative scenario of a Chinese blitzkrieg against Russia describing how the millions-strong Chinese army could overrun the Russian

“The manoeuvres showed that we can accomplish a necessary force build-up on the border with China,” said Alexander Sharavin of the Institute for Political and Military Analysis.

Non-military strategy

However, Moscow’s main strategy in dealing with the potential Chinese threat

called Russia China’s “major and most important” strategic partner.

Mr. Putin’s strategy enjoys overwhelming approval in the Russian expert community, but even its ardent supporters admit it is fraught with a risk that the Russian bear may be strangled in the Chinese dragon’s embrace.

Vladimir Radyuhin



VAYU at Dubai 2013



Heralding start of the flying display, an Emirates A380 leads MB339s of the UAE Air Force Al Fursan National Aerobatic Team at Dubai Air Show 2013.

Air Show on the Gulf

The observation recently made by a senior public figure at New Delhi is hardly an exaggeration: the national airline of India is (not what the official flag carrier claims) Emirates! There are ten destinations in India served by this Airline from Dubai and, statistically, an Emirates flight lands at an Indian airport every 20 minutes of the 24 hour day. Add to that the swarms of airliners from Qatar Airways and Etihad flying into India - and the point is well taken. In addition, Emirates flies to five destinations in Pakistan, two in Bangladesh and one each in Sri Lanka and Afghanistan, the latest being Sialkot. The world's biggest airline has got still bigger as the following article enunciates.



The 7 UAE pilots, under command of Lt Col (pilot) Nasser Ahmed Al Obaidli before start of their aerobatic performance. The number 7 represents the 7 Emirates of UAE while the primary colours of the team are gold for the desert and black for oil (black gold)

Partnership, performance and presence drive Raytheon's focus

“Success in the global marketplace is based on relationships, and Raytheon is proud of its long and sustained history across the Middle East spanning five decades,” said Matt Riddle, president of Raytheon International, Inc. “We partner closely with our customers to help them address and solve their most challenging issues by delivering creative and cost-effective solutions that meet a range of national and civil security requirements.”



As the *Vayu* team flew in to Dubai for attending the 2013 edition of this Air Show on the Gulf, it was easy to postulate on the subject. Flying south-westwards from Delhi, the route is over Sind and then over the northern Arabian Sea after existing the Makran Coast in Baluchistan, overhead Muscat within 45 minutes and then descending to land at Dubai, all within three hours or so. The fact that Indians in the United Arab Emirates (UAE) constitute the largest population segment of that country, nearly 30 percent, makes this an important ‘constituency’, with the majority of Indians living in the three largest cities of the UAE : Dubai, Abu Dhabi and Sharjah. While most Indian migrants support the manufacturing and transport industries, a sizable minority of them are bankers or involved in professional services and entrepreneurship. Relations between India and the UAE have traditionally been friendly, however there is little apparent attempt to engage this Government in aerospace and defence matters. Take the Dubai Air Show as an example. There was no presence of Indian officials, as the Indian MoD’s Defence Exhibition Organisation does not take part at Dubai, however being majorly present at many other ‘Shows’ including those at Moscow, London, Seoul ...

PAC at the Show

In sharp contrast was the showing by Pakistan’s Aeronautical Complex from Kamra. Dubai is just an hours’ flight from



Shoulder patch of the PAF ‘Thunder Air Demo Team’



Air Chief Marshal Tahir Rafique Butt, Chief of the Air Staff, Pakistan Air Force along with Mr Li Yuhai, Central Executive Vice President of Aviation Industry of China with JF-17 Thunder of No.16 Squadron, PAF at Dubai.

EADS underscores commitment to Middle East

From commercial and military aircraft to satellites and secure communications systems, EADS and its Divisions, Airbus, Astrium, Cassidian and Eurocopter, presented a broad selection of cutting-edge products, technologies and services. For the first time in the Middle East and under the strapline ‘EADS, delivering innovation’, the EADS Group had an integrated presence in a central position at the show alongside the Airbus, Eurocopter and Cassidian products static display. EADS has representative offices in the United Arab Emirates (UAE), Saudi Arabia, Oman, Qatar and Egypt. The Middle East is playing an ever more important role in international business and is a key strategic partner of EADS; the founding companies of EADS having had a presence in the Gulf region since the 70’s.

Karachi and, again, very large numbers of Pakistani migrants are present in the UAE. At earlier Shows, the PAC have displayed the K-8 Karakoram advanced jet trainer and Mushshak basic trainer at Dubai but in 2013, flew in two JF-17 Thunder multi-role fighters, along with two Super Mushshaks. On static display were single examples of these two types, with the others at the flight line to participate in the flying display every afternoon.

On hand was Air Commodore Khalid Mahmood, JF-17 Programme Director at PAC Kamra, along with a team from No.16 Squadron PAF, pilots and technical personnel to present the Thunder in all its glory (representative weaponry displayed alongside the aircraft) while the PAF Chief of the Air Staff, Air Chief Marshal Tahir Rafique Butt and Staff attended the inaugural ceremony as also took part in the previous days Dubai International Air Chief's Conference (DIAC).



Air Commodore Khalid Mahmood, Deputy Chief Project Director for the JF-17 programme.

The JF-17 Thunder was in good company : apart from this Sino-Pak jet fighter, on hand were the French Rafale and Eurofighter Typhoon, each of these types putting up impressive flying display to interest potential operators in the region. While the UAE Air Force have yet to officially announce their selection of a next generation fighter which will supplant the current fleet of (present generation but most potent) Mirage 2000-9s and F-16C Block 60s, the JF-17 is certainly destined to garner massive orders from other Air Forces looking to replace the large numbers of obsolescent MiG-21s, F-5s, Mirage III/5s still in service. PAC



JF-17 Thunder of the PAF taxiing out at Al Maktoum Airport, before carrying out aerobatics at the Dubai Air Show.

is taking the lead, supported by CATIC (China Aero-technology Import Export Corporation) and the future is predictable. In fact, Western companies are concerned: as the *New York Times* reported, "in the past, Chinese companies have been known mainly as suppliers of small arms, but that is changing quickly. From drones to frigates to fighter jets, the companies are aggressively pushing foreign sales of hightech hardware to other nations, mostly in the developing world".

In this context, the Indian LCA programme continues to languish and

the Tejas 'challenge' to the Thunder for the world market remains a non-starter. There was actually a real opportunity presented to ADA/HAL some two years back with a European aerospace group offering to virtually 'adopt' the LCA for the export market, getting involved in 'cleaning up the design', providing advanced production techniques and creating a joint marketing and product support entity but their strenuous efforts died out after hitting the continued rock-like indifference of the Indian bureaucrat.

Falcon fleet in the Middle East doubles

Dassault Aviation presented an expanded lineup of Falcon business jets at this year's Dubai Air Show, demonstrating the improving outlook for business executive jet sales in the Middle East. Two Falcon models, the 7X and 900LX trijets were on display. The Middle East is also expected to be a major market for the all new Falcon 5X, due to enter service in mid 2017 and was one of the highlights for Dassault at the show. The Middle East is a vital market for business aviation and, with the gradual recovery of the worldwide economy, it is once again showing signs of sustained growth. The Middle East Business Aviation Association (MEBAA) forecasts that the number of business jets operating in the region will double by the end of the decade. "The business jet market in the Middle East shows promise for a healthy future," said Eric Trappier, Chairman and CEO of Dassault Aviation. "The Dubai Air Show is the perfect place to showcase our revamped model line and detail the all-new Falcon 5X large cabin jet that we unveiled at the National Business Aviation Association Convention in Las Vegas recently."



BAE Participation at Dubai Air Show 2013



“We are showcasing our advanced swing-role fighter, Eurofighter Typhoon, alongside our latest products at this year’s Dubai Airshow. We’re very pleased to be participating in this year’s Dubai Airshow at its new home, Dubai World Central. BAE Systems is dedicated to supporting the UAE with all its current and future aerospace requirements, and the Airshow is the perfect arena to demonstrate our capabilities, show our support for the UAE aerospace sector, and meet with our industrial partners,” commented Ben Bridge, Managing Director, Middle East & Africa, BAE Systems. “During the show we are showcasing our Hawk advanced jet trainer and the Royal Air Force’s elite acrobatic team, *Red Arrows*, will be putting their Hawk jets through their paces with an aerobatic demonstration every day”

Mega orders by mega carriers

There were great expectations much before the Dubai Air Show began on 17 November, now at its new location, the purpose-built venue at the Dubai World Centre and its Al Maktoum International Airport, Jebel Ali. The formal announcements on Day One were certainly not anti

climatic! Within hours of opening, the order ‘tally’ had crossed US \$160 billion, edging past the previous ‘record’ of US \$155 billion in 2007, with major orders announced by Etihad Airways, Emirates Airline, Fly Dubai and Qatar Airways, all headquartered in that sliver of desert country along the Arabian Gulf.



Models of Boeing airliners at the Company’s large stand in the Exhibition Hall

Etihad Airways places \$2.8 billion CFM LEAP engine order

Etihad Airways, the national Airline of the United Arab Emirates, announced that it had selected CFM International’s advanced LEAP-1A engine to power 26 Airbus A321neo scheduled to begin delivery in 2018. The order is valued at \$2.8 billion U.S. at list price, including a long-term services agreement. To support the new fleet, Etihad has signed a 15-year Rate per Flight Hour (RPFH) agreement, under the terms of which CFM will guarantee maintenance costs on a dollar per engine flight hour basis. CFM recently completed ground testing of the first LEAP engine, accumulation 310 hours and more than 400 cycles over a five-week test plan. The foundation of the LEAP engine is heavily rooted in advanced aerodynamics, environmental, and materials technology development programmes.



First off the block with orders was Abu Dhabi-based Etihad Airways which announced a deal for 56 new Boeing 777s valued at US\$25.2 billion at list prices, including related GE engines. The deal also sees Etihad become launch customer for the 777-8X which is expected to enter service around the end of this decade. The airline also ordered 30 Boeing 787-10 Dreamliners, making Etihad the largest customer for the pioneering composite aircraft.

“We rarely make announcements at air shows, but when we do the world listens,” said James Hogan, President and CEO, Etihad Airways, who are very much in Indian news with their stakes in Jet Airways.

Not to be left behind, Dubai-headquartered Emirates Airline rapidly overtook the news with an unprecedented

order for 150 Boeing 777X – officially launched on 17 November at the Show itself plus options for another 50 and an additional 50 Airbus A380 ‘mega airliners’ for a total of US\$99 billion.

The Emirates deal, which was signed by HH Sheikh Ahmed Bin Saeed Al Maktoum, Chairman and Chief Executive of Emirates Airline with the Presidents of both Boeing and Airbus, was witnessed by HH Sheikh Mohammed Bin Rashid Al Maktoum, Vice President of the United Arab Emirates, and the Ruler of Dubai.

Low-cost airline FlyDubai was also in the news with their US\$11.4 billion order for 111 Boeing 737s and 738s, and finally Qatar Airways topped off the morning’s historic agreements with the signing of a US\$19 billion letter of intent for 54 Boeing 777s.



UAE officials and Air Force officers at the Dubai Air Show.



United Arab Emirates (UAE) unmanned system developer Adcom used the 2013 Dubai Airshow to unveil the Global Yabhon, which at 10 tonnes is its largest unmanned aerial vehicle (UAV). Also on display was the United-40 UAV, which was Adcom’s first high-stability tandem bi-wing UAV and formed the basis for the larger Global Yabhon.



Shoulder patch of the UAE ‘Joint Aviation Command’, formed in 2012 to combine the various helicopter wings of the UAE Army, Navy and Air Force.



Cassidian’s UAV Sagitta enters integration phase

‘Sagitta’, Cassidian’s research programme aiming at development of future Unmanned Aerial Systems’ (UAS) technologies, has entered into a new decisive phase: Following development and testing of core elements, the integration of the aircraft starts in Cassidian’s Military Air Systems Centre Manching, close to Munich. In the project ‘Sagitta’ Cassidian is conducting basic research into future Unmanned Aerial Systems Technologies together with universities and research institutes. It includes the construction of a flight demonstrator, the purpose of which is to verify the validity and feasibility of the theoretical research results. The integration is planned to be finalised end of next year; first flights of the ‘Sagitta’ demonstrator are scheduled for 2015.

Airbus Military exhibits complete product family

Airbus Military exhibited their A400M new generation airlifter, A330 Multi Role Tanker Transport, and C295 medium transport and surveillance aircraft at the Dubai Airshow. This was the first time that the A400M was displayed in the Gulf, reflecting the company's strong belief in the "importance of the event and in the A400M's outstanding suitability for the air forces of the region". The A330 MRTT is one of three operated by the UAE Air Force and Air Defence. Additionally, an Airbus Military C295 medium transport of the Royal Air Force of Oman was on static display throughout the show. More than 20% of all C295 orders have come from the Middle East and North Africa and the aircraft, as well as the smaller CN235, is "well proven" in the operating conditions of the region.



A400M

Earlier, the official opening of the show, was done by Sheikh Mohammed Bin Rashid accompanied by HH Sheikh Mansour Bin Zayed Al Nahyan, UAE Minister of Presidential Affairs. The VIP delegation toured the massive 645,000 square metres airshow site, which includes a single 42,870 square metres exhibition hall, which is equivalent to four cricket fields! Over 1,000 exhibitors from some 60 countries took part in Dubai 2013 entry to which was tightly controlled both for professional and security reasons. Although the last day was washed out because of heavy showers, and flying display on the first day affected by sand storms, there were over 50,000 visitors at the Show.

Amongst many political heads visiting Dubai Air Show 2013 was UK Prime Minister David Cameron who was flying the flag for the Eurofighter Typhoon which is ranged against the French Rafale for a potential 60 aircraft requirement of the UAE. As a common platform, Mr Cameron welcomed the Airbus orders from Emirates and Eithad Airways, as well as the news that Rolls-Royce had won a \$5bn order from Etihad Airways to supply Trent XWB engines for the 50 Airbus A350s.

Boeing launches the 777X

Boeing launched the 777X programme at the 2013 Dubai Airshow with a record-breaking number of customer orders and commitments for the newest member of its twin-aisle product family. Agreements for 259 airliners from four customers across Europe and the Middle East provide a strong foundation to support development and production of the airplane. Representing the largest product launch in commercial jetliner history by dollar value, 777X orders and commitments include Lufthansa with 34 airplanes; Etihad Airways with 25; Qatar Airways with 50 and Emirates with 150 airplanes. The combined value of the agreements is more than \$95 billion—at list prices.



Airbus wins 160 orders and commitments worth US\$44 billion

Airbus won a total of 160 orders and commitments at the 13th Dubai Airshow worth US\$44 billion, underlining the strong appeal of its widebody aircraft. The A380 and A350 XWB in particular, were demonstrated to be “spot-on with customer requirements and expectations”. The order intake included 142 firm orders worth US\$40.4 billion (50 A380, 40 A350-900, 10 A350-1000, 26 A321neo, 10 A320neo and 6 A330-200F) and 18 Memorandum of Understanding worth US\$3.6 billion. By value, Emirates placed the single largest order for 50 additional A380s, worth US\$20 billion. By numbers, Etihad Airways placed the single largest firm order for Airbus at the Dubai airshow with 87 aircraft (40 A350-900, 10 A350-1000, 26 A321neo, 10 A320neo and one A330-200F) worth US\$19 billion at list prices.



Airbus' presence in the static display area included the latest A380 delivered to Emirates, a Qatar Airways A330-200F and a multi-role C295 airlifter from the Royal Air Force of Oman

Much Success for Bombardier

Bombardier Aerospace concluded a successful week at the 2013 Dubai Airshow, having announced firm orders and commitments for up to 38 aircraft valued at up to \$2.01 billion US. With three of its business and commercial aircraft on static display, as well as the *CSeries* aircraft's full-scale passenger cabin and cockpit demonstrator, the airshow was an excellent opportunity for the Company to showcase a selection of its aircraft and broad range of services to clients and prospects in the Middle East and Africa. Throughout the event, executives from Bombardier Commercial Aircraft were joined by customers for a series of announcements related to its *Q400 NextGen* and *CSeries* aircraft programmes. Air Côte d'Ivoire, Palma Holding Limited, Nok Air and Abu Dhabi Aviation signed firm orders and commitments for up to 22 *Q400 NextGen* turboprops, and Bombardier also confirmed that Nok Air was the launch customer for an extra capacity seating option that will allow the *Q400 NextGen* aircraft to accommodate up to 86 passengers. Alongside representatives from the governments of Canada and Northern Ireland, Bombardier also announced that Iraqi Airways signed a letter of intent for up to 16 *CS300* aircraft, bringing the total number of orders and commitments for *CSeries* aircraft to 419.

Russian Helicopters at Dubai Airshow 2013

Russian Helicopters demonstrated commercial models currently in production, including the Ka-32A11BC, as well as the new Mi-171A2, the latest Ka-62 and the modernised Mi-26T2. The company and Rosoboronexport jointly presented the military Ka-52 Alligator, the Mi-28NE Night Hunter, the multirole Mi-35M and the Mi-17V-5 and Mi-171Sh military transports. Russian-made military helicopters are already in operation with armed forces across the Middle East. The most widely deployed are models from the Mi-8/17 series, which includes the modern Mi-171Sh and Mi-17V-5. These helicopters can fly a wide range of missions and can operate in different climates and temperatures from minus 50°C to plus 50°C.



Bell Helicopter showcases NextGen products and upgrades

Bell Helicopter featured a number of commercial and military aircraft on static display, showcasing their capabilities to meet the mission requirements in the Middle East. “We have spent more than half a century serving the Middle East and this region continues to represent a very important part of Bell Helicopter’s balanced business strategy,” said John Garrison, Bell Helicopter’s President and CEO. Six Bell products were prominently featured at the Dubai Airshow, each suited for the “challenging environment, geography and diverse missions” of the region, including three newly upgraded and enhanced commercial aircraft - the Bell 412EPI, Bell 407GT and Bell 429WLG. Also on static display were three military rotorcraft - the Bell AH-1Z, Bell UH-1Y and the Bell-Boeing V-22 Osprey.



Emirates orders 50 additional A380s, boosting fleet to 140

Dubai-based Emirates airline placed an additional order for 50 A380 aircraft, confirming the continued strong demand for very large aircraft in the Middle East that are needed to meet the region’s higher than average traffic growth. The order was signed at a ceremony at the 2013 Dubai Airshow witnessed by His Highness Sheikh Ahmed Bin Saeed Al-Maktoum, Chairman and Chief Executive Emirates Airline and Group and Fabrice Brégier, Airbus President and CEO. Following delivery of their first A380 in July 2008, Emirates has now taken delivery of 39 A380s. Their 39th A380 is on Airbus’ static display at the 2013 Dubai Airshow. All Emirates’ A380s are powered by Engine Alliance GP7200 engines.



Airbus A380

USN transition to P-8A

The US Navy's transition to the Boeing P-8A Poseidon multi-role maritime aircraft is "progressing well and on schedule". Three operational squadrons are in various stages of the process: Patrol Squadron Sixteen (VP-16) is passing through its Inter-Deployment Readiness Cycle (IDRC) before beginning the initial P-8A deployment in December and, achieving Safe for Flight (SFF) status in January 2014. Patrol Squadron Five (VP-5) has passed SFF and began IDRC in early August. Poseidons have been delivered to Patrol Squadron Forty-Five (VP-45) after its last deployment on the Lockheed P-3C Orion in June. All three units are based at NAS Jacksonville, Florida.



The USN has faced shortages in its inventory with only 47 P-3C and EP-3E mission aircraft airworthy after excessive fatigue grounded more than 50% of the fleet in 2007. Work to rectify the situation has been ongoing ever since and the US Navy expects to have enough aircraft to meet its Primary Aircraft Assigned figures by the end of the fiscal year 2015. The US Navy has announced it will acquire 68 Poseidons in full rate production lots two to six during fiscal years 2015 to 2019.

Boeing Apaches for Indonesia, S Korea

The sale of eight Boeing AH-64E Apache Block IIIs to Indonesia has been confirmed, with the US Army to also convert Indonesian pilots on the helicopters. A Foreign Military



Sales (FMS) notification for the deal had earlier been passed to the US Congress from the Defence Security Co-operation Agency on 1 September 2012.

Meanwhile, on 23 August 2013, a \$904.4 million FMS for the Republic of Korea covering 36 AH-64Es was announced by the US Department of Defence. In addition to the attack helicopters, the deal with Boeing includes logistic support, spares and a Longbow crew trainer. A separate contract for sensors has been awarded.

Texan Team for RAAF

BAE Systems have announced its teaming with CAE and Beechcraft to bid for the Australian Defence Force's Project AIR 5428 Pilot Training System. The team will offer a solution based on the Beechcraft T-6C Texan II. A selected platform will be assessed for its suitability for No.4 Squadron RAAF and the Aircraft Research and Development Unit, with initial operating capability expected between 2015 and 2017.



Netherlands confirms F-35 acquisition

According to Netherlands Defence Plan, the decision is to acquire 35 F-35A Lightning IIs for the *Koninklijke Luchtmacht* (Royal Netherlands Air Force), but there will be another round of defence budget cuts. The current F-16 fleet will be further reduced from 68 to 61 in 2014, one of the current four



HYD Show

F-16 squadrons to be disbanded and Leeuwarden AB will lose its status as a main operating base. The F-35As are scheduled to replace the F-16s from 2019. The 35 F-35As do not include two test aircraft currently stored in flyable condition in the USA.

Joint Air Force for Central European Nations



There are ongoing discussions between Croatia, Hungary, the Czech Republic and Slovakia on creating a joint Air Force in the next five to six years. The countries would subsequently purchase the same types of aircraft and organise joint maintenance and training, as well as sharing bases, infrastructure and spareparts. The 2019-2020 timeframe has been identified as a potential date for an integration agreement after Croatia's last MiG-21bis reach the end of their service lives, followed by Hungary's and Slovakia's MiG-29s.

Boeing AV-8B Upgrades

US Marine Corps Boeing AV-8B Harrier IIs will have their mission computers upgraded by General Dynamics Information Systems as part of the \$6.1 million 18-month Future Airborne Capability Environment (FACE) programme. The



upgrade will give the aircraft an open architecture avionics system by installing an additional third-generation processor based on commercial off-the-shelf technology. The computer will run new navigation and other software developed for the Advanced Mission Computer on the Boeing F/A-18E/F Super Hornet.

Delay in RMAF MiG-29 replacement

The Royal Malaysian Air Force's plan to acquire 18 new Multi-Role Combat Aircraft (MRCA) to replace its MiG-29Ns has been postponed owing to "financial consideration".

"For the time being, the government does not have any plans to replace the current MiG-29 fighter jets," Malaysia's Defence Minister Hishammuddin Hussein stated on 9 September.



Malaysia has considered the Boeing F/A-18E/F Super Hornet, Dassault Rafale, Eurofighter Typhoon, Saab Gripen and the Sukhoi Su-30 as potential options to meet its MRCA requirement.

RAAF to acquire mix of manned/unmanned maritime aircraft

The Royal Australian Air Force is reviewing requirements for manned and unmanned replacements for its Lockheed AP-3C Orions which are to be retired by 2020. The service plans to acquire a mix of eight Boeing P-8A Poseidons and seven high altitude long-endurance (HALE) unmanned systems, such as the Northrop Grumman MQ-4C Triton. According to CAS, Air Marshal Geoff Brown, "We are looking at the right mix of capability and the answer that we're coming up with is that the number of P-8As is a little on the low side." Phase 2B is currently planned to deliver an initial operational capability (IOC) in the 2017 to 2020 period. The unmanned system acquired under Phase 1B has a planned IOC around 2021-22.

FA-50s for the Philippines

The Philippine Air Force is negotiating with Korea Aerospace Industries for the delivery of two FA-50 lead-in fighter trainers before the end of 2014. The aircraft are first of a requirement for 12 FA-50s under a P18.9 billion (\$432 million)

deal being negotiated with the Korean manufacturer. "Our target is to have at least two initially by the end of the fourth quarter of 2014 and the rest over the following six months," said PAF chief, Lt Gen Lauro Catalino de la Cruz.

T-50s for Indonesian Air Force

The first two Korean Aerospace Industries (KAI) T-50I Golden Eagle lead-in fighter trainers for the *Tentara Nasional Indonesia-Angkatan Udara* (TNI-AU, Indonesian National Defence-Air Force) arrived at Iswahyudi AB on 11 September. They will be assigned to Skadron Udara 15. The aircraft were escorted in during the last phase by TNI-AU Hawk Mk 53s, after delivery flight from South Korea via Kaohsiung International Airport in Taiwan and a stopover in the Philippines.



On 28 June, KAI had announced that the military type certificate for the T-50I had been approved. Six Indonesian pilots began training on Golden Eagles in Korea in February and will become flight instructors on them. Indonesia ordered 16 T-50Is in 2011 and the first flew on 14 March this year. Six T-50Is, including the initial examples that arrived in Indonesia, are painted in the colours of the Elang Biru display team. Deliveries are due to be completed in the first half of 2014.

Ghana to lease C295s for UN tasks

According to reports from the country, the Ghana Air Force will lease two Airbus Military C295 transports to the United Nations with an option to buy the aircraft at end of the lease. Under the arrangements, the United Nations effectively pays for the aircraft that Ghana will eventually keep. Ghana took delivery of two new C295s in November 2011 and April 2012, based in the capital Accra and Tamale and used to provide combat support for humanitarian assistance missions. Ghana Air Force was operating a similar service on behalf of the United Nations in Cote d'Ivoire.

UAE receives third A330 MRTT

The third (and final) A330-243 Multi-Role Tanker Transport (MRTT) for the United Arab Emirates (UAE) has been recently delivered by Airbus Military, which increases the number of A330 MRTTs in service worldwide with Australia, Saudi Arabia, the UAE and the United Kingdom to 17, with a total of 28 ordered. The UAE's tankers are based at Al-Ain International



Airport in Abu Dhabi. An initial five United Arab Emirates Air Force crews completed their training with Airbus Military in August, with the final five due to start in September and complete their courses early next year.

Phase out of Brazilian Mirage 2000s

The Dassault Mirage 2000 is to be retired by the *Força Aérea Brasileira* (FAB). Ten former *Armée de l'Air* Mirage 2000Cs and two 2000Bs under a lease arrangement, replacing Mirage IIIBRs as a 'stop-gap' before delivery of the type selected to fulfill the F-X programme (which was later abandoned) and were assigned to 1° *Grupo de Defesa Aérea*, primarily in the air defence role. The fleet was originally due to be withdrawn in December 2012.

The replacement for the F-2000s has been impacted by delays in the long running F-X2 programme, the successor to F-X. A total of 36 fighters

are sought for approximately \$4.5 billion, with considerable technology transfer and other offsets included in the contract. The Boeing F/A-18 Super Hornet, Dassault Rafale and Saab JAS39E Gripen are under consideration, but the programme has been postponed four times, the last being a six-month delay in the middle of 2013.

First Production Atlas for French AF

The first production A400M Atlas, which had been delivered from the final assembly line at Seville earlier, was formally handed over to the *Armée de l'Air* on 1 August 2013. Later the same day, the French Air Force held another ceremony to mark the arrival of this A400M at Orléans-Bricy, where it is used by the Multinational Entry into Service Team to prepare the transport for operational service with the European launch customers.



The first two A400Ms have been produced to the initial Operational Clearance standard, as has the first for Turkey. The fourth production A400M will be completed to Standard Operating Clearance 1 with various upgrades, including an ability to airdrop payloads and personnel.

On 30 September, an agreement was signed between the chiefs of the French and German air forces, concerning the training of crews and support personnel for the Atlas. From the summer of 2015, both countries will train maintenance personnel at Wunstorf in Germany, while operational flight training will take place at Orléans-Bricy, starting next year for the French and 2018 for the German Air Force.

Russian Air Force begins training with Yak-130s

Since April 2013, the Russian AF has been training its pilots on new Yak-130 combat trainers at Borisoglebysk Training Centre, Central Russia. The number of Yak-130s at this base have been steadily increased since autumn 2012, when Irkut Corporation delivered the first Yak-130s out of contract for 55



Yak-130s. The first batch of fifteen trainers were delivered to the Russian Air Force in 2012.

The Yak-130s will provide lead in fighter training for Russian pilots in preparation for operating new generation combat aircraft, including Su-30SMs and Su-35s which are entering service with the Russian AF.

Afghan Air Force receives C-130 Hercules

On 9 September 2013, Afghanistan's Air Force took delivery of its first two C-130 Hercules transport aircraft, which will boost its capabilities as the NATO coalition begin to withdraw. The C-130 aircraft, gifted by the United States, will be used to



airlift troops and supplies across Afghanistan, with two other C-130s due to be delivered by the US next year. Air power is crucial in the rugged country where a poor road network is often interdicted by insurgents.

Hermes 450 exceeds 70,000 hours in Afghanistan



Operated by the *Theatre Integrated Unmanned Air Systems* (ThIUAS) Battery at Camp Bastion, UK forces have clocked maximum flying hours as compared to any other nation with H-450 in Afghanistan. The system provides headquarters staff with persistent intelligence, surveillance, target acquisition and reconnaissance via electro-optical and infrared sensors out to a range of 150 kilometres. The H-450 can be used for a wide range of tasks such as reconnaissance of an area prior to operations, and maintaining surveillance over troops on the ground.

V-22 sale to Israel expedited

The Pentagon plans to 'fast track' the sale of six Bell-Boeing V-22 Ospreys to Israel, allowing the nation to begin receiving tilt-rotor aircraft in two years, according to US Defence Secretary Chuck Hagel, which means that the Israelis will receive the V-22



ahead of US Marine Corps aircraft in the production schedule. Israel is the first foreign customer of the advanced tilt-rotor aircraft, which can take off and land like a helicopter, and rotate its propellers in flight, allowing it to fly fast like a fixed-wing aircraft.

Elbit's Advanced Helmet Mounted Systems for Korea



Elbit has been awarded a follow-on contract to supply advanced Helmet Mounted Display (HMD) systems for the ROK Army's Surion helicopter. Elbit Systems will supply the HMD systems to Korea Aerospace Industries Ltd. (KAI), which manufacture the Surion helicopter. This contract award follows an initial contract that was signed with KAI in 2009 as part of the Korean Helicopter Programme (KHP) and in which Elbit Systems and KAI completed and demonstrated a successful integration of Elbit Systems' HMD on the Surion.

17th Dornier 328 for US Military

At a ceremony in Operpfaffenhofen, southern Germany on 9 July 2013, the 328 Group formally handed over the 17th Dornier 328 turboprop to Sierra Nevada Corporation (SNC) for operations by the United States Military. The ceremony marked the completion of a four-year contract worth more than \$200 million, including spare parts support. The US Military accepted



the aircraft in three tranches from 2009 to July 2013. The 328 Group purchased 15 of the aircraft outright from various sources, while SNC directly acquired two of the aircraft. The Dornier 328s were selected to provide critical logistics support for the US Military.

All 17 Dornier 328s had to meet specific configurations and conditions to include Phase 1-6 inspections. 328 Group completed approximately 220,000 man hours to meet the demands of the programme. Auxiliary Power Units (APUs) were installed on five aircraft, a retrofit that had only been accomplished once before, which was 11 years ago on a newly-built aircraft. Retrofits on spoilers were a new undertaking and accomplished on seven aircraft. Other modifications included the fitting of gravel kits, avionic upgrades, and a High Frequency communications system, as well as flight deck standardisation. .

NGC to upgrade French Navy E-2C Hawkeyes

Under a \$34.5 million US Navy contract, Northrop Grumman Corporation will modify the French Navy's fleet of three E-2C Hawkeyes with an upgraded Identification Friend or Foe (IFF) system, further increasing commonality and interoperability with US Navy E-2D Advanced Hawkeye aircraft. Included in the upgrade will be the installation of AN/APX-122A IFF Mode 5/ Mode S Interrogators and AN/APX-123 IFF Mode 5/Mode S Transponders.



The French Navy have been operating the E-2C Hawkeye since 2000, with its squadron, the Flotille 4F, based in Lorient, France being the only country other than the United States to operate its E-2 Hawkeyes from an aircraft carrier, and the two navies have operated Hawkeyes from each other's carriers. The first of these took place in May 2001 when a US Navy E-2 Hawkeye flew from the deck of the USS *Enterprise* to the deck of the French carrier *Charles de Gaulle*.

USAF's 61st Airlift Squadron receives C-130J Super Hercules....

The USAF's 61st Airlift Squadron at Little Rock Air Force Base, Ark., has received its first Lockheed Martin C-130J Super Hercules, being ferried from the Lockheed Martin Aeronautics Co. facility. The 61st AS, which has operated C-130s since 1956, is part of the 19th Airlift Wing that is assigned to Air Mobility Command. Lockheed Martin is on contract to deliver nine C-130J-30s currently designated for assignment to the 61st AS.



....and AFSOC receives additional MC-130J Commando II

A US Air Force crew has ferried an MC-130J Commando II Special Operations Forces tanker from the Lockheed Martin facility, the Lockheed Martin-built aircraft assigned to Air Force Special Operations Command. The Commando II supports such missions as in-flight refueling, infiltration/exfiltration, and aerial delivery and resupply of special operations forces.



Raytheon delivers 2000th MTS



Raytheon has delivered the 2000th Multi-Spectral Targeting System (MTS) from its factory in McKinney, Texas. As the leading provider of electro-optical, infrared, laser designation and laser illumination capabilities integrated into a single sensor package, Raytheon offers detecting, ranging, tracking and precision fire control capabilities for a wide range of customers. The MTS product family, which includes the US Army's Common Sensor Payload, has been integrated on 35 different platforms, for every branch of the U.S. military and various international partner countries. MTS platforms include unmanned aerial vehicles, manned fixed-wing aircraft and rotary-wing aircraft.

F-35A fires AMRAAM

On 30 October 2013, a F-35 Lightning II made its first live-fire launch of the AIM-120 advanced medium range air-to-air missile (AMRAAM) over a military test range off the California coast. The was fired from an F-35A (AF-6) conventional take-off and landing (CTOL) variant fighter operating from the F-35 Integrated Test Facility at Edwards Air Force Base, Calif. The AIM-120 AMRAAM (Advanced Medium-Range Air-to-Air Missile) is a radar-guided air-to-air missile and is the US military's standard air intercept missile carried on tactical fighter aircraft. The F-35's fire control system programmes the missile's internal guidance unit and provides mid-course updates from the aircraft via a data link to guide the AMRAAM toward its target.



Cassidian's Tracker UAV for Austria



The Austrian Ministry of Defence has ordered 6 Tracker mini unmanned air systems, comprising 18 aircraft. After evaluation of the mini-UAS operation in accordance with the Austrian Armed Forces capability development plan, a further procurement of mini-UAS is intended between 2016 and 2017. The Tracker can be deployed for missions including detection, reconnaissance, identification, classification, tracking, over-the-hill targeting, target or axis designation, special force and anti-terrorism action, littoral / border control, force protection, convoy support, dismounted warfighter missions and Military Operations in Urban Terrain (MOUT). Following a pre-programmed and reconfigurable plan in the course of the mission, the Tracker flies entirely automatically, which enables the operators to devote themselves to their reconnaissance assignment.

IAI to supply heliborne LAHAT Missile Systems

Israel Aerospace Industries (IAI) have been contracted for supply of a large number of LAHAT missile systems including their integration on combat helicopters. The LAHAT system, comprising quad-pack launchers, a MOSP-3000 (Multi-mission Optronic Stabilised Payload) day/night observation, targeting and



designation system, a firing computer, avionics and multifunction displays - all manufactured by IAI - will be installed, integrated and tested on board the helicopters by IAI.

The LAHAT (LAsER Homing ATtack) missile is an advanced lightweight guided missile with pinpoint accuracy at long ranges (> 8km). Additional capabilities include Line Of Sight (LOS) and Non-Line of Sight (NLOS) firing, a small launch signature and an extremely light launcher. A quad-pack LAHAT launcher weighs 75kg including four missiles, canisters and launcher. This enables the helicopter to carry a sufficient number of missiles (8-16), substantially enhancing its firepower, while maintaining its maneuverability and endurance even at high temperatures and high altitudes.

...and Maritime Patrol Radar upgrades

Israel Aerospace Industries' (IAI) ELTA Systems Ltd., was awarded multi million (US) dollars worth of contracts to supply its maritime patrol aircraft radar (the ELM-2022) to a 'foreign operator' for an important aircraft upgrade programme. The operator reselected the ELTA system as part of an upgrade of several aircraft.

As the number of this radar's operators continues to grow and accrue operational experience, IAI/ELTA continues to add new modes of operation and extend the radars' capabilities, which allows the radar's operators worldwide to benefit from the



cumulative experience gained by its large community of users. The ELM-2022 is considered by many to be the most effective maritime surveillance radar in its class, and we are proud to continue receiving new orders from return customers. "ELTA's commitment to performance, quality and support services has been rewarded over the years with a high degree of customer loyalty," a spokesperson said.

Raytheon, USAF complete series of SDB II test flights



Raytheon and the US Air Force have concluded a series of test flights with the Small Diameter Bomb II (SDB II) culminating in direct hits on targets moving at operationally representative speeds. Earlier supporting tests were performed in a multitude of different environments and scenarios, key to maturing seeker algorithms and validating the weapon's aerodynamic performance. All test flights helped reinforce the system's capability to satisfy a critical warfighter need. SDB II can hit targets from a range of more than 40 nautical miles. "It has a powerful warhead capable of destroying armoured targets, yet keeps collateral damage to a minimum through a small explosive footprint. It is highly accurate and offers warfighters the flexibility to change targets through a datalink that passes inflight updates to the weapon."

New development contract for Eurofighter Typhoon

A major new Development Contract, the 'Evolution Package A2' to pave the way for continuous capability enhancements of the Eurofighter Typhoon has been signed by Eurofighter Jagdflugzeug GmbH and the NATO Eurofighter and Tornado Management Agency (NETMA).

Evolution Package 2 consists of a number of improvements including enhancements to major avionics sensors such as the Radar and the Defensive Aids Sub Systems (DASS) of the Eurofighter Typhoon, including those designed to cater to latest operational requests of customers and important enhancements to the Multifunction Information and Distribution System (MIDS).



In addition, the package will include further improvements to the Flight Control System (FCS) and the Utility Control System (UCS) that will allow the Eurofighter Typhoon to be more compatible with evolving requirements within the commercial aviation air space environment.

A-10s phased out from Europe

After 30 years of deployment in Europe, the last 4 Fairchild A-10 Thunderbolt II's (aka 'Warthogs') left Spangdahlem air base in Germany on 17 May 2013. Owing to budget cuts, the 81st Fighter Squadron 'Panthers', part of 52nd Fighter Wing, have been withdrawn from the US Air Force in Europe. The 81st Squadron will be deactivated soon and the A-10 aircraft will be sent to Davis-Monthan air base in Arizona.

(text and photo: Joris van Boven)



First USN F-35C Squadron established

The US Navy re-equipped Strike Fighter Squadron VFA-101, as its first Lockheed Martin F-35C Lightning II Unit, on 2 October at Eglin AFB, Florida. Two aircraft had been delivered to the unit at the time of the ceremony with a further four destined for the VFA-101 already at NAS Patuxent River, Maryland.



Raytheon awarded USN next generation radar contracts

Raytheon Company has been awarded a \$385,742,176 cost-plus-incentive-fee contract for the engineering and modeling development phase design, development, integration, test and delivery of Air and Missile Defence S-Band Radar (AMDR-S) and Radar Suite Controller (RSC). AMDR is the US Navy's next generation integrated air and missile defence radar and is being designed for Flight III *Arleigh Burke* (DDG 51) class destroyers beginning in 2016.

AMDR consists of an S-band radar, an X-band radar and a Radar Suite Controller. AMDR-S is a new development integrated air and missile defence radar designed for long range detection and engagement of advanced threats. The X-band radar is an existing horizon-search radar. The RSC provides S- and X-band radar resource management, coordination and interface to the Aegis combat system.

Spanish Navy deploys Skeldar UAS

Saab's Unmanned Aerial System (UAS) Skeldar is now operationally deployed on-board the Spanish offshore patrol vessel BAM *Meteoro*. Skeldar is supporting the Spanish Navy with surveillance capabilities while taking part in the EU Atalanta operation in the Gulf of Aden. Earlier this year, Saab announced a contract to deploy the Skeldar Unmanned Aerial System (UAS) for maritime operations, and prior to the Atalanta deployment, successful integration trials were conducted on-board the BAM *Relámpago* in the waters outside the Canary Islands.



Skeldar is a rotary wing, short to medium range UAV that can be controlled from a tailored control station. It can be equipped with a wide range of payloads, including surveillance, reconnaissance, target acquisition and 3D mapping and can be used for both civil and military purposes.

AN/SPQ-9B radars for US Navy Vessels

Northrop Grumman has been contracted by the US Navy to supply three AN/SPQ-9B radar systems for amphibious and *Arleigh Burke*-class ships. Under the \$20.4 million contract award, Northrop Grumman will supply three AN/SPQ-9B radar systems for delivery in the second quarter of 2015. This contract adds to the 53 radar systems the company has already delivered, or is under contract to deliver. Northrop Grumman began low-rate initial production of the AN/SPQ-9B in 2000 and full-rate production in 2004. This latest series of radars will be installed on the LPD-27, LHA-7 and DDG-79 ships, the latter being the first guided missile destroyer (DDG) to be modernised, which will lead the way for installation of the AN/SPQ-9B radars onto the upcoming Flight III DDG-51 destroyers.

Raytheon's Griffin missile demonstrated

Raytheon and the US Navy demonstrated the Griffin missile's combat proven capabilities in a maritime environment by successfully engaging fast-moving small boats from various platforms throughout a series of at-sea tests. During one of the tests, the MK-60 Patrol Coastal Griffin Missile System was integrated on a *Cyclone*-class Patrol Coastal-class ship, where the missile was employed against remote-controlled boats simulating a threat to the ship.

The MK-60 Patrol Coastal Griffin Missile System includes a proven laser targeting system as well as a Navy-designed launcher and battle management system featuring the Griffin missile. This system will provide the Navy's Patrol Coastal class ships with their first operational capability against small boat threats outside of current gun range.

The Griffin missile is a multi-platform, multi-service weapon that has a proven track record for successful rapid integration with land, sea and air assets. The combat-proven Griffin AGM-176A is an aft-eject missile designed for employment from platforms



such as the C-130 aircraft. The Griffin BGM-176B is a forward-firing missile that launches from rotary- and fixed-wing aircraft, ground-launch applications and maritime platforms, is 43 inches long, weighs 33 pounds, has a 13-pound warhead, and is in series production.

Elbit delivers Sea King Full Flight Simulator

Extending Elbit Systems' advancement into the full flight simulators market, their new simulator has the latest cutting edge technology to train Sea King naval helicopter aircrew. The Sea King Helicopter Full flight Simulator is a Flight and Tactical Full Flight Mission Simulator designed specifically for Navy's commando airlift and anti-submarine warfare operations squadrons. With high fidelity aircraft and flight models, the Sea King full-flight simulator is designed for Sea King pilots and observers including initial and periodic training as well as evaluation of new procedures and doctrines. The simulator can simulate various naval warship deck landings, emergencies and night flying with night vision goggles for a complete air crew experience.

12th Production P-8A Poseidon for US Navy

Boeing delivered the 12th production P-8A Poseidon on schedule on 25 October 2013, enhancing the long-range maritime patrol capabilities of the US Navy. Boeing is on



contract to build and support 37 P-8A aircraft as part of four LRIP contracts awarded in 2011, 2012 and 2013. The US Navy plans to purchase 117 P-8As, which are based on the Next-Generation Boeing 737-800 platform, this versatile multi-mission aircraft providing anti-submarine warfare, anti-surface warfare, intelligence, surveillance and reconnaissance capabilities and will replace the Navy P-3 fleet.

Boeing 787-9 Dreamliner with RR Trent 1000 engines in first flight

On 17 September 2013, Rolls-Royce Trent 1000 engines powered successful first test flight of the Boeing 787-9, the second member of Boeing's 787 Dreamliner family, which took off from Seattle. It continues 'a series of firsts' for the Trent 1000, which powered the first test flight of the 787-8 in December 2009 and that aircraft's entry into service in October 2011. The engine will also power the 787-9 entry into service in 2014, with Air New Zealand.



A further engine upgrade, the Trent 1000-TEN (Thrust, Efficiency and New technology), is being developed and will enter service in 2016. The engine will contribute to the industry-leading economics of the recently-launched Boeing 787-10, which will use at least 25 per cent less fuel than any other aircraft of its size. The Trent 1000-TEN will be an option on all Boeing 787 variants.

Japan Airlines order Airbus A350 XWBs



Japan Airlines (JAL) has signed a purchase agreement for 31 A350 XWBs (18 A350-900s and 13 A350-1000s), plus options for a further 25 aircraft. This is JAL's first ever order for Airbus aircraft and is also the first order Airbus has received from Japan for the A350 XWB, confirming its continuing success with world leading airlines across the globe. JAL and Airbus aim for entry into service from 2019, with the airline's A350 XWBs gradually replacing its ageing fleet approximately over a six year period.

On 19 September 2013, the Airbus widebody family of flight test aircraft, the A380, A330 and the all-new A350 XWB, took off from Toulouse flying together for the first time before continuing on separate flight test missions.



Lufthansa to acquire A350s



Lufthansa, which is the largest operator of Airbus aircraft will expand and modernise its long-haul fleet with a commitment for up to 55 A350-900 aircraft (25 firm and 30 options), with the flexibility to convert some of the order to the larger A350-1000. This landmark A350 order comes just six months after Lufthansa made the strategic decision to become an all-Airbus operator for its single-aisle fleet. Counting all commitments (firm and options) into account, the figure rises to 232 aircraft, which is one more than the 231 Airbus aircraft currently in operation with the Lufthansa Airline.

VietJetAir to acquire 100 new A320 Family aircraft

Vietnam's VietJetAir has signed a Memorandum of Understanding for up to 92 Airbus A320 Family aircraft and will lease eight more from third party lessors. The agreement signed with Airbus covers 42 A320neo, 14 A320ceo and six A321ceo, plus 30 purchase rights for the A320 Family. VietJetAir is an existing A320 operator, with eight leased aircraft already in service. The carrier took delivery of its ninth A320, delivered new from Airbus via the US leasing company AWAS.



'Regional' A330 variant launched

A lower-weight and thrust version of the A330-300 has been launched by Airbus, to be known as the A330 'Regional'. According to the company, this is optimised for use on the domestic and regional routes in high growth markets and concentrated air traffic sectors. The variant was revealed at the Aviation Expo in China, in September 2013. Compared to the standard A330-300, the new variant will be configured to seat between 356 and 400 passengers on 3,000nm (5,556 km) sectors. Reduced fuel consumption per seat and maintenance costs will result in 15% lower operating costs compared to the standard long range A330-300.

The A330 'Regional' incorporates a number of innovations from the A380 and A350XWB families, including a dual head-up display, new navigation systems, slimline seats and Wi-Fi connectivity. Airbus envisages demand for the aircraft will be high in Asia, especially China and India, and, significantly, "the aircraft's cost will be similar to the A321ceo."

CFM56-5B Engines for A321ceo Family

Delta Air Lines have selected CFM International's CFM56-5B engines to power 30 firm A321ceo (current engine option) aircraft. The agreement is valued at more than \$850 million at list price, including spare engines and a suite of material support agreements for the new fleet. The materials agreements provide for the comprehensive repair and replacement of life-limited and non-life limited parts for the CFM56-5B engines. The agreements also provide Delta with technical data for component repairs and engine overhaul to assist their operations.



Mi-171A1s and Ka-62s for Vertical de Aviacion of Colombia

Russian Helicopters and Colombia's Vertical de Aviacion have signed agreements for five Mi-171A1s and five Ka-62s for deployment in Mexico for cargo and passenger flights. The



Bell 429WLG unveiled



Ka-62s will be used in Colombia to service the oil industry. Deliveries of the Mi-171A1s are expected to start in 2015, and of the Ka-62 in 2016. Russian Helicopters and Vertical de Aviacion will work together for certification of the Mi-171A1 in Mexico and the Ka-62 in Colombia.

Eurocopter's AS350 assembly line in the US

Beginning in 2014, Eurocopter will install the necessary industrial capabilities to upgrade the American Eurocopter plant in Columbus, Mississippi, to a final assembly and test site for Eurocopter AS350 helicopters, the top-selling civil helicopter in the US market. The plan was developed with two main objectives firstly as a way to offset the impact of the reduction in local production of UH-72A Lakota helicopters and secondly, to help provide a boost to sales in the US market, especially with government and law enforcement agencies. Preparations will begin almost immediately, with the final assembly line scheduled to begin production in the fourth quarter of 2014. Operations are set to expand in 2015 and the plant will produce up to 60 additional helicopters annually by 2016.

Bell Helicopter displayed the Bell 429WLG for the first time at the National Business Aviation Association (NBAA) 2013 conference, held in Las Vegas, Nevada in October. The aircraft is an upgrade to the Bell 429 and features wheeled landing gear in place of traditional skids. "Offering a wheeled landing gear option for the Bell 429 builds on our ongoing efforts to innovate our current products as we introduce new ones," said Danny Maldonado, Bell Helicopter's executive vice president of Sales and Marketing.

The Bell 429WLG also has reduced drag due to the loss of skids and an increased cruise speed. The aircraft is expected to be delivered in the first half of next year.

JetBlue deal marks 10,000th Airbus A320 Family Order

Just days after taking delivery of its very first A321 aircraft, JetBlue Airways has placed a new order for 15 A321ceo (current engine option) and 20 A321neo (new engine option) aircraft. In addition, the airline has opted to upsize 8 A320ceo and 10 A320neo aircraft currently on backlog to 8 A321ceo and 10 A321neo, respectively.



Rolls-Royce Trent XWB Engines to power Lufthansa A350-900s



Lufthansa has selected Rolls-Royce Trent XWB engines worth \$1.5bn, including TotalCare service support, to power 25 Airbus A350-900, the airline also having options for a further 30 of this aircraft. The Trent XWB is the fastest-selling member of the Rolls-Royce Trent engine family, with more than 1,400 ordered prior to its entry into service next year. Nico Buchholz, Executive Vice President, Lufthansa Group Fleet Management, said, "Having followed the development of the Trent XWB, we have been impressed with the performance of the engine and are pleased it will be powering our new fleet. The Trent XWB and Airbus A350 make a powerful combination, enabling us to continue to deliver the highest levels of customer service."

MRJ delayed - again

First flight of the Mitsubishi Regional Jet (MRJ) has been delayed by more than a year to the second quarter of 2015, with service entry of the regional jet also been put back to the second quarter of 2017, the second significant delay to the MRJ programme. The airliner programme was launched in 2008 and was originally due to fly in 2012, but in that year Mitsubishi Aircraft Corporation (MITAC) postponed it to the end of 2013. "Design and respective certification (of aircraft components and systems) have taken greater resources than anticipated, which in turn, impacted component deliveries and aircraft fabrication," according to MITAC. "MITAC has established this new schedule to take into account the fulfillment of respective safety certification standards." MITAC has booked 165 orders for the MRJ since launch customer All Nippon Airways ordered 15.

Spanish MoA orders Bombardier 415

The Spanish Ministry of Agriculture, Food and Environment has signed a firm purchase agreement for one Bombardier 415 amphibious aircraft with delivery of the aircraft expected in late November 2013. Since the first Bombardier 415 amphibious aircraft was delivered in 1994, a total of 84 Bombardier 415 and four Bombardier 415 MP aircraft have been delivered to

governments and firefighting agencies around the world. In addition, 80 CL-215 and CL-215T amphibious piston aircraft remain in-service worldwide.

Dassault delivers 500th Falcon 2000

Dassault Aviation have achieved a venerable milestone when the 500th Falcon 2000 was delivered into service from the Little Rock Completion Centre. The aircraft, a Falcon 2000S, will be operated by a customer based in the UK. The Falcon 2000 fleet has accumulated nearly 2 million flight hours to date, reflecting its huge popularity among business jet operators. The Falcon 2000 first flew 20 years ago, in March 1993 and was the first business jet in the world to be designed using a fully digital mockup. Originally conceived for the United States coast to coast market, the Falcon 2000 family has since grown to include six additional versions responding to Falcon operator needs of the time.



Garuda Indonesia order 35 ATR 72-600s

Indonesia's national airline Garuda Indonesia, ATR, and the Danish leasing firm Nordic Aviation Capital (NAC) have an agreement for the procurement of 35 new ATR 72-600 aircraft into Garuda's fleet, including 10 on option. The aircraft will be configured with 70 seats, and feature the 'Armonia' cabin, giving the ATR '-600s' the highest standards of comfort in a regional aircraft. The aircraft will be used for the development of both tourism and business throughout the Indonesian archipelago as well as to feed Garuda Indonesia's main hubs.



Macquarie to acquire four Sikorsky S-92A and S-76D helicopters

Macquarie Rotorcraft Leasing, the helicopter operating leasing business of the Macquarie Group, has contracted to acquire two S-92A and two S-76D helicopters from Sikorsky Aircraft Corp. along with an unspecified number of options to acquire additional aircraft. The four new helicopters will be configured initially for the oil and gas service markets. Sikorsky recently delivered its 200th S-92 helicopter, and the worldwide fleet has logged more than 600,000 flight hours to date, mostly serving the offshore oil and gas segment.

Tenth AW119Kx for Life Flight Network



AgustaWestland has delivered the 10th AW119Kx in support of Life Flight Network's air medical transport missions, this aircraft also being the 150th AW119 from the Philadelphia assembly line. "As we mark the occasion of the 150th AW119 built by AgustaWestland, I want to take the time to thank the dedicated production team who has contributed to the aircraft's success both in the US and internationally," said Bill Hunt, CEO of AgustaWestland Philadelphia Corporation. "The new technology introduced in the AW119Kx will allow Life Flight Network and customers across all market segments to complete their missions safely and reliably."

CAE contracts in Africa and China

CAE has sold four full-flight simulators (FFSs) and some flight training devices to customers in Africa and China. They include a Boeing 787 simulator to Ethiopian Airlines, a Sikorsky S-92 helicopter simulator to the Zhuhai Flight Training Centre (ZFTC) in China, and two other FFSs to an 'undisclosed' customer in Africa. The contracts are worth approximately C\$50 million at list prices and bring the total FFS sales that CAE announced to date during fiscal year 2014 to 27.

Turkey's 'Buy+Make' BTA

The Turkish Aerospace Industries Hürkus A basic trainer prototype made its first flight on 29 August 2013. TAI has designed the Hürkus as a basic trainer for civil and military operators, naming it after Turkey's first civil aviator and aircraft builder, Vecihi Hürkus. A contract with the *Savunma Sanayii Müsteşarlığı* (Undersecretariat of Defence Industries) for two flying and two static test examples was signed on 15 March 2006.



The Hürkus A, the baseline trainer variant, will be certified to European Aviation Safety Agency CS-23 standards. The military B model will have upgraded avionics to prepare student pilots for fourth and five-generation fighters. An armed version, Hürkus C, is also under development and TAI has plans to offer an intelligence, surveillance and reconnaissance variant for maritime operations.

The aircraft was originally intended to meet a *Türk Hava Kuvvetleri* (Turkish Air Force) requirement for 55 new basic training aircraft, but an order for 40 TAI-assembled Korea Aerospace Industries KT-1 Ts plus options for an additional 15, was placed on 30 August 2007, with deliveries from November 2010. The options subsequently lapsed and TAI is now hopeful of an order for 15 of its new type.

(This is similar to the Buy+Make policy in India's DPP, where the Pilatus PC-7 is sought to be augmented by the HAL HTT-40).

Debut of Pilatus PC-24 mockup

At the NBAA 2013, the annual Business Aviation Conference and Exposition, visitors saw the Pilatus Super Versatile Jet, following its unveiling at the European Business Aviation Conference and Exposition in Geneva, Switzerland in May 2013. Pilatus Aircraft Ltd are displaying their new flagship business aircraft mockup to garner feedback from prospective customers around the world.



“We think the PC-24’s speed, range, cabin size, short-field performance, cargo door, and price represents a compelling combination unlike anything else in the business jet market. Given the overwhelming positive response we have heard since EBACE, we are excited to bring the PC-24 mockup to Las Vegas and give our prospective customers an opportunity to see it up close and in person,” said Markus Bucher, CEO of Pilatus Aircraft Ltd.

Dassault Aviation unveil Falcon 5X, powered by Safran

Dassault Aviation unveiled the Falcon 5X, a new-generation business jet with a new flight control system, new aerodynamics and other advanced technologies, many pioneered in Dassault’s military programmes.

The Falcon 5X represents an important addition to the Falcon product line, expanding its offering in the large-cabin segment. The new jet has a cabin height of six feet, six inches (1.98 m), an important consideration for passenger comfort on flights of 10 or 11 hours duration. The 16-passenger aircraft has a range of 5,200 nautical miles (9,630 km), connecting for instance, Paris with Beijing. Functionality and modern style blend in the cabin following extensive research into new cabin technology and styling techniques. The aircraft will be powered by new-generation Silvercrest engines from Safran Snecma.



Safran has been chosen by Dassault Aviation to supply the engine and key equipment on the company’s new Falcon 5X business jet. Safran will supply the complete integrated powerplant system (IPPS) for Dassault’s new business jet, including the Silvercrest engine (Snecma), nacelle and thrust reversers (Aircelle), and the engine suspension system. The new Silvercrest engine combines the latest technologies developed through intensive R&D by Safran’s two engine specialists Snecma and Turbomeca.

First flight of Next Generation Fire Scout

On 31 October 2013, Northrop Grumman Corporation and the US Navy successfully completed first flight of the next-generation MQ-8C Fire Scout unmanned helicopter at Naval Base Ventura County, Point Mugu, Calif. The MQ-8C Fire Scout is designed to fly twice as long and has three times the payload capacity of the current MQ-8B variant. Based on a larger commercial airframe with additional fuel tanks and an upgraded engine, the MQ-8C will be able to fly up to 12 hours or carry up to 2,600 pounds.



Currently, the MQ-8B Fire Scout is on its seventh at-sea deployment supporting anti-piracy missions on board US Navy frigates. The system has also been used extensively in Afghanistan since early 2011 to provide airborne surveillance to ground commanders. Using on-board sensors to capture full-motion video, Fire Scout can identify targets and then distribute the information in real time to various users. This capability allows ship-based commanders to maintain awareness of a specified area or keep an eye on a target of interest for long periods of time.

2nd A350 XWB test aircraft flies

The second A350 XWB (MSN3) has completed its first flight that lasted approximately five hours. The aircraft is equipped with an array of flight test equipment. The first A350 XWB to fly (MSN1) had first flown on 14 June and has to date flown some 330 flight test hours in almost 70 flights. These flights



have been devoted to the identification and freeze of all flap and slat configurations, loads and aeroelastic testing and evaluation of the aircraft's handling characteristics and systems' operation throughout the operational envelope. Three more A350 XWB test aircraft will join MSN 1 and 3 to perform the planned 2,500 hours up to Type Certification.

Airbus Military A400M's 2000th flight



Airbus Military's development fleet of five A400M new generation airlifters has completed its 2,000th flight, this milestone flight, during a routine flight-test sortie from Manching to Toulouse on 18 October. Since the first flight of the A400M on 11 December 2009, the development fleet has clocked 5,665 flight hours. The photo shows crew of the aircraft with supporting ground crew in front of Grizzly 5 immediately after the flight.

Sagem systems for French Tiger and NH90 helicopters

Sagem (Safran) has signed a contract with French defence procurement agency DGA for the development and production of a new version of the MPME (*Module de Préparation de Missions*) mission planning system for helicopter crews, to be



deployed by the French army's air arm (ALAT). The new version of the MPME system is designed to support the service entry of the army's Tiger HAD (support & destruction) and NH90 TTH Caïman tactical transport helicopters.

The MPME system is operated in a network from transportable tactical modules or in a fixed infrastructure, which allows helicopter crews to plan their mission as a team, and supports formations comprising different types of helicopters. Mission planning is based on advanced functions enabling replay on the ground of flight paths in three dimensions. The MPME multiplies effectiveness during the most critical mission phases: at night, for deconfliction, avoiding known surface-to-air threats, use of weapons, landing zones, etc.

Airbus Military C295 firefighter

Airbus Military has begun trials of water bombing with a specially modified C295 aircraft at a site near Cordoba, Spain specially equipped for aerial firefighting. The flights "went well" and further tests are planned in the near future to make a more detailed analysis of the C295 as a firefighter aircraft.



Irkut delivers 500th ship-set

Airbus and Aerolia have celebrated the delivery by Irkut of the 500th ship-set of the nose landing gear bay for the A320 Family. Airbus started its partnership with Irkut Corporation in 2004 by signing an agreement for components supply as part of the strategic industrial partnership for the A320 programme. Irkut received major work packages which included the supply of keel beam, flap track and the nose landing gear bay for the A320 Family. The first ship-set of the nose-landing gear bay was delivered first to Airbus in 2007 then to Aerolia from 2009 when the company took over the production for Airbus of the nose landing gear bay. Ever since Irkut has been gradually increasing the production rates of this very complex component and is currently supplying 12 ship-sets per month. "Producing A320 Family components for Airbus has guided us towards playing a key role in international industrial cooperation. During our long term partnership, Irkut Corporation has demonstrated that it can produce high quality components fully in line with international standards," said Oleg Demchenko, President of Irkut Corporation.



Bell Helicopters for Avincis Group

Bell Helicopters have contracted with Avincis Group for the sale of up to 20 helicopters comprising the Bell 429, Bell 412 and Bell 412EPI, primarily for Life & Rescue operations. The Bell 412 seats thirteen passengers and two crew members and is certified for single pilot IFR with a Pratt & Whitney PT6T-3D Twin Pac engine. The Bell 412EPI offers a rugged airframe built with safety in mind, upgraded engines and the Bell BasiX Pro Integrated Avionics System, which includes four 10.4" high resolution LCD primary/multi-function display units for vital flight information in an easy-to-scan layout. This system is specifically designed to meet the requirements of twin-engine helicopters and is optimised for IFR, Category A and JAR OPS3 compliant operations.

Bell and Lockheed Martin team on V-280

Bell Helicopter and Lockheed Martin will work jointly on the Bell V-280 Valor, making Lockheed Martin the first of Bell Helicopter's V-280 programme tier one team members, with the additional team to be announced in the coming months.



The Bell V-280 Valor was recently selected by the US Army to enter into negotiations for the Joint Multi-Role (JMR) Technology Demonstrator (TD) programme, with contracts awarded in September 2013. The transformational features of Bell Helicopter's third generation tilt-rotor capitalise on combat-proven technology. "The Valor is designed to deliver the best value in procurement, operations and support, and force structure, through increased maintainability, component reliability and systems designed to reduce operational and support costs".

First Production AW189 in maiden flight

The first production AW189 8-tonne class twin engine helicopter has made its maiden flight at Vergiate plant in Italy, and is expected to be delivered to Bristow Helicopters Ltd. by end of 2013 to carry out offshore transport missions in the North Sea, with operational readiness planned in early 2014. An additional two AW189 helicopters are currently under assembly in Vergiate and a second AW189 final assembly line is being established at AgustaWestland's Yeovil facility in the UK, which will initially build the AW189 helicopters to be used for the UK's new Search and Rescue service. The new helicopter is optimised for long range offshore transport and SAR missions and has already received orders for more than 80 units making it the market leader in its class since its launch at Paris Air Show in June 2011.



Sikorsky S-97 RAIDER Helicopter in final assembly

Sikorsky Aircraft Corp., a subsidiary of United Technologies Corp. has initiated final assembly of the prototype S-97 RAIDER helicopter following acceptance of the fuselage structure from Aurora Flight Sciences. Consisting of an integrated cockpit, cabin and tail cone, the composite fuselage arrived on 20 September 2013 at Sikorsky's Development Flight Centre in West Palm Beach, Fla., where the company will complete a light tactical rotorcraft designed to outmatch conventional military helicopters in speed, maneuverability, payload, range, and high altitude operations. Sikorsky proved the efficiency of the rigid rotor co-axial design in 2010 when its 6,000-lb. gross weight X2 demonstrator helicopter achieved 250 knot flight speed, or twice the speed of conventional helicopters. It also demonstrated low pilot workload and low acoustic signature.



The RAIDER prototype aircraft will improve on the X2 demonstrator by showcasing precision maneuvers in low flight speed, high G turning maneuvers at over 200 knots, hot day hover performance at altitudes up to 10,000 feet, and significant improvements in payload and flight endurance compared with conventional light tactical helicopters.

LM's Paveway II DMLGB employed

Lockheed Martin's Paveway II Dual Mode Laser Guided Bomb (DMLGB) was successfully employed in recent US Navy Tactics Development exercises at the Naval Strike and Air Warfare Centre in Fallon, Nevada. During four missions over a two-day period, F/A-18C/D Hornets and F/A-18E/F Super Hornets released 36 GBU-12F/B bombs fitted with recently upgraded Paveway II DMLGB guidance kits. The weapons were used in tactically representative engagements against fixed targets



and met all mission success criteria, demonstrating the increased operational utility of the enhancements.

Selex ES Hawk-S for Royal Navy

Selex ES's SLX Hawk-S camera was launched recently at DSEi 2013, with the Royal Navy, via prime contractor MSI-Defence Systems, to be the launch customer for the new product. The Hawk-S is a medium wave Thermal Imaging (TI) camera with a continuous zoom lens which can provide a resolution of up to 1.3 Megapixels. MSI-Defence Systems has placed an order for 18 of the cameras with associated engineering support to replace the current Albatross cameras in the Royal Navy's Automated Small Calibre Gun systems.

First missile launch from MK 41 launcher using ExLS

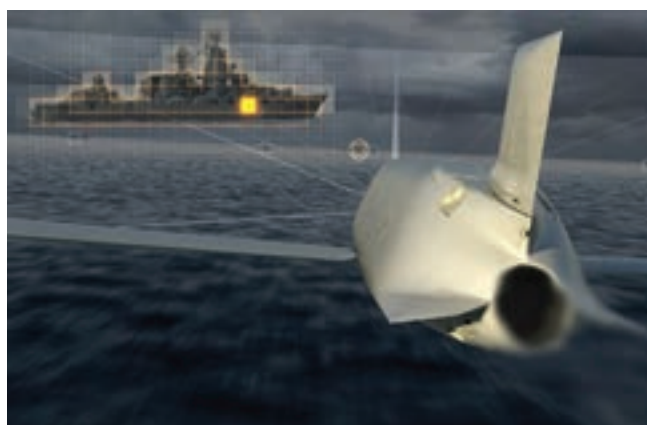
MBDA and Lockheed Martin have demonstrated the first launch of a Common Anti-air Modular Missile (CAMP) from Lockheed Martin's MK 41 Vertical Launching System



(VLS) launcher using the host variant of the Extensible Launching System (ExLS). This is the first test by MBDA and Lockheed Martin since the May 2013 announcement of cooperation between the two companies to offer MBDA missile systems for use with the MK 41 and ExLS family of launchers. The test used MBDA's soft vertical launch technology to eject the CAMM from its canister and position the missile for main motor ignition. Lockheed Martin, in collaboration with MBDA, is developing a 3-cell stand-alone ExLS CAMM launcher for those navies whose ships cannot accommodate the larger MK 41 VLS but desire the superior missile packing density, survivability and reliability that the 8-cell MK 41 launcher has been offering for over 30 years to 13 navies worldwide.

Lockheed Martin's LRASM Air-Launch Flight Test

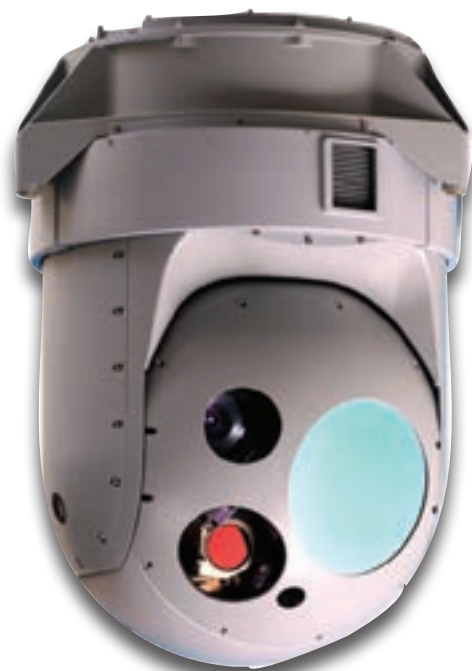
Lockheed Martin have recently completed the successful first flight test of the Long Range Anti-Ship Missile (LRASM) in support of the Defense Advanced Research Projects Agency (DARPA) and the Office of Naval Research (ONR) programme. LRASM is an autonomous, precision-guided anti-ship standoff missile leveraging the successful Joint Air-to-Surface Standoff Missile Extended Range (JASSM-ER) heritage, and is designed to meet the needs of US Navy and Air Force warfighters in a robust anti-access/area-denial threat environment. JASSM-ER, which recently completed its operational test programme, provides a significant number of parts and assembly-process synergies with LRASM, which results in cost savings for the US Navy and Air Force (air- and surface-launched) Offensive Anti-Surface Warfare programmes.



Elbit Systems in DCoMPASS Contract

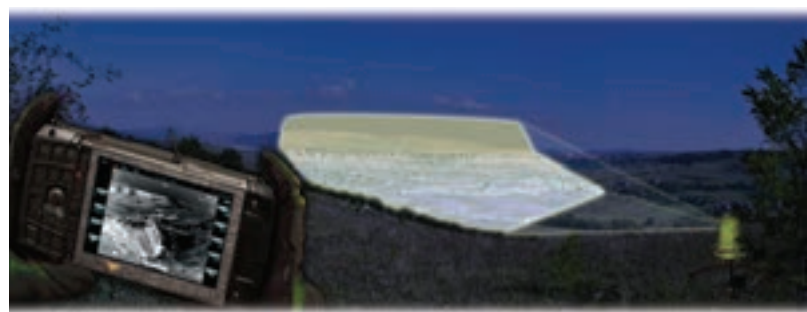
Elbit Systems Electro-optics – Elop Ltd. (Elop), has been awarded a follow-on contract to supply its advanced Digital CoMPASS electro-optical (EO) payload systems to an 'Asia-Pacific' air force to be installed onboard helicopters. DCoMPASS (Digital Compact Multi Purpose Advanced Stabilised System)

is a highly stabilised, low weight, multi-sensor electro-optical (EO) payload system, providing solutions for airborne applications (both fixed and rotary-wing aircraft) as well as for land and naval platforms. With cutting edge optical technology for 24/7 observation providing day and night ISTAR capabilities (intelligence, surveillance, target acquisition and reconnaissance), DCoMPASS is effective even in the harshest of weather conditions.



IAI's Ground Target Acquisition System

Israel Aerospace Industries' (IAI) have 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 in ground observation and target acquisition. GTAS can be used on the ground or on a vehicle, and is carried plus operated by a single soldier without the need for calibration and fine leveling. 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. The GTAS total system's 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.

IAI introduces new POP300D-HD Payload

Israel Aerospace Industries' Tamam Division has introduced a new POP300D-HD - True High Definition (HD) Day and Night Stabilised Optronic Payload using a 1280x1024 detector for the thermal imager and a full HDTV1920x1080 (1080p) detector for the EO camera in the 10" ball. This configuration also includes a qualified, battlefield proven, Laser Designator Range Finder (LDRF) with hundreds of systems delivered. The new HD sensors combined with the laser designator make POP300D-HD the ideal solution for multi-mission scenarios such as targeting, accurate geo-location and wide-area scanning, surveillance and rescue missions.



CFM Expands TRUEngine programme

CFM International is expanding its TRUEngine programme with the launch of its new TRUEngine LLP designation, designed to offer the industry an easy means of evaluating the operating history of used, life-limited parts (LLP). To earn the TRUEngine LLP designation, currently being offered for the



CFM56-5B and CFM56-7B engine models, life-limited parts are subjected to a rigorous records audit and engineering review/analysis and engineering review to evaluate their configuration and maintenance history relative to airworthiness limitations substantiated by GE and documented in the engine manual.

Launched in 2008, the TRUEngine designation provides assurance to owners, operators, and engine buyers that engines qualified for the TRUEngine programme have been maintained to CFM's configuration. An independent study has clearly shown that engines maintained with OEM parts and repairs maintain higher asset value than engines that include non-OEM parts or repairs. About 7,500 CFM56 engines operated by 88 operators have received the TRUEngine designation.

F-35 Lightning II programme passes 10,000 flight hours

The Lockheed Martin F-35 Lightning II programme continues its operational maturation, surpassing 10,000 flight hours in September 2013. More than half of the total hours were accumulated in just the past 11 months. Through September, F-35s flew 6,492 times for a total of 10,077 flight hours. The new milestone effectively doubles the safe flight operations of the F-35 in a year, compared to reaching 5,000 flight hours in six years.



Massive orders for Boeing and Airbus at Dubai Air Show 2013

Airlines of the Gulf placed numerous high-value orders at the Dubai Air Show 2013: Dubai-based Emirates Airline placed an order for 150 of Boeing's new 777 series, in a \$76bn (£47bn) deal. Other orders were from Etihad Airways, Qatar Airways and Lufthansa for some 109 of the new 777, previously

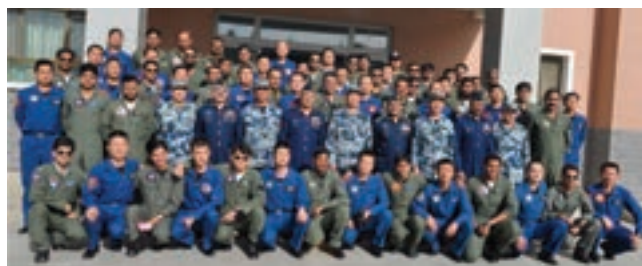
codenamed 777X, brought sales total to \$95bn. Emirates has also ordered 50 Airbus A380s, in a deal worth \$23bn. The airline is already the biggest customer of the A380 and the new deal will bring its total orders for the airliner to 140.

Etihad Airways announced a firm order for 87 Airbus aircraft, including 50 A350 XWBs, 36 A320neo aircraft and one A330-200F as part of its fleet modernisation strategy. The deal - valued at \$19bn - includes options for 30 more airliners (see article on Dubai Air Show 2013).



PAF and PLAAF in air exercise 'Shaheen II'

In September 2013, China and Pakistan conducted a three-week long air exercise *Shaheen II* (Falcon II) in the Hotan Prefecture of China's northwestern Xinjiang Uyghur Autonomous Region. The exercise was second in a series of joint Sino-Pakistan air exercises, the first of which was held in Pakistan in March 2011. *Shaheen II* marked the first time a foreign air force exercised alongside the PLAAF in Chinese airspace. While there was no official information regarding the type or number of participating aircraft from either side, an Associated Press of Pakistan (APP) report stated that an unspecified number of Chengdu F-7PG and Mirage 5 aircraft had flown north over the Karakorams to Hotan for *Shaheen II*. The Sino-Pakistani JF-17 Thunder which is operational with two Pakistan Air Force squadrons, was not sent to participate on this occasion.



Group photograph of Air Marshal Sohail Aman, DCAS (Operations) PAF and Lt Gen Zheng Qun Liang, Deputy Commander PLA Air Force, along with personnel of the two air forces at Hotian on 23 September 2013.

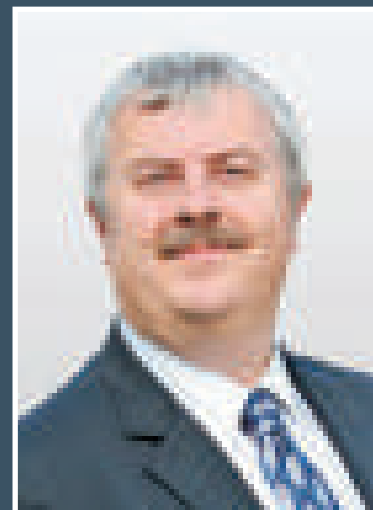


PAF F-7PG taxis past JH-7 on the tarmac while another JH-7 is on the runway threshold.

Hotan airfield, from where the exercise was conducted, is close to the disputed Aksai Chin region, where a stand-off between India and China took place in April 2013. The facility has a single 3,200 m runway at an altitude of 1,400 m above sea level, making it a challenging operating environment for combat aircraft. While China does not appear to have a permanent air force base at Hotan, publicly accessible satellite imagery routinely shows combat aircraft parked out in the open at the airfield, suggesting that they are deployed in and out as needed. Skid marks on the runway suggest that aircraft operate typically from Rwy 29 (landing from the East, taking off toward the West). Satellite imagery from June 2013 shows two J-11s at Hotan.

The exercise was conducted during a high point in Sino-Pakistani relations, with the preceding months having seen a number of bilateral agreements being signed, including an agreement on a Kashgar-Gwadar road link. The military cooperation was underscored by conclusion of the tenth round of defence and security talks between China and Pakistan, held at Beijing in August 2013.

Sébastien Remy, Senior Vice President and Head of EADS Innovation Works spoke with VAYU during his recent visit to Bangalore.



VAYU: We are happy that Bangalore was chosen to establish an innovation centre for EADS. How did this come about?

SR: EADS Innovation Works started its operations in Bangalore in 2009. We selected Bangalore since Airbus already had an engineering centre in the city at the time and we just set base in their facility. This made sense because our role is to prepare for the future in partnership with business units of the Group. It was logical to join forces and to put our people together with Airbus at the same location. Moreover being in Bangalore means that we are close to the pool of talent. Bangalore being home to numerous aerospace companies and high-end research institutes is a dynamic city. Currently, we have eight engineers in Bangalore who are working on cutting-edge projects.

VAYU: What are the projects assigned to this Centre?

SR: EADS Innovation Works in Bangalore is working on a number of projects. I will give you a brief snapshot:

Aerothermics: Electrical devices on board air vehicles generate a lot of heat which may lead to malfunctioning of these units or result in premature failure. This is undesirable from the point of aircraft reliability. As the electrical consumption on board next generation air vehicles including UAVs and commercial aircraft increases, heat generation will become a bigger and bigger problem. Hence, the team here is already studying how to evacuate this heat or design higher heat tolerant systems.

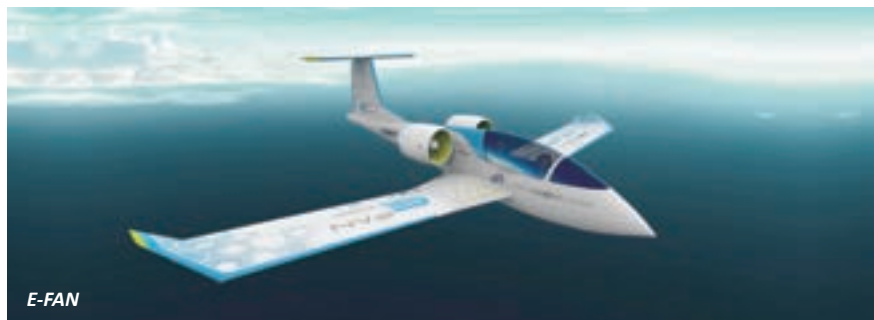
Image Treatment / Attitude Recognition System (based on Cloud Computing): Today, users maintain their own infrastructure for image treatment purposes but since the amount of data that needs to be handled is huge the physical infrastructure becomes obsolete very quickly. So, engineers at our Centre in Bangalore are looking at how to get rid of the physical infrastructure and use cloud computing to store the data as well as process it. More specifically, they are working on mathematical processes and algorithms which will allow huge amounts of data/images stored on the cloud to be

analysed and produce reasonably sized actionable information. This has both military and commercial applications. As an extension of this, a team here is developing video processing algorithms which can recognise pre-defined 'abnormal' individual and crowd attitudes. This has applications particularly in homeland security. For example, such an 'attitude recognition system' can help security agencies detect a man with a concealed weapon in a crowded place based on his behaviour or that of the crowd around him.

Radar Signal Processing: EADS Innovation Works Bangalore in collaboration with Cassidian India is leading a research project in sensor signal processing. The performance of sensors like radars can be significantly enhanced by 'cognition', where the environment is sensed and the sensor is adapted in real-time for optimal performance. This research is likely to lead to next generation of radar systems which will achieve higher performance by processing algorithms instead of increase in transmission power. This ongoing research work has resulted in publications in leading journals and filing of a patent.

VAYU: Is there any other India centric activity?

SR: Yes, of course. Recently, EADS signed a letter of intent with CEFIPRA (Indo-French Centre for the Promotion of Advanced Research) to promote aerospace research in India. Under this programme calls will be given to leading Indian universities and institutes to propose





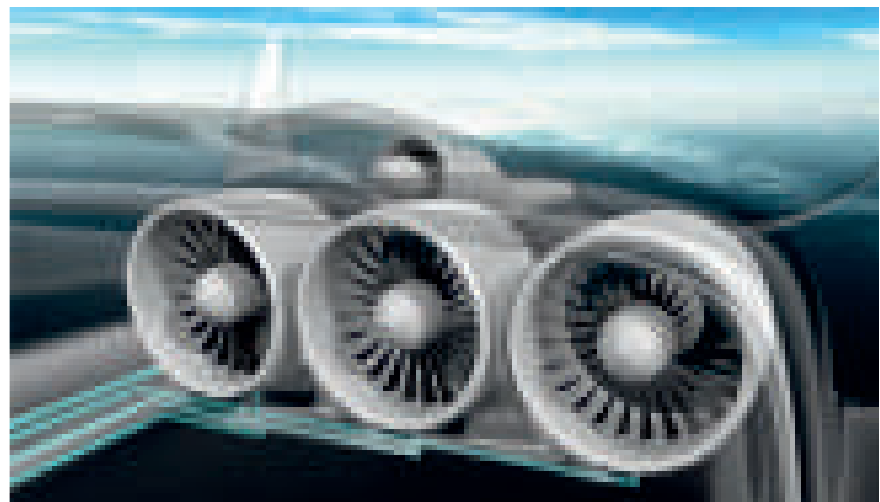
transnational 'Technology Capability Centres' with Composites Technologies, Metallic Technologies, Sensors, Electronics & Systems Engineering and Energy & Propulsion being some of them. We are headquartered in Munich but have 20 sites all over the world. In all we have 800 people including PhDs and engineers. Just to give you an idea of the emphasis EADS puts on R&D: In 2012, the Group invested more than Euro 3 billion in R&D activities. Today, EADS has a roster of more than 32,000 active patents and close to 1000 new patents are filed each year.

At a global level, we are working on a bold and revolutionary new concept, an all electric aircraft, called the E-Fan. It was on display at this year's Paris Air Show. E-Fan is equipped with two electric motors which

research projects for funding in areas such as avionics, composite materials and high-performance computing. We are also looking at ways to facilitate French post-doctoral fellows to pursue research work in India. Then we have set-up a research chair in the field of 'Mathematics of Complex Systems' in collaboration with the Tata Institute of Fundamental Research. The Chair's lead objective is to develop innovative research involving theoretical and computational work in general mathematics of complex systems including control theory and data assimilation.

VAYU: Can you give an overview of your global operations?

SR: Sure. EADS Innovation Works focuses on R&D in technology fields that are critical for EADS' future programmes. We are organised around seven



E-Thrust concept

provide a combined power of 60 kiloWatt. The motors are in turn powered by a series of Lithium polymer batteries which currently give an endurance of around one hour. Battery cells are distributed in the wings and the frame of the aircraft instead of being placed in a single battery container. The pilot can monitor the health of each cell from the instrumentation available in the cockpit and if there is a problem he can reconfigure the battery system through on-board software. New batteries with a higher energy density will be installed later on which will increase the endurance to up to 90 minutes. The E-Fan is particularly suited for basic pilot training and aerobatics. The aircraft is ready for flight and will take to the skies very shortly. The plan is to have the aircraft in service by 2017. This technology when matured can also be used in unmanned aerial vehicles.



Tropospheric airship concept

Guardians of the Golden Gate

'Semper Paratus'



US Coast Guard Air Station San Francisco, co-located at the San Francisco International Airport in San Francisco, California, is one of four air stations in the Coast Guard's 11th District which encompasses the states of California, Arizona, Nevada and Utah. This covers a coastal length of more than one thousand miles and offshore waters of Mexico and Central America extending to South America. The Coast Guard's 11th District operational units are located throughout the state of California, with the District and Pacific Area headquarters located on Coast Guard Island in Alameda, California, along the eastern side of San Francisco Bay. Most of CGAS San Francisco's operations are conducted in the San Francisco Bay area and the Sacramento River delta.

The Coast Guard is one of five armed forces of the United States and the only military organisation within the Department of Homeland Security, but earlier, the Coast Guard has operated as part of the Department of Transportation. The attacks of 9/11 served as a catalyst

for the transition and the Coast Guard officially became part of the Department of Homeland Security in 2003, further expanding the role of the aviation units beyond Search and Rescue duties. The passing of the Homeland Security Act in 2002 brought increased emphasis on the maritime security role. The Coast Guard is responsible for conducting security patrols over America's major maritime infrastructure. For the Air Station at San Francisco, this includes the enormous port facilities at San Francisco and Oakland, along with the waterways that lead inland to Stockton and Sacramento.

By law, the Coast Guard has eleven missions to perform: Ports, waterways and coastal security, drug interdiction, aid to navigation, search and rescue, living marine resources, marine safety, defence readiness, migrant interdiction, marine environmental protection, ice operations and law enforcement.

Air Station San Francisco operates four Eurocopter MH-65C Dolphin helicopters, which are used for search and rescue missions. These helicopters allow the unit

to provide coverage along 300 miles of coastline from Point Lucia, located south of Big Sur, California, to Point Arena in the north.

The history of Coast Guard Air Station San Francisco dates back to 15 February 1941, when the unit was established and the construction of the station was completed. The first aircraft employed by the station a PBY-5 Catalina and two RD-4 Dolphins. On 1 November 1941, the station's aircraft and personnel were placed under command of the US Navy, where they continued to conduct search and rescue and coastal patrols missions through the end of World War II. The air station resumed normal operations under Coast Guard command after release from the Navy on 30 June 1946.

The first helicopter type stationed in San Francisco was the HO3S-1 Dragonfly in 1947. In the early 1950s, the Grumman HU-16E Albatross replaced the air station's aging fixed-wing inventory. This general-purpose amphibian aircraft proved to be a highly adaptable platform for search and rescue missions. The Air

Station received the HH-52A Sea Guard helicopter in 1963, which was a significant improvement over its predecessor with its improved flight characteristics and capabilities.

In 1978, the station's C-130s were relocated to the newly-constructed Coast Guard Air Station Sacramento, ending 37 years of Coast Guard fixed-wing aviation in San Francisco. In 1991, Air Station San Francisco received its first HH-60 Jay Hawk to replace the H-3 Pelican as the medium-range search and rescue helicopter. Aviation restructuring throughout the Coast Guard meant a short tenure for the HH-60 in San Francisco; in June 1996, four HH-65s were moved to San Francisco from San Diego. In autumn of 2001, the air station transitioned to the HH-65B, with an upgrade in the avionics package. In the spring of 2006, the HH-65B was upgraded to the HH-65C after the installation of new Turbomeca Ariel 2C2-CG engines.

The MH-65 Dolphin has been in the Coast Guard's inventory since 1984, and is expected to remain in service through to 2027. The Coast Guard is upgrading the helicopters with state-of-the-art enhancements that will extend mission capabilities and improve their reliability and maintainability.

"With introduction of the MH-65D, we are using the latest in technology," said Lt Ian Culver, a pilot based at Air Station San Francisco. "The conversion to the MH-65D is completed during one flight, mainly focusing on the new avionics package. The transition to the MH-65D will be mostly completed by visiting personnel from the Aviation Training Center in Mobile, Alabama. Remaining aircrew members will be trained by unit instructors," he continued.

The conversion and sustainment project is modernising the aging helicopters with digital technology. The upgrades include GPS and inertial navigation, as well as updated cockpit instrumentation. The MH-65 conversion and sustainment project is accomplished in six phases or complementary discrete segments. The Coast Guard upgrades the aircraft at the Aviation Logistics Centre in Elizabeth City, North Carolina.

The Coast Guard is relying on new student pilots to join the force as well as former U.S. Army, US Navy, US Air

Force, and US Marine Corps pilots to bring additional skills and experience to C.G. units. Approximately forty percent of current aviators have a background in one of the other branches of the US military. "For many of them, it is a culture shock! However, bringing in these experienced pilots helps keep us at a higher level of skill," said Cdr Brian Glander, Air Station San Francisco's Executive Officer.

"Student pilots begin their training at Naval Air Station Pensacola, with pilots from other branches of the U.S. military," explained Culver. "We start with approximately 25 hours flying

a number of qualifications for hoisting, boat missions and operations utilising night vision goggles.

Of the station's four MH-65Cs, there is always one helicopter available for deployment aboard one of the Coast Guard's 'cutters' – a term for a vessel longer than 65 feet. "Basically, we can do our operations in the San Francisco Bay area with three aircraft," explains Philips. "One of our recent deployments to the Arctic region was to oversee the oil drilling conducted by Shell. Deployments like that clearly show how far we reach in our missions."



time in the Cessna. Then we transition to the T-34/T-6 for an additional one hundred hours of flying. To complete the training, helicopter pilots transit to the TH-57 for nearly 125 hours. After completing the training the new pilots will transit to their assigned unit to learn more about search and rescue flights and working in a team," said Culver. New pilots assigned to the unit will start with about four to six familiarisation flights. "We learn how to conduct search and rescue operations specific to our area of responsibility," said Lt Cdr Harper Phillips, Operations Officer at Air Station San Francisco. "The majority of the flights we conduct are training flights in order to prepare for real-life action". Every six months, each pilot has to pass

Besides search and rescue and oversea deployments, the station is also involved in a new mission introduced in 2007, the airborne use of force. For this purpose, MH-65s are able to carry both the M-14-T and M240H machine guns to conduct such missions. Cdr Glander was involved in the introduction of this new type of mission to the Coast Guard. "My personal goal is to fully institutionalise the new law enforcement role in the business processes of the unit, so it can be modeled as a standardised template for other Coast Guard units. We've come a long way and we want to find the best method of operating and training dedicated crew members for new missions."

Carlo Kuit and Paul Kievit/ Bronco Aviation



End Of An Era - VC10 bids Farewell to Arms

Vayu's UK Editor Richard Gardner reports from RAF Brize Norton, England

Friday, 20 September 2013, was a significant day for the Royal Air Force for it marked the end of a 47-year long service career for Britain's last great four-engine airliner, the iconic Vickers VC10. In the early 1960s, RAF Transport Command operated a worldwide schedule of long-distance cargo and trooping routes from the UK to Canada and the USA in the West, and to Hong Kong, via Singapore, the Middle East and Cyprus to the East. The main strategic RAF transport aircraft at that time were the 23 modern turboprop-powered Bristol Britannias, popularly known as 'The Whispering Giants'. These were very smooth flying and comfortable times for the military and civil servant passengers compared to the previous generation of piston engine transport aircraft, which required many refuelling stops along the way and took several days to reach their final destinations. When the Vickers VC10

was introduced by BOAC in 1964, it is beautiful, rear-engine long-range airliner represented the latest commercial aviation technology, with four very powerful Rolls-Royce Conway turbofan engines, a short take-off and landing runway performance, intercontinental range, and a fuselage cross section that offered more internal space and a much quieter cabin

than the rival US Boeing 707s and DC-8s. It was also very much faster than the Britannia, with a cruising speed of around 600 mph. In fact, with the demise of the Concorde, the VC10 has remained the fastest jet airliner in the world right up to its retirement, with its Mach 0.96 cruising capability - no Boeing or Airbus cruises as fast today!



The RAF VC10 fleet originally numbered 14 aircraft, and all featured a large cargo door, which enabled a useful mix of passengers and freight to be carried. They flew not only on RAF scheduled routes worldwide, but accompanied fighter and bomber detachments to overseas destinations on operational missions and also joint exercises with other friendly nations. They could also be fitted with a VIP cabin and for more than three decades were used to fly the Queen and senior government and Service officials on state business on flights all over the globe, including to India on many occasions, especially in support of joint air exercises and official visits. Since 1966, when the RAF VC10s were delivered in the transport role to the appropriately numbered No 10 Squadron, they have taken part supporting every international conflict or natural disaster relief operation in which the UK has been involved.

During the Falklands War in 1982 they were in continuous use shuttling men and supplies between the UK and the forward air head on Ascension Island in the South Atlantic. After this war the need for additional tanker aircraft to supplement the 30 Victor tankers, had the British government ordering the conversion of 14 ex-airline Super VC10s as three-point tankers for a second RAF squadron, No 101. These were needed mainly to provide sufficient air refuelling capacity for the expanding Tornado F3 fighter fleet, but eventually all the VC10s were given a receiving and tanking capability by fitting them with three refuelling points, with fuselage mounted hose units for refuelling large aircraft, and two wing-mounted

Pods for fast jets, which could use all three points simultaneously if needed. The converted Super VC10 aircraft (which were bigger than the standard version) were completely rebuilt by British Aerospace at Filton, Bristol, with large internal fuel tanks, self-supporting equipment for deployments to remote airfields, and close-circuit TV to aid refuelling at night and in bad weather. The high tail, rear engine configuration gave the VC10s outstanding turbulence-free in-flight stability and this made aerial tanking far easier and safer for the receiver aircraft than when tanking from aircraft with low, conventional horizontal stabilisers and underwing engines. In 1987, No. 101 Squadron celebrated its 60th anniversary in style by flying non-stop and breaking the world air speed record between the UK and Australia, taking 15 hours and 53 minutes in flight, with two air refuellings en route, over the Mediterranean and Indian Ocean, to Perth.

By the 1990s the RAF VC10 and Super VC10 fleet had expanded to 28 aircraft. Some retained their passenger/cargo cabins and could be used for long-range trooping flights as well as for tanking operations. During the first Gulf War in 1991, No 101 Squadron deployed to the Middle East where it flew over 1,400 flying hours on tanking operations, delivering eight million kilograms of fuel to coalition aircraft. During the 1990s VC10s were based in Cyprus, Turkey and Bahrain supporting the No-Fly Zone over Iraq, and later continued to fly tanking missions in support of coalition air forces over Kosovo.

During the second Gulf War in 2003, VC10s were deployed to Saudi Arabia where they achieved a 100% tanking

sortie success rate and also took part in casualty evacuation flights between the war zone and Cyprus. From 2009 to 2011 No. 101 Squadron VC10s flew from Oman supporting RAF and US Navy fast jet fighters operating over Afghanistan. The last major operation involved supporting the UN operations over Libya in 2011. Finally, the detachment based in the Falkland Islands returned to its home base at RAF Brize Norton in England. The RAF is now continuing to use its Lockheed Tristars as transports and tankers, but is gradually building up its new fleet of 14 Airbus A330 Voyagers which will replace both VC10s and Tristars.

The author was fortunate to be invited to fly on the very last operational VC10 tanking sortie on the last day of its service career. No other VC10s remain in civil or military service. It was a beautifully clear day and the four and a half hour sortie involved the last two Super VC10s flying in formation out over the North Sea, where they refuelled each other (largely for the benefit of a BBC TV crew aboard the second aircraft!) and then in turn refuelled two Tornado GR4 bombers and two Typhoon fighters, before making final approaches and fly-bys over Lossiemouth, Leuchars and Preswick in Scotland, then Samlesbury and Warton (BAE System factories) before a final formation break and landing back at RAF Brize Norton. It was an emotional moment as squadron personnel and their families gathered around the steps of the sleek grey aircraft to pay their final respects and share in the sense of history, and a job well done. The VC10s have thus ended almost half a century of safe and reliable flying, with no aircraft losses in all that time, and a reputation shared by its crews for being a superb flying machine. Its beautiful shape in the skies and impressively high levels of engine noise will be greatly missed by all lovers of aviation, though it has to be pointed out that the new Voyagers carry three times as much fuel as a VC10 yet they can also carry 250 passengers and their baggage as well as being able to tank aircraft at the same time!

So farewell Queen of the Skies, only the English Electric Canberra bomber has served longer in the RAF's history- 55 years in front line service.

[Author's photos]



Ancient Aviator Anecdotes

A Presidential Encounter

In 1967, as a Wing Commander, I was based at Jamnagar in command of our Air Force's first Hunter Operational Flying Training Unit, which I had raised. One morning our Station Commander called all three Commanding Officers and senior section commanders to his office. He briefed us on a forthcoming transit visit by a foreign Head of State during a brief refueling halt. Secrecy and security of this particular air movement was of paramount importance hence, barring personnel essential for duties in connection with the visit, the air base was to close down. The only persons from outside the base were the Chief

Member and myself. Rumours as to the identity of the visiting dignitary were rampant but it was only on the morning of the visit that we learned it was Gamal Abdel Nasser, President of Egypt returning after a top-secret visit to New Delhi. A foreign four-engine aircraft landed quietly and His Excellency was received by the Chief Minister and the Station Commander and driven to our Mess.

I received the President at the entrance and was introduced as the President of the Mess Committee while escorting him into our anteroom. Contrary to our briefing, General Nasser spoke English very well, was very friendly and (as I was to learn shortly) had quite a sense of humour. After

On departure he signaled one of his aides who handed him a gift wrapped parcel, looked around and came to where I was standing at the back, presented it to me, bent down and whispered "From one President to another, thank you for your hospitality and goodbye." The gift, which was of course presented to others too, turned out to be a carved wooden cigarette box. It was not too long after this visit that we learned about the Egyptian and Arab debacle in the 1967 war. This must have been a great setback to the ardent nationalist President who passed away three years later. Apprehensive that the gift might tempt me to resume smoking, my wife's periodic attempts to



Minister of the State and a representative from the Intelligence Bureau. Within this directive, all operational, technical and administrative arrangements were finalised.

At that time I was also the President of the Mess Committee of our Officers Mess and was tasked with looking after the VVIP and his small delegation in our Mess, which was to be sealed off by a security cordon. Even our Mess staff was not permitted inside the anteroom; refreshments were therefore to be served personally by the Mess Secretary, Food

I had served him, he patted the empty chair beside him, asked me to sit down and murmured quietly with a smile, "the Presidents must talk with each other!" He asked me if I had ever visited Egypt and I replied that I hadn't but mentioned the name of the Egyptian Air Force officer who was my colleague during the Air Staff course at our Defence Services Staff College in Wellington in 1960-61. He said he knew Adi Khairat very well and went on to relate a few incidents from his own days as an instructor at the Egyptian Army staff college.

quietly dispose of it have to be foiled as it remains the only memento of my having met a foreign President in person!

The Name Of The Game

My post retirement foray into the field of education taught me a great deal more than I needed to know. The quest for (new) knowledge continues to be a fertile field for students and researchers. What amazed me however were the range, depth, nature and varieties of subjects chosen. One young lady (granddaughter of an air force colleague of mine) once got in touch with

me and said she was researching for a paper titled 'Origin and Application of Appellations' (and yes, I had to look it up in the dictionary!).

She was apparently trying to establish a connection between the meaning of given names (as an identity) and outcomes (both professional and personal). From me, she desired to know the origin of my given family name and, since I was the same age as the air force (read: a fossil), could I please confirm as to whether there had ever been a squadron leader by the name *gyani* in our *education* branch and/or a wing commander named *judge* who for a while taught air force *law* to flight cadets? I was able to provide the information and confirmation requested but her very unusual choice of subject did set me thinking...

Some fellow vintage air veterans may recall a story doing the rounds of officers messes over half a century ago. It concerned the financial exploits of an enterprising officer of the Accounts branch who 'borrowed' capital from the Public Fund in his custody on Saturdays after duty hours, patronised the race courses in Poona and Bombay and replaced the amount before duty hours on Monday mornings. Undoubtedly these weekend excursions must have been both lucrative and discreetly executed as they continued for quite some time before the *law* in all its majesty caught up with him (it seems that the horses he followed, followed other horses thus leading to detection of a major deficit of Public Fund in his custody). Those of us who have been at the receiving end of air force law know that its application is swift, sure and just. The subsequent inquiry and legal proceedings led to the officer being handed over to civil authority and thereafter his incarceration in Yerawada Jail in Poona.

Some time after we had heard this story, I was ferrying an aircraft from Bangalore to Halwara and made an overnight stop in Poona. It enabled me to catch up with my coursemates posted there and, like most young officers in those days, we ensured that the Mess Bar made high profits before we decided to dine at a well known Chinese restaurant in town. Seated next to our table was a

family and the gentleman at the head, no doubt recognising a couple of my companions, gave us a friendly smile and a wave. On my enquiring about his identity, my coursemate explained that he was an inmate of Yerawada Jail. Apparently his most efficient management of jail accounts, coupled with exemplary personal behaviour, persuaded the jail authorities to allow him out from time to time to visit his family. I asked for the officer's name to which he replied, 'Flight Lieutenant Gerry Lawless.' (I hope the young lady is reading this!)

Sugu's Story

Among the more colourful characters I knew in the air force, was my coursemate 'Sugu.' We met as cadets in 1951 and, as I grew to know him, I realised that the affected swagger in his gait and attitude hid a carefree loner and freethinker who marched to his own drummer. At an age and stage when our interests were focussed almost exclusively on flying and girls (not necessarily in that order), Sugu went further and meticulously maintained a personal daily diary. Once you earned his trust and friendship however, he would gladly give you his last rupee as freely as he took yours. If he felt that a particular rule or regulation intruded upon his 'rights,' he treated it with benign neglect. Post graduation he went on to fly twin/multi-engine fixed wing and rotary wing aircraft.

As bachelor officers our meetings were infrequent but when we did, we usually shared accommodation. One Sunday he decided to accompany me to church. When I expressed surprise that a good Brahmin would do so, he merely said he wanted to check out the girls. Yet that same evening he gave me an erudite analysis on the pitfalls of organised religion. Though possessed of a good intellect, he chose to use it sparingly. Among his eclectic collection of books (ranging from philosophy to pornography) I came across a sealed register marked 'Sugu's Story'. He turned down my request to read it saying I could do so after he retired and penned his memoirs. Besides, he added, it contained some very unflattering profiles of his coursemates, including me!

Sugu developed a taste for the 'juice' and many was the occasion when his bar book was closed well before the end of the month much to his annoyance; he considered the Rs. 75 per month limit an immoral imposition. Like all his peers he was constantly falling in (and out) of love, the only difference being (after a couple of 'sundowners') his tendency to propose to the young lady of the moment. Of course what was actually proposed, was never quite made clear. In the mid-1960s he met, courted and married a trainee nurse and brought her to Delhi on their honeymoon. He hired a taxi to take her sightseeing after which he turned up late one evening at our home where he introduced his bride, announced that they had come for dinner and requested me to go and settle the taxi fare. I not only had to pay but also pacify the irate driver (evidently a teetotaler) who had indignantly refused Sugu's offer of a bottle of Black Knight whisky in lieu of the fare! In the early hours of the morning I drove them to an address in Hauz Khas and then on to the railway station to catch a train.

In the late 1960s we accidentally met at the air base in Jodhpur to which he had been attached for disciplinary purposes. It seemed he had been posted to command an NCC Air Squadron, reported with family to find there was no reserved accommodation awaiting him, so had checked into a starred hotel and instructed the management to send the bill to Air HQ! (The resulting brouhaha can be better imagined than described.) Little did I know that our drinks together that evening were to be our last meeting as, soon after, we received the sad news of his death in a helicopter flying accident. End of story? Not quite : read on.

In Bombay in 1989 my wife and I went to visit a patient in the Breach Candy hospital. The Matron happened to come in, took a long look at us and waited for us to exit when she politely asked for my name and profession. With a remarkable memory Sugu's widow identified herself and recollected with pleasure the one evening they had spent with us 25 years earlier. So, though we never got to read his story, Sugu is still an unforgettable character well remembered by his coursemates and friends.

Air Vice Marshal (ret'd) Cecil Parker

25 Years Back

LCA enters next design phase

With Project Definition Phase (PDP) of the Light Combat Aircraft now completed, the LCA is moving into the detailed design and engineering phase. Conceding that the PDP was slightly behind schedule, Dr VS Arunachalam, scientific adviser to the Defence Minister, has said “we will catch up in the design stage”. Some of the problems faced during definition were optimisation of weight and performance and the extensive wind-tunnel tests.

One of the major problems will be the availability of resources. The LCA project was originally sanctioned Rs 560 crore. Dr Arunachalam said he would be happy if the final project cost could be contained at Rs 2,000 crore, but some critics of the project say it would be much more. A contract has been signed with General Electric of the US for supply of 11 F-404 engines to be used during the prototype development of the LCA. An agreement with Ericsson of Sweden provides for co-operation in producing the multi-mode radar.

CAG criticism of HAL

The Comptroller and Auditor General of India has criticised Hindustan Aeronautics Limited (HAL) for not transferring cost overruns incurred in the Design and Development (D and D) projects in full measure to the Indian Air Force, the major beneficiary. In his report on HAL presented in Parliament in mid-November, the CAG said there were considerable cost and time overruns as compared to originally sanctioned estimates in respect of D and D projects such as Ajeet, Kiran Mk II, HPT-32 and Ajeet Trainer.

HAL offers Do 228 executive version

The first executive-transport version of the HAL-built Dornier 228-101 has been demonstrated by the Kanpur Division of HAL to potential operators in Delhi, Calcutta, Bombay, Bangalore and Hyderabad. Offered for long-range, fast executive air transportation, HAL are confident that there is a vast market for the type in India and its exclusive market territories abroad. With confirmed orders for some 140 Dornier 228s in hand, HAL are completing phase III aircraft for the Coast Guard and Air Force and will be in a position to produce one aircraft a month from 1989-90.

IAF to phase out MiG-21s

The IAF will begin to phase out its MiG-21 fighters from 1992, as indicated by the Chief of the Air Staff, Air Chief Marshal SK Mehra. Several versions of MiG-21s were first inducted in early 1963, followed by licence-manufacture by HAL. The MiG-21F

From Vayu Aerospace Review Issue VI/I 1988

was followed in turn by the MiG-21PF, MIG-21FL, MiG-21MF, MiG-21M and the MiG-21bis. Besides, the IAF has operated various two-seat operational conversion trainers of the type for nearly 25 years.

Naval capability being upgraded

The Indian Navy feels that it should have armed assault helicopters which can carry troops and provide them air cover during landing. CNS Admiral Jayant Nadkarni has said that negotiations were on with two foreign shipyards for design work for an aircraft carrier to be built at the Cochin Shipyard. This apart, the Navy hopes to launch the first of the SSK class submarines, being built at the Mazagon docks, early next year.

As for ships, the Navy has three indigenously-designed classes of ships under construction in the Indian yards. The first type of these ships to come out will be Project 25 corvettes, the lead ship of which is scheduled to be commissioned in the middle of the next year. A bigger class, called Project 16A, which is a more advanced version of the *Godavari*-class, is under construction and the first ship of this type is expected to be commissioned in early 1994. A far bigger frigate, displacing 5,000 tonnes, is also under construction in Bombay and the first of these ships is expected to be launched in late 1994.

The year 1988 also saw the Navy commissioning the third and last of the *Godavari* class frigates and a nuclear-powered submarine acquiring from the Soviet Union. The Admiral said the nuclear submarine had been taken on lease to familiarise the Indian Navy personnel with its operation and maintenance.

Chinese F-7M upgrade

The Collins Division of the Rockwell International Corporation has signed an agreement with the People's Republic of China to provide advanced avionics equipment for the Chinese F-7M fighter upgrade programme. A light tactical fighter, the F-7M Airguard is designed for air defence, interceptor and ground support roles. This Mach 2 plus delta-wing aircraft is being modified for the export market.

'Operation Cactus'

Southern Air Command played a vital role in making 'Operational Cactus' in the Maldives a quick success. According to Air Vice-Marshal AG Saline, it was at 11 am on 3 November that the SAC got the first alert and within six hours all preparations had been made to meet any eventuality. Despite hostile weather (it was raining heavily) that night, the IAF transport fleet did an enviable job by making 60 sorties. Apart from the 200 sorties to and from the Maldives made till the 7th November, the Air Force had also moved 100 tonnes of essential items and equipment.

Tejas by any other name



Even while we await ‘the real’ initial operational clearance (IOC) for the Tejas LCA by end of 2013 (*déjà vu*), how many know that the father of Burmese Revolution, General Aung San’s war time *non de plume* was ‘Tejas’ ? Of course, the Burmese pronounce it *Teza* or even *Tay Za*.

It would be befitting that the Tejas be offered to the neighbouring friendly Myanmar Air Force whenever it be ready for frontline service with the IAF.

Light fighters vs flying dinosaurs



Air Marshal Johnny Greene, who passed away recently, had a distinguished career in the IAF and was one of the pioneers when the Gnat light fighter was inducted. He commanded No.2 Squadron IAF with distinction and eventually went on to become Deputy Chief of the Air Staff, having also been involved with formulation of the Air Staff Target for the light combat aircraft which was originally conceived as a ‘Super Gnat’.

Johnny was an unabashed supporter of the lighter fighter approach. The Gnat’s AEW was 4,000 kg against the IAF’s main fighter bomber of the time, the Sukhoi Su-7’s 15,000 kg. Curiously, both types carried virtually the same weapons load. One of the enduring legends in the IAF was his remark after he flew the monstrous Su-7 for the first time. On landing, all he had to say was a cryptic “Why ?”.

Like the dinosaurs of past, the Su-7 was extinct soon enough.

Vayu (Sena) howlers

A brief history of the various squadrons at Ambala is given in the publication marking Platinum Jubilee of Ambala (‘Oldest Air Base of the Indian Air Force’). Here is a beauty : “No.3 Squadron Cobras which was first formed in October 1941 (was) equipped with Hawker Hunters”. If so, they would have wiped out the Japanese in Burma within hours.



Unfortunately, they did not have this superlative transonic jet fighter bomber (then) but went to war with the Hawker Audax biplane which they flew against the Pir of Pagaro’s Hurs in Hyderabad (Sind).

Flying boat of a third kind



*Actually, the water is so clear it looks like the boat is hovering !
Taken at Bora Bora Pearl Beach*

“Oh My God” OMG! OMG!

The pilot was welcoming the passengers on the plane shortly after take-off. “Thank you for flying with us this morning. The weather is...” then suddenly he starts screaming while he is still on the loud speaker:

“Oh My God OMG! OMG! This is going to hurt...OMG!”
Silence reigned! Pin-drop silence !

Finally after a small gap - he gets back on the microphone talking to the passengers: “I apologise for this incident...but the stewardess just dropped a very hot cup of coffee on my lap...you should see my pants from the front”.. A passenger replies angrily “Why don’t you come back here and see our pants from behind !”

Contributed by Lalit Mehra

Afterburner

Saab

Shinmaywa