

# VAYYU

VI/2014

## *Aerospace & Defence Review*



## **VAYYU's 40<sup>th</sup> Anniversary**

**Interview with the CNS  
Reflection and Introspection**

**Herald The Rising Sun !  
The Albatross' Nest**

Lockheed Martin



Cover: The ShinMaywa US-2 Amphibian Aircraft

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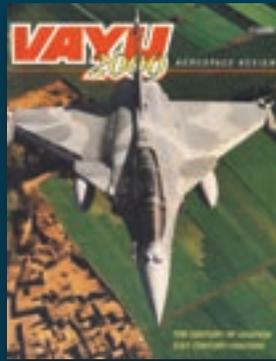
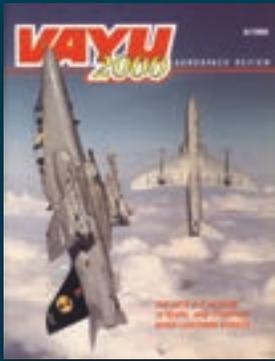
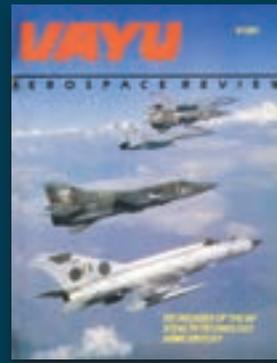
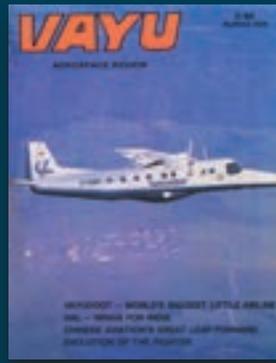
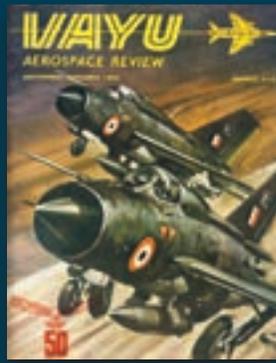
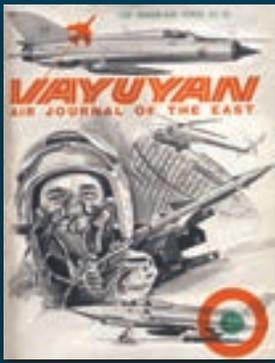
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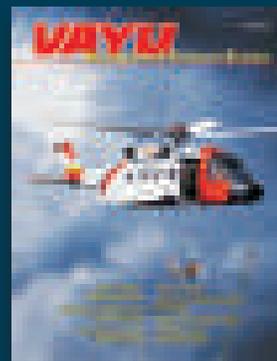
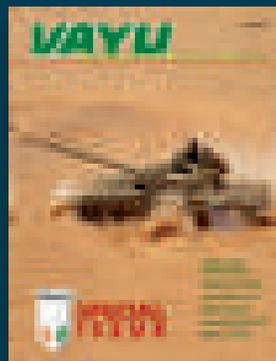
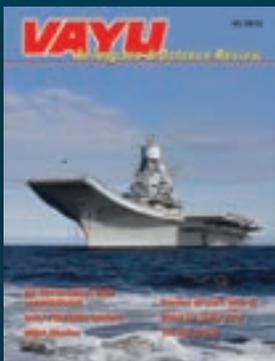
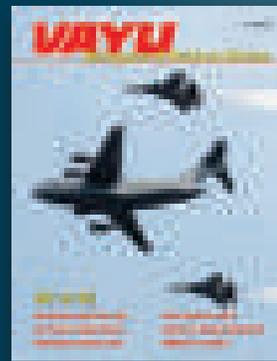
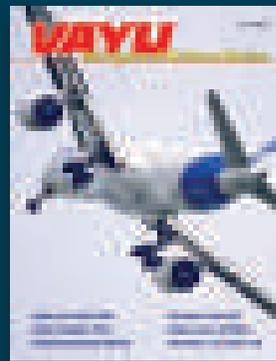
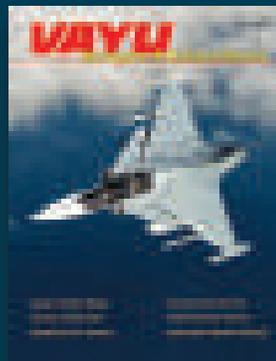
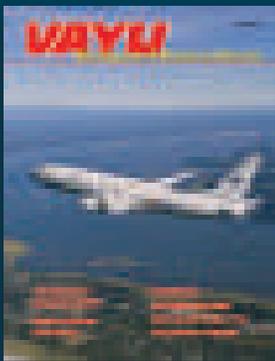
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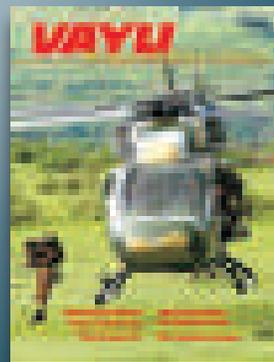
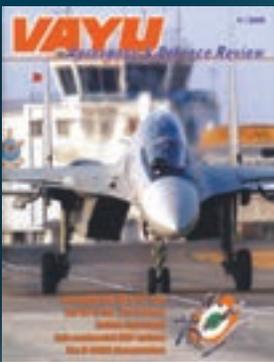
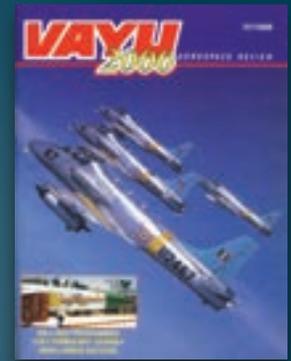
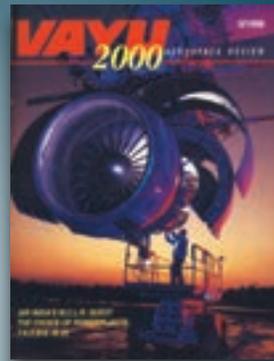
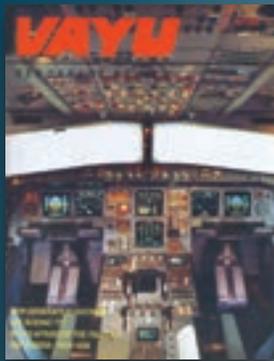
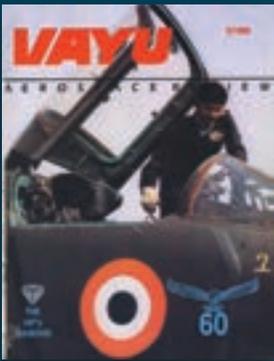
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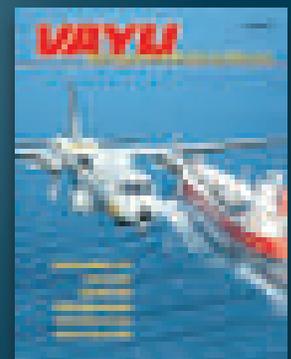
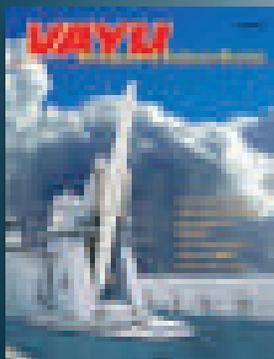
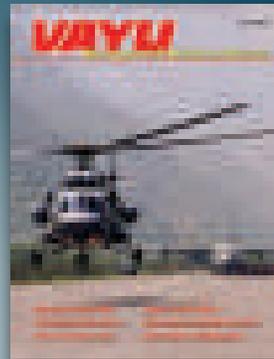
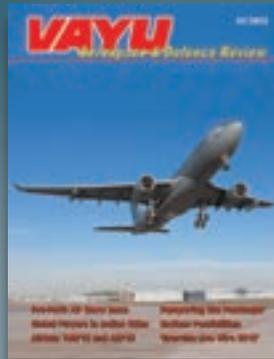
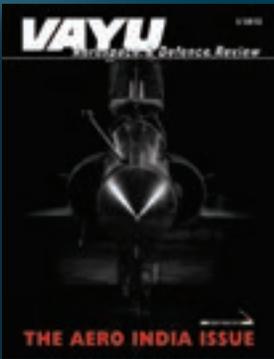
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# Anniversary



## Defence (procurement) minister

Going by the public statements made so far by Defence Minister Manohar Parrikar, one could be forgiven for mistaking him as minister for defence procurement. In practically every statement he promises “transparency and speed in defence procurement”. To be fair, he admits it will take him time to grasp issues relating to national defence. Even so, if he continues promising only faster procurement, it might well become a self-fulfilling prophecy. It would be worrying to have a defence minister who measures his success in capital rupees spent. Instead, Mr Parrikar must focus on adding capability. This can be done at relatively nominal cost.

A striking example is on advanced towed array sonars for the navy. Over the last two decades, the navy has built up a powerful and enormously expensive fleet of capital warships - the aircraft carriers, destroyers, frigates and corvettes that control the seas in war. Yet these warships, each costing several thousand crore rupees and crewed by a couple of hundred sailors, have remained desperately vulnerable to enemy submarines. This is simply because they lack advanced towed array sonar, or ATAS, which the Defence R&D Organisation (DRDO) had promised to deliver but did not. By now procuring ATAS from the global market - each worth a piffling Rs 50 crore - tens of thousands of crores worth of naval warships have become combat capable.

Such examples abound within the military. Yet the ill-informed public narrative on defence procurement centres on enormously expensive weapons platforms that, in many cases, are operationally ineffective even after lavishing billions because smaller systemic or structural drawbacks restrict their full employment. In militaries like that of Pakistan, where money is short even after unfairly burdening the national exchequer, there is awareness of the need to obtain bang for the buck. India’s relative wealth has not nearly been translated into commensurate capability.

Remaining with the Navy (ironically the most cost conscious service), there is constant breast-beating over the submarine shortfall and China’s growing lead in submarine numbers. The media constantly harps on how India has just 13 submarines compared to China’s 53 conventional and 5 nuclear attack submarines, though that lead could increase this afternoon giving how fast China is building more. Everyone’s solution, predictably, is to throw more money at the problem, by quickly sanctioning Project 75I, which envisages building six new submarines for a mind-numbing Rs 50,000 crore.

Yet if one were to scrutinise the on-going Project 75, under which Mazagon Dock Ltd, Mumbai is building six Scorpene submarines, a sane planner would be aghast to discover that these submarines, which have been in the works for more than a decade, will be operationally hamstrung when they finally roll off the line. The submarine’s key weapon is the heavyweight torpedo and, incredibly, the MoD has omitted to buy any for the Scorpene. In 2011, Finmeccanica subsidiary WASS had been selected to supply 98 torpedoes for some Rs 1,850 crore. Since that contract remains unsigned, the Scorpene will join the fleet without their key weapon.

Yet, nobody in the military, the ministry, the government or the media is called to account for allowing a Rs 1,850 crore procurement to stall the battle-readiness of Rs 24,000 crore worth of submarines. One can forgive the ministry, manned as it is by generalists for whom torpedo sounds like a variety of libido. The Prime Minister’s Office, with so many ministries to meddle in, can only focus on big bang procurements and that means those that are regularly reported on, or those that the military is pressing for. The media, especially

top editors, choose not to waste mind space on the nitty-gritty of defence economics, and instead focus their collective gaze on high-voltage procurement contracts that can be easily remembered by the billions they cost.

Take the media fanfare over the selection of the medium multi-role combat aircraft (MMRCA), an apparently fixed match that was won by the French Rafale fighter, the least expensive of the two most expensive fighters on offer, which were predictably ushered into the final selection. Currently, this \$20 billion tender remains the single most reported defence story, with uncounted column inches speculating on the imminent signature of the Rafale contract. This newspaper has been practically alone in carrying cost-benefit analyses on the Rafale proposal, and in debating whether the opportunity cost of buying this fighter is too high.

In contrast, there is little mind space for the little things that would improve operational capability at little cost. Maintenance, that boring process that can put a hundred additional Sukhoi-30MKIs into the sky just by better inventory control and technician training. Light fighters, especially the Tejas Light Combat Aircraft (LCA), which should be the pride of India but sadly remains the unwanted child of the Air Force. Force multipliers, like airborne refuelling aircraft and airborne early warning and control systems, can be wisely procured and deployed to make each squadron as effective as two. But this is humdrum stuff. So are issues like night-blindness that dramatically reduces combat capability across the three services, especially the Army.

It is these mundane essentials that Mr Parrikar must focus on. Appointing a tri-service chief would spare him the confusion of having to navigate the tri-service jockeying for funds and resources. He must institute a detailed capability audit, in which each service presents a plan for optimising their existing weapons and platforms rather than just stretching out their palms for newer, better and, of course, more expensive toys. It is militarily prudent to get our existing kit working optimally - the military equivalent of fixing the Indian Railways before building fancy new bullet train lines.

*Ajai Shukla in Business Standard*

## Aviation sector needs a sensible policy, fast

The draft civil aviation policy announced by civil aviation minister Ashok Gajapathi Raju which envisages, among other things, the listing of the profit-making Airports Authority of India (AAI) and Pawan Hans Helicopters Ltd, and scrapping the rule requiring airlines to have five years’ flying experience and a fleet 20 aircraft (5/20 rule) if they want to fly abroad, is welcome. So is the proposal to review, on an equal-opportunity basis, controversial bilateral agreements with foreign airlines. These have been talked about for several years and airline veterans say much of the new draft policy was proposed by the first NDA government in 2000. The minister, however, should have set a timeline or laid out a road map for the final policy since most of the problems have been discussed threadbare over the years and there must be several committee reports, including on Air India’s revival, gathering dust. Now he, too, is setting up an expert group to frame policy and also decide the future of Air India. AI should be the cornerstone of the new aviation policy as the government is sinking in around Rs 30,000 crore to keep it alive.

Six months have already elapsed since the new government took over and the need for an aviation policy is imperative if this sector, already burdened with heavy losses, is to grow. There have been piece-

**UTC**

meal decisions, many of them taken by the earlier UPA government, that favour a few to the detriment of most domestic airlines, not to mention national carrier Air India. However, what is different this time is that the Modi government can be depended upon to implement the final policy.

The announced draft policy was very vague. Mr Raju should have at least been specific about how much stake the government wanted to divest in AAI and Pawan Hans. He will have to be more assertive and not depend totally on the bureaucracy when framing policy. The bureaucracy is partly to blame for the mess in Air India as their tribe occupied the post of AI chairman as it was a stepping stone to higher positions in government. Meanwhile, the minister has said the 5/20 rule, to his mind, “does not make sense”, is “opaque” and “no country in the world has such a rule”. So, every day that he allows it to exist he will be perpetuating a senseless rule made to benefit certain airlines.

From *The Asian Age*

## Hosting Obama

As Prime Minister Narendra Modi’s NDA government completes 6 months at the Centre, its record on the economic front has been equivocal. Inflation is down, but that is more due to crashing global commodity prices than any big policy steps announced by the Modi government. On the key issue of education, piloted by HRD minister Smriti Irani who appears to be under the influence of RSS ideology, the country has moved backwards. But foreign policy, an area where Modi has personally taken charge, has seen bravura steps which should dramatically improve India’s international standing.

The capstone of these efforts has been Modi’s diplomatic coup in getting President Obama to be the chief guest at the next Republic Day parade. Indian non-alignment had been defined chiefly as holding the West, led by the US, at arm’s length — which explains why the India-US nuclear deal elicited so much political opposition in India (including from BJP) despite its signal achievement of bringing to an end India’s nuclear pariah status. It also explains why, despite India’s long history of inviting foreign heads of state to grace Republic Day parades, a US president has never been invited before.

The signal sent by the R-Day invitation is even more important as Modi was denied a US visa for long. It indicates that the prime minister sets national interest above personal grudges, as a transformed relationship with the US promises much. It provides India access to high technology, capital and an enormous market for its goods and services. The many convergent interests between India and the US include co-operation on terror, which threatens both nations.

Modi began his innings with an unprecedented invitation to SAARC neighbours to attend his government’s inauguration. His first foreign tour was to Bhutan and he subsequently visited Nepal, testimony to his government’s intention to pay close attention to immediate neighbours. He visited Japan and played host to President Xi Jinping, drumming up investment offers of \$35 billion and \$20 billion respectively. He won the hearts of NRIs in the US and Australia, opening up the possibility of mobilising India’s vast diaspora for its development. And he made India’s case forcefully at multilateral meets such as Brics, East Asia summit, UN General Assembly and G20. If we see this much action and innovation in spheres other than foreign policy as well, India will be a transformed country in no time.

From *The Times of India*

## India no banana republic

Many hubristic public figures who often proclaim, in the media, that “India is no banana republic”, may be less strident, if they learnt the actual implications of such a label. It is not merely a term used for small Central American dictatorships whose economies depend on export of bananas, but has a wider connotation. According to economic theory, a country qualifies as a “banana republic” if it is “operated as an enterprise, for private profit from the exploitation of its national resources, by collusion between ruling politicians and favoured monopolies.” While its “legislators are for sale,” government officials “exploit their posts for personal gain through bribery, corruption and nepotism”, the central government is so ineffective that “it cannot provide public services and has little control over much of its territory.”

The uncanny familiarity of these attributes is a grim reminder of the snide aphorism that one hears from foreigners: “Everything that you hear about India is true; but so is the opposite.” India treads a thin line; a nuclear-weapon state and growing economy, aspiring to great-power eminence; it is, simultaneously, a nation negotiating a slippery slope from which it could easily plunge into the abyss of banana republic status. As we have seen in the past few years, all it takes for such a precipitous fall from grace (in the prophetic words of Winston Churchill) is for power to go “to the hands of rascals, rogues, freebooters... and men of straw”.

The test of a nation’s mettle and the calibre of its leadership is a crisis situation. Whether it is a natural disaster, terrorist strike, hijacking or trans-border incursion, the Indian state’s response to any emergency has followed a depressingly familiar sequence. The onset of a crisis finds the organs of state caught unawares and the leadership stricken with paralysis.

The multiple ministries, departments and agencies involved, pull in different directions, lacking coordination and a firm hand on the tiller. Frenzied and haphazard damage-control measures, eventually, bring the situation under control, mostly with the military’s help. A phase of national breast-beating follows, accompanied by a free-wheeling blame-game. The state apparatus, thereafter, relapses into its earlier comatose condition — no wiser and unrepentant — to await the next disaster.

This is not an indulgence in hyperbole, because having seen such episodes occur many times over, in the recent past, most of us have reconciled ourselves to the Indian state’s sub-standard performance and even learned to rationalise it with the sad home-spun aphorism: “We are like that only.” Our fatalistic acceptance of incompetence and inefficiency, coupled with tolerance for venality, and the low worth we place on human life and dignity, promise to brand India as a second-rate nation, even if it becomes a great power.

It was, perhaps, in the hope that he would rescue India from such a fate, that the electorate swept Narendra Modi to power with an unprecedented majority. So far, Mr Modi has not disappointed. An example is the demonstration he provided, not just of his nonconformist approach but also, of moral courage, by broaching the taboo topics of cleanliness, sanitation and public defecation on Independence Day. Accustomed as we are, to soporific speeches full of anodyne sentiments, from the ramparts of the Red Fort, Modi’s blunt words have woken the nation to the grim reality of our garbage-strewn cities, towns and villages; and the need to do something about it. As if to emphasise his commitment to clean up India, Modi had the chutzpah to include this topic, even in the recent Washington Post editorial that he jointly issued with President Obama. (to be continued...)

Admiral Arun Prakash in *Indian Strategic Studies*

## **Airbus Cassidian**

## Keeping a Promise

Air Marshal Brijesh D Jayal feels that the first steps to better governance are being taken!



Hours of debates and many news column inches have accompanied the completion of a hundred days of the new government in office. Save moderate voices, the general impression emerging out of this noise has been one of disappointment at the promised *achhe din* not having dawned overnight. When our democracy has given the current political dispensation a clear majority and a five-year term to deliver on its slogan of “minimum government, maximum governance”, one wonders whether this hundred-day report card is about genuine progress or media grand standing. In reality, governance is far

removed from electioneering. Elections are about selling dreams and scoring debating points. Governance is the period when such aspirations need to be fulfilled through administrative tools and institutions within the framework of laws.

The concept of governance is as old as civilization itself and signifies the process through which policy decisions are taken and then implemented. Within this broader concept, the government, more narrowly, boils down to the executive, whilst governance is the process that is adopted. It involves many actors of which the government can either be the only

one or one of many. The term “maximum governance” was a slogan actually implying good governance, the essential features of which are efficiency and effectiveness, together with transparency, responsiveness and accountability.

In our system, both at the Centre and the states, the government of the day is the executive and comprises the elected political leadership and the administrators. Whilst the elected representatives forming the government belong to the political domain and come and go through the electoral process depending on the public mood, it is the administrators that are meant to



Appropriately, Jawaharlal Nehru called the IAS “the steel frame”.

However, over the decades, there has been a progressive erosion of this steel frame. It is now not uncommon for it to be referred to as “rusted” by none other than distinguished members of the IAS fraternity itself. The respected scholar and administrator, N.C. Saxena, has observed that “over the years, whatever little virtues the civil services possessed — integrity, political neutrality, courage and high morale — are showing signs of decay”. Not surprisingly, a 2012 report analysing surveys conducted in 12 Asian countries by the Hong Kong-based organisation, Political and Economic Risk Consultancy Limited, concluded that of those surveyed, the ‘worst’ bureaucracy was in India, which made it a bureaucratic nightmare for businesses.

Not that any of these observations and findings are news for the proverbial *aam admi*. For as long as one can remember, the very thought of visiting a government office to transact any business conjures up visions of rent seeking, harassment or even outright insults, so much so that the term, bureaucracy, has now come to signify in the minds of the people all that is negative about governance and governments.

Bureaucracy in our context has come to denote a system where the inclination is to follow rigid and complex procedures and red tape and endless deliberation with no accountability for the end result. Such a system can hardly encourage innovation and

new ideas and is a misfit in this information age. To extricate the system from this listless state, it follows that any attempt towards good governance must start with looking at the bureaucracy itself, since it must remain the primary tool through which effective governance can truly be achieved.

Media reports had indicated that within a week of taking over the reins, the new government had initiated a detailed exercise of identifying competent civil servants based on factors such as performance over the past decade, dedication to duty, quickness of delivery and political neutrality. To those with an ear to the ground, this was a clear signal that the government was determined to deliver on its promise of good governance by first laying the correct foundation, namely, following a merit system to identify those that would constitute its steel frame. Not surprisingly, this news escaped wider attention and debate. Had it been otherwise, it would have dawned on critics that the government was moving along a predetermined plan to revitalise the moribund administrative system, which has over decades been reduced to utter submissiveness and decay. This is not to say there do not exist pockets of excellence, but these are now exceptions rather than the rule and because they are misfits in the system, their worth is not valued. One is reminded of Ashok Khemka, the upright IAS officer of Haryana, who has been transferred more times than possibly even he can remember.

provide continuity, neutrality and general stability to the system of governance. Vallabhbhai Patel, independent India’s first home minister and deputy prime minister, often referred to as the ‘Iron Man of India’, is credited with having established the all-India civil services, for which he is remembered as their ‘patron saint’. Of these, the Indian Administrative Service and the Indian Foreign Service are considered the elite. In particular, it is the IAS that is the *prima donna* of all the civil services, primarily because on its shoulders rests the onerous responsibility of efficient and effective governance in the country.



It was only when some 300 senior-level transfers and appointments were announced, including those of 48 joint secretary-level officers, that the subject stirred comment and debate. The general reaction that this was unprecedented in quantitative terms is perhaps a pointer to how widespread and deep the rot really was if you are a believer in genuine good governance. If, on the other hand, you look at it from a partisan standpoint, then there is always the bogey of political vendetta, which has been raised even by some eminent journalists. Since the first bold step towards the slogan, 'maximum governance', has now been initiated, it is only fair that we await its impact before rushing to premature judgment.

To translate 'minimum government', which was the other half of the slogan, into more measurable terms, it is worth looking at two significant aspects. One, the existing laws within which the government must function and two, how it is organised to govern effectively. Looking at the first aspect, we have so many archaic laws in our statutes that it is possible to justify virtually any interpretation that may suit a *babu's* whims. Who would believe that in this information age, the law dealing with the subject of communications is the Indian Telegraph Act of 1885, albeit with amendments?

It needs recalling that a commission appointed by the earlier National Democratic Alliance government to review outdated laws had recommended repealing 1382 acts of which so far only 415 stand repealed.

Since a government based on archaic laws is a recipe for a system that is inherently out of harmony with the modern-day needs and aspirations of society, clearly it flies in the face of the concept of responsive governance. Not surprisingly, in his first address to the joint session of Parliament, the prime minister had stressed that archaic laws hamper governance and had pointed to the government's desire to identify such laws and weed them out. In pursuance, a committee already stands constituted to review all such acts and is expected to submit its recommendations within three months. Judging by the atmosphere now prevailing in the North and South Blocks, it is unlikely to seek extensions.

As for organisational aspects, the government has already made changes to existing structures by merging key ministries in an apparent attempt to bring more synergy in governance and make decision-making quicker and more efficient. It has also announced the winding up of the Planning Commission. A stop has been put to government departments taking their differences to courts for arbitration. Undoubtedly these are but the initial steps and with time many more should follow. Some may even argue that for a fledgling government perhaps it is better to make haste slowly, others may differ with some of these prescriptions. But for anyone to criticise the government for not attempting to streamline governance, one of its major election promises, certainly defies logic.

It would be fair to say that many preliminary and foundational steps towards achieving good governance have indeed been initiated. For a system of governance that has over decades found comfort in sloth and decadence, where power and pelf were more prevalent than accountability and transparency and where quick response to the needs of society found no place, the reversing of this trend will need all the energy and support that the government and others can harness. Vested interests and *status quoists* will put every conceivable obstacle in the path of these historic changes to try and derail the effort. Perhaps the hundred-day report card was one such psychological volley.

Now that merit as the criterion for promotions and appointments in the civil services has been acknowledged as a significant step towards good governance, there is equal justification to extend this principle to the armed forces. Recent happenings have demonstrated that all is not well with the seniority-based system for senior promotions and appointments at present in vogue in the uniformed services. Reports of lines of succession being planned and manipulated are merely the tip of this destructive iceberg and are neither good for morale nor for the internal health of the armed forces. The principle of merit-based promotions and appointments at senior levels in the armed forces is not just an extension of good governance but vital for national security as well.



Then Defence Minister Arun Jaitley is introduced by the CNS Admiral Robin Dhowan to senior officers at Navy Commanders Conference in New Delhi

# Boeing



**Lt. Gen Kamal Davar, former Head of the DIA, suggests an**  
**Agenda for the new Indian**  
**Defence Minister**

The nation, at long last, has got a full time Defence Minister in the Narendra Modi government, with Goa's erstwhile chief minister Manohar Parrikar's appointment as the new helmsman for the Armed Forces.

That the overall security environment, including in our immediate neighbourhood in the recent past, has been deteriorating will be stating the obvious. That India's preparedness for the formidable security challenges looming large on its geopolitical radar, as well as in the internal dimension and emerging non-traditional threats, is currently wanting will be a gross understatement.

The new Defence Minister's first and foremost task would be to carry out a brutally frank assessment of India's capability to simultaneously wage a two-and-half-front war (China, Pakistan and

internal security operations), separately or all together, as the worst but a possible option. It will not be prudent on my part to point out, publicly, the actual glaring deficiencies in our combat potential.

Nevertheless, the service chiefs would be bringing to his notice our receding combat potential and Defence Minister Parrikar must address with utmost alacrity all critical voids in our preparedness. He will have to 'thump the table' with Finance Minister Arun Jaitley for necessary budgetary allocations. Jaitley, in his short tenure as the Defence Minister, is now fully aware and appears sympathetic to the shortcomings in our security apparatus.

India's budgetary allocation for defence is just around 1.75 percent of its GDP, and this must be raised to at least 3 percent as recommended by many successive Standing Committees on Defence in the Parliament.

It is worth factoring that China spends nearly 7.5 percent of its GDP on defence and even cash-strapped Pakistan spends over 5 percent.

Importantly, the new Defence Minister will have to override the endemic inertia in his bureaucracy and their propensity to delay even crucial decisions. Corruption must be firmly dealt with, but the systemic procedures for defence procurement must be streamlined to deliver critical military equipment speedily.

Vital acquisitions like the inordinately delayed Medium Multi Role Combat aircraft and helicopters for the Indian Air Force, submarines for the Indian Navy, mountain and field artillery for the Indian Army, raising of the Mountain Strike Corps, induction of force multipliers for the three services and rapid construction of border infrastructure among the scores of

projects requiring fillip need to be sincerely addressed.

The Defence Minister will have to vigorously push his sluggish Defence Production Department, the under-performing defence Public Sector Undertakings and also the listless Defence Research & Development Organisation (DRDO) to live up to the expectations of the Armed Forces, an uphill task by any standards! The Modi government has wisely raised the Foreign Direct Investment in defence to 49 percent and now our single window-clearances to encourage production of state-of-the-art equipment in India with foreign collaborators must be ensured. We have to reverse the tag of being the world's largest importer of arms by ensuring indigenous production of our defence requirements.

India's nuclear preparedness in light of its First-No-Use doctrine and the alarmingly growing Pakistani nuclear arsenal, likely Pakistan-China collusion against India, will have to be re-analysed. India has to diligently endeavour for a credible nuclear triad capability to ensure a modicum of deterrence in this troubled region.

The new Defence Minister will be aware that as we strive for "peace and tranquility" on the undelineated and troublesome India-China border, we should never forget the basic fact that a rising and assertive China only respects strength. Thus we need to speedily narrow down the military gap vis-à-vis China whilst endeavouring to resolve the vexed border issue with them.

Defence Minister Parrikar will have to factor in the increasing Pakistani ceasefire violations along the Line of Control/ International Border in Jammu & Kashmir, especially with respect to the impending state assembly elections in that state. Pakistan's sinister Inter-Services Intelligence (ISI), in collusion with some of its separatist followers in the Valley, will spare no efforts to disrupt the state's tryst with democracy and all security agencies must thus synergise to resolutely thwart Pakistani mischief. The withdrawal of US forces from neighbouring Afghanistan by the year-end may cause increased violence in J&K with some terrorists relocating to the state from Afghanistan.

In view of the tragic and highly avoidable incidents which have taken place

recently in the Kashmir Valley resulting in a few casualties to innocent Kashmiri youth, the Defence Minister may ask the Indian Army to re-visit the necessity of continuing with the Armed Forces Special Powers Act in the entire state.

All aspects of the nation's security preparedness must emerge from a well-conceived and an all-encompassing National Security Doctrine. For formalising it, the new Defence Minister must take into confidence the three service chiefs, the Integrated Defence Staff apart from the Modi government synergising all

nation's security and nuclear policies - an inexplicable exclusion till now. A re-look at the institution of the widely debated and professionally desired appointment of the Chief of Defence Staff for rendering integrated services and single-point advice to the government on vital military matters is sine qua non.

Finally, the Modi government must speedily implement the already announced 'One Rank One Pension' policy. Let this new dispensation make all efforts to accord the desired levels of respect and recognition to its Armed Forces and its veterans.



*India must continue to engage with Afghanistan as the withdrawal of US and NATO forces will pose a new security challenge in the region*

existing institutionalised mechanisms like the Cabinet Committee on Security, the National Security Adviser's Office, Ministry of Home Affairs, Ministry of External Affairs, Finance Ministry, civil intelligence agencies and the nuclear establishment among others.

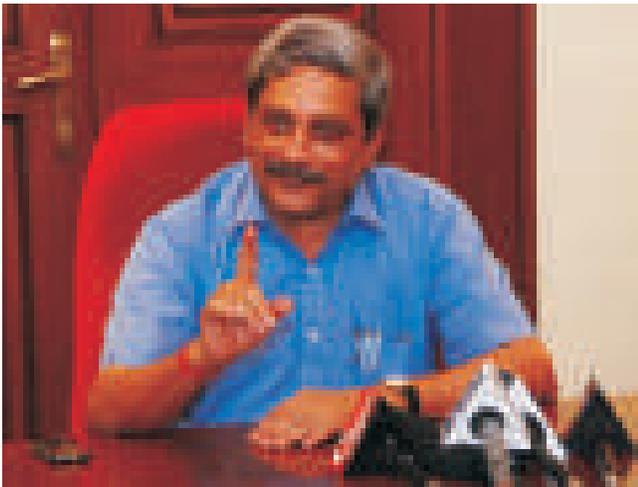
The new Defence Minister would do well to get the three Service Chiefs into the macro loop regarding formulation of the

From picturesque and laid-back Goa to stressful Delhi is not everyone's cup of tea; Defence Minister Parrikar now has a formidable task awaiting him. For ensuring the nation's safety and security, he deserves everyone's good wishes and support.

*(Lt Gen Kamal Davar (ret'd) was the first head of India's Defence Intelligence Agency and Deputy Chief of the Integrated Defence Staff)*

## Manohar Parrikar is India's 36th Defence Minister

When Arun Jaitley was appointed Defence Minister in addition to his charge as Finance Minister in May 2014, it was clear that the Modi Government would expand the cabinet at a later date and appoint a full-time Raksha Mantri. On 10 November, amid a flurry of other appointments, former Goa CM Manohar Parrikar formally took over from Jaitley and became the 36<sup>th</sup> Defence Minister of India.



Parrikar expressed his gratitude toward the PM for “entrusting him” with such a crucial post, while also frankly admitting that he had much to learn about defence. He was hopeful that his administrative experience while in charge of Goa would help him with his new responsibilities. The new Defence Minister highlighted indigenous manufacturing and skill development as key thrust areas for the future, and also committed himself to transparent and swift defence procurement.

Manohar Parrikar is an alumnus of IIT Mumbai, and is the first IIT graduate to become Defence Minister of India.

## PM hands over HAL Dhruv to Nepal



On 25 November 2014, India's Prime Minister Narendra Modi handed over an HAL Dhruv ALH Mk.III to the Prime Minister of Nepal Sushil Koirala at Kathmandu. The helicopter will be operated by the Nepalese Army Air Wing. “This is in line with the PM's thrust on 'Make in India' and the Government's policy of neighbourhood”, said Dr. R.K. Tyagi Chairman, HAL. A HAL technical support team will be positioned at Kathmandu to provide maintenance and logistics support. The Government of India had earlier provided two Dhruv ALHs to the Nepalese Army in November 2013, which with Shakti engines and advanced glass cockpit and avionics would be eminently suited for operations in mountainous terrain and adverse environmental conditions.

Dhruv ALH have been operated by the Indian Air Force, Indian Army, Indian Navy, Coast Guard, BSF and State governments since 2002, with some 140 Dhruvs logging more than 120,900 flight hours.

## Russia-India 'Strategic Vision'

During President Vladimir Putin's forthcoming visit to India in the second week of December, it is expected that a “strategic vision” would be announced, also covering areas of energy and regional economic cooperation besides increased Russian investments in India. External Affairs Minister Sushma Swaraj and Russian Deputy Prime Minister Dmitri Rogozin have met earlier in November to finalise the joint “economic vision” package.



External Affairs Minister Sushma Swaraj with the Deputy Prime Minister of Russia Dmitri Rogozin in New Delhi

Russia's Deputy Prime Minister Dmitry Rogozin has stated that, “We are working on a strategic agreement that will include, in particular, Russia's participation in the development of nuclear energy in India, and we hope to have this document ready by the time of Mr Putin's visit”. Specifically, he noted that “India is interested in Russia's short and medium-range MC-21 airliners. We also discussed the possibility of assembling the Sukhoi Superjet-100 airliner in India. Interest was also expressed in possible aircraft engine manufacturing projects”.

Rogozin also referred to Russian Helicopters which “have established a good reputation in India... our proposal concerns the

**Saab**

possibility of using various models of the Ka-226, for both civil and military purposes. Its high-altitude performance characteristics are in fact unique, with no analogues in the world, which is important for India's mountainous terrain."

## 'No advanced stealth fighter for India till 2025 ?'

According to defence analysts, the IAF is not likely to get a futuristic stealth fighter anytime before 2024-2025. Technical and price differences continue to mar the joint project with Russia to develop the fifth-generation fighter aircraft (FGFA) with India expressing its "deep concerns" to Russia about being denied "full access" to the T-50 project despite the fact that "it is supposed to be an equal partner in financing this". The Governments of India and Russia are still to sign the final design & development phase contract for the FGFA, thereby upsetting schedules and projected timelines.



Moreover, India's work-share in the FGFA project had been reduced to just 13% from the earlier anticipated 50%. "Russia is yet to clear our lingering technical doubts about the project. But with President Vladimir Putin coming to India in December 2014, there might finally be some forward movement," according to a source at the MoD.

India and Russia had finalised the \$295 million preliminary design contract in December 2010, according to which the Sukhoi T-50 would be "tweaked" to Indian requirements as a "prospective multi-role fighter". But the final R&D contract, which was to be signed by 2012, is still not done. India and Russia will reportedly each contribute \$5.5 billion on the programme which includes design & development, infrastructure build-up, prototype development and flight testing.

## Su-30MKI ROH facility at HAL Nasik

Mr G Mohan Kumar, Secretary Defence Production, inaugurated the Su-30MKI ROH Project Stores facility at HAL Nasik on 31 October 2014 which augments HAL's activities at this Division, which already includes a facility for ROH of 15 aircraft per year. "This will provide full maintenance support and enhance the serviceability of Su-30MKI fleet through its life-cycle.



We are also making efforts to indigenise parts required for this aircraft and make the country self-reliant in this segment," noted Dr RK Tyagi, Chairman HAL.

## Composites MRO hangar at HAL established



Secretary of Defence Production, Mr G Mohan Kumar at HAL's Helicopter Complex, Bangalore on 23 October 2014. Also seen are Dr RK Tyagi, Chairman, HAL and Mr T Suvarna Raju, Managing Director (Helicopter Complex)

The Secretary Defence Production, Mr G Mohan Kumar reviewed various projects of HAL during the presentation made by HAL's top management at its corporate office. He also laid the foundation stone for the composites MRO hangar during his day-long visit to various facilities of HAL. The composites are used in various products of HAL such as helicopters (like the ALH and LUH) and aircraft (including the LCA Tejas).

## Irkut

## Tejas LCA SP-1 in maiden flight

The first HAL Tejas Light Combat Aircraft (LCA) built to Series Production (SP) standard (LA-5001) made its maiden flight in Bangalore on 30 September 2014, piloted by HAL Chief Test Pilot Air Cmde KA Muthana. This has come nine months after IOC II was granted in December 2013, and within one year of receiving the build standard documents.



According to HAL Chairman Dr RK Tyagi, “The aircraft is now ready for IAF operations.” A number of series production aircraft are at various stages of completion in HAL Bangalore. The first contract for delivery of aircraft was signed in 2006 for 20 Tejas Mk.I aircraft, the build standard documents were finalised in September 2013 and Initial Operational Clearance (IOC II) was accorded in December 2013.

## LCA PV-6 first flight

The Tejas LCA two-seat prototype PV6 made its flight flight at Bangalore on 8 November piloted by Gp Capt Vivart Singh (CO designate of No.45 Squadron) along with Gp Capt Anoop Kabadwal. This is the 16th LCA to have flown. “The aim of this flight was to check the twin cockpit functionality which is similar to series production two-seater aircraft. All systems functioned as expected during the 36 minute flight.” PV6 is the second two-seater and has the capability to deliver all air-to-air and air-to-ground weapons as required by the Indian Air Force for the Final Operational Clearance.

The PV6 has absorbed all the major design modifications undertaken during the last 2500 plus flights in the programme. This is, in fact, the final prototype leading to series production trainers.



## Maiden flight of LCH TD-3

The third Technology Demonstrator (TD-3) of the Light Combat Helicopter (LCH) made its maiden flight in Bangalore on 12 November 2014. TD-3 was escorted by a Dhruv helicopter in a flight that was described as “flawless” by HAL Chairman Dr RK Tyagi. He also said that HAL is “making all efforts to achieve IOC by September next year.” The maiden flight, lasting 20 minutes, was piloted by Wg Cdr Unni Pillai and co-piloted by Gp Capt SHK Nair.



HAL is expected to manufacture 179 LCH for the Indian armed forces. The scope of this programme covers design and development of two technology demonstrators, one full scale mock-up, one break away fuselage (BAF) and Initial Operational Clearance (IOC). During development of the LCH, the HAL board sanctioned a number of LCH-related projects, such as a modified rotor system, manufacturing of TD-3 and TD-4 for acceleration of development flight testing, indigenous development of Integrated Avionics and Display System (IADS) and Automatic Flight Control System (AFCS) in order to reduce the dependency on foreign vendors and develop indigenous technology.

LCH TD-1 was first flown on 29 March 2010 and the LCH programme has since logged 388 test flights totalling a little over 285 hours.

## “India needs 440 new helicopters”: Arun Jaitley

“The Indian armed forces need to acquire 440 helicopters and most of them would be acquired from Indian companies, including PSU HAL, to enhance capacity building,” then Defence Minister Arun Jaitley stated on 9 November. “Almost 440 helicopters between three Services have to be acquired. Some will be acquired from abroad and most of them have to be domestically manufactured... we have also announced Indian entities can apply and even public sector (firms can apply) so as to have capacity building in India,” he added. This decision is expected to generate business worth over Rs 40,000 crore (US\$ 6.7 billion) for the indigenous aerospace sector.

On the IAF’s requirement for 56 (Avro replacement) transport aircraft for which only private sector Indian companies are eligible, Jaitley said that “This time we cancelled the earlier decision ... they will be manufactured in India and only Indian companies should apply which means Indian companies with joint ventures can apply”.

### Tender for 56 naval utility helicopters withdrawn

A tender for import of 56 naval utility helicopters (NUH) at an estimated cost of Rs 9,000 crore has been scrapped by the Defence Ministry, which has decided that the selected rotorcraft will be manufactured in India by local firms, with foreign collaboration. The Navy needs to replace its ageing fleet of HAL Chetaks which have been in service for over 30 years. The tender was issued two years ago and was sent to major helicopter manufacturers including Sikorsky, Eurocopter (now Airbus Helicopters), Kamov and Agusta Westland. The specifications are for a 4.5 tonne, twin-engined helicopter with the ability to operate from a ship's deck in rough sea conditions.

### Government clears 33 defence manufacturing projects

The GoI has cleared 33 pending defence projects, including those of Reliance Aerospace, Bharat Forge, Mahindra Telephonic Integrated Systems and Tata Advanced Materials, in a move that is expected to boost advanced manufacturing and attract large investments. The 33 projects include 14 cases whose applicants have been informed that licences were no longer required, as a vast number of defence items have been delicensed. This development gives a boost to the 'Make In India' campaign which seeks to make the country a hub for global manufacturing, the government having liberalised the foreign direct investment (FDI) policy in the defence sector by hiking the cap from 26% to 49%.

The licensing committee also discussed the possibility of removal of stipulation of annual capacity in the industrial licence as also to permit sale of licenced items to other entities under the control of home ministry, state governments, PSUs and other defence licenced companies without requiring approval of the department of defence production.

### IAF Commanders' Conference

During an Air Force Commanders' Conference at New Delhi from 14 October, the CAS lauded the whole-hearted involvement and commitment of personnel during the recent floods



in Jammu and Kashmir as well as the subsequent relief operations at Visakhapatnam, being in conformity with the IAF's motto 'People First Mission Always'.

The year 2014 is being observed as the 'Year of Wherewithal' and the CAS exhorted the Commanders to strive for greater serviceability of aircraft, equipment and high operational status of crew. While laying emphasis on Human Resource Development, the CAS directed all personnel to upgrade their knowledge in order to embrace emerging technologies with greater ease. He also asked the Commanders to be ever responsive to any kind of sub conventional threats.

### Russian Air Chief visits India

Colonel General Viktor Nikolaevich Bondarev, Commander-in-Chief of the Russian Federation Air Force (RFAF) called on Air Chief Marshal Arup Raha at Air Headquarters on 17 November 2014. Over the next three days, Bondarev visited the National Defence Academy followed by a visit to a Su-30MKI squadron, and then to the Air Force Academy (AFA) at Dundigal to get a first hand account of the training being carried out on the PC-7 Simulator and the Virtual Tower Simulator. He also interacted with instructors and trainees at AFA.



This visit, which "aimed to enhance ties between the Air Forces of both countries", also coincided with the commencement of Phase II of the *Avia Indra* Exercise being conducted by the IAF and RFAF at Halwara in Punjab.

### 'Avia-Indra 2014' in the Punjab

The Indian phase of *Avia Indra*-2014 joint air force exercises between Russia and India was held at Air Force Station Halwara in the Punjab between 17-27 November. The Russian delegation was headed by Major General Alexander N Lyapkin and consisted of fighter and helicopter aircrew as well as air defence personnel. During the exercise, Russian personnel flew Su-30MKIs, Mi-17s and Mi-35s of the IAF.



In the first phase, such exercises were held during August 2014 in Voronezh at the Pogonovo range and in Astrakhan Region at the Ashuluk training range. During this phase, joint Russian-Indian crew flew the Mi-35 and Mi-8, as well as the Su-30SM.



Major General Alexander N Lyapkin of Russian Federation Air Force (RFAF) and Air Commodore PK Vohra AOC, AFS Halwara with other officers seen on the flight line on 24 November 2014

## More A-50 AWACS for IAF

As reported by Russian sources, the General Director of the Beriev Aircraft Company has confirmed that the Government of India is to procure another three Beriev A-50EI AWACS aircraft, which will supplement the earlier batch delivered to the Indian Air Force and operated by No. 50 Squadron.



## IAF Mi-17V5s in fire-fighting operations

In early November, massive and widespread fires were blazing in the forests 30 km east of Visakhapatnam, causing widespread destruction. On request from the State Administration, four IAF Mi-17V5 helicopters were pressed into action at Visakhapatnam using 'Bambi Buckets' with a capacity of 3,500 litres of water each.



A total of 100,000 litres of water were used to douse the fire, involving 42 trips by the fire-fighting helicopters. The forest fire was brought under control in short order, and afterwards, forest and district officials were taken on a sortie to assess the situation. This incident marked the third time that IAF helicopters were utilised for fire-fighting this year.

## Service Chiefs review requirements

On 11 November 2014, Chiefs of the Indian Army, Navy and the IAF gave the newly appointed Defence Minister Manohar Parrikar an overview of their 'war preparedness' besides listing immediate requirements for aircraft, artillery and submarines. The main discussion reportedly focused on the fact that the Army had not inducted new artillery howitzers since 1987 when the Bofor guns were received; no new submarines other than a nuclear vessel leased from Russia inducted in 15 years and critically, dwindling of the IAF's combat aircraft force with decisions skewed on the induction of new aircraft.



The Defence Minister, who had taken charge a day earlier, was also given a brief on dynamics of the Line of Actual Control (LAC) by the Defence Secretary RK Mathur. CNS Admiral RK Dhowan briefed Mr Parrikar on overseas deployments in the Indian Ocean and the Navy's outreach in the South China Sea.

**DRDO**

## RSAF Chief with IAF CAS

Major General Hoo Cher Mou, Chief of the Republic of Singapore Air Force (RSAF) made an official visit to India from 11 November 2014. The visiting RSAF Chief met with the CAS, Air Chief Marshal Arup Raha, for discussions on “matters of mutual interest”.



Major General Hoo Cher Mou, Chief of the Republic of Singapore Air Force, with Air Chief Marshal Arup Raha at Air Headquarters

The RSAF Chief later visited Air Force Station Agra to get a firsthand account of the training pattern being followed at the Para Troopers School (PTS) and the Mid Air Refueling Squadron (MARS). He also visited Air Force Station Kalaikunda where a team of RSAF personnel is undergoing ‘Joint Military Training’ (JMT). Annual Air Staff talks between the Air Forces of India and Singapore commenced in 2006, and the IAF-RSAF JMT is an annual programme that has regularly been held since 2008. The JMT provides an ideal platform for exchange of air tactics and training philosophy to the pilots of the two countries.

## Sixth Boeing P-8I delivered to IN

Boeing has delivered the sixth P-8I maritime patrol aircraft to the Indian Navy, on schedule, arriving at Naval Air Station *Rajali* on 24 November 2014, joining the earlier five operated by INAS 312A (see story in this issue). This is part of the contract for eight P-8Is



ordered in 2009, with the final two to be delivered in 2015. “The P-8I’s arrival in India is another key milestone for the programme and marks our final delivery of the year,” said Dennis Swanson, vice president, Boeing Defence, Space & Security in India. “The Indian Navy is currently conducting missions with the first five aircraft, and this newest P-8I will begin flight trials in the coming months.”

The P-8I incorporates not only India-unique design features, but also Indian-built sub-systems that are tailored to meet the country’s maritime patrol requirements. The P-8I features open systems architecture, advanced sensor and display technologies, and a worldwide base of suppliers, parts, and support equipment. “We have a great partnership with India, which has helped us keep the programme on schedule and on budget,” said Mark Jordan, Boeing P-8 International programme manager.

In order to efficiently design and build the P-8I and the P-8A, the Boeing-led team is using a first-in-industry, in-line production process that draws on the company’s Next-Generation 737 production system. P-8I aircraft are built by a Boeing-led industry team that includes CFM International, Northrop Grumman, Raytheon, Spirit Aero Systems, BAE Systems and GE Aviation.

## Royal Swedish Navy Chief in India

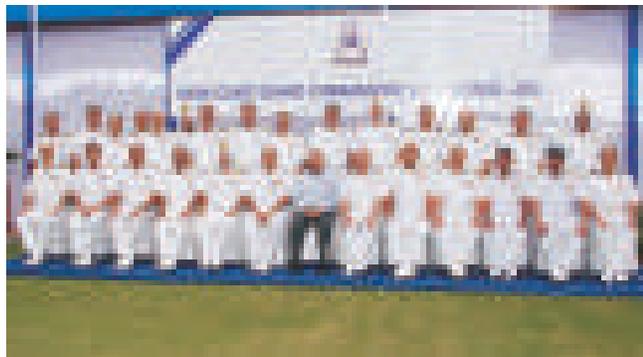
Rear Admiral Jon Thornqvist, Chief of Staff Royal Swedish Navy led a delegation to India during 9-13 November to review existing bilateral ties and explore opportunities for enhanced naval cooperation. The Swedish Admiral met senior naval officers at IHQ/MoD(Navy) Delhi and at the Ministry of Defence and later travelled to Headquarters Western and Southern Naval Commands at Mumbai and Cochin respectively. Key areas of discussion at the Southern Command were anti-piracy measures and Joint Maritime Cooperation.



Naval co-operation between the two countries spans a wide spectrum of activities that include collaboration in ship building, technology transfer and anti-piracy operations in the Gulf of Aden. The India-Swedish Memorandum of Understanding on Defence Cooperation and Production was signed in 2009.

### 33<sup>rd</sup> Coast Guard Commanders' Conference

Defence Secretary RK Mathur inaugurated the 33rd Coast Guard Commanders' Conference on 24 September 2014 at Coast Guard Headquarters, New Delhi, the Conference intended to enable Coast Guard Commanders to evaluate the operational capabilities and development of infrastructure to tackle future challenges.



The Defence Secretary stated that “rapid expansion of the Coast Guard needs adequate supplement of trained manpower and assured that notwithstanding the austerity measures, it would be the endeavour of the Defence Ministry to support the operational posture of the Coast Guard”. Vice Admiral Anurag G Thapliyal, Director General Indian Coast Guard, said that in the last three and half decades of existence, the service has seen a significant transformation and achieved various milestones. “The process of asset augmentation and force multiplication is progressing with full support of the Ministry of Defence”.

### ICG in Exercise Dosti-XII

Exercise *Dosti-XII*, involving the Indian Coast Guard, the Maldives National Security Service (Coast Guard) and the Sri Lankan Coast Guard, was conducted at Male, Maldives from 28-31 October 2014. Prior to conduct of the exercise, an Initial



Planning Conference (IPC) was conducted at Kochi, India during 15-16 September 2014 to work out exercise details. Some five ships and two aircraft participated in *Dosti-XII* — two ships from Indian Coast Guard, ICGS *Samar* (with HAL Chetak on board) and ICGS *Rajdoot*; one ship, SLNS *Samudra* from the Sri Lankan Coast Guard; and two ships from the Maldives National Security Service, MCGS *Huravee* and MCGS *Shabeed Ali*. In addition, an ICG Dornier 228 was also deployed for the exercise.

### ICGS Samudra Paheredar in overseas deployment

Indian Coast Guard Ship *Samudra Paheredar*, the second indigenously-built Pollution Control Vessel (PCV) undertook an overseas deployment of 45 days to the East Asian countries of Singapore, Philippines, Japan and Vietnam in support of international cooperation through exchange of information and bilateral exercises.



During the long overseas deployment the ship also battled two severe typhoons, ‘Phanfone’ and ‘Vongfong,’ in the South China Sea. The Japan visit of the ship coincided with the 10th Heads of Asian Coast Guard Meeting conducted at Yokohama from 30 September to 1 October. The joint exercise with Japan Coast Guard (JCG) was witnessed by Heads of Coast Guard and delegates from 18 participating countries.

### New Talwar-class frigates

Russia is offering to build three additional Project 11356 frigates (*Talwar*-class, a modification of the *Krivak* III) for the Indian Navy. Earlier, Russian shipyards had built two sets of three Project 11356 frigates, the last being INS *Trikand*. Negotiations on the third set of three frigates have been taking place following a formal Indian request. According to Vladimir Spiridopulo, programme manager at the Russian Northern Design Bureau, part of this upgrade will include the integration of BrahMos missiles.

## Improved performance at Cochin Shipyard

Cochin Shipyard Limited (CSL) has paid a dividend of Rs 17 crores to the Government of India. The performance of Cochin Shipyard has been consistently positive over the last several years despite a very challenging business environment in the shipbuilding and ship repair sector. Cochin Shipyard's turnover has increased five fold from Rs 373 crores in 2005-06 to Rs 1637 crores in 2013-14. Likewise, net profits have more than doubled over the same period, from Rs 94 crores to Rs 194 crores.

The highlight of the past year's performance was the launching of the first indigenously built aircraft carrier *Vikrant* on 12 August 2013. The yard also exported two Platform Supply Vessels (PSVs), besides delivering five Fast Patrol Vessels (FPVs) to the Indian Coast Guard.

## Indian Naval Ships on overseas deployment

Indian Naval Ships *Mumbai*, *Talwar*, *Teg* and *Deepak* under the Command of Rear Admiral R Hari Kumar, FOC Western Fleet, departed on a two-month long overseas deployment to East Africa and the Southern Indian Ocean Region on 1 October 2014. During the course of deployment, the ships are scheduled to visit Antsiranana (Madagascar), Mombasa (Kenya), Dar es Salaam (Tanzania), St Denis (Reunion Island, France), Port Louis (Mauritius), Port Victoria (Seychelles), Nacala (Mozambique) and Simon's Town (South Africa). While in South Africa, INS *Teg* will participate in Exercise IBSAMAR along with the Navies of South Africa and Brazil.

## 155mm howitzer project cleared

The Defence Acquisitions Council (DAC), chaired for the first time by Defence Minister Manohar Parrikar on 22 November, has given initial clearance for acquisition of 814 mounted 155mm howitzers which have been urgently required by the Army for the past two decades. A fresh tender or RFP (request for proposal) will now be issued for the 155mm/52-calibre mounted artillery in the



File photo of Indian Army howitzer

'Buy & Make India' category, with 100 guns to be bought off-the-shelf and the rest 714 to be subsequently manufactured in India. If the guns had been bought a decade ago, as was envisaged, they would have cost half of the Rs 15,750 crore figure.

"Private companies like L&T, Tata, Bharat Forge, Punj Lloyd, Ashok Leyland, Mahindra Defence and the like can respond to the RFP after tying up with a foreign collaborator. The 814 guns, with a 40-km range, will equip 40 medium artillery regiments of the Army," said an official.

## 65<sup>th</sup> Infantry Day marked

The Indian Army celebrated the 65th Infantry Day across Northern Command on 27 October. Lt Gen HJS Sachdev, Chief of Staff of Northern Command, laid a wreath on the '*Dhruva Shahid Smarak*' in Udhampur, in remembrance and honour of



martyrs of the Infantry arm. Similar memorial services were held in other Cantonments all over India. 27 October is celebrated as Infantry Day as it was on this date in 1947 that an Infantry Company of the 1<sup>st</sup> Battalion Sikh Regiment was airlifted from Delhi to Srinagar to stem the invasion by tribals, clandestinely led by regulars of the Pakistan Army.

## Information Management and Analysis Centre (IMAC) inaugurated



Defence Minister Manohar Parrikar inaugurated the Indian Navy and Coast Guard's joint operations facility centre, Information Management and Analysis Centre (IMAC) at Gurgaon on 23 November 2014. Minister of State for Defence Rao Inderjit Singh, Chief of Naval Staff Admiral RK Dhowan, Defence Secretary RK Mathur, DG Indian Coast Guard Vice Admiral AG Thapliyal and CMD BEL SK Sharma are also seen in this picture

**HAL**

## Air medical services in India

**A**ir ambulance services with a fleet of EC135 T3/P3 helicopters are being launched following a tripartite agreement involving Indian operator Aviators Air Rescue Private Limited, US air medical provider Air Medical Group Holdings, and Airbus Helicopters.



Artist's impression of EC135 in Aviators air ambulance livery

This joint effort will initiate a new era of helicopter emergency medical services (HEMS) beginning Q4 2015, using three Airbus-built EC135 T3/P3 helicopters operated by Aviators in southern India. More EC135s are expected to be phased in during 2016 for expanded nationwide coverage. The establishment of these operations – including the training of pilots and medical personnel, along with the definition of practices and procedures – will be supported by Airbus Helicopters and Air Medical Group Holdings Inc. Aviators' HEMS services will be offered to state governments, rescue groups, hospitals, clinics, public and private companies, as well as for individuals through subscription.

## Bell Helicopter, Textron Systems in agreement with Dynamatic Technologies

**B**ell Helicopter and Textron Systems, both subsidiaries of Textron Inc. have on 19 November signed an agreement with Dynamatic Technologies Limited of Bangalore, establishing Dynamatic as a single source supplier of major airframe assemblies for the Bell 407GX and 407GT.



Michael Loeffler, Vice President of Supply Chain, Bell Helicopter and Udayant Malhoutra, CEO and MD of Dynamatic Technology Limited, at the contract signing

The agreement is for a seven-year period with options to extend through the life of the product and follows a MoU signed in 2012 to mutually explore business opportunities for the production of Bell's model 407 airframe assemblies. Textron Systems will work cooperatively with Dynamatic and Bell Helicopter to support in-country procurement operations. "Both companies remain engaged in identifying additional business opportunities to further build on Dynamatic's supplier capabilities as Bell Helicopter looks to invest and expand operations in the region."

## Nirbhay cruise missile tested

**I**ndia's first indigenously designed and developed long range subsonic cruise missile Nirbhay was successfully flight tested on 17 October 2014 from the Integrated Test Range (ITR), Balasore, Odisha. The entire mission, from launch till the final splash down was "a perfect flight," achieving all the mission objectives. The 1,000 km-class cruise missile has been designed and developed by ADE (Aeronautical Development Establishment), at Bangalore.

The Nirbhay cruise missile, propelled by a solid rocket booster developed by the Advanced Systems Laboratory (ASL) was launched from a mobile launcher specifically designed by the Vehicles R&D Establishment (VRDE). As the missile achieved designated altitude and velocity, the booster motor got separated, the turbofan engine took over further propulsion, and the wings opened up in response to commands generated by the on board computer (OBC), stabilising the flight.

The missile was tracked by ground-based radars and parameters monitored at indigenous telemetry stations by team from DRDO's ITR and LRDE (Electronics and Radar Development Establishment). Additionally, an Indian Air Force Jaguar fighter closely monitored the missile in flight.



### Order for South Korean minesweepers cancelled

The Ministry of Defence (MoD), headed by the newly appointed cabinet minister Manohar Parrikar, has negated the earlier deal to buy eight mine countermeasure vessels from the South Korean Kangnam Corporation. This significant decision is presumably to address the vexed issue of 'corruption in defence deals' but also to promote the 'Make in India' policy of the new Government. Goa Shipyard Limited could be asked to build eight such specialised vessels with foreign collaboration, through a fresh tender in which Kangnam could also participate, as the firm has not been blacklisted.

The South Korean firm was shortlisted during the UPA tenure, as it was 'L-1' against the tender floated in 2008. Under the proposed deal, Kangnam Corporation was to supply two minesweepers to the Navy, while the remaining six vessels were to be built by Goa Shipyard Limited, through technology transfer. The Indian Navy currently operates seven to eight serviceable minesweepers, acquired from the erstwhile Soviet Union in the late 1970s.

### Prithvi-II successfully test fired

On 14 November, the Indian Strategic Forces Command successfully test-fired the indigenously developed nuclear-capable Prithvi-II surface-to-surface missile, which has a strike range of 350 km, from a test range at Chandipur. The missile, which is capable of carrying a 500 kg to 1000 kg warhead, was test-fired from a mobile launcher in salvo mode from launch complex 3 of the Integrated Test Range. The tested missile was randomly chosen from the production stock and the entire launch activities were carried out by SFC and monitored by scientists of Defence Research and Development Organisation (DRDO) as part of a training exercise.

### LRSAM successfully tested

An Indo-Israeli Long Range Surface-to-Air Missile (LRSAM) was successfully flight tested against a flying target at a range in Israel on 10 November 2014. Israel Aerospace Industries (IAI) carried out the test in the presence of DRDO scientists and officials of the Indian Armed Forces. The LRSAM system is jointly developed by DRDO and IAI.

All systems are understood to have performed as expected and the missile made a direct hit on the aerial target. The system is being developed for both Israeli Defence Forces and Indian Armed Forces.



Avinash Chander, Scientific Advisor to the Defence Minister, was present during the test along with President of IAI Joseph Weiss and other senior IDF officials. He termed the event as "a milestone" in the cooperation between the two countries in developing advanced weapon systems.

### Air India's MRO facility with Boeing and GE

A maintenance, repair and overhaul (MRO) facility in Nagpur built by Boeing is to be handed over to Air India in late-2014. Boeing built the facility as part of offsets after receiving orders for 68 aircraft in 2005. Built at an estimated cost of \$107 million, the facility covers an area of 50 acres, and can accommodate three widebody aircraft at a time.



Separately, Air India will build an engine MRO unit along with General Electric (GE) for \$89 million, next to the airframe MRO facility built by Boeing. The airline has acquired 50 acres for this purpose. The company is also investing in similar facilities in Hyderabad, Kolkata, Mumbai and Delhi.

### Vistara signs FHS-TSP contract with Airbus

Vistara, the new full-service carrier based in New Delhi, has signed long term Flight Hour Services Tailored Support Package (FHS-TSP) contracts with Airbus starting this year with the entry into service of its fleet of 20 leased A320s.



The FHS-TSP contract provides an integrated and guaranteed service ranging from components supply and repair to full airframe maintenance and engineering service. An on-site Airbus team will manage daily maintenance activities, ensuring high dispatch rates for Vistara. Airbus' FHS currently covers more than 150 aircraft with operators of A320, A330, and A380 fleets.

## FSTC agreement with Vistara

Gurgaon-based FSTC (Flight Simulation Technique Centre) has signed a pilot training agreement with Vistara. FSTC's facility is already being used by airlines such as Spicejet, Indigo and Jet Airways to train their pilots. FSTC is a joint venture company with SIM Industries BV, Netherlands, a Lockheed Martin subsidiary, and the Flywings Aviation Group based in India. FSTC has the latest Airbus A320 and Boeing 737-800 full flight Level D simulators located at its training site in Gurgaon, and recently received EASA approval for its Airbus A320 simulator, making it the only pilot training centre in the region to have this approval.

## 100th A320 for IndiGo



IndiGo received its 100<sup>th</sup> Airbus A320 on 4 November 2014, marking the completion of its first order of 100 aircraft placed at the Paris Air Show in 2005. The aircraft, registered VT-IAY, was delivered to IndiGo in New Delhi after flying in from Hamburg via Istanbul. Celebrating the milestone, IndiGo announced the launch of the '6E Scholar' programme in partnership with Mensa India. The low-cost carrier has decided to sponsor the education of 100 underprivileged children with IQ at the genius level. As part of the 6E scholar programme, Mensa India will hold IQ tests to identify children with 98 per cent IQ score. These 6E scholars would further be placed into educational streams best suited to their aptitude.

The current IndiGo fleet stands at 84 A320 aircraft, with the airline having two separate orders of 180 and 250 A320-family airliners to begin deliveries from 2015 onward.

## IndiGo MoU for 250 A320neo

India's largest domestic airline by market share, IndiGo and its co-founders, Rakesh Gangwal and Rahul Bhatia, Group Managing Director of InterGlobe Enterprises, have signed a Memorandum of Understanding (MoU) for 250 A320neo family aircraft. The



agreement is Airbus' single largest order by number of aircraft. IndiGo has previously placed orders for 280 Airbus aircraft (100 A320ceo and 180 A320neo).

## AAI selects Saab for A-SMGCS

Saab has been selected by the Airports Authority of India (AAI) to deploy Advanced – Surface Movement Guidance & Control Systems (A-SMGCS) at five airports in India, which will enhance situational awareness and runway safety at these expanding airports. The A3000 A-SMGCS will fuse multilateration and SMR surveillance data to provide air traffic controllers with precise surveillance of the airports' runways and taxiways, along with the identification of aircraft. In addition, the A-SMGCS will feature Safety Logic runway incursion detection and alerting algorithms to provide controllers with advanced warnings of potential runway incursions. The A-SMGCS will also include functionality for Airport-Collaborative Decision Making (A-CDM) initiatives.

Saab will be deploying its A3000 A-SMGCS, Saab multilateration and SR-3 Surface Movement Radars (SMR) at Ahmedabad, Amritsar, Guwahati, Jaipur, and Lucknow Airports. Previously, Saab had deployed A-SMGCS at Chennai, Kolkata and Mumbai Airports and an A-SMGCS multilateration and SMR at Delhi Airport.

## IGI renews contract for Rockwell Collins' ARINC

Since 2009, IGI has benefitted from Rockwell Collins' ARINC vMUSE common-use passenger processing system, ARINC SelfServ Kiosks for self-service check-in, the ARINC VeriPax Passenger Reconciliation System and ARINC BagLink for baggage messaging, as well as a Baggage Reconciliation System and a Local Departure Control System deployed by Rockwell Collins' airport system integrators. The technology is deployed at Terminal 1D and Terminal 3. As part of the renewal, IGI will also be working closely with Rockwell Collins to develop new and cutting-edge solutions to facilitate passenger processing and reduce congestion, such as deploying mobile and portable check-in devices throughout the airport. The contract renewal includes a migration of technology and updates without disrupting existing operations, ensuring seamless transition for the airport.

## Safran R&D collaborations with Indian institutions

French defence firm Safran has announced Research and Development collaborations with the Foundation for Innovation & Technology Transfer (IIT, Delhi), and Society for Innovation & Development (IISc, Bengaluru) to initiate research and development in the field of advanced avionics systems for the development of next generation aerospace technologies. These two agreements were signed in the presence of the French Ambassador to India, François Richier.



Seen from the left are: Alain Coutrot, Deputy Director, Research & Technology at Safran, Prof Mary Mathew from IISc, François Richier, French Ambassador to India, Dr Anil Wali from IIT

In the initial stage, the projects are slated to involve the development of advanced, safe and secure multicore architectures and the evolution of advanced machine learning algorithms with low computational requirements. The contribution from these projects is expected to significantly enhance advanced avionics and security applications. Safran is looking to develop long-term R&D collaborations with Indian academic and research institutes.

## Five Indian university teams in 'Lockheed Martin challenge'

Teams from five leading Indian universities presented their conceptual designs to Lockheed Martin officials in New Delhi, launching the *C-130J Roll-On/Roll-Off University Design Challenge* to develop cargo aircraft modules for disaster relief operations worldwide. Over the next year, the company will fund grants for each university team to work with local industry partners and mentors from the Defence Research and Development Organisation (DRDO) to develop design specifications for their proposed modules. In addition to funding, Lockheed Martin will also support each team with engineering, technical and business development expertise. The company will award three of the teams a second-year

grant in November 2015 to develop a prototype of their module, as well as additional mentoring to develop a go-to-market strategy. At the end of the design challenge, Lockheed Martin will work with each team to explore options with government and industry to mature the prototype for global markets.

Lockheed Martin's urban unmanned aerial system programme with DTU has been equally successful and forms the basis of the company's future collaborative research and development efforts in India.

## Airbus and Tata collaborate on 'Avro replacement programme'

Airbus Defence and Space and Tata Advanced Systems (TASL) have submitted a joint bid to replace the Indian Air Force's fleet of Avro aircraft with the Airbus C295 medium transport. The teaming follows a detailed industrial assessment and evaluation of the Indian private sector by Airbus, which concluded with the selection of Tata Advanced Systems as the Indian Production Agency (IPA) exclusive partner for the programme.



A total of 56 aircraft are involved and in the event of contract award, Airbus Defence and Space will supply the first 16 aircraft in 'fly-away' condition from its final assembly line in Europe. The subsequent 40 aircraft will be manufactured and assembled by the Tatas in India. This will include undertaking structural assembly, final aircraft assembly, systems integration and testing, and management of the indigenous supply chain.

## Snecma and Max Aerospace in JV

Snecma (a Safran company) and Max Aerospace signed an agreement on 21 October 2014 to create a joint venture named *Max Aero Engines Private Limited* (MAEPL), which will offer military aircraft engine maintenance, repair and overhaul (MRO) services in India. MAEPL will provide complete engine support solutions, in particular shop-level maintenance and flight line services. More specifically, its main role will be providing maintenance services for the Snecma M53 engines powering the IAF's Mirage 2000H fighters, starting from 2015.

## Thales and BEL in new joint venture

The Ministry of Corporate Affairs has approved the incorporation of a Thales-Bharat Electronics Limited joint venture company, BEL-THALES Systems Limited. This joint venture company will primarily focus on the design, development, marketing, supply and support of civilian and select defence radars for India and global markets. The first board meeting of BEL-THALES Systems took place on 26 September 2014.



BEL holds a 74 % stake while Thales 26% of the equity in the JV Company. The initial product portfolio of BEL-THALES Systems Limited will comprise solutions for air surveillance, including Air Traffic Management radars, and certain ground-based military radars. The ultimate objective of the JV is to expand its scope in other fields than radars, in the defence electronics domain.

## Rockwell Collins and Zen Technologies in MoU

On 7 October 2014, Rockwell Collins and Zen Technologies signed a memorandum of understanding “to combine their strengths in simulation and training to offer industry-leading, high fidelity solutions to Indian military customers.” Rockwell Collins, based in Cedar Rapids, Iowa, with facilities in Hyderabad and NCR, provides world-class aviation simulation and training products, systems and integration solutions. Zen Technologies, based in Hyderabad, India, specialises in supplying industry-leading ground military simulation and training solutions.

The announcement coincides with the recent launch of the *Make in India* campaign, which is aimed at enhancing the country’s prominence in global manufacturing while creating jobs by increasing the flow of new technology and capital. The MoU also marks the first time that a global simulator original equipment manufacturer has partnered with an Indian simulator manufacturing company to cater to the Indian defence market.

## MKU introduces 6<sup>th</sup> generation armour technology

MKU has introduced its 6<sup>th</sup> Generation armour technology, identified as Polyshield V6. The new technology reduces weight of the armour in a helicopter by up to 40% and is almost 30% thinner than standard solutions. The reduced weight improves the performance and mission capability of armoured helicopters. This technology has been developed after extensive R&D by MKU’s team of experts and engineers based in Germany and India. Helicopter

armouring solutions manufactured using the 6<sup>th</sup> Generation Polyshield V6 technology and conforming to Stanag 4569 level I weigh only 12kg per square metre. Polyshield V6 technology increases the useful payload of a helicopter without compromising on protection or mission range.

## Airbus D&S periscope maintenance facility

Airbus Defence and Space’s Optronics business unit and the Indian MoD have signed a Euro 13 million contract for the delivery of a periscope maintenance facility in Delhi, which dedicated facility will be for the maintenance and repair of all periscopes across India’s submarine fleet, and is due to be completed in September 2016.



The establishment of the periscope maintenance facility and the training of technicians from the Indian Navy in Germany and India is seen as a first step in establishing an in-country service capability for future naval operations. For implementation of the facility, Airbus Defence and Space is partnering with Tata Consultancy Services and H&H Precision Pvt Ltd.

## Honeywell and Tata Power SED in manufacturing agreement

Honeywell Aerospace has signed a licensing agreement with Tata Power’s Strategic Engineering Division (SED), enabling it to

produce Honeywell's Tactical Advanced Land Inertial Navigator, or 'TALIN' in India. This technology enables vehicles and artillery to navigate very precisely, even where GPS satellite guidance is not available.

Aligning with the Indian Government's objective of growing its indigenous defence industry and the call for 'Make in India,' Honeywell will licence the design, hardware and expertise to assemble, test and, in the future, build the production kits for TALIN to Tata Power SED. This will mark the first time India has produced inertial land navigation technology, providing the Indian Armed Forces with a locally constructed advanced land navigation technology that is not limited by a reliance upon GPS.

## Mauritius acquires HAL Do 228

On 27 November 2014, at Port Louis, the Government of Mauritius signed a contract for a HAL-Dornier 228 maritime surveillance aircraft, fitted with specific role equipment to meet the requirements of 'policing' the extensive Exclusive Economic Zone (EEZ).



The contract worth some Rs 100 crores (USD 16 million) was signed by Mrs Kan Oye Fong Weng Poorun, Senior Chief Executive, Prime Minister's Office (Mauritius) with Mr S Subrahmanyam, Managing Director, HAL (MiG Complex and Accessories) (see photo). The aircraft is equipped with 360° surveillance radar, FLIR, TCAS, apart from weather radar and other key customer-specified equipment.

## Navigation satellite IRNSS 1C launched

ISRO launched, via the Polar Satellite Launch Vehicle (PSLV) C26IRNSS 1C, third of a seven-satellite constellation of the Indian Regional Navigation Satellite System (IRNSS), on 16 October 2014. The satellite is similar in composition to its predecessors, 1A and 1B, and carries navigation and ranging payloads. Initially, the satellite was put into a sub-geosynchronous transfer orbit with a 282.56km perigee and 20,670 km apogee. It was later lifted to a geo-stationary orbit.

IRNSS is intended to make India self-reliant in navigation and surveillance from outer space and will be utilised for two services; standard positioning service (SPS) extended to all users and restricted service (RS) which will be encrypted. ISRO also announced that the fourth navigational satellite of the IRNSS segment will be launched in December and that the project will be fully operational as expected by 2015.



IRNSS-1C being assembled with PSLV-C26 in the mobile service tower

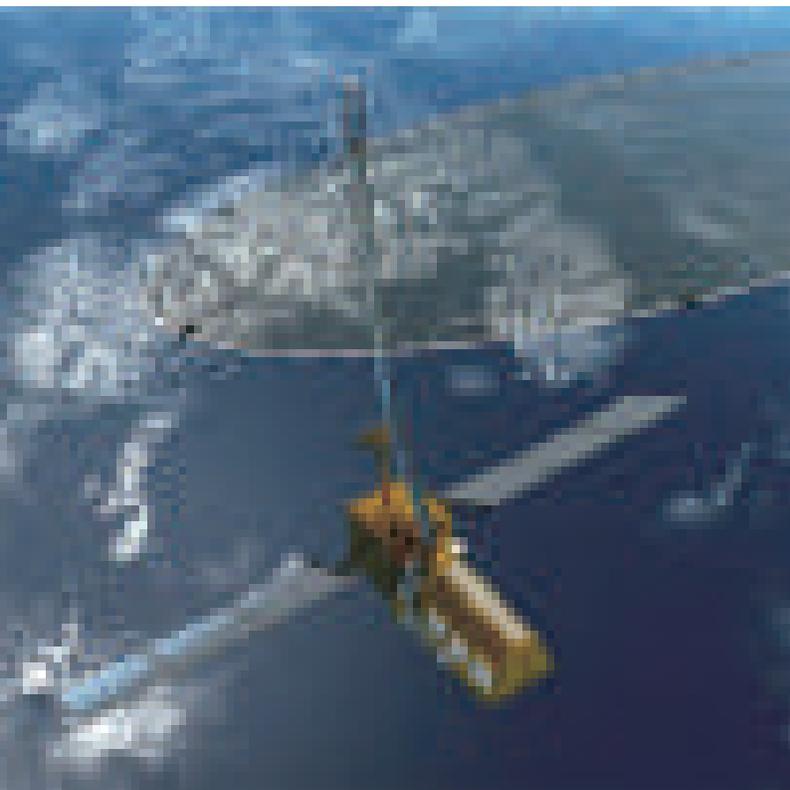
## Indian GSAT-16 delivered to French Guiana for next Ariane 5 launch



Both satellite payloads for Ariespace's sixth Ariane 5 mission of 2014 are now in French Guiana, as preparations continue ahead of this heavy-lift flight scheduled for early December 2014. The GSAT-16 satellite arrived at Félix Eboué International Airport near the capital city of Cayenne in October 2014, delivered by a chartered cargo aircraft. Designed, assembled and integrated by the Indian Space Research Organisation (ISRO), GSAT-16, which will weigh approximately 3,150 kg at liftoff, is to deliver C- and Ku-band telecommunications services that include very small aperture terminal (VSAT) transmissions, TV broadcasting and emergency communications.

Ariane 5's early December flight is designated VA221 in Ariespace's numbering system for its family of launchers, which also includes medium-lift Soyuz and light-lift Vega rockets.

## US and India collaboration on future space programmes



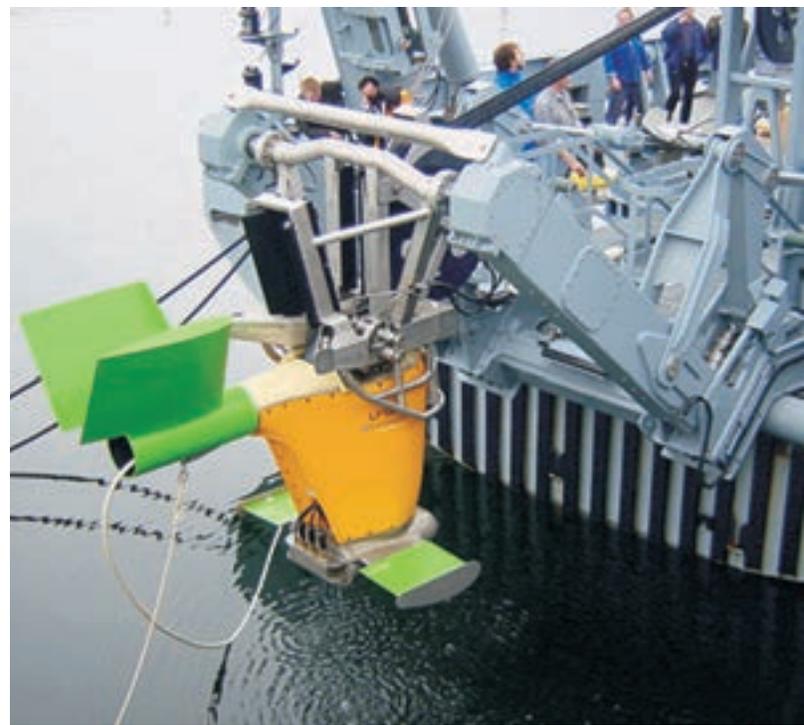
In a meeting in Toronto, NASA Administrator Charles Bolden and K Radhakrishnan, chairman of the Indian Space Research Organisation (ISRO), signed two documents to launch a NASA-ISRO satellite mission to observe Earth and establish a pathway for future joint missions to explore Mars. While attending the International Astronautical Congress, the two space agency leaders met to discuss and sign a charter that establishes a NASA-ISRO Mars Working Group to investigate enhanced cooperation between the two countries in Mars exploration. They also signed an international

agreement that defines how the two agencies will work together on the NASA-ISRO Synthetic Aperture Radar (NISAR) mission, targeted to launch in 2020.

NASA's Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft orbited Mars on 21 September, while ISRO's Mars Orbiter Mission (MOM), India's first spacecraft launched to Mars, arrived on 23 September to study the Martian surface and atmosphere and demonstrate technologies needed for interplanetary missions.

## Atlas Elektronik selected to supply advanced towed sonars

On 12 November, the MoD signed a contract for purchase of six advanced towed array sonar (ATAS) systems from German firm Atlas Elektronik. The order is valued at approximately 40 million Euro (Rs 306 crore). Atlas was selected as the lowest bidder for the ATAS requirement in November 2012, but complaints against the company repeatedly delayed the formal contract agreement, as the MoD was forced to investigate all proceedings thoroughly.



These six ATAS systems are intended equip three *Talwar*-class frigates (INS *Talwar*, *Trishul* and *Tabar*) and three Delhi-class destroyers (INS *Delhi*, *Mumbai* and *Mysore*). Other Indian Navy vessels will receive ATAS systems through separate procurement orders in the future. At present, most Indian Navy warships are equipped only with Passive Towed Array Sonar (PTAS) and the indigenous BEL HUMSA hull-mounted sonar.

It is understood that the urgency of the ATAS requirement has resulted in Atlas Elektronik being instructed to produce all six ATAS systems in Germany, and also being granted offset waivers.

### Air Marshal BS Dhanoa is AOC-in-C SWAC

Air Marshal BS Dhanoa was commissioned in the Indian Air Force as a fighter pilot in 1978, is an alumnus of the Rashtriya Indian Military College, National Defence Academy and a graduate from the Defence Services Staff College at Wellington. He succeeds Air Marshal Daljit Singh who retired after the serving 38 years in the IAF.



Air Marshal BS Dhanoa took over as Air Officer Commanding-in-Chief of South-Western Air Command (SWAC) on 1 November 2014 at Gandhinagar and is seen here with senior officers of SWAC

The Air Marshal has flown over 3,000 hours on various frontline operational aircraft and is a category A Qualified Flying Instructor. He has held various command and staff appointments including Commanding Officer of a MiG-21 squadron during Operation *Safed Sagar* in the Kargil war in 1999 and Station Commander of a frontline fighter base. He was also the first Air Officer to command an Indian Military Training Team in Tajikistan.

### Air Marshal Jagjeet Singh takes over as AOM

Air Marshal Jagjeet Singh VSM took over as Air Officer-in-Charge Maintenance (AOM) at Air Headquarters on 1 October 2014. He was commissioned in the Aeronautical Engineering branch in 1977 and is a Post Graduate in Electrical Engineering and a Post Graduate Diploma holder in management. His various instructional posts include tenures at Air Force Technical Collect (AFTC) and Technical Type Training School (TTTS). He has commanded a premier Base Repair Depot and held the post of Senior Maintenance Staff Officer (SMSO) at Central Air Command (CAC).



### Air Marshal B Suresh is SASO Western Air Command

Air Marshal B Suresh AVSM, AVM took over as Senior Air Staff Officer of the Western Air Command, Indian Air Force on 1 November 2014. The Air Marshal is a graduate of the Rashtriya Indian Military College in Dehradun, and the National Defence Academy at Khadakwasla. He was commissioned as a fighter pilot in the Indian Air Force on 13 December 1980.



### Lt Gen BK Chopra takes over as DGAFMS

Lt Gen BK Chopra, Senior Colonel Commandant of Army Medical Corps assumed the appointment of Director General Armed Forces Medical Services in New Delhi on 1 November 2014. A graduate of Ganesh Shankar Vidyarthi Memorial Medical College in Kanpur, he did his post-graduation in Surgery and Orthopaedics and was commissioned in the Army Medical Corps in 1977 and has held various regimental, clinical and staff appointments during last 37 years in the armed forces. The General Officer has been appointed as President's Honorary Surgeon by the President of India.



### Antoine Caput is Thales Country Director

Antoine Caput is Thales' new Vice President and Country Director for India, based in New Delhi, taking charge on 1 November 2014. With extensive experience in the ground transportation sector, Antoine is responsible for all Thales operations in India and was, until recently, in charge of Thales's road tolling and traffic control business. Before joining Thales in 2000, Antoine spent 10 years at Alcatel CGA, where he was in charge of export sales for East Asia. At Thales, Antoine has held various senior positions in contract management and later in purchasing. From 2005 to 2007, he managed Thales's joint venture with Panda Electronics in Nanjing, China.



# Approvals Ahoy!

The new Government on fast tracking defence procurement



Russia is keen to meet the P-75I requirement with the Amur-class submarine, an export derivative of the Lada-class pictured above (photo: United Shipbuilding Corp)

On 25 October 2014, while most of India was celebrating the long Diwali weekend, then Defence Minister Arun Jaitley and the Defence Acquisition Council (DAC) were readying another yet another draft of approvals for sorely needed modernisation of the Indian armed forces. In October the DAC approved proposals worth a mammoth Rs 80,000 crore (\$ 13 bn), key among which were the long-awaited Rs 50,000 crore (\$ 8 bn) conventional submarine programme known as 'Project 75-I' and the Rs 3,200 crore (\$ 520 mil) procurement of Rafael Spike anti-tank guided missiles (ATGMs) from Israel.

The ATGM order will be fulfilled through production at Bharat Dynamics Limited (BDL) in Hyderabad, via implementation of a Transfer of Technology (ToT) arrangement, and encompasses 300 launchers along with 8,000 missiles. This also means that despite closer Indo-US ties and greatly increased engagement between Indian and American leadership since the

Modi government took charge earlier this year, the MoD has elected not to pursue production of the Raytheon Javelin ATGM. Future co-development of advanced variants of this missiles system, however, remains an option.



A soldier seen operating Spike missile unit

Project 75-I, a six-boat requirement for diesel-electric submarines incorporating contemporary air-independent propulsion (AIP) technology, has been gestating for five years, with an RFI having been circulated by the Navy in early-2010. As reported in *Vayu* V/2014, the proposal approved by the DAC in October has seen the original RFI modified and now requires that all six vessels be constructed at a single Indian shipyard, instead of having four built in two separate Indian yards and two abroad, as per the initial plan. The Navy's earlier approach was seen as an attempt to hedge against the delays that have plagued Project 75 (*Scorpene*-class), currently being executed by Mazagon Dock Limited (MDL). This plan evidently found little favour with the MoD, which appears to remain firmly committed to the mantra of indigenisation. The MoD will now take two months to assess public and private shipyards in India to identify those capable of executing the ambitious programme in collaboration with a foreign manufacturer.



*IN Dornier 228 of INAS 310 with specialised surveillance equipment clearly visible (photo: Angad Singh)*

Other approvals include 363 BMP-2 ‘Sarth’ infantry combat vehicles for the Army, to be built at Ordnance Factory Medak at a cost of Rs 1,800 crore; 761 radio relay containers for Rs 662 crore; 1,768 railway wagons for long distance transport of Army equipment at a cost of Rs 740 crore; and 12 Dornier 228 aircraft equipped with surveillance equipment for the Indian Navy, which will be built by Hindustan Aeronautics Limited at a cost of Rs 1,850 crore.

Speaking at the DAC on 25 October, Mr. Jaitley once again reiterated that national security is a priority for the government, saying, “Hurdles and bottlenecks in the procurement process should be addressed expeditiously so that the pace of acquisitions is not stymied.”

**Angad Singh**

## **New Minister, new meeting, artillery cleared!**

Shortly after former Goa CM Manohar Parrikar took charge of the MoD from Arun Jaitley, he chaired his first DAC meeting. The new minister made a strong but cautious start on 22 November, clearing a key proposal for procurement of 814 155mm/52 calibre mounted-gun systems for the Indian Army. The proposal is valued at Rs 15,750 crore under the ‘buy and make’ category of the defence procurement procedures (DPP), which will see the first 100 guns bought off the shelf from an original equipment manufacturer and the remaining 714 manufactured in India. This was a crucial decision in light of the Army’s severely deficient indirect fire capability, with no new guns inducted since the 1987 Bofors scandal.

In addition to the mounted guns, the DAC cleared the Air Force to expand the Integrated Air Command and Control System (IACCS) with a sanction of Rs 7,160 crore. The IACCS presently has 5 nodes and an additional 4 nodes will be set up to connect the Indian mainland with Island regions for seamless communication and connectivity.

On the other hand, the Minister deferred decision on two major IAF programmes — the 56-aircraft Avro replacement tender and a proposal for 106 additional Pilatus PC-7 MkII trainers. Parrikar explained the delay, saying he “wanted to study issues, some of which cropped up at the last minute,” relating to the two proposals. The projects remain under consideration and decisions will be taken in the near future.



*Large numbers of BMP-2s are already in service, and a future ICV programme is planned (photo: Angad Singh)*

Additionally, the MoD cleared a Rs 2,000 crore procurement for two Swimmer Delivery Vehicles (SDVs), which are midget submarines used for maritime special operations such as clandestine insertion of commandos into hostile territory.

# VAYU at Neuve Chapelle

## Honouring the Indian Army in WWI



*Colour party of Kingsmen march to the Indian Army Memorial at Neuve Chapelle*

**O**n 28 October 2014, gathered at the imposing Indian Army Memorial at Neuve Chapelle in northern France, were contingents of the British Army, members of the Jullundur Brigade Association, platoon of the '1914 Sikhs' from the UK, parties of French Sikhs from Paris, school children and their teachers from north-western England plus many others who got together to commemorate that historic battle of 28 October 1914. *Vayu* was there, in witness of this historic and emotional remembrance ceremony, an exclusive for its readers.

“The history of the Indian Army contains few nobler pages than that of the 28th October 1914”, stated Field Marshal Sir John French Commander-in-Chief of the British Expeditionary Force after the action that day by a mere 500 men of the Indian Army who recaptured the vital village of Neuve Chapelle in northern France from the vastly larger number of German troops in the opening days of what has become known as the First Battle of Ypres.

The Indian Corps had arrived piecemeal in Marseilles barely a month earlier, hastily re-equipped with Lee Enfield Mk.III rifles and some warm clothing and then rushed to northern France and Flanders to reinforce the beleaguered BEF which faced the formidable combined German and Bavarian Armies, before their final push to capture the Channel ports and thus complete capitulation of France. The Indian troops were fated to undergo a harassing experience, outnumbered and outgunned, without the bombs, grenades and other munitions freely used by the enemy. The 1500 yards of this front were held by the Jullundur Brigade comprising the 1<sup>st</sup> Manchesters, 47<sup>th</sup> Sikhs, 59<sup>th</sup> Frontier Force and 15<sup>th</sup> Sikhs.

Exactly one hundred years to the date, Brigadier Peter Rafferty, Colonel of the Duke of Lancaster's Regiment, heirs to the 1<sup>st</sup> Manchesters gave the following address at the Jullundur Brigade Commemoration at the Indian Army Memorial, Neuve Chapelle.

Invoking the quote of Major General Mohindar Singh Chopra, Founder President of the Jullundur Brigade Association, Peter Rafferty said, “There is something unique



*Air Commodore N Tiwari, from the Indian Embassy at Paris lays a wreath at the IAM*

and central to the faiths that the men-in-arms professed, to have made it incumbent upon men of different religions, Christian, Sikh, Muslim and Hindu, to have lived and fought and died together. Thus we gather here, today, Hindu, Muslim, Sikh and Christian to commemorate the legacy we, as an extended Regimental family, hold so dear. We come together to mark events that bound us together 100 years ago and in our Regimental affiliations today, continue to do so.

Thus I welcome all of you, but in particular our guests who have travelled from the Indian sub-continent and our gracious French hosts. We remember the Jullundur Brigade; the men of 1st Manchesters, of 15th and 47th Sikhs and of the 59th Scinde Rifles of the Lahore Division, part of the Indian Army Corps. As the current Duke of Lancaster's Regiment, we also remember the 4th King's Liverpool Regiment, 1st South Lancashire Regiment and 1st Loyal North Lancashire Regiment who fought in or with other Indian Army brigades, here at Neuve Chapelle or elsewhere, at Givenchy, Festubert, Ypres and Loos. We remember also the Dogra, Gurkha, Pathan, Rajput, Jat, Garwhali, Bhopal, Punjab and Baluch fighting men commemorated at this site. We remember in particular the many who sacrificed all, so that we may reflect here today on what might have been.

Many of us here today have known war and conflict. War shows man at his lowest, but also in the tragedy of war, we see men at their best. Human spirit, compassion, mercy, resilience and sacrifice come to the fore in times of war; it is the sacrifice that we recognise and reflect upon today. The story of the Jullundur Brigade is of lives lost or damaged, ambitions never fulfilled, marriages never made, children never born; the what ifs, that never were.

On 25th October 1914 the Jullundur Brigade, 15th Sikhs, 34th Sikh Pioneers and 59th Rifles relieved French Cavalry in the line. On 26th October the German Army captured Neuve Chapelle, creating a salient in the British line and in so doing forced the South Lancashire Regiment to retire. These first events were the start of a 14 month odyssey here in France that would not end until 26th December 1915 when the last Indian soldier left for other theatres of war. More battles were to be fought, more losses sustained, more acts of heroism recorded such as those of Corporal Issy

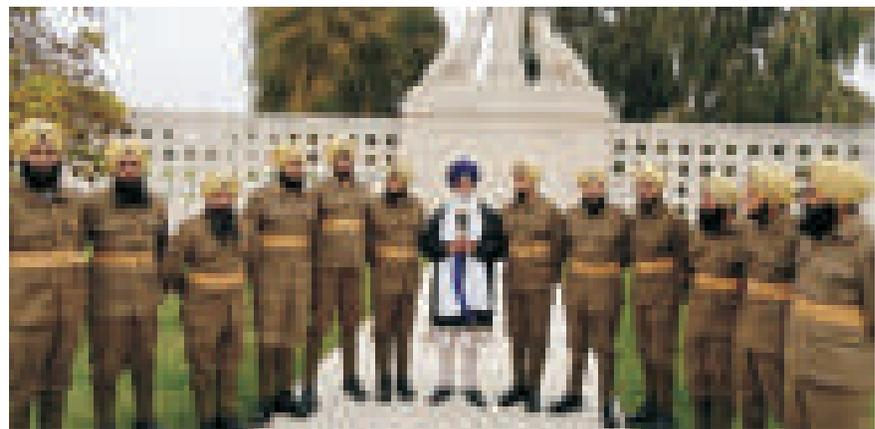


*Wreath in honour of 'The Jullundur Brigade'*

Smith of 1st Manchesters and Lieutenant Smythe of 15th Sikhs, who were both to win the Victoria Cross in 1915, joining Sepoy Khudadad Khan of 129th Baluchis, the first Indian and Muslim recipient of the Victoria Cross.

But here, at Neuve Chappelle, on 28th October 1914, exactly 100 years ago, at 1030hrs in the morning, British and French artillery commenced firing on the village. Elsewhere, 3 miles south of here at Festubert, the 2nd Manchesters were fighting a desperate defence that would lead, tomorrow, 29th October, to the award of the Victoria Cross to both Second Lieutenant James Leach and Sergeant John Hogan, the Regiment's first VCs of the war.

At precisely 1100hrs at a position just 1000 yards to our north, the 47th Sikhs and 34th Pioneers attacked. After horrendous fighting they captured the main street of Neuve Chappelle, but after a day of hard fighting, lack of available British or Indian reinforcements led them to be forced to retire with significant losses.



*Jathedar Mal Singh from Takht Keshgarh Sahib in the Punjab with 'troops' of the '1914 Sikhs' at the Indian Army Memorial, Neuve Chapelle*

As we now begin our Service of Remembrance of that action, consider the what ifs and the never wheres; but consider also that in the words of the official history of the Indian Corps in France, published in December 1917 : The history of the Indian Army contains few nobler pages than that of 28th October 1914."

The British Army contingent at Neuve Chapelle on 28 October 2014 was led by Brigadier Peter Rafferty, the Commanding Officer, RSM, OC and Padre of the 2<sup>nd</sup> Battalion Duke of Lancaster's Regiment, with a Colour Party of 10, The King's Division Band of 35, and 80 Kingsmen. There were four Mayors, those of Manchester, Tameside, Blackpool and Neuve Chapelle, while *The Jullundur Brigade Association* mustered 30 persons and the '1914 Sikhs' another 20. There were 35 Army ACF Cadets, a total of 88 school children from the UK, Religious Leaders from the Christian, Hindu, Muslim and Sikh communities and others. The Indian Embassy in Paris was represented by the Air Attache, Air Commodore N Tiwari.

The divine presence that morning at Neuve Chapelle of Jathedar Mal Singh of Takht Keshgarh Sahib at Anandpur Sahib in the Punjab was very inspiring; his *ardaas* invoked God's blessings on those who had been killed in action on the battlefields a century before.

After the moving service, the book '*Neuve Chapelle : The Jullundur Brigade in France & Flanders 1914-15*' was formally released at the Memorial. The Sikh community of France thereafter served *langar* to those present at the Indian Army Memorial in Neuve Chapelle, one hundred years after the epic battle.

# “Maritime Resurgence”

**VAYU** Interview with

## Admiral RK Dhowan

**PVSM AVSM YSM ADC, Chief of Naval Staff**

**VAYU** : While the nation views the Indian Navy with a sense of pride, as a three-dimensional force it is often felt that the fleet is ageing and replacement of ships and aircraft has not been adequately funded. Could you kindly elucidate on the Navy’s aspirations based on its essential requirements and the immediate prospects of meeting these?

**CNS**: In my opinion, force structure planning, by its very nature, is a complex process and is based on envisaged operational requirements, assured long term funding and credible sources of supply. Today, the Indian Navy operates a balanced force comprising aircraft carriers, multi-role destroyers and frigates, fleet tankers, amphibious ships and a multitude of aircraft and submarines capable of blue water operations in the Indian Ocean Region (IOR) and beyond. The present force levels of the Indian Navy are being augmented for undertaking tasks defined for the Indian Navy, as also confront the challenges of piracy in the IOR and shoulder the responsibility of coastal security.

The acquisition programme of the Navy is continuing apace and recent years have seen us moving steadily on the path of modernisation with major inductions including the nuclear submarine INS *Chakra*, aircraft carrier INS *Vikramaditya* with its integral fighter aircraft, *Kolkata*-class destroyers and ASW corvettes. Maritime surveillance capability has also been bolstered with the recent induction of Boeing P-8I Long Range Maritime Patrol aircraft from the USA. All this has provided the Indian Navy the much-needed offensive

strike capability and also enabled us to operate at enhanced ranges. Our capacity for offshore patrol and hydrographic survey has been augmented with the induction of new offshore patrol vessels and survey ships. The years ahead would see the induction of nuclear-powered submarine INS *Arihant* and some more destroyers, corvettes, Project 75 (*Scorpène*-class) submarines, offshore patrol vessels and cadet training ships, to name a few.

**VAYU** : A maritime scholar has emphasised that “in some senses, the defence of Ladakh and Arunachal Pradesh lies in the Indo-Pacific, the Indian



The INS Vikramaditya at sea



*Ocean and in ASEAN waters, just off the Andaman and Nicobar Islands.” What additional role is envisaged for the Indian Navy considering the strategic significance of the A&N Islands?*

**CNS**: The Andaman and Nicobar Islands provide strategic advantage to India. I believe that harnessing the geographical advantage makes it imperative that certain infrastructure development is undertaken at these locations. This would provide enhanced maritime surveillance capability for the Indian Navy and also facilitate as a forward base for the Armed Forces and enable safeguarding the interests of our nation on our Eastern seaboard. The location of the islands enables us to undertake effective maritime surveillance in our areas of interest and extend our operational footprint as required by our national interests and security imperatives.

**VAYU** : You have recently stated that the “blue print for the future Indian Navy is firmly anchored on self-reliance and indigenisation” and that the Indian Navy is being transformed from a ‘Buyers’ Navy’ to a ‘Builders’ Navy’. Is not this transformation feasible across the defence spectrum, also impacting the other services for whom the Navy’s approach can be emulated?

**CNS**: The Indian Navy has recognised the advantages of being a ‘builder’s navy’ rather than a ‘buyer’s navy’ right from the initial stages. India’s first indigenous

## IAI Malat

warship was commissioned in 1961 and ever since, self-reliance has been the guiding principle of IN's perspective plans. It is a matter of significant achievement that the modernisation programme of the Navy is focused on indigenous warship construction and is largely driven by Indian shipyards and industry. Consequently, we are one of the very few countries in the world having the capability to produce a wide variety of warships, ranging from an aircraft carrier to fast attack craft. Our quest for indigenisation has resulted in warship and submarine construction being undertaken consistently in our own public shipyards. Even some private shipyards have been awarded contracts for warship building and we hope that this will further augment our national capabilities.

We are proud to say that as on date 119 indigenously-built ships have been commissioned from DPSU and private shipyards ranging from small patrol craft to frontline destroyers. Presently, all 41 ships and submarines on order are being constructed in Indian shipyards. The launch of the indigenous aircraft carrier, *Vikrant*, at Cochin Shipyard in August 2013 was a major milestone. Other major warship construction programmes include six destroyers (Project 15A and 15B) and six Project 75 submarines at Mazagon Dock Limited, while fifteen ships are under construction at Garden Reach Shipbuilders & Engineers Limited, Kolkata. Five OPVs, three training ships and five survey ships are also under construction at various private/public shipyards in Gujarat.

The Government policy of 'Make in India' would definitely give a thrust to indigenisation across the entire spectrum of defence procurement for the armed forces of the country.

**VAYU:** *The Indian Navy has reportedly faced shortages in the authorised strength of Officers and Sailors (18-19% and 17% respectively in 2011). What steps are being taken to bring down the current shortages?*

**CNS:** The Navy has taken several publicity related measures and enhanced inductions to mitigate the present shortages of manpower in officers and sailors cadres in a phased manner. As a result, the current shortages have reduced to approximately 14% in officers and 17% in sailors. Some of the measures instituted towards addressing shortages are enumerated in the succeeding paragraphs.



*Admiral RK Dhowan inspecting Navy personnel at South Block*

The Navy has implemented image projection campaigns and each publicity campaign has been carefully timed to attract the best and brightest youth by publishing extremely attractive advertisements in leading newspapers all over the country. The latest image projection campaign conducted by the Indian Navy titled 'Ocean of Opportunities' was very well received by the youth. Today's youth comes from developing India's aspiring classes and expects from the Navy a way of life unrivalled in professional and personal growth. Therefore the theme highlights the multitude opportunities offered by the Navy to its aspirants. In addition, advertisements on popular TV and radio channels are aired to meet our objective.

The infrastructure at Indian Naval Academy at Ezhimala, Kerala, is being enhanced to create additional capacity for ab-initio training of officers. Since 2013, BTech degrees are being awarded on completion of training. NCC cadets are motivated to join the service through a 'Special Entry Scheme' for the NCC.

We have also sought to address shortages in the specialised fields of naval architecture, aviation, submarines, etc by introducing dedicated and specific entries. The University Entry Scheme, open for induction into technical branches, has been expanded to the Executive, Logistics, Education, Pilots and Observers entries since 2012. Additionally, as per the renewed policy, V<sup>th</sup> semester Engineering students along with VII<sup>th</sup> semester students are now eligible for induction into the Navy

under this scheme. A new entry scheme for induction of Short Service Commission (Information and Technology) and Short Service Commission (Sports) officers has been introduced.

Shortages in respect of sailors in the Navy are temporary and have appeared due to accretions to the sanctioned strength. Recruitment has been enhanced to fill shortages. Further it is also planned to augment the training infrastructure for sailors. The Navy plans the induction of personnel through ten years induction plans in respect of all branches/ trades of sailors. The induction plans factor the training capacity of ab-initio and downstream training institutions. Efforts are made to avoid cyclic variations in recruitment, which have adverse implications from a human resource development point of view.

**VAYU:** *What is the present status of the Naval LCA programme? The first LCA (Navy) prototype NP-1 undertook its maiden flight on 27 April 2012 but progress has since been limited. Has installation work on the SBTF at Goa been completed as a prelude to induction of the LCA (Navy)?*

**CNS:** The first Naval Prototype (NP-1) has been regularly flying towards progressing the flight trials of the aircraft. Construction of the second prototype (NP-2) has been completed and the aircraft would be making its first flight shortly. With regard to the Shore Based Test Facility (SBTF), the buildup of the take off area was completed in October 2013 and that of the landing area was completed

**Rubin**



LCA Navy prototype NP-1 seen landing after a test flight

in early January 2014. Certification of the facility was undertaken by Russian test pilots and the facility was declared fully operational on 29 January 2014. Since then, Indian Navy MiG-29K pilots have been utilising this facility for undertaking Field Carrier Landing Practice.

**VAYU:** *Is the Indian Navy planning to acquire amphibian aircraft in the near future? Could you kindly give us a view on their utilisation and the operational scenario that this category of aircraft will fulfill?*

**CNS:** Yes, the Indian Navy is pursuing a case for procurement of amphibious aircraft. As you might be aware the Short Sealand amphibious aircraft was inducted into the Indian Navy's aviation arm in 1953. Due to our strategic location in the Indian Ocean region, the necessity to increase surveillance near the coast and in the island territories has become vital for rendering expeditious support to people in distress. It has necessitated the procurement of a whole new range of equipment to enhance the capabilities of the Indian Navy. Amphibious aircraft, due to their speed, endurance and capability to operate from land and sea, especially where airfields are not available, will be the most effective means to fulfil the required roles. The aircraft will be utilised for a variety of other tasks in the national interest, such as humanitarian assistance and disaster relief (HADR), long range search and rescue, medical casualty evacuation and logistic support at sea.

**VAYU:** *In safeguarding the country's maritime interests and projecting combat power, the Indian Navy is focused on augmenting and building its technical and*

*support infrastructure, for maintenance of new induction platforms and repairing the equipment being inducted. Kindly elucidate on what is being done in this respect?*

**CNS:** The Indian Navy's expansion is based on its Maritime Capabilities Perspective Plan and is aimed at meeting current and future national security objectives and challenges. Extensive plans have been put in motion to augment technical infrastructure for supporting and maintaining the current force levels as well as new inductions. Plans include augmentation of existing facilities in Naval Dockyards and Naval Ship Repair Yards for creation of new jetties and new dry docks.

The technical infrastructure augmentation in the Naval Dockyards and Ship Repair Yards is being undertaken through the Annual Technical Works Programme. In the past three years, a total of 47 projects have been completed and a number of projects in progress/ being considered for implementation over the next few years.

As regards augmentation of docking capacity, cases relating to provisioning of a shiplift at Naval Dockyard, Visakhapatnam, a graving dock at Kochi, creation of dry dock and wharf project at Naval Dockyard Mumbai capable of docking ships up to aircraft carriers and induction of a floating dock are planned in the years ahead.

**VAYU:** *The Indian Navy is now down to about a dozen operational diesel-electric submarines. Could you comment on developments in the Project 75(I) submarine acquisition programme and indicate a possible timeline for this new submarine project?*

**CNS:** There has been significant progress made on the P-75(I) programme. You would be aware that the proposal for the construction of all six submarines in India is being pursued with the MoD. This will provide a substantial boost to indigenisation in this critical sector. P-75(I) envisages acquisition of six state-of-the-art conventional submarines with high stealth features, Air Independent Propulsion (AIP), and advanced weapons and sensors. The submarines will be constructed at a suitable Indian shipyard, in collaboration with an identified foreign collaborator under Transfer of Technology (ToT). Considering the enormity of the project, in both technological and financial terms, it will be handled expeditiously in accordance with comprehensive guidelines.

**VAYU:** *Kindly update us on the Navy's MRMR programme as well as the suggestion that this be linked to the Coast Guard's maritime patrol aircraft requirements so as to streamline in-service logistics.*

**CNS:** The Navy's MRMR programme is not linked with the Coast Guard's maritime patrol aircraft case, as the requirements for both the services are vastly different. The



The Governments of India and Japan have initiated cooperation on the ShinMaywa US-2 amphibian

## Atlas Elektronik

Request for Proposal by both the Services was therefore forwarded separately.

The case for procurement of MRMR aircraft as replacement of Islander aircraft on 'Buy Global' basis was accorded AoN (Acceptance of Necessity) by the DAC on 23 February 2012, and the RFP was issued in August 2013. Induction of these aircraft would augment aerial surveillance capability, thereby enhancing the maritime domain awareness in the IOR and IN's area of interest. We are targeting contract conclusion in or about a year's time.

**VAYU :** *The programme for seven follow-on frigates to the Shivalik-class, designated Project 17A, has seen little progress since the last Shivalik-class vessel was commissioned in 2012. Considering the large number of vessels on order at various PSU shipyards, could tenders be issued to private yards in order to expedite induction?*

**CNS:** CCS approval for P-17A has not yet been accorded. The CCS sanction is in advanced stage of consideration by the government. Tender issue to private sector shipyards for P-17A is not envisaged as the existing DAC approval is for the ships to be built at DPSU shipyards. MoD and the Navy have encouraged private sector participation in host of auxiliary craft, offshore patrol vessels and in future for the landing platform dock, coastal ASW vessels and large survey vessels.

**VAYU :** *On the design and development of Kolkata-class (P-15A) and Kamorta-class (P-28) warships, it was indicated that the Navy "could not wait indefinitely for DRDO and other domestic agencies to develop certain critical systems, such as towed array sonars, AIP modules etc." Would the Indian Navy consider global procurement for such systems?*

**CNS:** I firmly believe that the need of the hour is to be 'optimally self reliant.' Procurement of critical systems from global sources is therefore only where inescapable. However our long term objective is to move towards developing capabilities for making future ships 100% 'Made in India.'

**VAYU :** *At the bi-annual Naval Commanders' Conference in New Delhi between 24-26 June 2014, you pointed out that Mine Counter Measure Vessels (MCMVs) remain a key capability gap for the Navy. It is understood that a South Korean firm was selected to fill this requirement as far back as 2011. What*



Project 17 frigate INS Satpura at sea during Exercise Malabar 2012

*steps are being taken to fill the MCMV capability gap?*

**CNS:** The induction of MCMVs has not proceeded as planned due to unforeseen developments, leading to a shortfall in force levels. The Navy is working at various options to quickly induct MCMVs.

**VAYU :** *"If India is to fulfill its maritime destiny, the government, the armed forces, the civil services, the media and the public must have a maritime vision and a thorough understanding of the maritime concepts as outlined in the Indian Maritime Doctrine." This doctrine was issued in 2004. How far, in your view, have the stakeholders progressed towards the fulfillment of this concept and what needs to be done in the near future?*

**CNS:** The Indian Maritime Doctrine of 2004 was revised and the second edition promulgated in 2009. Our maritime doctrine provides the common reference point, language and purpose that guide us in our actions. The doctrine remains flexible to changes in the operating environment. It is complemented by the Indian Maritime Military Strategy, promulgated in 2007. Over the last decade we have witnessed the maritime vision of India progressing steadily and surely. India is now on a path of maritime resurgence and looking towards the seas and over the horizon. In fact, the 21<sup>st</sup> century is likely to be the 'century of the seas' for India. The Indian Maritime Doctrine and the Indian Maritime Military Strategy have been placed in the public domain and, in articulating our maritime outlook, have contributed to developing shared understanding and perspective

amongst the various stakeholders. India is a maritime nation, with increasing utilisation and dependency on the seas for national prosperity. This will require increasing interaction and coordination amongst all stakeholders. The maritime vision, doctrine and strategy of the Navy will continue to be reviewed and refined, and be made available to all stakeholders as part of a longer cooperative effort of strengthening our maritime capability.

**VAYU:** *Your message to the nation on the eve of Navy Day 2014, please!*

**CNS:** On the occasion of Navy Day 2014, I would like to reiterate that the Indian Navy, as the nation's prime manifestation and instrument of maritime power, is committed to maintaining the highest standards of professional excellence and to remaining vigilant and ready to meet the spectrum of needs for ensuring the nation's maritime security. We seek to create and sustain a multi-dimensional, multi-spectrum, combat-ready, networked force, and to work in tandem with other maritime agencies and forces so as to build a maritime environment that enables our national growth and prosperity. As we strive towards increasing indigenisation and self-reliance in naval technology, we shall remain committed to maintaining a 'clean and green' environment. We are deeply cognisant that our greatest strength is in our human resource, both uniformed and civilian, and shall keep investing in its welfare, well-being and training, in order to develop it into unmatched human capital. We shall pull together on our oars, maintaining a taut, efficient and happy Navy.

**DCNS**

Former CNS, Admiral Arun Prakash states that this is the time for

# Reflection and Introspection

*An albatross-eye view of INS Kolkata*

Given its trajectory since the turn of the century, the Indian Navy (IN) appears to be well on the way to becoming a world-class maritime force over the next few years. The Service, having crossed many significant milestones in the recent past, has much cause for celebration. However, like all dynamic and growing organisations the IN, too, has had its share of turbulence. The pain and trauma that accompanied the past year may qualify 2013-14 as “*annus horribilis*” for the IN but a silver lining could emerge if the right lessons have been learnt and corrective measures implemented – not just by the leadership of the IN but also by the politico-bureaucratic elite that guides its destiny.

Navy Day 2014, being observed on 4 December, thus, provides an appropriate occasion for reflection and introspection by the Service. Those on the outside can only ponder over the available media outputs and, perhaps, offer advocacy without being judgmental; which is what the writer attempts in this article.



*Talwar-class guided missile frigates in synchronised launch*



## Recent History

Let me start with the clarification that Navy Day does not signify a 'birthday' but commemorates a famous naval victory. For the record, the IN reckons its age from our first Republic Day in 1950, when the prefix 'Royal' was dropped from all nomenclature and His Majesty's Indian Ships (HMIS) became Indian Naval Ships (INS).

It was in the wee hours of 4 December 1971 that a squadron of small missile-boats audaciously approached Karachi harbour to unleash a barrage of guided missiles; sinking two Pak warships, setting alight a fuel storage facility, and bottling up the Pakistani Navy (PN) in harbour. It was a delayed but apt response to the (largely symbolic) bombardment of Dwarka port by PN destroyers in September 1965.

On the eastern seaboard, as the IN gathered flotsam from the sunken Pak submarine INS *Ghazi*, the aircraft-carrier INS *Vikrant* and her escorts blockaded East Pakistan ports, attacked airfields and interdicted shipping, thus hastening the

surrender of Pakistan forces. This swift and successful tri-Service campaign marked the slow dawning of realisation amongst India's ruling elite that the Navy could be a potent instrument of state policy.

If the 1971 war was the Navy's baptism by fire, the Great Asian tsunami saw it coming of age as a regional force. Within hours of receiving the first distress messages on 26 December 2004, IN ships and aircraft were speeding to the aid of not just our own citizens, but also Sri Lankan, Maldivian and Indonesian neighbours in distress. The alacrity with which the IN responded to this humanitarian crisis left an abiding impression of its competence and professionalism on foreign observers. This was reinforced by the sea-lift operation efficiently mounted by IN task-forces to evacuate South Asian refugees from war-torn Lebanon in 2006 and Libya in 2011.

The IN has, indeed, come a long way from the time it was seen as a 'Cinderella' Service surviving from one shoestring budget to the next. With patience and

doggedness, the Navy's visionary leadership ploughed a lonely furrow, trying to build a balanced and professional navy; till the onset of globalisation and emergence of multiple maritime threats served to loosen government purse-strings. They also ensured that the induction of increasingly sophisticated hardware and systems by the IN was accompanied by the evolution of strategies, doctrines and tactics.

Even as India is creating a navy that will soon take its place amongst the finest in the world, there continues to be a disheartening lack of maritime consciousness and strategic vision amongst India's decision-makers; which means that having created an expensive and capable maritime force, they may not know how to employ it as an instrument of state-policy.

This malaise of 'sea-blindness' is attributable, essentially, to ignorance of India's ancient maritime inheritance amongst most Indians. Therefore, before we focus upon more recent events, it is necessary to reflect briefly on India's maritime past, as seen by a visionary.

### Sardar Panikkar's Maritime Vision

One of the very few Indians, ancient or modern, to have undertaken a reconstruction of India's maritime past and to offer a vision for the future, was diplomat and

historian Sardar KM Panikkar (1895-1963). Panikkar, in his writings, paints a fascinating picture of India's maritime past, describing seagoing activities that took place in the open expanses of the Arabian Sea and Bay of Bengal two to three millennia before the Greeks, Phoenicians, Carthaginians and Romans ventured into enclosed waters of the Aegean.

Starting with the Mauryan emperors, Panikkar recounts the continuum of cultural and religious osmosis from India's east coast to SE Asia and traces Indian maritime activism through the Andhra, Pallava, Pandya, Chalukya and Chola dynasties that were instrumental in creation of Hindu kingdoms right across SE Asia. He rightly concludes that such deep-rooted cultural influence could not have been implanted in this region, dubbed *Suvarnabhumi*, without constant and substantive seafaring activity linking it with India.

As far back as 1945, Panikkar declared that "India cannot exist unless the Indian Ocean is free". Presciently predicting that the naval policy of a "resurgent China" would seek southward expansion, he advised that the future IN would best serve the nation's maritime interests by defending a "steel ring created by Singapore, Ceylon, Mauritius and Socotra" around India.

A look at some of the recent additions to the IN inventory, as well as hardware in the pipeline provides an illuminating insight into the Navy's perspective planning. Two nuclear-powered submarines and an aircraft carrier joined the fleet, and an indigenous carrier is under construction in Kochi. On order are seven stealth frigates, six diesel submarines, and 40 other warships. The aviation arm will acquire twelve Boeing P-8I maritime patrol aircraft, 45 MiG-29K multi-role, carrier-borne fighters and over 100 ship-borne helicopters during the next decade. All these items signify a committed expenditure in the region of US \$ 30-40 billion over the next ten years.

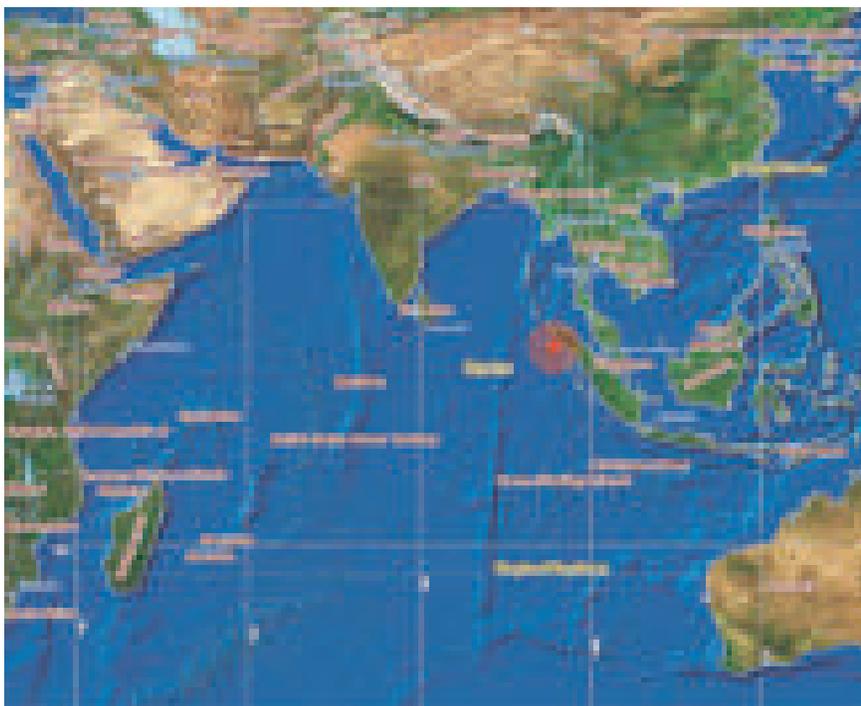
It would have pleased the Sardar to see that his dream is being progressively realised by the steadfast endeavours of the Navy's leadership; inspired by his prophetic writings. However, as the following 'serial snapshots' show, the recent past has seen much ebb and flow in the fortunes of the IN.

### Twin landmarks for the Navy

August 2013 saw the IN achieving two long-awaited landmarks that heralded its arrival in the 'big league' of navies. On the 9<sup>th</sup> of that month the nuclear reactor of ballistic missile submarine (SSBN) *INS Aribant* attained criticality. This product of the Advanced Technology Vessel (ATV) project, launched by Dr Manmohan Singh in June 2009, will shortly become the 'third leg' of India's nuclear deterrent force. Three days later, Raksha Mantri AK Antony ceremonially launched India's first home-built indigenous aircraft carrier (designated IAC-1, to be eventually named *INS Vikrant*) in Kochi.

The *Aribant* has been undergoing a gruelling and comprehensive programme of harbour-trials and is likely to go to sea by end-2014. For the DRDO, the delivery of this SSBN has been a singular achievement in the face of formidable challenges. The success of this project has been attributed to the high level of synergy attained by the three players: IN, DRDO and DAE; the user (Navy) being placed in the 'driver's seat' of the project and the autonomy granted to the project, which enabled rapid decision-making and significant private-sector participation.

The 37,500 ton IAC-1 is the largest warship ever to be built in India and is designed by the Directorate of Naval Design (DND), with consultancy in specific areas being sought from Italy and Russia.



The Indian Ocean Region : IN's prime area of interest

Powered by four US-built gas turbines which would give it a top speed of 28 knots, its 830-foot long angled flight deck would provide adequate runway for launch of the MiG-29K and LCA (Navy) from the ship's 14-degree ski-jump. The ship's hull is in the water and installation of machinery and systems is underway in Cochin Shipyard. It could take anything up to 5-6 years before the INS *Vikrant* goes to sea.

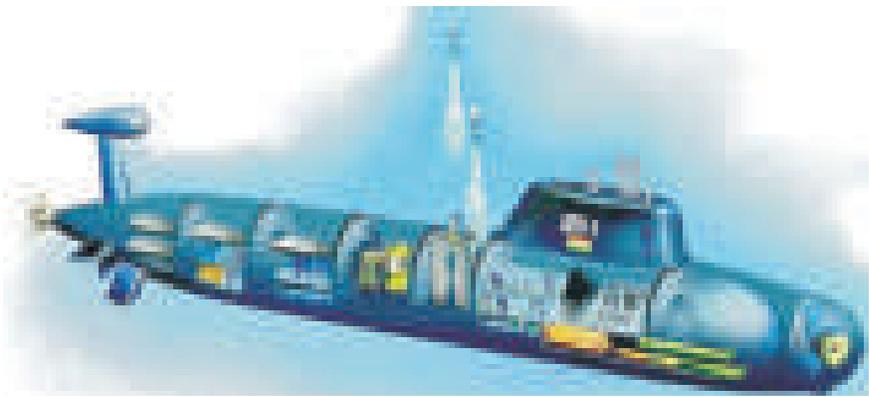
Staff requirements for the follow-on IAC-2 are being drawn up and critical design decisions will hinge on the choice of aircraft type that will operate from it. Depending on whether the aircraft is conventional (MiG-29K, Sea Gripen, Rafale, F/A-18, F-35C) or short take-off and vertical landing (F-35B) type, the ship will need to be equipped either with a catapult/ski-jump plus arrestor wires or merely a ski-jump. This decision will result in radical variations in design and operating philosophies.

### The *Sindhurakshak* tragedy

Just as nation-wide applause for this twin event was slowing down, the submarine INS *Sindhurakshak* suffered a catastrophic explosion and sank in the shallow waters of Mumbai dockyard on 14 August 2013. Eighteen crew-members of the Russian-built *Kilo*-class boat, engaged in weapon preparation for an operational patrol, perished in this accident. Tragic loss of lives apart, this accident provided a harsh reminder of our dangerously low submarine force-levels.

The Navy's plans call for a force-level of 30 submarines, but even if the Service is to maintain a half that strength, it is necessary to establish sustained serial production of submarines. Failure to establish a national submarine design and building capability has been an egregious omission for a growing military power like India. An important contributory factor has been the extended delay, of over a decade, in selection of a suitable submarine type with air-independent propulsion (AIP) by the MoD.

The *Sindhurakshak* accident also re-focused attention on some major systemic failings. Firstly, forty-seven years after acquiring its first submarine in 1967, the IN still lacks a submarine rescue vessel (SRV) which can enable the crew to escape from an incapacitated submarine. Secondly, in its trademark style of languid functioning, the MoD took six months to float international



Concept drawing of INS Arihant (image from rusnavy.com)



INS Vikrant after launch at Cochin



MiG-29KUB of INAS 303



*INS Sindhurakshak at Portsmouth, UK, where it was berthed on the way to India after its mid-life overhaul*

tenders and select a company to salvage the submarine. It was another four months before the hulk could be raised and bodies of the trapped crew extricated. Lastly, the Russian military-industrial complex has never recovered from collapse of the Soviet Union, and a steep decline in quality control as well as product support is being acutely felt by India's armed forces. This calls for an urgent review of the Navy's heavy reliance on equipment of Soviet/Russian origin.

### **Formal Induction of INS Vikramaditya**

The 44,500 ton former Soviet aircraft-carrying cruiser 'Admiral Flota Sovietskogo Soyuza Sergei Gorshkov', was re-commissioned in Severdovinsk on 16 November 2013 as INS *Vikramaditya*, and arrived in its home-port, Karwar in January 2014. The extensively re-designed ship started an intensive 'work-up' programme for its crew as well as squadrons of MiG-29K and Kamov Ka-31 that form her air-group.

The ship was formally inducted into the IN by PM Narendra Modi on 14 June 2014 - a mere 19 days after his taking over as Prime Minister. This was a gesture that not only focused limelight on the IN and its newly anointed Chief, but also sent out a number of significant signals.

Domestically, the PM's 'day at sea' was a message of reassurance for his countrymen that national security was going to be accorded the priority that it deserves. To external observers, the PM's presence on the Navy's latest and most modern warship was a reminder that the IN, an influence for regional peace and stability, could also be a

powerful policy tool. This visit also served to boost the morale of the IN which had recently received rough treatment at the hands of an intrusive media.



*INS Vikramaditya is now the flagship of India's Navy*

### **INS Kolkata**

The commissioning of INS *Kolkata* in Mazagon Docks Ltd (MDL) Mumbai, again by PM Narendra Modi, on 16 August 2014 marked an event of considerable significance, both for the IN as well as the nation. So far, the largest Indian-built warship to join the

navy, the size, firepower and advanced technologies incorporated in this 7,500-ton guided-missile destroyer make it a formidable weapon platform. What places the *Kolkata* many notches above most of its contemporaries is the advanced multi-function radar embedded in its mast and a long-range surface-to-air missile (LR-SAM) to be delivered shortly, both being the fruits of a joint Indo-Israeli venture.

This event adds another feather in the cap of DND, which has earlier designed ships of the *Vikrant*, *Delhi* and *Shivalik* classes. *Kolkata*'s design incorporates 'stealth' features, which render it difficult to detect by radar, infra-red or acoustic sensors. Mention also needs to be made of the Navy's unique Weapon and Electronic Systems Engineering Establishment (WESEE), which undertook the herculean task of integrating the concoction of Russian, Israeli, Dutch, French, Italian, and Indian systems which went into this ship.

Mazagon Docks deserves credit for having skilfully built modern warships and submarines for the IN for the past half-century. However, it must be noted that every MDL project has been dogged by huge time delays (*Kolkata* took eleven years to build) and embarrassing cost overruns, which have had an adverse impact on the Navy's force levels and fiscal planning.

## Serial accidents

The issue that demands close scrutiny of the naval staff at this juncture is the putative 'chain of accidents' that has served to dent the Navy's image during the past year. One could pose the question: "is the Navy professionally deficient or merely maladroit in its public relations?" But as this discussion shows, the answer is not so simple.

Of the dozen or so 'accidents' cited, only two involved loss of life on board submarines, and warranted a thorough probe and follow-up action. The remainder were of relatively trivial nature - collisions, groundings and minor fires - that happen in all active seagoing Services. Navies that have zero accidents are the ones that stay put in harbour. There being no common thread running through them, the episodes were dealt with by the Service in the customary manner. In any other country they may have rated passing mention, but India's ill-informed, sensation-hungry and predatory media decided to project each incident as a disaster of Titanic proportions.

The media also tried to convey the impression that the IN was operating 'old ships' and 'leaky submarines' that hazarded their crews. All Navies nurture their warships so they can squeeze the maximum life out of them. The USS *Enterprise* retired in 2012 after 52 years of service and our own INS *Viraat* will be close to 60 when she is finally decommissioned. By any standards, our naval fleet is relatively young; with a large proportion of modern and newly constructed ships, some approaching middle age and others nearing their stipulated retirement age.

Whether new or old, it is the responsibility of naval Commanders to ensure that no warship is deployed unless it meets stringent requirements of safety and seaworthiness as well as crew competence. In this context, the accidents on two Soviet-era *Kilo*-class submarines call into question, not only Russian workmanship, but also our own operating and maintenance procedures.

Since 2008, the Navy's operational tempo has mounted steadily on account of overseas deployments, anti-piracy patrols, tactical exercises and acceptance, by the IN, of 'brown-water' or coastal security commitments. If this has brought excessive strain on personnel as well as ships and machinery, it is, again, the responsibility of Naval Commanders to ensure that commitments remain commensurate with



INS *Viraat* at sea with replenishment tanker and escort

resources and unwarranted pressures are not imposed on men and machines, nor are safety norms violated.

## The Chief's resignation

A crisis had begun to brew towards mid-2013 with the *Sindhurakshak* explosion, and the straw that broke the camel's back seems to have been provided by an incident of fire on board the submarine *Sindhuratna*, at sea, on 26 February 2014; resulting in the death of two officers. The sustained, and somewhat hysterical, media blitz, seen by many as motivated, now reached a crescendo and drove a despondent Admiral DK Joshi, the Naval Chief, to submit his resignation, on grounds of "moral responsibility".

However, the indecent haste with which the resignation was accepted clearly spoke of two facts: (a) that relentless media focus had panicked the MoD and (b) that there was relief on Raisina Hill that a sacrificial lamb had presented itself. Apart from being an indication of the huge chasm between the military and the politico-bureaucratic establishment, this was also a commentary on the moral pusillanimity of the latter. The Navy happens to be an integral component of the MoD and a proactive RM should have authoritatively deflected unfair media criticism of the Service, obviating the necessity of accepting the Chief's resignation.

The final irony lay in the RM's stinging rebuke delivered to assembled Naval Commanders in November 2013, accusing the Navy of "frittering away national

resources." Shri Antony did not pause to think that his indictment was premature and not founded on any facts available, since the formal inquiry was still underway. He also failed to appreciate that by berating the 'Integrated HQ of MoD (Navy)' he was, in fact, castigating the Ministry that he headed.

Tragedy was, thereafter, followed by farce. In a demonstration of complete indifference towards a crucial national security issue, the government allowed the Navy's top post to lie vacant for 50 days before a new Chief's name was announced!

## Tyranny of the bureaucracy

India is being propelled by the combined weight of geo-politics, economics, demographics and military power into regional and international prominence and greater responsibilities are bound to devolve on it. India's 'maritime awakening', however, remains inchoate and having created an expensive and potent maritime force, the political leadership must now acquire the vision and confidence to use it as an effective instrument of state policy.

After many years of precarious existence, the IN stands on reasonably firm ground. Its share of the budgetary 'cake', having slowly but steadily crept up to 18%, will hopefully reach the 25% mark. The new Chief is, no doubt, doing all that he can to restore confidence of his Service and the nation that the IN remains an efficient and combat-ready professional maritime force. He would, by now, have also obtained an authentic evaluation of how operations,



*'Perfect flight' : Sea Harriers of INAS 300 during ceremony at INS Hansa*

maintenance and training are being conducted in the Service and ensured that flaws and inadequacies, wherever found, are being speedily remedied.

Admiral Joshi's resignation, half-way through his term, was a fine ethical gesture and a rarity in India's public life where the concept of 'moral responsibility' has disappeared and, till recently, even convicted criminals clung to office till the bitter end.

Now that Admiral Joshi has made public his angst over serious shortcomings in the MoD, it is incumbent on the new government to address the lacunae in our national security structure. As he pointed out on TV, under current rules the Chief carries the full burden of operational and administrative responsibility for his Service, but lacks standing and authority within the MoD. On the other hand, MoD the bureaucracy is vested with authority for 'defence of India' and the three service HQs, but has zero accountability - especially when things go wrong.

The time and public money spent on Groups of Ministers, Task Forces and Committees will have been wasted if we fail to acknowledge the root of the malaise pinpointed repeatedly by them. *It lies in the flawed policy of subordinating the armed forces, not to political control but, to the tyranny of a lethargic and uninformed civilian bureaucracy.*



*Their 'tail-hooks' neatly tucked in, line up of Indian Navy MiG-29Ks at INS Hansa*

# Herald The Rising Sun!



## ShinMaywa's US-2 Amphibian Aircraft

***Cmdr Sujeet Samaddar (retd) on the paradigm shift in Indo-Japanese defence and industrial cooperation***

After the seminal summit meeting between Prime Minister Modi and Prime Minister Abe on 1 September 2014, it is interesting to record the growing salience of India in Japan's security policies and India's own increasing recognition of Japan's potential as a balancer in the Asian security construct. Commencing from a brief mention in the National Defence Policy Guidelines (NDPG) of 2010 which recognised India's potential for securing 'maritime navigation,' it was the NDPG 2013 which elevated India to amongst the "prominent security players" and noted that Japan will strengthen its relationship with India in a broad range of fields, including maritime security.

Japan has long been a trading nation and is highly dependent upon the seas for its sustenance. Japan recognises the centrality of India in securing its Sea Lines

of Communication (SLOCs) as well as the potential that the Indian economy offers for stimulating Japan's economy through directed trade and investment in India. On its part India too recognises that building a more robust and hardware-driven relationship with Japan would serve India's interest as well. Thus, there is congruence

in the objectives and aspirations of both countries in developing their relationship to a higher plane (pun intended !)

Therefore, it was little surprise that during Prime Minister Abe's visit as Chief Guest for India's Republic Day parade, Prime Minister Manmohan Singh described Japan as being "at the heart of our Look East



## Amphibian aircraft can be tasked for multifarious naval and maritime missions such as

- ▣ Surveillance, reconnaissance, intelligence gathering and on-spot investigation in the EEZ and on the High Seas by landing alongside the potential violator of law or peace
- ▣ Long-range fleet operational logistics support
- ▣ Long-range naval logistic and maintenance support through ferrying of specialised dockyard/aircraft repair yard personnel and spares to a fleet and its aviation elements during overseas deployment
- ▣ Long-range and rapid Visit, Board, Search and Seizure (VBSS) operations on law -breaking seafarers
- ▣ Mainland to distant island and inter island logistic support without need of runways
- ▣ Monitoring, servicing and protection of offshore assets
- ▣ Oceanic Search and Rescue (SAR) and casualty evacuation (CASEVAC) from stricken ships, submarines and oilrigs



- ▣ Controlling of derelicts and abandoned vessels
- ▣ Humanitarian Assistance and Disaster Relief (HADR) operations in the Indian Ocean Region
- ▣ Countering small arms, shoulder launched weapons and drugs trafficking and terrorism at sea
- ▣ Countering illegal human migration
- ▣ Prevention of poaching and illegal fishing
- ▣ Prevention of toxic cargo dumping at sea
- ▣ Anti-piracy missions
- ▣ Support for deep sea mining activities, offshore cable laying and hydrocarbon prospecting
- ▣ Recovery of ditched aircrew at sea

Policy” and emphasised that the partnership between “a strong and economically resurgent Japan and a transforming and rapidly growing India can be an effective force of good for the region and the world.”

It is highly significant that Prime Minister Narendra Modi chose to make his first major overseas tour to Japan and that Japan graciously responded by accommodating the PM’s change of plans. At the Summit meeting of 1 September, the partnership was elevated to a “special strategic and global relationship” and their meeting was declared as the “dawn of a new era in Japan-India relations.” One significant outcome was the emphasis on bolstering trade and investment including high technology programmes in the infrastructure, power and telecommunications sectors.

Of particular significance was the path-breaking and unique defence technology cooperation where the Prime Ministers hailed progress made with discussions in the Joint Working Group (JWG) set up for cooperation on the Shinmaywa US-2 amphibian aircraft programme. The two leaders also directed their officials to commence working level consultations between the two countries with a view to promoting broader defence equipment and technology cooperation.

The US-2 project was also discussed in the last two summit meetings. A Joint Working Group (JWG) to explore modalities for cooperation on the US-2 aircraft has also been formed and several meetings have been held.

The Indian Navy has long had requirement for a multipurpose amphibian aircraft combining high-speed surveillance and prompt response SAR in a single platform. The Japanese US-2 amphibian aircraft, with the shortest take-off and landing performance extant, long radius of operations and highest sea state operations capability, succinctly meets these requirements. The US-2 aircraft selection is supported professionally by the IAF and Coast Guard as well.

The Government of Japan has offered to collaborate with India to undertake a ‘model technology transfer project’ including final assembly and integration, as well as maintenance repair and overhaul of the US-2, along with manufacture of other aerostructure parts, with the aim of building a world class aeronautics industry in the Indian private sector.



### Why an amphibian?

At this juncture, it may be useful to understand the contours of the US-2 amphibian aircraft programme, and indeed the genesis of amphibian aircraft themselves.

Amphibian aircraft made their debut on 28 March 1911 when the Fabre Hydravion took-off from water at Martigues. By end of World War I, amphibians had completed transcontinental flights and in some instances were even refuelled by ships and submarines at sea. Post-1918, amphibian aircraft were at their zenith. After World War II, however, these aircraft lost their charm somewhat, although limited civil and commercial applications

continued. *(The incredible Dornier X flying boat of the 1920s represented, in more ways than one, the inherent potential of such an approach – see box item).*

Modern technological advances have made it possible today for amphibian aircraft to conduct a variety of naval missions ranging from benign to constabulary and even to military operations. Indian Naval Aviation, which formally ‘took off’ at Cochin on 11 May 1953, began operating the Shorts Sealand, an amphibian as its first aircraft. However, the expertise of operating such aircraft was thereafter, lost as the Indian Navy progressed to induct conventional aircraft and soon developed

a carrier-borne capability. With advent of modern technology in amphibian aircraft, it is only natural that Indian Navy has now sought to re-acquire such unique capability, so as to truly realise its ‘blue water’ ambitions.

Amphibian aircraft combine the capabilities of sustained surveillance and prompt response, whether for relief or arrest, in a single platform, such capability being not available on any other type of aircraft. The modern amphibian aircraft can be regarded as a veritable force multiplier since it fulfils a multitude of missions in a single platform. Unlike helicopters and conventional aircraft, amphibian aircraft can land at almost any suitable expanse of water, and unlike ships, amphibians can reach an area of interest far faster, to enforce both the will and the law of the country and thus are a natural platform of choice for benign and constabulary missions.

Amphibian multi-utility cargo and transport aircraft are capable of a variety of missions. Under Article 98 of the United Nations Conventions on the Law of the Seas (UNCLOS), “every coastal State shall promote the establishment, operation and maintenance of an adequate and effective search and rescue service regarding safety on and over the sea and, where circumstances so require, by way of mutual regional arrangements cooperate with neighbouring States for this purpose.” Amphibian aircraft fit this purpose admirably.



As regards piracy, one of the most pressing international problems facing the seafaring community today, as per the United Nations Convention on Law of the Seas (UNCLOS), military aircraft are “entitled to seize (Article 107),” enjoy “right of visit (Article 110)” and “right of hot pursuit (Article 111).” Amphibian aircraft can thus be very useful in conducting anti-piracy missions and efficient, effective and economic policing operations for safe and secure seas. Once the deterrence value of amphibian aircraft is clearly established by conducting a few successful operations that bring culprits to book, the seas will become far safer and more secure in the future and at lesser operating cost.

### Increased Operational Capabilities

In a world frequently challenged by natural disasters such as floods, tsunamis and cyclones, amphibian aircraft can provide rapid relief to a devastated population. Requiring neither runway nor other airfield facilities, modern amphibian aircraft can safely land within a few metres from the coast and relief material and teams can be ferried ashore through integral boats requiring no logistic support from the shore.

Some few recent examples illustrate this: *Typhoon Haiyan* devastated the Philippines, a friendly Asian nation, in November 2013. Amphibian aircraft could have transported Indian relief material/

personnel within hours of occurrence, as no runway or ATC facility would have been required. In the September 2014 floods that ravaged Jammu and Kashmir, the US-2 with its short take off and landing capabilities, using highly sophisticated Boundary Layer Control (BLC) technology, could simply have landed in the Dal lake itself to provide relief material and troops to rapidly alleviate sufferings of the many victims ensnared in the area. Its slow speed, low altitude flight capability could be used for airdropping food, medicines and other stores without loss owed to breakage etc.

Amphibian aircraft can also support remote communities in distant island territories or remote land frontiers, which are in proximity of deep lakes and rivers with logistics and medical support.

Of particular relevance to the Indian Navy, and in fact all Services that operate long range air missions out to sea, whether with long-range maritime reconnaissance (LRMR) aircraft, or carrier-based fighters, or shore-based maritime interdiction and strike aircraft, is the choice of the most suitable aircraft that can conduct near all-weather high speed rescue operations for aircrew who have bailed out over, or ditched, in the sea. Similarly, the rescue of a crew of distressed ships or submarines is faster and surer with amphibian aircraft than by using ships or even helicopters.

Such an asset builds a mighty confidence in the crew that they have a very good chance of recovery even at sea – a capability that does not exist as of now. Additionally, amphibian aircraft may also undertake combat missions. Rapid and precision insertion and extraction of troops along undefended coastlines for covert or force projection operations is an obvious example, and of course landing in the country’s northern lakes to augment the Indian Army’s troops is also intriguing.

However not all amphibian aircraft are suited for such diverse missions. For mission effectiveness the main parameters of performance evaluation would be rough sea operations, range, payload, STOL capabilities, shallow water operations and beaching ability. Of these, rough sea operations are paramount for India. According to a study only about 60 per cent of all waves are below 1.2 m in height, but 96 per cent of all waves likely to be encountered are below 3 m in height. Amphibian aircraft must therefore, by design, have full operational capability to undertake maritime missions in wave heights of 3m as a norm so as to be available for missions at all times. Their range must be adequate to conduct missions into the Malacca Straits off the eastern seaboard and the Gulf of Aden off the western seaboard.

For disaster relief operations, an amphibian aircraft must have capacity for



onboard first aid, a sick bay for multiple patients and commensurate rescue gear. STOL features and shallow water operations must permit landing in busy waterways, possible riverine/high altitude lake operations as well as in open oceans. Low stalling speed would enable better observation of the target area to search for casualties swept away in cyclones or tsunamis. Payloads would vary with the mission but should be sufficient to carry up to a platoon strength of rescue personnel together with disaster relief material. In addition, amphibian aircraft should be able to land in the rivers and lakes of distant parts of the country and on short runways to support the local population. Total transportation capability should allow force commanders to put ashore a battalion-strength load of personnel to make mission planning truly versatile.

It is for these qualitative requirements for the successful conduct of a wide range of amphibian operations that the Shinmaywa US-2 remains the best available option. The operational benefits can be summarised as “allowing deterrence through ability to conduct quick action at sea ; catapult India as a lead nation for ensuring maritime safety and security in the IOR through long range surveillance and rapid response by a multi-role, all-weather high speed platform ; promote regional stability through enhanced strategic mobility for rapid intervention within IOR states when required/requested at the regional level ; give operational flexibility in long range sustained naval/military operations and support air operations of the IAF in the area of influence; provide focused logistics support through tactical transportation in the immediate area of interest ; support island territories and offshore assets, which have no airfields ; and even is undertake inland river or lake troop transport operations in remote and mountainous areas adjacent to northern borders.”

### Defence Industrial implications

From a defence-industrial perspective, the immediate opportunity for meaningful collaboration is for India to team with Japan for the co-production of the US-2 amphibian aircraft, which would bring contemporary aerospace manufacturing knowhow and expertise into India. In addition, India could also explore partnering with Japan for

co-production of the Kawasaki C-2 military cargo aircraft and perhaps the P-1 maritime patrol aircraft. There is substantial demand for these two aircraft types, both locally and globally, to make a viable business case with equitable sharing of costs and work share between the partners. India could also consider partnering with Japan and the US for the F-35 programme, which could well be considered as a fighter aircraft for the future aircraft carrier and explore the possibility of manufacturing F-35 parts in India.

Another opportunity lies in the recent RFI issued by the IAF for Intermediate Jet Trainer aircraft for which the Kawasaki T-4 may be found suitable. There is also strong partnership potential with the Kawasaki OH-1 helicopter, which could be a contender for the large number of light helicopters required by the Indian military. Thus, jointly participating in these five programmes — US-2, C-2, P-1, OH-1 and T-4 could dramatically transform the Indian domestic aerospace industry, particularly in the private sector. These platforms also have international appeal and possible exports to third countries as per mutually agreed norms could reduce the financial burden on both countries.

Such initiatives would not only build the Indian defence industrial complex but also go a long way to provide a fitting balance to China’s participation in the Pakistan Defence Industrial Complex. China’s arms exports in 2008-2012 grew by 162% compared to the previous five years, with the majority — about 55% — going to Pakistan. Most notably China has co-built F-22P (*Zulfiqar*-class) frigates, JF-17 Thunder fighter aircraft, patrol boats, guns, radars and other military equipment in Pakistan. In the near future, China and Pakistan would logically cooperate to manufacture next generation fighter aircraft such as the J-20 or J-31 currently under flight testing. Considering that the JF-17 has already attracted numerous potential operators in Asia and elsewhere, the future fighters may also reap similar success. This has grave implications on India’s security since Chinese arms sales to Pakistan are outside the international norms of embargo in delicate periods of conflict. Similarly, China has also participated, in similar if not greater measure, in building up the North Korean arms industry, which poses a grave and viable threat to Japan’s security.

Thus, such industrial benefits to India would include transfer of high technology aircraft and its parts manufacturing including a capability for final assembly, integration, testing and delivery of aircraft to India at no additional cost ; make India a global manufacturing and sourcing hub in aeronautics, particularly high-end aerostructures leveraging the Japanese supply chain ; generate large number of high skill jobs in the manufacturing sector; create a high technology aeronautics SME cluster ; conduct world-class primary research and establish lab and testing facilities in India ; Japanese industry are also potential collaborators for joint co-design, co-development and co-production of the proposed Indian Regional Transport Aircraft (IRTA).

From a financial perspective Indian collaboration can yield significant revenues for India. Assuming that the programme cost for the acquisition of 18 US-2 aircraft, maybe about US \$3 billion over a period of about seven years, the offset benefit alone to Indian industry would be about US \$ 900 million. It is known that the global demand for the US-2 is sizeable and several countries are watching the progress of industrial collaboration of the US-2 programme in India. Potential third party exports of US-2 aircraft under ‘Make in India’ could generate further earnings of US \$ 9-10 billion over a period of about 15 years. Interestingly, once expertise from co-production has been applied in India and indigenous private firms join global supply chains, exports of aero structures for commercial aircraft may yield annual steady state revenues of about US\$ 200-300 million. It is also possible that final discussions may influence other defence industrial collaboration projects to the mutual benefit of both countries.

Thus, for an India aspiring to regional power status, its Navy must not only be able to address the immediate security needs of the country and counter enemies of the state, but also be able to contribute in benign, constabulary and diplomatic operations in its area of interest and influence for the greater regional good. From a maritime perspective this power status contributes to burden sharing towards protection of global public goods and the oceanic commons to achieve firstly, freedom of navigation and safety at sea; secondly, promote regional stability through an open and participative security

architecture; thirdly, proactively alleviate suffering during disasters in the littorals of friendly nations: and, finally a constabulary capacity to maintain order at sea for the common good of the region. Whilst ships, submarines and aircraft are all qualified in some manner or the other for fulfilling the above missions each of these platforms are also limited by some capability gap or the other. Modern amphibian aircraft make possible a range of speedy options not achievable singly by either a ship or aircraft. Its unique multi-modal design permits airborne, seaborne and land operations in a single platform and thus is a highly effective force multiplier for the Indian Armed Forces and the Coast Guard.

The transfer of technology for ShinMaywa's US-2 would provide an unprecedented fillip to the Indian aeronautics industry, which in turn would reap rich financial dividends through third parts aircraft sales and exports of aero structures parts.

In the macro or strategic context, Japan-India strategic defence and security cooperation is an eminently laudable and a timely initiative. Together with the agreement to hold US-Japan-India trilateral dialogues and naval exercises off Japan later in 2014, the US-2 partnering for co-production in India would be a transformational and game changing epoch in the history of bilateral relations. Such a solid bedrock of a well calibrated and nuanced approach towards co-production of benign military products such as the US-2, would be basis of an incremental advance of capability spectrum for more hardware intensive aero space projects.

Multinational cooperation in this sphere could indeed be the defining a paradigm shift in the 'special' strategic partnership between India and Japan which bodes well not only for these two countries, but for all of Asia - and indeed the world.

## The Do X : Mother of all Amphibians

The Dornier Do X seaplane was conceived by Dr Claude Dornier in 1924, with detailed planning commencing in late 1925. The gargantuan aircraft took over 240,000 man-hours until it was completed in June 1929. At the time of its introduction it was the largest, heaviest, and most powerful flying boat in the world.

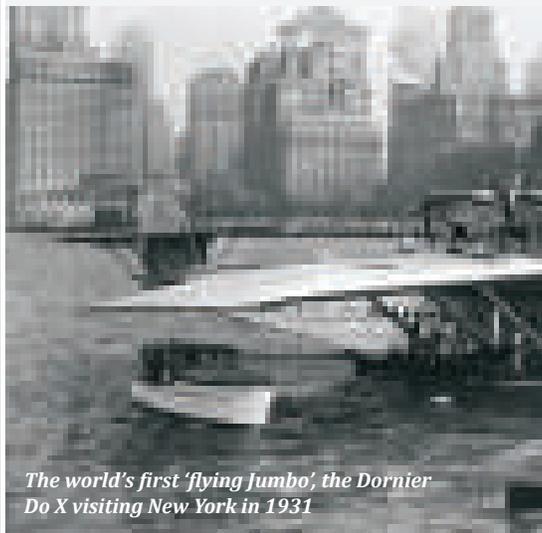
The Do X had a duralumin hull with a wing composed of a steel-reinforced duralumin framework wrapped in heavy linen fabric, covered with aluminium paint. The lower deck was constructed from nine watertight compartments, only seven of which were needed to provide full flotation.

It was initially powered by six pairs of 524 hp Siemens-built Bristol Jupiter radial engines in push-pull configuration, mounted in nacelles above the wing. The air-cooled Jupiter engines were unable to provide enough power to propel the aircraft above an altitude of 425 m (1,400 ft), so after completing over 100 flights between 1929-30, the Do X was refitted with twelve 610 hp Curtiss V-1570 'Conqueror' water-cooled 12-cylinder inline engines. The new engines enabled the giant seaplane to fly at 500 m (1,650 ft), a height necessary for transatlantic flights.

Dornier designed the flying boat to carry 66 passengers in luxurious comfort on long-distance flights or 100 passengers on short flights. The long-distance passenger accommodation approached the standards of transatlantic liners, incorporating a bar and smoking room on the main deck, a dining salon, and seating for the 66 passengers which could also be converted to sleeping berths for night flights. At the aft portion of the Do X were an all-electric galley, lavatories, and cargo hold. The cockpit, navigational office, engine control and radio rooms were on the upper deck.

The aircraft was launched for its first test flight on 12 July 1929, with a crew of 14. On its 70th test flight on 21 October that same year, the seaplane took off with 169 people on board setting a new world record for the number of persons carried on a single flight, a record that stood unbroken for 20 years !

The Do X was not a commercial success, however, and a botched landing near the city of Passau in Bavaria in 1933 tore the empennage off before the aircraft could begin its passenger-carrying career with Deutsche Luft Hansa. Instead, it was repaired and relegated to the *Deutsche Luftfahrt-Sammlung* aviation museum in Berlin. It remained on exhibit in Berlin until November 1943, when it was destroyed in an RAF air raid on the city.



The world's first 'flying Jumbo', the Dornier Do X visiting New York in 1931

# Project 75-India



Nuclear-powered Akula-class attack submarine INS 'Chakra' at sea

## Submarine scramble in the subcontinent

The Indian programme to acquire six Project 75I conventional submarines is a major milestone for the Indian Navy, the Indian shipbuilding industry, as also the global market for submarines. Predictably, the entire global submarine industry is eagerly awaiting release of the formal Request for Proposal (RFP) by the Indian Defence Ministry under the P-75I programme. The Indian government's decision to have all six of these boats built at India's own shipyards has made the issue of technology transfer critical for the success of that programme. This has certainly forced analysts to rethink possible proposals by international suppliers, including Russian ones.

### The Russian involvement

Russia's eagerness to secure involvement in the Project 75I programme is absolutely understandable. Moscow played a major role in the creation of India's submarine fleet; in the 1960s and 1970s it supplied

the first eight Indian submarines (Project I641K, *Foxtrot*-class). Later on, in the 1980s and 1990s, India bought 10 Project 877EKM (*Kilo*-class) boats from the Soviet Union and Russia. These boats form the core of the Indian submarine fleet to this day.

In the 2000s India launched a major programme of upgrading its Project 877EKM submarines at Russian and Indian shipyards. As part of that programme, the Indian boats were first in the world to be armed with the unique Russian *Klub-S* missile system, which consists of two-stage supersonic anti-ship missiles and subsonic cruise missiles for destroying surface targets.

The depth of Russian-Indian partnership in submarine building is demonstrated by the two countries' unprecedented cooperation in the segment of nuclear submarines. Moscow has supplied two nuclear subs to India under long-term lease arrangements, including one Project 670 (*Charlie I*-class) boat, which was delivered in

1987 and returned in 1991, and one Project 971I boat (Improved *Akula I*-class), which was delivered in 2012 under a deal signed in 2004. India's lease of Russian nuclear submarines is unprecedented; there are no other examples of such close international defence cooperation. It demonstrates Russia's willingness to share its most critical, strategically important, and extremely sensitive defence technologies with India.

### The French offer

France's DCNS shipbuilding concern will participate in the Indian P-75I tender with yet another iteration of its *Scorpene*-class submarine. Six such boats are already being built under a 2005 contract with DCNS at the Mazagon Dock Limited shipyard in Mumbai. The French offer to build another six *Scorpene* submarines under the Project 75I programme would therefore appear to have the greatest chances of success, were it not for the issues being faced by the deal signed in 2005.



A Korean Navy Type 214 submarine undergoing trials

From publicly available information, it is understood that India is facing numerous problems with the *Scorpene* project, with construction of the *Scorpene* boats running behind schedule and over budget. Under terms of the original contract, all six submarines were to be delivered to the Indian Navy in 2012-2016, but delivery of the first boat has now been postponed until 2016-2017, and the last of the remaining five will probably happen by 2022.

For India, placing an order for another six *Scorpene* submarines under Project 75I would mean putting all its eggs in one basket. Furthermore, such a decision would delay the delivery of boats under the Project 75I programme until 2030 or even later. That would have obvious and very negative implications for the capability of the Indian submarine fleet.

However, the French bid for the Project 75I tender has one clear advantage, namely a high degree of compatibility between the AIP-equipped *Scorpene* boats with the submarines of the same type that are already being built in India.

French shipbuilders have a reputation for always trying to use “purely French” naval technology and weapons solutions. This leaves the customer with a limited range of options, and makes them dependent on French suppliers of subsystems, parts and components. While DCNS has declared its willingness to integrate technology from other suppliers (including Russian) into the design of its boats, the company has little experience of such integration in practice.

Another issue with the French offer is uncertainty over the AIP systems for future versions of the *Scorpene*. Until now, DCNS has been marketing its original AIP system,

the MESMA, which is a steam turbine setup that burns ethanol or diesel fuel in a closed circuit. So far, only Pakistan has shown interest in the MESMA; this system is used in three French-built *Agosta 90* submarines operated by the Pakistan Navy. MESMA’s chances of winning new customers now look slim, and DCNS has already begun to market a replacement, which it describes as a “second-generation AIP system” based on the conversion of diesel fuel into hydrogen. This is in fact the same solution that is used in Russian and Indian systems. The new French AIP technology, however, is still in the early development stages, and it is not clear when it might be ready.

### The German boats

Germany’s ThyssenKrupp Marine Systems (TKMS) will bid for the Indian P-75I contract with Type 212A or Type 214 conventional submarines (or perhaps with a more recent design, such as Type 218) developed by its Howaldtswerke-Deutsche Werft (HDW) subsidiary. The Indian Navy already has some experience of operating German submarines. In the 1980s and early 1990s it received four Type 209/1500 boats, two of which were built by HDW and another two by Mazagon Dock Limited in Mumbai under licence.

The German offer clearly looks strong as it is based on HDW’s formidable expertise and an impressive list of customers operating Type 212A and Type 214 boats all over the world. One of the advantages of German submarines is the tried and tested AIP system used in Type 212A and Type 214 boats. Developed by Siemens, the German AIP technology relies on electrochemical generators that use hydrogen-oxygen fuel cells.

The downside is that German submarines are not equipped with long-range missile systems, and integrating such systems from other suppliers (such as Russia’s *Klub* or India’s own BrahMos) would probably be difficult for political reasons. Germany has strict arms export control legislation and several influential political groups that advocate even more stringent controls, on political and moral grounds. For a country such as India, buying German weapons systems, including submarines, would therefore be fairly risky for political reasons. When dealing with German arms suppliers, the likelihood of falling foul of various export restrictions or sanctions is greater than for any other arms exporter in the world. That creates obvious risks, especially for such a long-term project as P-75I, which is expected to take at least 15 years to implement.

Yet another downside is that German submarines probably have a far higher price tag and are more expensive to operate than the rival offers. That is especially true of the boats that use the Siemens-type, fuel cell-based AIP system, which has very high running costs. In essence, India will have to build an expensive and vulnerable chemical plant to keep its new submarines reliably supplied with fuel cells. Finally, the Siemens AIP technology has extremely stringent requirements in terms of the organisation and training of submarine and support personnel. In practical terms, that technology is compatible only with German industrial and military culture, and may not be suited for real-world use during a lengthy conflict.

### The Amur Project

Russia is bidding for the Indian P-75I contract with its very latest conventional submarine type, the *Amur*-class. This is an export designation of the Project 677 (*Lada*-class) submarine developed by the Rubin design bureau. Project 677 is described in Russia as a “4th generation non-nuclear submarine.” Work on this programme began in the 1980s; the boats were conceived as a universal replacement for the Soviet Navy’s 3rd-generation Project 877 (*Kilo*-class) submarines. The break-up of the Soviet Union and the ensuing recession in Russia caused major delays with the project and the construction of the first Project 677 boat *Saint Petersburg*. Economic problems in the 1990s also forced the developers to test several radically new systems directly on the first sub in the series (i.e. *Saint Petersburg*), rather than special experimental

boats. The *Saint Petersburg* essentially served as an experimental platform during its first several years in operation, with continuous sea trials conducted since 2004.

That approach, however, was not entirely without merit, and such a lengthy period of sea trials has enabled the developers to polish all the key Project 677 systems and components. All the teething problems have now been sorted out, and the boat is ready for mass production. In 2013-14 the Russian Navy signed contracts with the Admiralty Shipyards in St Petersburg to finish two Project 677 submarines that were laid down several years ago but then mothballed. The first of the two, the *Kronstadt*, should be launched by late 2015. Several more Project 677 boats will be built for the Russian Navy in the coming years.

The *Amur* (and its basic modification, the *Amur-1650*) is significantly smaller and more compact than the *Kilo*-class boats, but superior to them in every single respect. Its main advantages include a very powerful but highly economical main AC electric motor (this is the same advanced technology that is used in the Permasyn motors on Germany's latest Project 212A boats). The *Amur* also boasts very high-performance electronic systems, including the latest sonar complex, a highly automated combat control system, and electro-optical periscope masts. These are the very latest submarine technologies, and Russia is willing to transfer them to India.

### **Lada-class submarines**

Yet another strong advantage of the *Amur* boats is the tried and tested Klub-S missile complex which is already used on India's 877EKM *Kilo*-class boats. Besides, the *Amur* can be additionally equipped with vertical launchers for India's powerful supersonic BrahMos missile. The *Amur* can accommodate both the anti-ship and land-attack variants of the BrahMos. If the Indian Navy chooses the *Amur*, it will be able to carry on using the same missile system that is already used on the *Kilo*-class boats. India will also avoid dependence on foreign suppliers of missile systems if it opts for the submarine-launched modification of the BrahMos as the main weapon of its new submarines.

The options that can be installed on the *Amur* boats include AIP systems of both Russian and Indian design. The Russian AIP system is now in the final stages of development at the Rubin design bureau. Large-scale trials of that system



*A Scorpene-class submarine seen surfaced and underway*

are scheduled for 2015, and it will be commercially available by the time the Project 75I submarines are laid down. The *Amur* can also be integrated with Indian AIP technology. The Russian and Indian AIP systems both rely on generating hydrogen on the submarine from standard diesel fuel. This approach is radically different from the German technology, which requires submarines to carry a stock of special chemical reagents to generate hydrogen. The similarity of Russian and Indian AIP technology makes it relatively easy to integrate an Indian AIP system with Russia's *Amur* submarine design. What is more, the Russian and Indian AIP systems can use each other as a fallback option in case of unexpected technological problems emerging with either one of these systems.

Now that Russia's Project 677 (*Amur*) submarine programme has reached technological and commercial maturity, Russia is energetically marketing these boats to foreign customers, and several have already expressed great interest. One of them is China, even though that country appears to have made great progress in building its own nuclear and diesel-electric submarines. This is an indication that the *Amur* represents a pinnacle of truly advanced technologies, which the Chinese have so far been unable to acquire.

Finally, Russia has a fundamental advantage over other bidders for the Indian contract because it essentially offers a *joint project*. In fact, the proposal could best be described as Russian participation in an Indian project. What Russia proposes is to design a submarine tailored to specific Indian requirements and using advanced but mature technologies. The vessels will then be built in India itself. The industrial cooperation infrastructure for such a joint

programme is already in place. The Russian bid for the Project 75I tender is very similar to the programme under which Su-30MKI fighters are being built in India; that aircraft was designed by the Sukhoi design bureau to meet specific Indian requirements. Some of its key elements, such as the phased array radar, the thrust vectoring engine, and the integrated triplane airframe had already been developed, but their mass production had yet to begin. With professionalism of the Indian Air Force's technical team, the Indian Air Force deliberately accepted a certain degree of technical risks. That decision has paid off, and resulted in the acquisition of a highly advanced aviation complex that still remains relevant, even though its technical outlines emerged almost 20 years ago. A very precise and delicate balance was found between a strong innovation impulse received by the Indian and Russian aerospace industries, and the feasibility and practicality of new technological solutions. All of this bears striking resemblance to the current situation with the *Amur* submarines. Some of its key systems, including the AIP system, the permanent magnet motor, the sonar station, and the combat information and control system are currently at about the same stage of technological maturity as the active phased array radar and the thrust-vectoring engines were when work began on the Su-30MKI.

### **Decisive factors**

The Russian bid for India's Project 75I contract appears very attractive. Russia is offering a highly advanced submarine, which the Indians will find easy to operate because of their prior experience with Soviet and Russian submarine technology. The new Russian boats will be operated in an already "Russianised" environment, with familiar principles of operation and



*'Lada'-class submarine 'Saint Petersburg'*

maintenance, a tried and tested personnel training programme, a well-established support infrastructure, and the availability of repair and maintenance technicians and facilities.

Price wise, the Russian bid will almost certainly have an advantage over any rival Western offers. The same can be said about operational reliability. The main advantage of the Russian offer, however, is Russia's willingness to transfer technologies, including those of the most advanced and sensitive nature. That willingness has already been amply demonstrated by such joint programmes as the FGFA and the BrahMos missile, as well as Russia's decision to supply long-range *Klub* missile complex and nuclear submarines (which is completely unheard of by international standards). In many important areas, Western rivals either lack similar technologies, or are unwilling/unable to share them effectively with India.

Another important factor to consider is that Russian submarine designers and suppliers have already well-established contacts with the Indian Navy and Indian industry because the Indians have a long record of operating Soviet and Russian submarines. Those contacts were further strengthened during the programmes of repairing and upgrading India's *Kilo*-class boats. Indian systems are already being installed on the Indian Navy's upgraded *Kilo* submarines, and there are well-established contacts with Indian suppliers of other components. All of that will make it possible to secure heavy involvement of Indian suppliers and subcontractors in building Russian-designed submarines at Indian shipyards under the P-75I programme.

Finally, the Russian offer has a crucial advantage in the form of the powerful *Klub-S* missile complex and the ability to

accommodate the BrahMos missiles. These weapons systems are highly capable against surface targets at long range.

There is still a lot of uncertainty as to whether the Indian Navy will want the Project 75I boats to be equipped with an air-independent propulsion system, and if so, what kind of AIP technology it would prefer. This issue could potentially cause major new delays with the entire Indian programme of acquiring new submarines. The Indian Navy has no experience of operating AIP systems, even in trial mode, and it appears to be at a crossroads in that regard.

The world's navies that already operate AIP submarines appear to have become somewhat disillusioned by their practical experience with that technology. The running costs of such boats are extremely high because they require expensive consumables. The AIP machinery is very complex, temperamental and potentially unsafe; it also requires highly qualified, specially trained and very well-paid (i.e. expensive) personnel. Meanwhile, the payoff of such systems in terms of the submarine's performance does not appear very significant at this stage.

To illustrate, the Japanese Navy has recently announced that its next generation of large non-nuclear submarines will not rely on licensed Swedish AIP technology based on Stirling engine technology. They now however, believe, that it would make more sense to use high-capacity lithium-ion batteries on their new large ocean-going conventional submarines because that will result in a more substantial performance improvement.

Russia is also developing new high-capacity lithium-ion batteries for submarines. An experimental set of such batteries will be installed on the second Project 677 boat, the *Kronstadt*. If India

opts for the export version of Project 677, it may well secure access to the results of that R&D project.

The Indian Navy will have to decide whether it wants its new Project 75I submarines to be equipped with AIP systems, in view of the implications for deadlines, cost, and payoff in terms of performance. That decision will in many ways determine India's choice of submarine design for its Project 75I programme. The question of whether the Indian Navy should opt for an expensive AIP submarine is all the more relevant since India is also pressing ahead with a nuclear submarine programme. Clearly, any nuclear-powered boat will always outperform any non-nuclear submarine, regardless of the use of AIP technology.

India has made a fundamentally important decision to have all six of the Project 75I submarines built at its own shipyards. That decision entails more stringent and specific requirements in terms of properly localising the chosen submarine design and partnership between the developer and Indian industry. Another issue that will have to be looked at very closely is whether the offset requirements for the Project 75I contract are effective and realistic.

Based on what we know about the Indian Navy's combat strategies and tactics at sea, we believe that the most important requirement for India's future non-nuclear submarine is for the boat to be armed with a highly capable and multirole missile suite, with as many ammunition rounds (i.e. missiles) as possible. That should be the decisive factor in choosing the best submarine design for Project 75I.

**Konstantin Makienko**

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*Centre for Analysis of Strategies and Technologies (CAST, Moscow)*

# “Make in India !”

**VAYU** Interview with

## Mr. Alexey Rakhmanov, President of United Shipbuilding Corporation



**VAYU** : *The Indian Navy's Project 75(I) RFP for six AIP-equipped submarines is set to be issued shortly, with all six submarines to be built in Indian yards. Is USC amenable to a contract that involves the bulk of shipbuilding to be done in India? Which vessel will you be offering to meet the Indian Navy's requirements?*

**AR**: We understand the national 'Make in India' programme by Prime Minister Narendra Modi and are willing to participate in its realisation within the framework of Project 75(I). While making preparations for the announcement of the RFP, we held discussions with Indian manufacturers and jointly established production cooperation. I will take the liberty to highlight two systems. The heads of India's Naval Materials Research Laboratory (NMRL) and Rubin design bureau, our subsidiary company, exchanged information on the progress of AIP development in India and Russia and found that AIPs of both countries have common technological solutions. Specialists of

Rubin design bureau have also met the new BrahMos Aerospace CEO and MD, Mr Sudhir Kumar Mishra, and confirmed that if the Indian side deems it appropriate, the Indo-Russian missile BrahMos, which has already demonstrated its underwater launch ability, could be integrated into the Russian platform.

As to our experience of cooperation with Indian Industry, eleven systems of Indian origin including sonar, communication facilities, radar, and ESM were installed aboard Indian 877EKM (*Kilo-class*) submarines in the course of their modernisation. Indian systems have been integrated into the aircraft carrier INS *Vikramaditya* as well.

As far as we know, it has been decided by the Indian Government that private Indian shipyards can participate in Project 75(I); we know that these yards possess rather high technology, so we would be glad to gain experience by working together. The specific nature of Russian naval shipbuilding is such that design bureaus and shipyards are separate; therefore Russian designers are able

to interact with any shipyard of appropriate capabilities.

USC is ready to construct all six ships in India under the terms of the Indian MoD but, in our opinion, this will create certain difficulties for a local shipyard, which may result in increase of the cost of the project and delay its implementation. Issues related to subcontractors, adjustment of equipment which inevitably emerge during construction of the lead ship can be resolved in more effective manner at sites where the designer's office is located and at a shipyard which is capable to work with the lead ship. Therefore, we would recommend that India construct the lead ship in the country where the winner of the tender is based, and five follow-on submarines in India after preliminary training of Indian specialists.

However, in case the Indian Navy insists on the construction of all six submarines in India, we are certainly ready to meet this requirement within the timeframes that will suit the customer.



The 'Lada'-class (lead boat St Petersburg seen here) will form the basis of USC's 'Amur'-1650 design for the P-75I requirement

As for our proposal for Project 75(I), it is the fourth generation conventional submarine Amur-1650, an export modification of the *Lada*-class submarine designed for the Russian Ministry of Defence, equipped with AIP (air independent propulsion). Since 2010, the lead ship has been in operation in the Russian Navy and two follow-on

the third has passed sea trials and will fly a Russian Navy flag by the end of 2014. Sevsmash has to construct five more *Borey*-class ships, two of which are already under construction, with a third keel to be laid down in December 2014 followed by two more in 2015.

In addition, a series of fast-attack nuclear submarines of the *Yasen*-class and modernised



'Borey'-class ballistic missile submarine 'Vladimir Monomakh' at sea (photo: USC)

submarines are under construction at the Admiralty Shipyards in Saint Petersburg. This means they are proven vessels being ordered by the Russian Navy, and that is why we offer them with confidence to foreign customers. Rubin design bureau, responsible for the *Lada*-class design, is a world leader in submarine design. The company traces its history back to 1901, and over eight hundred conventional submarines have been built to the designs developed by Rubin.

**VAYU** : *The Russian submarine industry is presently in a period of impressive growth. Could you share details on some of the key programmes currently underway?*

**AR**: The Russian MoD is behind large-scale tasks for the renewal of the Russian Navy. At Sevsmash shipyard, where INS *Vikramaditya* underwent refit and modernisation, a series of nuclear strategic missile submarines of the *Borey*-class are being constructed. The Navy has already commissioned two of these vessels, and

*Yasen*-class are under construction at Sevsmash. Their multi-purpose strike system includes cruise missile vertical launchers and torpedo tubes, allowing weapons of various purposes to be used from the same launchers and torpedo tubes without modification.

If we consider the non-nuclear submarines, six ships of the improved *Kilo*-class (Project 636) will be delivered to the Russian Black Sea Fleet by the end of 2016. Following these, the second series of conventional submarines ordered by the Russian Navy are the next generation *Lada*-class boats. Owing to the improved stealth and higher armament capability over Project 636, *Lada*-class submarines are more suitable for the Russian strategic fleets – Northern and Pacific. Rubin is presently working on installation of air-independent propulsion (AIP) and lithium-ion batteries on non-nuclear submarines – these activities are carried out as per a schedule approved by the Russian MoD and will ensure the a significant increase of combat effectiveness of AIP-equipped submarines.

**VAYU** : *Warranty period of the aircraft carrier INS Vikramaditya expires on 16 November 2014. How will the Russian industry provide the support during operation of the ship operation in the future?*

**AR**: Long before the delivery of INS *Vikramaditya*, Sevsmash shipyard and Nevskoe design bureau had proposed long-term cooperation in maintaining technical availability of the aircraft carrier during its operation. They possess the necessary specialists, experience, and established joint contacts for this. In 2014, the aircraft carrier has been mainly at sea, the systems, including the air-technical complex, are working normally. The commissioning CO, Commodore Suraj Berry, was pleased to inform Nevskoe design bureau CEO Sergei Vlasov that the carrier's manoeuvrability is not worse than that of a comparatively small Project 11356 (*Talwar*-class) frigate.

In future, routine service work which is supposed to be carried out every year will be performed in accordance with a service contract. For example, against a guarantee, Sevsmash had replaced a special non-slip coating on the flight deck. In order to provide a flight safety it should be replaced once a year. Sevsmash and Nevskoe design bureau value their relationship with the Indian partners highly, and Russian specialists are ready to carry out aircraft carrier service maintenance during its complete life of forty years. I would like to mention that for the time being there is no air defence system on INS *Vikramaditya*. Should the Indian Navy take a decision on the air defence system, then of course Nevskoe design bureau would be prepared to integrate the chosen system with the ship.

I wish to take this opportunity to thank once again all the friends of Russia who played a decisive role in the life of INS *Vikramaditya*. By the joint efforts this project was conducted past all reefs and shoals to the successful completion. Today only five nations – India, China, France, USA and Russia have in their navies the aircraft carriers capable of carrying supersonic aircrafts with conventional takeoff and landing, and the INS *Vikramaditya* air wing can include over 24 multi-mission MiG-29K/KUB fighters.

I would also like to note that Nevskoe design bureau, which was founded in 1931, is the oldest design engineering



'Novorossiysk', the lead Project 636 (Improved Kilo) submarine undergoing sea trials in May 2014 (photo: USC)

company dealing with the large surface ships. It designed the largest surface ships of the Russian Navy including a several Project 1143 aircraft-carrying heavy cruisers of varying designs, Project 1123 anti-submarine helicopter carriers, and large landing craft. India has entrusted Nevskoe design bureau to design a land training complex (SBTF) in Goa and an aviation complex for indigenous aircraft carrier INS *Vikrant*.

**VAYU** : *We have little information about any possible future Russian aircraft carrier programme. Could you please tell us about the prospects of development of a new Russian aircraft carrier?*

**AR** : As early as 2005, officials of the Russian MoD talked about plans for construction of new aircraft carriers: 2-3 ships for replacement of the aircraft-carrying heavy cruiser *Admiral Kuznetsov*. Russian Vice-Premier, Mr Dmitry Rogozin, who is in charge of the military industrial complex, recently stated that construction of aircraft carriers for the Russian Navy is a geopolitical issue. Specialists from the Russian MoD and Nevskoe design bureau are conducting activities to determine the future aircraft carrier configuration. Nevskoe design bureau undertook design studies on light, medium and heavy aircraft carriers for the

Russian Navy, and within a short period of time these works will allow us to proceed to designing an aircraft carrier of the selected type, as soon as a decision is made by the country's leadership.

A related decision has already been taken by Russian MoD: the aircraft carrier *Admiral Kuznetsov* is to come to Sevsmash for refit and deep modernisation.

**VAYU** : *A few years ago, it emerged that Admiral Nakhimov, one of three Soviet-era Kirov-class nuclear battlecruisers, is to be upgraded and returned to service. Is this still under consideration? Could you share some details on the scope of work that would be involved with a project of this magnitude, and the modern systems that will be integrated?*

**AR** : Yes, Sevsmash has a contract with the Russian MoD for refit and modernisation of *Admiral Nakhimov*. After refit and modernisation, the ship should rejoin the Navy in 2018. She will practically become a new vessel and will be in service for another 30-40 years. Repair activities on the cruiser started early 2014, namely dismantling of the large-sized equipment and systems that are to be replaced and repaired. Docking of the ship for undertaking work on the hull is scheduled for this year.

Ship modernisation will be comprehensive, similar to the modernisation of INS *Vikramaditya*: hull repair, replacement



'Admiral Nakhimov' docked at Severodvinsk (photo: Oleg Kuleshov)



The 'Admiral Grigorovich' under construction (photo: Yantar Shipyard)

of radio electronic equipment and weapons. This work is well understood by Sevmash after experience gained from *Vikramaditya*. The ship will be brought back to life and acquire new qualities. Unfortunately, I cannot reveal all the details, except to say

that after modernisation the cruiser *Admiral Nakhimov* will be more capable than the presently operated *Kirov*-class heavy missile nuclear cruiser *Peter the Great*, which is at the moment the heaviest surface ship of the Russian Navy.

**VAYU** : There have been several conflicting reports on a future Russian Navy destroyer programme. Is such a programme under development, and if so, could you share some details on the proposed role of the vessels, their armament, sensors, displacement and likely delivery dates?

**AR**: Yes, the Russian Navy has issued an assignment to create a future destroyer class designated 'Leader' by 2018. Design of the new ship is being developed by specialists of the Northern design bureau, well known in India as developer of Project 11356 (*Talwar*-class) frigates and as a co-designer of Project 15 destroyers (*Delhi*-class) and Project 17 frigates (*Shivalik*-class).

Here we are talking about a multi-purpose ship of large displacement and increased endurance, equipped with attack weapons. The new destroyer is to replace the third generation ships of Projects 956 (*Sovremenny*-class) and 1155 (*Udaloy*-class), which presently constitute the core combat strength of Russian naval forces. The Russian MoD has defined rather wide-ranging tasks and functions, which may include anti-missile and air defence roles. It will therefore be a multi-purpose ship with a variety of strike weapons, good endurance and seakeeping abilities, and large displacement. The Russian Navy is presently deliberating on a suitable power plant for this class: it may be a nuclear plant, which would expand the ship's capabilities, but it could be a gas turbine as well.



Yasen-class submarine 'Severodvinsk' seen during Russia's Navy Day, 27 July 2014 (photo: Oleg Alekseev)

**VAYU** : *The 11356P/M frigate project (Admiral Grigorovich-class) is very similar to the Talwar-class operated by the Indian Navy. What are the key differences between the Indian Talwar-class and the new Russian frigates? When will the first vessel be commissioned?*

**AR**: Yes, these frigates are “kinsfolk” of Project 11356 frigates built at Russian shipyards for the Indian Navy. But despite similar appearances the ships for the Russian Navy differ in weapons and electronic equipment. This is because the first two frigates of the Russian series were laid down later than the Indian ships, in 2010-2011, when the Indian frigates were already under trials and being prepared for delivery. Thus, 11356 P/M Project frigates are carrying ‘Shtil-1’ missiles in 3S90M vertical honeycombed launchers for the first time in domestic shipbuilding history. This allows a reduced time for response to rapidly appearing air threats and enhanced the firing capability. The firing rate is increased six fold as compared to previous Shtil versions, ensuring all-round ship defence. Sea acceptance trials of the lead ship *Admiral Grigorovich* will begin this year.

**VAYU** : *Has the first Admiral Gorshkov-class (Project 22350) multirole frigate been commissioned in the Russian Navy as yet? Can you share a few details on the important features of this class of*

*ships and their differences from the older Krivak-class and Project 11356M vessels?*

**AR**: The lead frigate of the *Admiral Gorshkov* class starts trials now. The next one, named *Admiral Kasatonov*, is at an advanced stage of construction. Until recently the construction of this series had been going more slowly than desired because in the mid-2000s the Russian MoD designated renewal of the submarine fleet as a priority task. But now efforts are concentrated on ensuring security of remote sea areas by surface ship forces, so the ships of Project 22350 are to join the Navy soon. In terms of displacement this class is larger than Project 11356 by almost one thousand tonnes. On board this ship a large amount of modern R&D results are implemented in electronics and weapons, and this equipment shall undergo adequate tests. Therefore for the quickest renewal of the Black Sea fleet the Navy has taken the decision to build six Project 11356 frigates, tested and proved to be effective in training and combat roles.

**VAYU** : *Russia is almost completely reliant on import of Ukrainian gas turbines or critical propulsion components for warships. A number of Indian vessels use similar powerplants. Switching to domestic manufacture of powerplants is expected to take time – a few years at least. How is the Russian Navy planning to maintain serviceability of its*

*Navy ships? Has there been any discussion with the Indian Navy regarding this?*

**AR**: Long before the events in Ukraine, the Russian Government and the military industrial complex were concerned about the issues regarding import substitution in order to become as independent as possible from foreign suppliers. Therefore, back in 2006, state trials were completed for the M90FR engine (producing 27,500 hp) developed by the Turborus firm, of which 40% belonged to the Ukrainian company Zorya–Mashproekt, and the remaining Russian share was divided between NPO Saturn and Avrora, a well-known designer of automated control systems for surface ships. Saturn is known in India as a designer of engines for the Indo-Russian FGFA programme, but it also deals with development of gas-turbine engines for ships. Project 22350 frigates (*Admiral Gorshkov*-class) will be equipped with M90FR engines. These engines, or another type developed by Saturn – M70FRU – can also be installed on Project 11356 frigates, however four of them are required per ship due to less power per engine. The Russian MoD, as a customer of our ships, will take a decision in the near future.

Turborus will carry out warranty service of power plants delivered to India. And, certainly, USC will not leave earlier delivered ships without proper maintenance.



Frigate ‘Admiral Gorshkov’ seen moored at sunset (photo: USC)

# The Albatross' Nest

## Vayu at INS Rajali, home of Indian Navy LRMR

Tucked away near the sleepy hamlet of Arakkonam in the state of Tamil Nadu is a unique military facility. At first glance INS *Rajali* (also referred to as NAS Arakkonam, or simply by its three-letter code, 'ARK') is a verdant paradise, overwhelmingly lush and tranquil, the pervasive still humidity punctuated only by occasional bird calls or the brief chatter of human voices. That is, until the first of four Kuznetsov NK-12 turboprops powering the mammoth Tupolev Tu-142 ('Bear-Foxtrot') long-range maritime reconnaissance (LRMR) aircraft roars to life, shattering all illusions of what life on the base is truly like. These incredible Soviet-era craft loom over even the tallest trees at *Rajali*, and are dwarfed only by the gargantuan hangars built for their maintenance. Even though they now operate alongside a host of other aircraft types at Arakkonam, from diminutive HAL Chetak helicopters to the sleek new Boeing

P-8Is that will ultimately replace them, there is absolutely no question that the Tu-142s of Indian Naval Air Squadron (INAS) 312 *Albatross* are the *raison d'être* for this entire air station.

INS *Rajali* traces its origins back to the Second World War, constructed by Allied forces in 1942 for defence of South India after Imperial Japanese forces had occupied the Andaman Islands along with Burma and most of South East Asia. Among the earliest recorded units to operate from this location was No. 2 Squadron Indian Air Force, flying Westland Lysanders in the air cooperation role under the command of Squadron Leader AM Engineer between May and September 1942. Following the War, however, the airfield fell into disuse, although it remained nominally under control of the Indian Air Force.

The early 1980s brought about a possible revival at Arakkonam, with the Navy considering it as an eastern base

for its maritime patrol aircraft. Ilyushin Il-38s had already entered service at Goa in 1977 and talks were on for acquisition of the much larger Tupolev Tu-142. While Goa was to be the initial home for these Soviet behemoths, the Indian Navy recognised that INS *Hansa* was becoming increasingly crowded. In March 1988 the first Tu-142s arrived at Dabolim even as

work was underway to turn the airfield at Arakkonam into a suitable base for the Navy's newest acquisitions. Boasting the longest runway of any military airfield in South Asia, INS *Rajali* was commissioned on 11 March 1992 and has, for over twenty years, been home to the Navy's Tu-142 fleet, one of the most distinctive aircraft operating in the region.



### INAS 312 'Albatross'

The Navy's first long range maritime reconnaissance squadron was commissioned with five ex-IAF (and before that, ex-Air India) Lockheed L-1049 Super Constellation aircraft on 18 November 1976. Cdr RD Dhir was the commissioning CO and the squadron was initially based at INS *Hansa*, Goa. These were the Navy's first long range maritime patrol aircraft, although Soviet-origin Il-38s that began arriving in 1977 soon supplanted them. In any case, the Super Connies in Indian Navy service were never more than a 'proof of concept' programme to establish and validate maritime patrol operations under full control of the Navy.

The venerable Super Constellations were phased out by 1983 and five years later, on 30 March 1988, the first three Tu-142s reached INS *Hansa* after flying nonstop for 9.5 hours, covering a distance of over 7,000 km from Simferopol on the Black Sea coast. These three aircraft, bearing the serials IN311, 312 and 313, were joined by the next two aircraft, IN314 and 315, on 13 April 1988. Almost immediately thereafter, on 16 April 1988, INAS 312 was re-commissioned with Tu-142s by Defence Minister KC Pant, at INS *Hansa*. IN316



*The Tu-142M dwarfs a Dornier 228 of INAS 311 as it taxis past the INAS 312 apron*

and 317 left the USSR a few months later, reaching Goa on 16 August 1988, and the squadron reached its full complement of eight aircraft on 20 October 1988, when IN318 joined the (increasingly crowded) 'Albatross nest' at Dabolim.

When INS *Rajali* was commissioned in March 1992, INAS 312 and the Navy's Helicopter Training School (HTS), INAS 561 *Rotors* were almost immediately shifted

to this new location. The mighty Tupolev's long patrol sorties far from home minimised interference with the frenetic pace of flying conducted round the clock at HTS, making this basing arrangement quite mutually beneficial ! Since then, both units have remained at *Rajali*, and INAS 312 celebrated its Silver Jubilee on 18 November 2013 at the air station with launch of a 'coffee table book' plus commemorative memorabilia.





*Propelled by four of the most powerful turboprops in existence, an IN Tu-142M lifts off the runway...*



*... and slowly climbs into an overcast sky...*



*... finally landing in front of the ATC tower at Rajali.*

In its early years, the squadron functioned primarily in the LRMR and anti-submarine warfare (ASW) roles but over the quarter-century service of the Tu-142M, the aircraft has been subject to a series of modifications and upgrades, improving existing capabilities and adding additional abilities, such as ESM and networking. The Tupolevs of INAS 312 conduct missions all over the IOR, not necessarily only toward the East. Their incredible 12.5-hour endurance allows them virtually unlimited access to the vast waters of the region, and this range can even be extended by operating from forward locations in Indian territories or foreign countries, although the operating constraints of the aircraft mean that this is not done very often.

As is the case with most Soviet (and latterly Russian) aircraft, the Tu-142M's *Achilles' Heel* is maintenance. The impressive capabilities of these machines are fielded through a massive maintenance effort both in India and Russia. Onboard equipment is maintained by the OEMs, either under long term arrangements such as AMCs or via rolling contracts as necessary. Many of the new and upgraded systems on the Tu-142Ms involve technology transfer elements, so a significant portion of avionics support is conducted in India, even

if the OEMs are foreign firms. Spares and supply for the maintenance of the fleet is now under the ACNS (Air Materiel) post that was established last year at Integrated Headquarters MoD (Navy).

Similarly, aircraft maintenance is split between Indian and Russian facilities. The most basic line maintenance is carried out at INS *Rajali* itself, with third and fourth line maintenance done by the Naval Aircraft Yard (NAY) at INS *Hansa* in Goa. The aircraft require overhaul in Russia at approximately 1,500-hour intervals, which means an aircraft is dispatched to the Beriev Aircraft Company in Taganrog, Russia every 5 to 7 years depending on flying intensity. It takes approximately one year to complete overhaul of a single aircraft, and Indian Navy Tupolevs have been overhauled in the type's quarter century of service 21 times. The most recent of these, involving IN317, was handed over to the Navy on 6 August 2014 at the Taganrog plant, before making the long journey back to Arakkonam.

With no aircraft lost to attrition since induction, the Squadron's present aircraft strength remains at 8 aircraft. Of these, three are currently operational and two are under maintenance at *Rajali*. The remaining three are in need of overhaul and await MoD clearance for the necessary work. However, given the rapid pace with which the Boeing P-8Is are being inducted and made operational, it appears doubtful that any further overhauls will be sanctioned for the Tu-142M fleet, with retirement now seeming inevitable and the likely end for these ageing workhorses. Their operating costs are also viewed unfavourably compared to smaller aircraft such as the Il-38SDs of INAS 315 or newer aircraft such as the P-8Is. A fully-fuelled Tu-142M carries an astonishing 85 tonnes of fuel — just under half the aircraft's maximum take off weight of 185 tonnes! At maximum power, *each engine* consumes a little over two tonnes of fuel per hour and efficiency is only slightly improved at lower power settings.

Each of the colossal Tupolevs requires a typical crew of ten officers and sailors. There are two pilots, assisted in managing the mechanical complexities of the aircraft by a Flight Engineer, and in communication duties by a Flight Signaller. A navigator sits in the glazed nose of the Tupolev, a somewhat lonely station, but one with arguably the most impressive view! Three

Sensor Operators (SENSOs) occupy stations in the area behind the flight crew, along with the Senior Mission Commander, the officer who has overall control of the aircraft, its crew and its mission. The last position is probably the least enviable – a Flight Gunner mans a pair of GSh-23 guns in a cramped tail turret at the base of the vertical tail. For as long as the aircraft is airborne, this sailor has no direct contact with any of the crew and lacks the space to even stand and stretch his legs! In typical Russian fashion, crew comforts are not a priority. In fact, the original onboard latrine was nothing more than a bucket until a chemical toilet replaced it in more recent times.

Crew training is relatively streamlined, given that the type has now been in service for well over two decades. There are no simulators for the Tu-142M and pilots are selected after gaining sufficient experience flying with the Navy's three Dornier 228 squadrons (INAS 310, 311 and 318). Their journey begins, as is usual, with basic training at the Air Force Academy in Dundigal, after which they conduct multi-engine conversion on IAF Dornier 228s at Yelahanka AFS near Bangalore, before transferring to more 'Navy-centric' training on the Dorniers at INAS 550 in Cochin. From there they are assigned to operational flying duties on IN Dornier 228s based in various parts of the country. Once pilots cross 1,000 hours of operational flying on Dorniers, they are eligible to convert to either Il-38SDs at Goa, or Tu-142Ms and P-8Is at Arakkonam. Conversion is handled entirely within the Squadrons, and involves comprehensive ground lessons as well as copious amounts of flying time.

Observers chart a more straightforward path to the Squadron, arriving directly at INAS 312 after a 45-week course at the Navy's Observer School in Cochin. Once at *Rajali*, each observer is trained for at least three separate stations on board the aircraft (such as radar, sonar, navigation, or mission commander) before going on to specialise in a single discipline.

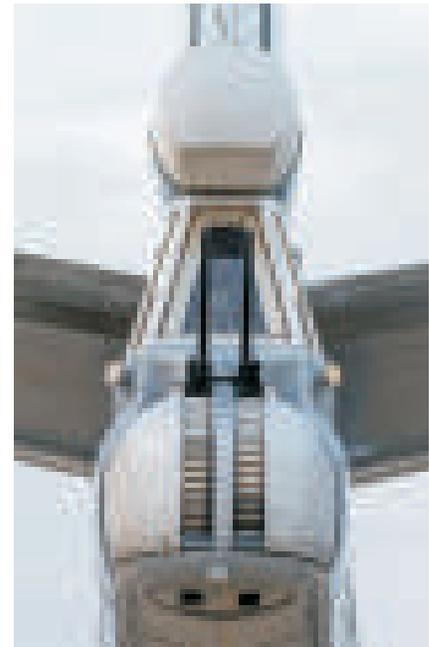
Once fully trained to conduct operations with the Tu-142M, these naval aviators find a formidable array of weapons and sensors at their disposal. Although successfully tested in the past for Sea Eagle anti-ship missile compatibility, their primary armament is the unique APR-2E high-speed torpedo (also referred to as an 'underwater missile'), three of which are carried internally in a

bay just aft of the massive search radar. The APR-2E is capable of speeds in excess of 60 knots over a wide range of operating depths, making it extremely effective in prosecution of targets. The twin AM-23 guns in the tail turret can be directed via a small aft fire control radar and, unusually, can also function as countermeasures dispensers, with the ability to fire flare and chaff cartridges. Additionally, the aircraft can carry depth charges and a large number of unguided 250 kg and 100 kg bombs internally.

Expendable sensors include explosive sound source (ESS) devices as well as a variety of sonobuoys: passive directional, passive non-directional, LOFAR (low frequency analysis and ranging), active non-directional, and temperature profile mapping buoys. There are various combinations of sonobuoys that can be carried, up to a maximum of 215, while the ESS capacity is limited to 120. Another unique payload is an indigenously-developed air-dropped SAR kit, with an inflatable life raft and supplies for relief operations at sea.

On-board sensors have evolved considerably since the type's induction. Originally, the aircraft were outfitted with an all-Russian avionics suite, key sensors being a Leninets 'Korshun' surface search radar mounted under the fuselage and an MMS-106 'Ladoga' magnetic anomaly

detector housed in a short boom atop the tailfin. In the mid-1990s, the Navy initiated an upgrade programme for the Tu-142M, incorporating primarily Israeli avionics. The sensor suite is similar to that found on some of the Navy's Dornier 228s, incorporating an Elta EL/M-2022A radar in place of the Korshun system, in



*The tail turret is seen to good effect in this image, along with the white radome of the aft fire control radar*



*INAS 312 Tu-142M on the apron, personnel near tail and working on the number 2 engine give a sense of scale to the enormous aircraft*

## INAS 311 'Kites' : quiet, efficient, reliable

INAS 311 is one of the newer squadrons of the Indian Navy, and was commissioned at INS *Dega*, Vishakhapatnam, on 24 March 2009 by the then FOC-in-C Eastern Naval Command, Vice Admiral Nirmal Verma. Cdr Sanjay Nandal was the commissioning Commanding Officer of the Squadron.

Although nominally based at Vizag, the Squadron operates detachments at various Naval Air Stations around the country, including one at INS *Rajali*. The Dornier 228s of INAS 311 are economical, reliable and highly effective in their maritime reconnaissance role. The aircraft are outfitted with one of the most sophisticated avionics suites in the Navy, incorporating an Elta EL/M-2022A search radar under the fuselage, a comprehensive ELINT/ESM suite, and an IAI Airborne Multi-mission Optronic Stabilised Payload (AMOSP) electro-optical turret near the starboard mainwheel. Their high availability means that Dorniers are the mainstays at any Naval Air Station and are heavily relied upon for operational duties.



*Dornier 228 of INAS 311 taking off, with ESM antennae visible on the wingtips, search radar in a dark underbelly radome, and AMOSP just ahead of the mainwheels*

addition to the Elbit AES-210 suite, a comprehensive ELINT/ESM package. This was later supplemented by the DRDO-developed 'Homi' ELINT/ESM system, which replaces the Elta suite on some Indian Navy Tupolevs. As presently configured, the Tu-142M fleet is vastly more capable than it was 25 years ago, with significant improvements to its original LRMR and ASW capabilities, along with a new ELINT role, limited search-and-rescue capabilities, better networking allowing it to reliably provide over-the-horizon (OTH) targeting information for surface vessels, and the ability to act as an airborne communications relay.

Operations in recent years have leveraged all the enhanced abilities of INAS 312's aircraft. Earlier this year the squadron was involved in the multinational search effort for the missing Malaysian Airlines Flight 370. A Tu-142M from Arakkonam was among the first aircraft to be dispatched from Indian shores, although it was soon replaced by the P-8Is of INAS 312A. Where the Squadron's aircraft have also excelled is in anti-piracy operations off the west coast of India. In May 2011, an INAS 312 aircraft was involved in a widely publicised successful rescue operation of a Chinese merchant vessel a few hundred kilometres off the Indian Coast. The aircraft was on an anti-piracy patrol when it observed an attempted hijacking. The Navy crew immediately warned the pirates to abandon

their bid to seize the ship, making low passes over the vessel whilst dispensing flares. This show of force was enough to convince the pirates to leave the area in some haste!

The Squadron's ASW capabilities are seldom detailed in public but Tu-142Ms regularly detect and track submarines entering and exiting the IOR. All sensor data picked up during patrols is reviewed and analysed to ensure that information remains updated and relevant.

There is no question that the men and inimitable machines of INAS 312 'Albatross' are a force to be reckoned with today, even as the sun sets on their era.



*The new and the old — a P-8I landing in front of parked Tu-142Ms at Rajali*

### Albatross-Alpha : INAS 312A

State-of-the-art Boeing P-8Is are now being rapidly inducted by the Indian Navy, helped along in no small part by the rapid rate at which they are delivered. Their strength already stands at six aircraft as of November 2014. At present, the Squadron has no nickname and exists simply as INAS 312A (spoken as '312-Alpha'). Once the Tu-142Ms are phased out, and the last of

the eight P-8Is on order are inducted, the squadron will be 'regularised' as INAS 312 and retain the 'Albatross' moniker.

Currently, there is limited infrastructure for the P-8Is at Rajali, with the majority of planned improvements still under construction. Eventual plans call for all eight aircraft to have hangars, a concept that is completely new to the base since the eight Tupolevs of INAS 312 spend the entirety

of their service lives parked out in the open. Delays have plagued the infrastructure development at Arakkonam owing primarily to its somewhat remote location, far from urban centres and therefore from competent engineering and construction resources.

However, there is a key advantage inherent to the P-8I: it is based on a highly successful, massively-produced commercial airliner, endowing it with high reliability



*Radome for the aft radar and the slender MAD boom can be seen in this image as IN324 taxis back to the apron*



*A P-8I makes ready for a night sortie from INS Rajali*



*IN324, the fifth P-8I delivered to the Navy, seen moments after touchdown*

and an extremely small logistical footprint, particularly in contrast to the Soviet-era behemoths it is replacing. Compared to the Tu-142M, the P-8I has a slightly reduced endurance of around 9-10 hours, but manages this with a mere 32 tonnes of fuel as against the 85 tonnes required by the older turboprop.

The P-8I is a heavily modified 737-800, and could be easily mistaken for its civilian cousin from a distance. Upon closer examination, however, the differences are more readily apparent — there is no questioning that this is the most menacing airliner to have ever graced the skies!

The 737-800 fuselage is strengthened and mated to wings derived from the 737-900. These wings feature two key modifications: sleek raked wingtips instead of the winglets typically seen on commercial 737 variants, and hardpoints for AGM-84

Harpoon anti-ship missiles, two under each wing, just outboard of the engines. The powerplants themselves are relatively unchanged, but the increased electrical power requirements for onboard systems require the CFM 56-7B turbofans to be encased in redesigned nacelles with bulges to accommodate larger 180kVA generators.

A combined weather/search radar, Raytheon's AN/APY-10(I), is housed in the nose of the aircraft, and is complemented by a Telephonics APS-143C(V)3 multi-mode radar (MMR) housed under the fuselage just aft of the landing gear. The AN/APY-10(I) is a variant made specifically for the P-8I and incorporates an air-to-air mode, allowing detection of threats in the air as well as at sea. It also includes an interleaved weather and surface search capability to provide the flight deck with accurate weather avoidance information

while allowing sensor operators in the cabin to performing surveillance tasks. The APS-143C(V)3 is more mission-specific to the LRMR role, featuring a multitude of modes geared toward maritime operations.

In addition to the radar, the aircraft has a retractable L3 Wescam MX-20HD electro-optical/infra-red (EO/IR) turret installed forward of the wing, along with a magnetic anomaly detector in a short boom near the APU exhaust. A full ESM/ELINT suite is incorporated, as are a number of indigenous systems such as a BEL-developed datalink and IFF interrogator.

Personnel requirements are similar to the Tu-142, with a typical mission involving 9-10 crew members, but archaic posts such as flight signaller and navigator are dispensed with, providing the P-8I with more mission operators to focus on the sensors. There are only two flight



## INAS 561 'Rotors' : cradle of Naval rotary aviation



*An INAS 561 Chetak lifts off to conduct SAR training*

INAS 561 was raised on 15 September 1971 with Lieutenant Commander S R Dasgupta as the commissioning CO. The squadron serves as the Indian Navy's Helicopter Training School (HTS) and operates the HAL Chetak helicopter. Trainee pilots must complete 75-90 hours of rigorous flying operations here before they are released into operational Chetak units or head for further conversion on other helicopter types operated by the Navy. Visitors at *Rajali* cannot but be impressed by the incredible amount of flying conducted by the Chetaks of the HTS as they mould new pilots and keep older aviators current. The Squadron has completed over forty years of operation, and has virtually shaped the helicopter arm of Indian Naval Aviation.



*A greeting from the flight deck of a P-8I*

technicians, whose primary role is loading the internal rotary sonobuoy launchers.

Crew training was initially conducted in the USA, but as more experience is gained, this will shift entirely to India and will be conducted in a manner similar to the other maritime reconnaissance squadrons. The first batch of ten pilots selected for P-8I conversion comprised four former Il-38 pilots, four from the Tu-142M fleet, and two Dornier pilots. Similarly, the mission operators all had prior experience in the role before conducting their conversion. There are no simulators in-country at present and while the terms of the contract with Boeing do not cover simulator construction in India, the Navy is exploring options for flying training of P-8I crews that would either see it build and operate a simulator at INS *Rajali* itself, or utilise commercial simulators to take advantage of the P-8I's commonality with the Boeing 737 airliner.

On board the aircraft, once again in stark contrast to the Tupolevs, the P-8I provides an unparalleled level of comfort to its crew. There are extra seats to accommodate additional crewmembers, reducing individual workloads if necessary, and toilet and galley facilities are similar to those found on commercial airliners, which puts a world apart from the spartan amenities offered by the two Russian patrol aircraft types operated by the Indian Navy.

The ability of the P-8I to attack underwater targets on ASW missions remains relatively unchanged when

compared to the Tu-142M, though the Boeing aircraft carries two more torpedoes than the Tupolev. The true 'game changer' is the AGM-84 Harpoon and the ability of the P-8I to autonomously detect, track and prosecute surface targets. While this capability also exists for the upgraded Il-38SD aircraft based at Goa, induction of the P-8I marks the first time that any of the Arakkonam-based aircraft will have an organic ASuW ability.

These formidable aircraft of '312-Alpha' are already operating all over the IOR, and have tracked surface vessels and submarines across the region. Before the Squadron

was even formally commissioned, they had conducted deployments away from their home base, operating from Port Blair as well as Malaysia during the MH370 search efforts. In fact, a P-8I was ready in place at a base in Malaysia within 24 hours of India's commitment to the international operation. Regardless of the type's fledgling status in the Navy, it has already deeply impressed crews and commanders alike, and there is nothing but heady optimism for the future of the P-8I in the Indian Navy.

**Angad Singh**  
(text and photos)

## Captain HS Jhaji – loss of a pioneering Naval Aviator

The *Vayu* visit to INS Rajali was unfortunately marred by the sudden and tragic passing of Captain HS Jhaji, CO-designate of INAS 312A, on 11 October 2014. Capt Jhaji, a former Tu-142 pilot with INAS 312, was the first Naval Aviator to be trained for the P-8I and later flew the first aircraft to India in May 2013. He was in charge

of the Navy's P-8I induction effort and also led the Indian search effort for the missing Malaysian MH370 airliner earlier this year. *Vayu's* Angad Singh spent some time with the Captain and found him a thorough professional and a charming gentleman. He took time from his busy schedule on the eve of the Squadron's commissioning to have a frank conversation about the capabilities

of his men and aircraft, as well as the hopes and challenges that lay ahead, and this article would not have been possible in its current form without his involvement.

It was a testament to his character that the entire station, including personnel from other squadrons, was united in mourning his tragic demise.



*Captain HS Jhaji (back row, centre) with the personnel of INAS 312*

# REGENERATION



Virtual Reality : BAE Systems carrier handling simulator at Warton (F-35B comes in to land on HMS QE)

**VAYU's** UK Editor Richard Gardner writes on the HMS *Queen Elizabeth*, whose recent launch has started the next phase of the British Royal Navy's strike carrier regeneration programme – the biggest single new UK defence project, apart from a new fleet of Trident nuclear missile submarines.

The decision by the British government in 2001 to replace the Royal Navy's three *Invincible*-class aircraft carriers with two 65,000-ton super-carriers was a major step as at the time these three ships were still relatively young, having only entered service in the 1980s. The lead ship, HMS *Invincible*, had played a major role, operating alongside HMS *Hermes* (now INS *Viraat*), during the Falklands War in 1982, operating an air group of Sea Harriers and Sea Kings, which have also become a familiar sight within the Indian Navy over the last three decades. As the Falklands campaign drew to a close, the Royal Navy's second new carrier, HMS *Illustrious*, was completed early and joined the fleet in the South Atlantic to relieve HMS *Invincible*.

During this short conflict the *Hermes*, originally completed in the 1950s, had been chosen as the RN's Task Force Flagship as it could operate a much larger number of aircraft than the new *Invincible* Class. The relatively small deck of the *Invincibles* was owed to the design specifications that were optimised for anti-submarine warfare, with the ability to also operate in the helicopter assault role if required. Arrival of the Harrier family of V/STOL combat jets resulted in the *Invincible's* deck design being adapted to take a ski-jump ramp to enable Harriers to take-off with greater weapon loads in all weathers with a higher safety margin in a pitching sea. For the rest of their RN service lives, these small (20,000t) carriers were compromised by having to operate both Sea Harriers and Sea Kings with inadequate



The outgoing Carrier HMS *Illustrious*



*Tugs nudge the HMS 'Queen Elizabeth' out from the docks*

deck space, especially when also operating RAF Harriers alongside RN Sea Harriers. Modifications to the ships saw the removal of the forward Sea Dart missile launchers with an added parking area, but when the options for replacing the ships arose in the

late 1990s it was decided to phase out all three *Invincibles* and build in their place two 65,000-ton carriers that would have three times more deck space, sufficient to operate 40 aircraft, with a surge capacity for up to 60. This would restore a carrier strike

capability that had been missing on this scale since the post-war generation of RN fleet aircraft carriers had all been withdrawn by 1979.

The first of the new generation of super-carriers, HMS *Queen Elizabeth*, was towed from its Rosyth assembly dock in July 2014 and is now afloat and its complex onboard systems will be completed and tested over the next two-three years. The F-35 combat aircraft will start ship integration trials in 2017 and initial deck operations will begin in 2018, with an interim operating capability in 2019. The ship will assume full operational status, with the ability to carry a mixed air group of F-35B fighter/attack aircraft, Merlin, Chinook and Apache helicopters by 2020. As the HMS *Queen Elizabeth* took to the water for the first time this summer, the last of the *Invincible*-Class, HMS *Illustrious*, has been retired from active service. This ship has been replaced as a helicopter carrier by HMS *Ocean*, which has been given a major modernisation.

The British Prime Minister, James Cameron, recently confirmed that it was

*Shape of the future : F-35 landing on USN carrier*





*'Queen Elizabeth' and 'Illustrious' size comparison*

planned to operate both of the new *QE*-class super carriers in service to ensure that at least one was always available for duty, with the option of having both in an emergency. Both ships will now be completed to a similar standard, with a deck layout optimised to operate up to 40 F-35Bs in the short take-off mode, using a bow ski-jump, and landing using a new rolling vertical landing technique that is intended to minimise deck wear while enabling a full weapons load to be landed back on board without the use of arrestor wires. Originally it had been intended to complete the second new carrier, HMS *Prince of Wales*, with a conventional angled deck, wires and catapults, but standardising on the VSTOL optimised configuration would not only be much cheaper to build and maintain, it would also allow a higher F-35B sortie rate to be generated from the four-acre deck. (During the 1982 Falklands War, the Royal Navy could launch four Sea Harriers in the same time the US Navy required to launch a single F-14 by catapult.) The *QE*-class carriers will have extensive deck parking areas and each of the two deck-edge lifts are big enough to allow two F-35s to be raised or lowered at the same time.

Behind the scenes, great progress is being made to prepare for the introduction of the F-35B, which promises a game-changing ISR/attack combination. This aircraft is completely dependent on complex integrated sensors and computerised systems with over 8 million lines of source codes - four times the number on the F-22 Raptor. Achieving operational reliability in the US

is proving a challenge for the US Services and Lockheed Martin, and full weapon system and situational awareness capability for the F-35 is being phased in over many Blocks reaching out to 2020. In the UK, much detailed work has been undertaken by BAE Systems at Warton to anticipate RN carrier operations using advanced computer simulations. This has created a virtual carrier operational environment that replicates how deck-movements, take-offs, approaches and landings will be carried out, day or night. As far as the new technologies will allow, future RN and RAF F-35B pilots will be able to make approaches and landings on the new ships that will revolutionise the

safety of night carrier deck landings for fast jets. Much effort has gone into the design of the day or night deck lighting system to indicate visually to the pilot exactly where he must touch down. Not only is the new system much safer, greatly improving situational awareness and pilot confidence, it will allow more intensive flight operations maximizing sortie rates. This UK-developed landing design and procedure, and virtual training environment, is now interesting the US Marine Corps, who are also due to operate the F-35B.

The integration of the F-35 and the new carriers has required a radical exploitation of CGI technologies to make training for future operations more comprehensive and realistic than ever, much safer and with a high level of automation onboard to reduce crew numbers as much as possible. The synthetic training environment will enable future pilots and flight deck management operators to become completely immersed in, and familiar with, the flying and deck operations before real flying takes place.

Not since departure of the Royal Navy's Buccaneers and Phantoms in 1980 has the service been equipped with such a potentially powerful and far reaching Fleet Air Arm. The work now being carried out in anticipation of the completion of the new carriers and their air groups will speed up their entry into service and reduce the severe capability gap that has emerged since the government imposed cost-cutting measures of 2010 took away so much front-line naval air strength.



*The 'Silent Service': RN sailors march below the looming HMS Queen Elizabeth*

# MRSVs and More

**VAYU** Interview with

**José Luis Montes Martínez,  
GM, Navantia India**



**VAYU:** *The Indian Navy has issued an RFP for four 'Multi-Role Support Vessels' (MRSVs) to be operated alongside INS Jalashwa. What class of ship is Navantia proposing to meet this requirement? Does the contract include provisions for landing craft to be carried within the MRSVs?*

**JLMM:** The MRSV is specified as acquisition category 'Buy & Make (Indian)', our partner being L&T. Our joint proposal to the IN is based on our *Juan Carlos I* design, implementing the necessary modifications to meet the RFP requirements. Amongst the main modifications are a reduction in length and a change in the type of propellers, from pods to conventional shaft lines, although the propulsion system remains diesel-electric. In fact, the contract will include provision for 4 landing crafts (LCM type), per vessel.

**VAYU:** *First of the Royal Australian Navy's Canberra-class LHDs are due for commissioning in 2014. Are trials of the vessel complete as yet? What issues were encountered during trials and how were they resolved?*

**JLMM:** The second and final sea trials were to be finished by end August, these trials have performed successfully. Navantia has supported the sea trials with a team of professionals on board the LHD. During the sea trials the team of Navantia jointly with the main contractor team dealt with common issues during the commissioning of the different systems to the customer and, fortunately, there was nothing to highlight.

**VAYU:** *What is the status of the Turkish LPD programme in collaboration with SEDEF? Are the modifications required by the Turkish Navy extensive compared to the basic Juan Carlos I design?*

**JLMM:** SEDEF will be the main contractor for this programme and Navantia will act as its technical partner. Our scope of

supply for the Turkish LPD has three main groups of activities:

- The first one includes engineering activities and we will provide SEDEF with design of the LPD and the Landing Craft Mechanised (LCM) as well as the Purchase Technical Specifications for the procurement of all materials and equipment.
- The second group concerns support activities; Navantia will provide technical assistance and support to SEDEF during the procurement activities as well as the construction of the vessel until final delivery.
- And last but not least, Navantia will deliver some equipment to SEDEF including the diesel generators, the turbo generator and the Integrated Platform Management System.

The tender was awarded on 27 December 2013 to our Turkish partner, SEDEF, and contract negotiations started in February 2014. Within the frame of negotiations, the contract technical specification are being discussed in detail with the client (SSM) and Turkish Navy. We expect the contract will shortly be ready and becoming operative approximately 120 days later.

The design of our proposal for the Turkish LPD programme is based on the *Juan Carlos I* but includes many changes to meet requirements from the SSM. The biggest difference is in the Combat

Management System (CMS). For the Turkish LPD, the CMS is a derivative of the Genesis supplied by the local consortium Havelsan-Aselsan. There are other changes too, like removal of the ski-jump, the accommodation has been modified, the forward aircraft elevator has been substituted by a hatch, the deck crane has increased its capacity, and many others. Regarding indigenisation of equipment and systems, SEDEF and Navantia will work closely to include as many Turkish equipment and materials on board of the LPD.

**VAYU:** *Please provide details on some of your other key projects for the global market!*

**JLMM:** Navantia's key projects include a wide range of naval ships:

- Latest generation frigates integrating the most advanced combat systems in the world.
- Various types of modern patrol vessels, with reduced crew and versatility for possible missions: exclusive economic zone protection, fighting against piracy and illegal trafficking, and frontier control.
- Replenishment ships, capable of supplying liquid fuels water and solid provisions to a combat group or the entire fleet.
- Conventional submarines, incorporating the most advanced AIP systems in the world.



**VAYU**: *Could you review the extent of your collaboration with Larsen & Toubro in India?*

**JLMM**: At present, our collaboration with L&T is in naval shipbuilding. We have till now agreed a partnership in two main programmes of the IN, being Multi-Role Support Vessels and Fleet Support Ships, the later having recently been given the acceptance of necessity. Since L&T has an excellent engineering team, we split work in a manner that maximises Indian content of the project.



On the other hand, we are presently discussing an extension of collaboration to other areas, but since as I say, we are now in discussions, I prefer not to go into details of this new collaboration. I am sure that, shortly, I will be able to provide additional information to *Vayu*!

**VAYU**: *Air Independent Propulsion (AIP) is a crucial requirement for the Indian Navy's long-delayed Project-75(I) submarine acquisition programme. Could you describe the AIP system on the S-80 class submarines as well as your*

*impressions on their suitability for the Indian Navy?*

**JLMM**: There is a significant R&D effort behind our AIP system, originally developed for the Spanish Navy. Important decisions have had to be taken to start development in order to get a system with better performance than others existing in the market, as required by the Spanish Navy.

- The first decision made was to use Fuel Cell technology, as it is

extremely compatible with submarine requirements (noise, weight, etc.).

- The second was to incorporate a promising technology: fuel reforming. This technology allows producing hydrogen from almost any hydrocarbon (fuel). Obviously, the energy required to do so is dependent on the fuel selection, which therefore, was extremely critical. The optimum was to select the same diesel oil used on board. However, the technology to reform it and to ensure compatibility with the

fuel cell technology was not granted. Hence, fuel selection was oriented to small hydrocarbon chains since they require less energy to be reformed. After detailed analysis, the trade-off was done between methanol and bioethanol, the latter finally selected. The advantages of bioethanol are its simple storage and management on board (liquid form); high availability all over the world; lower complexity in processing; being safer and more healthy than other alcohols.

The system is composed by the AIP Plant (Fuel Processor System, Fuel Cell Power Module, Power Conditioning System and few services required by pieces of equipment) and other auxiliaries (CO<sub>2</sub> disposal system, LOX tank, cooling system, AIP control system, converter, etc.).

The fuel (bioethanol) and oxygen are stored on board. When operation is required, the fuel feeds the processor to achieve the appropriate conditions for fuelling the fuel cell. To work, the processor also requires water and oxygen.

The fuel cell is fed by the reforming gas (60-75% hydrogen) and oxygen to produce DC power and water. The DC power requires to be conditioned to be connected to the submarine DC network. This conditioning is performed by means of the Power Conditioning System. Combustion of bioethanol is required during the reforming process. The CO<sub>2</sub> and water generated is treated by the CO<sub>2</sub> Disposal System that expels gases out of the submarine without affecting the submarine signatures.

An AIP control system makes all these subsystems work together!

## Spanish Navy F-100 class frigates sail together

On 10 July, the Spanish Navy's F-100 class frigates *F-101 Álvaro de Bazán*, *F-102 Admiral Juan de Borbón*, *F-103 Blas de Lezo* and *F-104 Méndez Núñez* left the Naval Base in Ferrol (Spain) together for exercises. Navantia's F-100 class frigates are new generation ships and some of the most technologically advanced in service in modern navies. The only European-built combat vessels already operating with anti-air and anti-missile Aegis combat system, the F-100 class has a unique capability, being able to detect and handle up to 90 targets simultaneously up to a distance of 600 km. Navantia has built five F-100 frigates for the Spanish Navy. It has also built four F-310 frigates—a design developed from the F-100—for the Royal Norwegian Navy. The Australian Navy has also relied on Navantia for the design and technical assistance in the construction of its three AWD.



# On-the-spot report



## EURONAVAL 2014

*The biggest warship ever designed by CMN: the C Sword 90 corvette adopts an innovative hull and superstructure design with sloped surface.*

As the 24th edition of Euronaval (27- 31 October) closed its gates at Paris-Le Bourget, feedback was overwhelmingly positive from the 30,000 or so people involved in the event; exhibitors, official delegations, leading international and European organisations, visitors and journalists. The French biennial event, founded in 1968, once again confirmed its position as leader of exhibitions for naval defence, marine safety and security in the view of the large number of international decision-makers present this year.

“The marine sector is becoming increasingly important on the international stage, underlined Patrick Boissier, President of Euronaval. Taking into account the potential of the Sea at a global level does, however, carry in its wake as many promises for growth as potential conflicts. The seas of the 21st century promise to be turbulent. Piracy, pillaging, illicit trafficking, terrorism and territorial conflicts all jeopardise this future and compromise the success of ‘blue growth’. This show is an essential tool for providing responses to these threats”.

This international biennial event is organised by the GICAN (French Marine Industry Group) representing and promoting the French naval industry. The

GICAN federates more than 150 companies and represents 30,000 direct jobs in France for a turnover of 6 billion Euros.

As a showcase of international “industrial excellence” with sales figures of 40 billion Euros each year for military vessel construction and equipment alone, Euronaval was testament to the rise in the importance of the maritime state in new international geo-strategic power balances in the 21st century. Over the next twenty years the international market devoted to naval defence construction alone is estimated as growing close to 900 billion Euros. This is especially driven by new entrants and buyers but also by an increasing number of manufacturers, all present at the event. Close to 500 new construction programmes, with a total of more than 3,800 new surface vessels and submarines are currently under development. These figures demonstrate that the naval defence sector is constantly developing and that the industrialists and

exhibitors present were at the heart of a particularly dynamic international market.

This 2014 event welcomed two new national pavilions from Australia and India, as well as new exhibitors from Belgium, Korea, United Arab Emirates and Turkey. 90 high-level delegations from 78 countries covering the five continents responded positively, a sign of the show’s prominence. The 300 high-level political and military authorities who “map out the structure of the future’s international navies” were able to meet the 350 exhibitors from 28 countries, who presented their sophisticated, high-performance skills to the market.

“Despite the fact that the European internal market is contracting, the global market of naval acquisitions is developing as a whole, driven by a certain number of countries who wish to increase the capacity of their fleet, either to address threats, or to protect the resources in their exclusive maritime economic zones”, remarked Patrick Boissier. “We are witnessing an increase in the demand for all types of vessels related to surveillance, and not just for coastal areas but increasingly for high seas, with corvettes, frigates and a large increase in the submarine sector.”

Inaugurated by Minister for Defence Jean-Yves Le Drian, the French biennial event covered a surface area of over 15,000

### The facts :

- 100 countries are bordered by the sea
- 80 countries possess a navy
- 60 countries possess a high-seas navy
- 40 countries possess a naval industry
- 30 countries export naval products

square metres and hosted important international visitors throughout the 5-day exhibition, with 110 nationalities and more than 300 accredited journalists from all over the world.

Attentive to the latest technological developments, each edition is enriched with innovations that lay foundations for the future and the development of the naval industry. This year the Euronaval Trophies created by the organisers, awarded iXBlue and Subsea Tech in the innovation category, and Automatic Sea Vision for export performance in the French SME category.

### Thales expands sonar offering...

At Euronaval 2014, Thales announced the launch of a new range of compact sonars for surface combatants and patrol vessels displacing 300 tonnes or more. Easy to install and operate, the new products include a hull-mounted sonar, the Thales BlueWatcher, and an associated towed array sonar, the Captas-1.

Thales BlueWatcher is a compact hull-mounted sonar that is easy to install (plug and play). This new sonar is based on the same technology as the FLASH dipping sonar for helicopters, which is internationally acclaimed for its operational performance and in service with the US Navy, the British Royal Navy and the French Navy. Captas-1, the latest addition to the family is a single ceramic ring configuration and uses the same technological building blocks as the Captas-2 and Captas-4, which are in service with several NATO countries.

### ...and launches new Searchmaster radar

Thales has also launched the new Searchmaster multirole surveillance radar with active electronic scanning antenna (AESA) technology. It features an AESA active electronic scanning antenna based on fully qualified technologies developed for the RBE2 AESA nose-mounted radar on the Rafale combat aircraft. The key benefits of this new product are extended range, 360° coverage, electronic scanning in the vertical plane for simultaneous short-range and long-range surveillance, with continuous detection in harsh environmental conditions. The radar has been selected by the French defence procurement agency (DGA) for the French Navy's upgraded Atlantique 2 (ATL2) maritime patrol aircraft.

### Agreements; Fincantieri and Finmeccanica

In the presence of Minister of Defence Roberta Pinotti, the Fincantieri shipyard in Muggiano (La Spezia) hosted the launching ceremony for the 'Pietro Venuti' submarine, the third unit of the four U212A 'Todaro' class twin units ordered to Fincantieri by the Central Unit for Naval Armament (NAVARM) for the Italian Navy. Alongside also announced at Euronaval was an important agreement for naval vessels sector signed between Fincantieri and Finmeccanica, aimed at increasing competitiveness on national and international markets through a more efficient and effective integrated offer by the two Companies. In particular, this collaboration will develop taking advantage



of the technical and commercial synergies between the Naval Vessels Business Unit in Fincantieri and Finmeccanica Group companies (the subsidiaries Selex ES, Oto Melara, WASS and the joint venture MBDA), benefitting from their knowledge in combat naval systems, electronics and surface and underwater warfare systems.

### Sagem's SIGMA 40

Sagem (Safran) has won a contract from the Royal Norwegian Navy in competitive bidding for the navigation system on its future ocean support vessel and polar research ship, the RV *Kronprins Haakon*. Both these ships will be equipped with Sagem's SIGMA 40 laser-gyro navigation system.

Developed and produced by Sagem, the SIGMA 40 is an inertial navigation system based on laser gyros and designed

for harsh military environments, being a high-precision, autonomous navigation system that contributes to the effectiveness of naval weapon systems and mission success. Sigma laser gyro navigation systems are used on some of the latest and most prestigious combat vessels, including the European *Fremm* and *Horizon* frigates, the *Mistral* BPC-class amphibious assault ship, and South Korea's amphibious helicopter carrier, the LPX *Dokdo*. The Sigma 40XP version of the system was chosen for the *Scorpène* class conventional submarines built by French naval shipyard DCNS, for the modernisation of navigation systems on *Améthyste*-class nuclear attack submarines and for the future *Barracuda* class submarines.

### 200th BlueNaute navigation system

Sagem also announced at Euronaval that it had delivered the 200th BlueNaute precision attitude and heading reference systems for civilian maritime applications. In production since the end of 2012, BlueNaute systems stand out from previous-generation products by their "exceptional reliability and robustness". These qualities make BlueNaute systems "especially appreciated" for the most demanding operations: support vessels for offshore oil (especially in dynamic positioning systems), coast guards, maritime police forces, etc. BlueNaute's main customers are based in the United States, Europe, Southeast Asia and the Middle East.

### IAI expands radar family

Israel Aerospace Industries (IAI) has expanded its Maritime Surveillance Radar family. Models of two new additions to this family - the ELM-2022ES radar and the ELM-2022ML lightweight radar - were displayed at the event.

The ELM-2022ES radar system, developed by Elta Systems Ltd., provides optimal maritime and ground surveillance and imaging capabilities, in addition to simultaneous air surveillance. The system implements the proven operating modes

and processing algorithms of the ELM-2022 family, while using the unique capabilities of Active Electronically Scanned Array (AESA) technology. The radar system combines mechanical scan in the horizontal plane with fine beam shifting, and full electronic scan in the vertical plane, providing improved detection, particularly at high sea states.

ELM-2022ML uses a unique front-end design in which most of the radar components are installed directly on the mechanical antenna array. Weighing only 50kg, this radar is suitable for the growing market of small to medium UAVs as well as light reconnaissance aircraft and helicopters. All modes and capabilities of the existing radar are retained. This radar is especially suitable for maritime law enforcement and HLS missions.

"We are monitoring developing market requirements for performance and size and continue to add new versions and modes of operation to extend the capabilities of our radars," said Nissim Hadas, IAI



The ELM-2022ES



The Q 400 Maritime Patrol Aircraft



Executive VP and Elta President, "these two new members of the ELM-2022 family allow us to provide an optimal solution for every platform category and customer requirement."

### MBDA provides Sea Ranger solution for light combat vessels...

With MBDA entering into active negotiations with various export prospects regarding CWSP (Compact Warfare System Package) systems, the company has decided to give the product a commercial name. As of now, CWSP will be included in MBDA's portfolio of products and marketed as Sea Ranger. This is a combat system based on the most recent missile additions to MBDA's product range. It is



aimed at vessels having responsibility for the safety and security of highly sensitive coastal zones or for providing logistics ships with an effective means of self defence. The system is provided as a turnkey solution by MBDA, integrating the radar and optical sensors as well as a command, control and communication system (C3S) allowing for the optimal deployment of Sea Ranger's air defence and anti-ship missiles in complex environments.

### ... and readies SIMBAD RC for deliveries

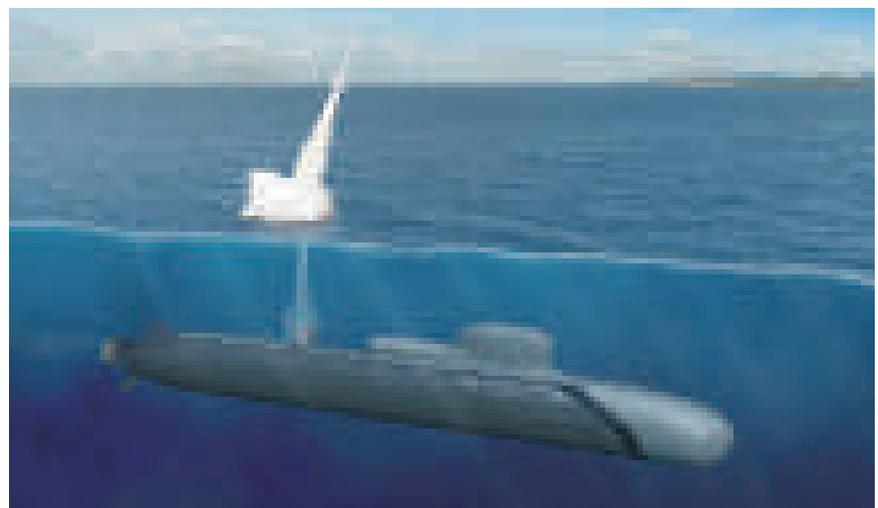
The Simbad-RC ship self-defence system of MBDA has entered the qualification phase. The first deliveries of series production units will occur in 2015. The Simbad-RC is the "remote controlled" variant of the Simbad twin launcher system equipped with two ready-to-fire Mistral missiles,



already in service with the French Navy and with several navies around the world. Designed to be the main air defence system of Fast Patrol Boats and auxiliary ships or a complementary air defence system for corvettes/frigates, the system is mounted on a stabilised launcher and remotely controlled from the ship's operations room, where a single operator can control two launcher systems. The system allows the warship self-protection against a wide range of threats ranging from anti-ship missile to FIAC's. Up to now, the Simbad-RC system has been ordered by two navies for several dozen units.

### DCNS unveils SMX-Océan...

DCNS has unveiled the SMX-Océan conventionally powered attack submarine. The new vessel draws extensively on the design of a state-of-the-art nuclear-powered submarine, with a number of key innovations that give this diesel-electric adaptation "truly outstanding performance".



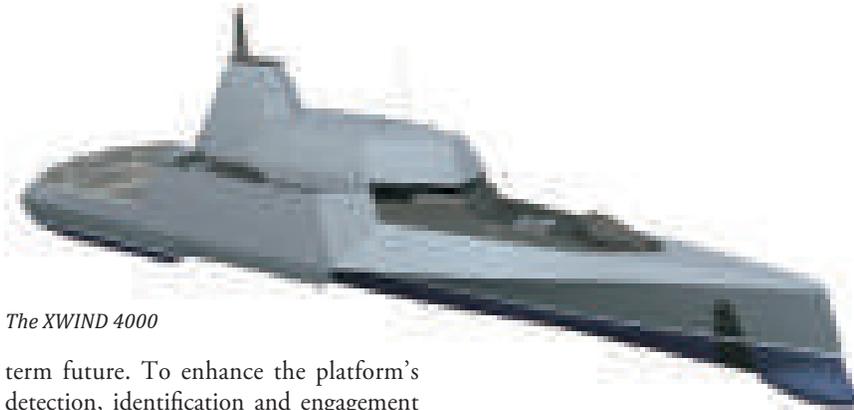
The vessel promises submerged endurance and deployment capabilities that are unprecedented for a conventional-propulsion submarine. With up to three months' endurance, an SMX-Océan could cross the Atlantic six times without surfacing. Its transit speed is up to 14 knots. To achieve this level of performance, DCNS teams have developed and combined a number of innovations including a high-performance air-independent propulsion (AIP) system using second-generation fuel cells for submerged endurance of up to three weeks. The SMX-Océan features the same combat system, provisions for Special Forces' missions, masts and general layout as the *Barracuda* SSN.

With a total of 34 weapons including torpedoes, mines, anti-ship missiles, cruise missiles and anti-air missiles, the SMX-Océan's firepower will be "unprecedented" for an SSK.

The SMX-Océan concept ship design also includes vertical launchers, another major innovation in SSK design, to provide a salvo capability for cruise missile strikes on land targets.

### ... and presents the XWIND 4000 concept ship design

DCNS also presented the XWIND 4000, a concept ship combining all of the Group's main innovations for future naval surface systems. The uniquely designed XWIND 4000 concept ship presented by DCNS at this year's Euronaval show features all the latest innovations being developed by the Group's R&D teams. These innovations will be available on DCNS surface ships in the short to medium



The XWIND 4000

term future. To enhance the platform's detection, identification and engagement capabilities, surveillance UAVs or armed UAVs are part of the combat system design. These offboard systems can deploy a broad range of optronic, radar or electronic warfare payloads as well as rockets or missiles. DCNS is a pioneer in this field and the only warship designer already offering this solution. The UAVs remain under the commander's orders at all times and are controlled from the ops room.

The XWIND 4000's innovative all-digital design is also apparent in the intuitive human-systems interfaces for the ship's two nerve centres, touchscreens, voice commands and Kinect technology in the ops room, and 360° vision, augmented reality technology and user interfaces similar to smartphones on the bridge. All the digital systems run on a secure datacentre architecture hosting combat system and platform management applications in a virtual environment that allocates resources as operational requirements evolve.

### Tomahawk enhancements showcased in tests

The US Navy and Raytheon have completed successful back-to-back Tomahawk cruise missile flight tests that validated recent software improvements. The upgrades improve weapon system performance. In

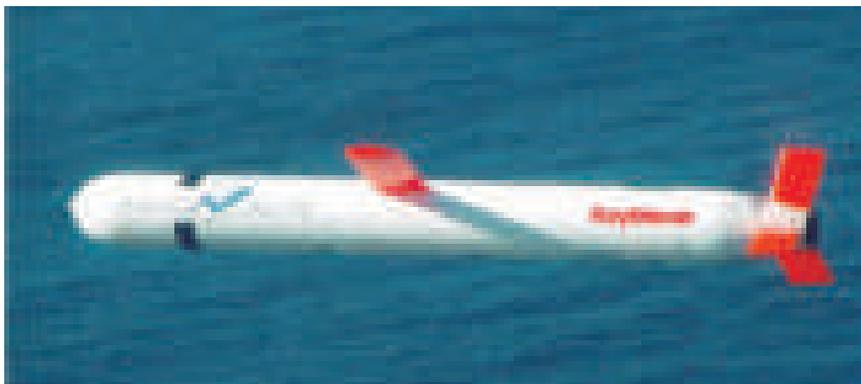
the first test, the nuclear submarine USS *Hampton* (SSN 767) fired a Tomahawk Block IV from the sub's vertical capsule launch system. The missile flew a pre-planned mission until a strike controller located at a maritime command centre directed the Tomahawk to a new target. The missile successfully demonstrated enhanced flex retargeting before striking the updated target at the Naval Air Warfare

Centre Weapons Division, China Lake weapons range.

In the second test, the guided missile cruiser USS *Lake Champlain* (CG 57) launched a Tomahawk Block IV. The Tomahawk flew a series of pre-planned high altitude manoeuvres demonstrating improved performance in this flight regime. The missile completed a pre-planned vertical dive impacting a target on San Nicolas Island off the Southern California coast. The US Navy has conducted more than 70 successful Tomahawk Block IV flight tests since 2006. The cruise missile has been employed in combat more than 2000 times since it was introduced.

### Rafael unveils naval Iron Dome missile defence system

Rafael's "Iron Dome" will now have a naval variant. At Euronaval, Rafael unveiled C-Dome, which endeavours to help combat vessels counteract any threats from the air, including missiles, helicopters and tiny



unmanned drone aircraft, which could increasingly become tools of combat and reconnaissance at sea just as they have on land in recent years. Large naval vessels generally have radar-based interception systems to counter incoming threats. But Rafael executives say C-Dome offers innovations. It can fire up to a missile per second, cover a 360-degree range while piggybacking on a vessel's own radar systems with heat-tracking missiles that zero in on multiple incoming threats at a time.

## SeaCat from Atlas Elektronik

The surface of the planet Mars is better charted than the bottom of our oceans. The formidable characteristics of the sea, such as extreme water pressure, darkness and the lack of data transmission channels, limit the possibilities for obtaining measurement data. Wireless communication underwater is therefore an essential factor in the future research and utilisation of the oceans, and still remains a major technical challenge. Within the scope of studies commissioned by the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw), as well as the research and development work of German companies, the foundation for a digital communication network under has been laid over the past few years. In this regard, key roles are being played by the Underwater Acoustics and Marine Geophysics Research Institute (FWG) of the Bundeswehr Technical Center for Ships and Naval Weapons, Maritime Technology and Research (WTD71), the companies L3-Communications ELAC and Atlas Elektronik and the research body Fraunhofer Institute FKIE.



RACUN 2: Launch of SeaCat

Building on previous results, important components were incorporated into an international project of the European Defence Agency (EDA), beginning in 2010, with the participating nations German, Italy, Netherlands, Norway and Sweden. This project has the designation RACUN (Robust Acoustic Communication in Underwater Networks); its goal is to develop and demonstrate the capability for



RACUN 3: Release of a 'ground knot'

establishing an underwater ad-hoc robust acoustic network between several moving and stationary nodes. In the time leading up to 2014, several network protocols were developed and tested at sea with international collaboration.

The high point of the project was the practical demonstration of the technology in May 2014. In the Mediterranean off La Spezia, between Genoa and Pisa, it proved possible to set up and successfully operate a large mobile digital network under the water surface. With a total of 16 communication nodes, the two successfully developed methods were demonstrated at sea to observers from the various nations.

For these trials, the research ship "Planet" of WTD71 was used to deploy the autonomous underwater vehicle "SeaCat" developed by Atlas Elektronik. This robotic mini-submarine scanned the seabed with its sonars and immediately reported the location of submerged objects of interest, e.g. wrecks, to the underwater network. Via a gateway buoy in the communication network, these data were received by acoustic means and forwarded to a shore station by radio.

Thanks to the key technology developed in the RACUN project, a significant

basis has been created for underwater communication, with the prospect of achieving further advances in the utilisation and exploration of the oceans.

RACUN is being carried out by a consortium consisting of various European companies and institutes under the lead management of Atlas Elektronik. The project partners include FWG, L3 Communication ELAC Nautik, Fraunhofer FKIE, Develogic, FFI, Kongsberg, FOI, SAAB, TNO, CSSN, the University of Padua, WASS and Cetena. The project supervision team, comprising representatives of the participating nations, is headed by WTD 71/FWG.

## Atlas Elektronik's Cerberus Mod 2 diver detection sonar

Signalis and Atlas Elektronik UK have jointly developed an interface for the Cerberus Mod 2 Diver Detection Sonar (DDS) into Signalis' Styris system providing a Coastal Surveillance solution featuring fully integrated above and underwater surveillance sensors. Styris is the Signalis Integrated Maritime Surveillance and Security solution which is a single, common software solution for the collection, processing, fusion and display of data from a wide range of external sensors such as radars, AIS, RDF, cameras, weather stations and now the Cerberus Mod 2 DDS. Cerberus Mod 2 is the latest generation of Atlas Elektronik UK diver detection sonar and is specifically designed to detect and classify open and closed circuit divers, swimmers, swimmer delivery vehicles and UUVs. The system is proven, flexible and has been qualified for military use and is provided in a lightweight, easy to deploy package. The system can be configured for various environments and applications such as permanent seabed installation for a 24/7 port and harbour security and surveillance.



# Vayu : behind, and beyond, the Ruby Years



Defence Minister S Swaran Singh at the inauguration along with then Air Chief, Secretary for Defence and noted journalist Mr Prem Bhatia

**V**ayu completed 40 years of publication in November 2014, its Ruby-hued years replete with the passage of aerospace events which were meticulously recorded, reviewed and analysed. Launched in New Delhi on 7 November 1974 by the Defence Minister of India, *Vayu* (called *Vayuyan* in its initial years) has strived to maintain its reputation as a professional purveyor of events as they take place, without fear or favour as behoves a professional journal in aerospace, the cutting edge of science and technology.

As the editorial succinctly put it on the eve of the new millennium in December 1999, when *Vayu* turned 25, “As the editors looked back at a quarter century of aviation and space events in India, they went through a virtual time warp, going over the milestone events which were faithfully recorded in issues of the journal over the 300 months gone by. Naturally, much has changed – but a lot has not !”

This startling fact will surely be ascertained by readers today who have the interest, or curiosity, to wade through this Special Issue. Faces (of people) and models (of aircraft) have surely changed

but attitudes have not. Sadly, there has been increasing procrastination in decision making : major programmes, both in defence and civil aviation, which dragged on without clear direction even as successive Chiefs, Secretaries and Ministers have come and gone but actions remained “on ice.”

As this 40<sup>th</sup> Anniversary issue is put together, the nation is at a crossroads, awaiting directions which will determine the

efficacy of the indigenous aircraft industry in the coming decades. We can hope that with astute leadership and stability in governance today, we will finally see the host of bunched up programmes unravelled so that this nation can “get on with it”. In the following 40 pages, which carry select news over the past 40 years, mostly about India but also concerning the neighbourhood and programmes of future pertinence, the reader can look at events through an ‘inverted telescope’, so to speak, which is both edifying and sobering but would surely provide a basis for rational decision taking.

For ourselves, we will continue with the vision of our founders. It is gratifying that over the 40 years of its existence, *Vayu* has come to be acknowledged as amongst the leading aerospace journals extant. Its editors and writers, who stand tall amongst the finest journalists of the world, continue to receive prestigious awards from professional organisations such as The Royal Aeronautical Society of the UK and other international institutions.

*The Vayu Aerospace Review* continues to soar high, even as it wings towards its Golden Jubilee in 2024. Fly with us !

**The Editors**



Trophy presented to the Vayu Aerospace Review by the Royal Aeronautical Society at 'Journalist of the Year Awards' function at Paris

# 40

Years  
of

# VAYYU

**V**'ayayan' was launched at New Delhi on 7 November by Defence Minister S Swaran Singh, in presence of CAS Air Chief Marshal OP Mehra and various senior officials. The Minister said that "magazine of the kind I am releasing today will touch the chords of those serious minded and who want to go deeper in disseminating knowledge ...".

In this first Issue, the objectives were clearly enunciated in that "the journal is intended to span, appropriately, the gap for a specialised Asian aviation magazine. It will be our endeavour to offer the highest standards of accuracy, presenting solid fact and data recorded in an informative and readable manner. Although international in flavour, this aircraft magazine will have a strong Asian bias. It is our hope that the vantage point of New Delhi, as geographic centre of the arc from West Asia to the Pacific, will enable the 'Vayayan' to heighten its impact on Governments and industry, making each the better informed on aviation parameters and programmes so that trends could be identified, analysed and perhaps, eventually, even shaped".

In an exclusive interview on 'The Indian Air Force in the Decade Ahead', the CAS articulated on the IAF of the 70's, outlining plans to "develop the Gnat into a relatively inexpensive close support aircraft, the HF-24 into an advanced strike aircraft and start of the MiG-21M production". There was need for "a proper MR/ASW aircraft, the Dakotas and Packet to be retired and the Vampire replaced by the Kiran jet trainer".

## 1974

**The following were main news carried in this first issue.**

- ◆ A significant development is setting up of a Design Organisation in HAL headed by a whole time Director responsible for planning and co-ordinating all the design and development activities of the Company. Mr SC Das is now Director, Design and Development. The total number of employees of all categories on the rolls of HAL was 37,669, an increase of 604 during the year ended 31<sup>st</sup> March 1974.
- ◆ The HF-24 Mk. II is virtually rejected as the Indian Air Force has not confirmed its initial interest in the afterburning Orpheus 703. HAL have submitted firm proposals for the Mk. III or HF-73, and this aircraft could reportedly exhaust the growth potential of the HF-24. The HF-73 would have maximum hardware commonality with the HF-24 and if the GOI sanction is received within 1974, the aircraft is envisaged as entering squadron service in 1981-82. Meanwhile, the first of the production Marut trainers will be delivered to the IAF by late November 1974, the Mk. II prototypes having completed all flight testing required (over 300 test flights).
- ◆ The second Indian-built *Leander*-class frigate, INS *Himgiri* was commissioned at Bombay on 23 November. Similar to the

INS *Nilgiri*, the first such type to be built at Mazagon Dock Yard, the *Himgiri* carries a MATCH Alouette III helicopter and is equipped with Seacat short-range anti-aircraft missiles amongst other armament.

- ◆ HAL Kanpur will be delivering the 69<sup>th</sup>, and last, Avro 748 to the Indian Air Force in 1975 but owing to the delay in submission of the Dhawan Committee report, plans for the production of the freighter version (30 HS 784Ms) and development of a maritime reconnaissance variant at the insistence of the IAF, has resulted in an inevitable break in production and idle capacity at Kanpur, "causing serious concern and the matter is being pursued with the Government for an expeditious final decision".
- ◆ Air India has ordered its fifth Boeing 747B for delivery in December 1975. During the Fifth Plan, Air India was to procure three wide bodied jets and the DC-10 was strongly considered but its lower operating cost was outweighed by additional investment in new engineering facilities, ground support equipment and crew training which would have been entailed. Air India may now make its debut with larger capacity jets on the Far East Sector, initially to Australia and it is also likely that AI will start flying to Montreal in Canada since Canadian Pacific have been permitted to fly to India.
- ◆ In view of the changed traffic pattern owing to steep rise in aviation fuel costs, with a "significant" drop of traffic in

regional routes without any such change in truck routes, the economies of wide-bodied aircraft are under examination, including those of the A.300B Airbus, DC-10, Tristar and also the Boeing 727 and Tu-154.

- ◆ Ma Ning was recently identified as commander of the Chinese Air Force which is interpreted as a move to rehabilitate the Air Forces' standing which was under a cloud because of the support it gave the late Lin Piao. The Chinese Air Force has had no representation on the politbureau while the Navy has an alternate member.
- ◆ Amidst news of Pakistani troop movements and concentrations along the Durand line on the North West frontiers of Pakistan bordering Afghanistan, it is reported that PAF Sabres, operating from Quetta, have carried out napalm bomb attacks in Baluchistan.
- ◆ The PAF has recently received the first of 45 Saab-Scania MFI-17 Supporter primary trainers and these are to be employed at the PAF College, Risalpur, replacing the earlier T-6 Texans. The MFI-17s are also equipped for the ultra-light strike role.
- ◆ A group of scientists at the Tata Institute of Fundamental Research (TIFR) have been undertaking a series of important rocket astronomy experiments in the largely unexplored ultrasoft X-ray region. In their first such experiment, they launched a payload consisting of two tanks of proportional counters on board a spin-stabilised Centaure IIA from Thumba.

# 1975

◆ Defence Minister S Swaran Singh has said that it would be incorrect to say that the Indian Air Force was facing difficulty in equipping itself “properly” owing to foreign exchange shortages. “Our effort has always been to keep our defence preparedness at a satisfactory level within our resources.” Some days earlier, the Defence Minister had maintained that the Indian Air Force was well equipped to meet any “legitimate” defence situation and although there were certain deficiencies in the air arm of Indian defence, “these were being rectified”.

◆ The Soviet Defence Minister, Marshal Andrei Grechko, accompanied by Chiefs of the Soviet Air Forces and Navy, Air Chief Marshal PS Kotakhov and Admiral SG Gorshkov, respectively, with principal officers visited India for three days in February. Considerable significance has been attached to this high powered defence visit to India as it has been reported that detailed talks covered the whole gamut of present co-operation and collaboration between the two countries concerning India’s security requirement. Reports have it that the Indian Navy is to receive eight *Nanuchka* type missile boats and other surface craft. As far as airborne MR/ASW requirement is concerned, three or four

Ilyushin Il-8s are likely to be procured with delivery in 1976.

◆ According to reports from London, the keen Indian interest in procuring Jaguar strike fighters has been toned down because financial problems could “not be satisfactorily resolved”. Sources in both the Indian High Commission and BAC have been reported to have stated that New Delhi has shown considerable interest in the Jaguar but would not confirm that the deal for 50 aircraft plus spares etc. worth about Rs 400 crores had “failed” because the British Government had refused to extend credit on easy terms to the Indian Government.

◆ Indian Naval missions visiting Moscow recently have discussed a comprehensive list of requirements, which includes more submarines, *Kresta*-type helicopter carriers as well as long-range maritime reconnaissance aircraft. As the Beriev Be-12 amphibian has been considered quite unsatisfactory, Indian interest in possible Soviet ASW and MR aircraft has narrowed down to the Ilyushin Il-38. Reports also refer to the Soviet offer of VTOL aircraft for the INS *Vikrant* as a replacement for the remaining obsolescent Seahawks. As development of the Sea Harrier is still uncertain, the IN may be interested in the Yak-36 which is apparently the type to be employed in the first conventional aircraft carrier being commissioned by the Soviet Navy.

◆ The Indian Navy’s second Sea King ASW helicopter squadron, INAS 336, was commissioned at INS *Garuda*, Cochin, on 20 December 1974. The Unit will be committed on the Western coast of India, the total number of Sea Kings in Indian Navy Service is now twelve, in two squadrons.

◆ As part of Indian Airlines’ fleet rationalisation and re-equipment programme, four DC-3s and two Viscounts have been sold to operators in Cambodia and one Viscount to an Indian private air carrier (Hans Air). IA is now left with two Viscounts and one DC-3, the former for operating the long over water Calcutta-Port Blair (via Rangoon) route and the latter for logistics support. Meanwhile, the Corporation has formally placed an order for two

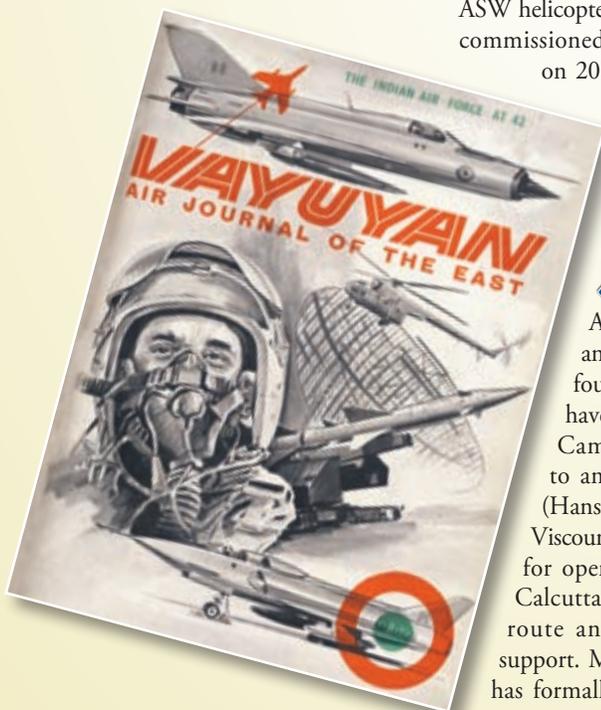
additional Advanced Boeing 737s and these will be delivered in the course of 1975 to take the total in IA inventory to 12.

◆ On 22 April, the Union Cabinet approved Indian Airlines proposals to buy three Airbus A300B2 aircraft. IA had recommended the procurement of these wide-body aircraft to augment its fleet from late 1976, because of superior technical performance and attractive financial credit terms. Purchase of the three A300B2s, which will cost Rs. 94 crores, including spares, ground and other ancillary equipment, will be financed mainly by French and West German credit (totalling Rs. 83 crores) with the balance being met through loans on soft terms. Part of the arrangement, as is learnt, is the lease amount of each of the three Caravelles operated by IA and buy back the six other Caravelles when they are phased out of IA service.

◆ The Satellite Introduction Television Experiment (SITE) began from 1 August with a message from the Prime Minister. About 2,400 villages in six different states- Andhra Pradesh, Madhya Pradesh, Karnataka, Orissa, Rajasthan and Bihar have got the benefit of the TV programmes. In addition, some of the programmes will also be received by regular TV sets in and around Delhi, Amritsar and Nadiad near Ahmedabad.

◆ Chairman of the Indian Space Research Organisation (ISRO), Prof Satish Dhawan, said that for the first time in the country, TV sets had been designed and set up primarily for educational purposes by a team of dedicated people from various fields of education, the sciences, etc. Moreover, the project has been a collaborative effort between ISRO, All India Radio and NASA of the USA, with the latter providing a special satellite for one year.

◆ Aryabhata, India’s first satellite, completed six months in orbit on 19 October 1975, with 2740 orbits around the earth and successfully functioning for over 4300 hours in space. The project report and the management structure for the second satellite have now been finalised. The satellite, to be launched in 1977-78 will carry out an earth observation experiment. ISRO also intends to launch satellites from India, with the help of Indian-made rocket launcher SLV-3 sometime after 1978. These satellites are to be named Rohini Satellites (RS).



# 1976

◆ Hindustan Aeronautics Limited is proceeding with four new aircraft projects, being the armed Kiran Mk. II jet trainer whose prototype flew end July 1976; the HPT-32 primary trainer the Ajeet trainer (to fly in 1978); and an Advanced Light Helicopter (ALH) to be designed and developed with Aerospatiale assistance, (having a fenestron tail rotor design) and to be operated from helipads as high as 6000 metres above sea level.

◆ The first production HAL Ajeet light fighter flew on 30 September and deliveries of this combat aircraft to the IAF are now underway, in spite of delays in delivery of the special Martin-Baker G-4 ejection seat and Lucas-manufactured Hobson longitudinal control unit.

◆ The IAF plans to induct the definitive MiG-21bis into service during next year to supplement and eventually replace the MiG-21Ms and MiG-21FLs in service. The MiG-21bis will be powered by the Tumansky R-25 engine and have “improved ground attack capability”

◆ The IAF have “turned down” the Soviet offer of MiG-23 swing-wing strike fighters, largely on the basis of inadequate range to meet its requirements. The IAF has also shelved the HAL proposal for a SNECMA M.53-powered derivative of the HF-24 Marut but is studying an alternative design with the Tumansky R-25 engine (the HF-25).

◆ Commenting on Professor Satish Dhawan’s reports which “cleared” operations by the HS 748, Air Chief Marshal OP Mehra has said that the Indian Air Force continued to operate the HS 748 without any “rethinking” and would continue to receive the new HS 748s for which orders had been placed with HAL.

The lone aircraft carrier INS *Vikrant* is to undergo modernisation but no decision has been taken concerning new flying equipment on board. Although the Indian Navy is keen on acquiring 12-15 Sea Harrier VTOL fighters, financial aspects are considered as daunting for the present.

◆ The Indian Navy’s first long-range maritime reconnaissance unit, INAS 312, was formally commissioned at INAS *Hansa*, Goa on 18 November, Equipped with ex-

Air India / ex-Indian Air Force Lockheed L.1049G Super Constellations fitted with ASV-21 radars, the Navy are anticipating the replacement of these essentially civil airliners with dedicated MR Ilyushin Il-38s from Russia.

◆ The first of three Airbus A.300 B2s on order by Indian Airlines was delivered to the Corporation on 30 October, 1976, with the second and third airliners reaching Bombay in monthly intervals thereafter. Flight deck crew training was earlier completed at Toulouse and of some 65 engineering and 100 commercial personnel. The Airbus



introduction would increase capacity on the trunk routes by 25 to 30 per cent. Three IA Caravelles will be retired in 1977.

◆ Air India issued a letter of intent for the purchase of a sixth Boeing 747 and the proposal is at present under consideration of the Government. The corporation also retained its options on two Anglo-French Concorde while the decision on the Boeing 707 replacement will be taken towards the end of this decade.

◆ Indian Airlines have initiated the start of twice weekly flights to Male, in the Maldives group, from 2 February. HS 748s will operate from Trivandrum to Male whose airport runway has recently been lengthened and strengthened by the Pakistan Government. IA is currently examining the feasibility of operating

scheduled services between Srinagar and Leh but introduction of this service may have new aircraft type as Leh would require operation by more advanced jet aircraft for its high altitude airfield.

◆ According to estimates, Air India has earned a net profit of Rs. 51 million last year, the highest so far. The total operating revenue in 1975-76 was Rs, 1939.5 million and the estimated financial results reflect considerable improvement over the last year’s performance mainly due to the higher load factor achieved, improvement in yields, strict control on expenditure and introduction of additional services on the UK and Gulf routes during the year. Indian Airlines on the other hand, has made an estimated profit of Rs. 33.8 million in 1975-76 and operating revenue of the airline improved from Rs. 960 million in 1974-75 to Rs. 1071 million in 1975-76. The improvement in the financial position was due to an increase in the number of passengers and volume of freight carried as well as economy measures undertaken by the airline.

◆ The Indian Space Research Organisation (ISRO) has requested the European Space Agency (ESA) to put an Indian-made experimental communications satellite on board the ‘Ariane’ rocket expected to be launched in three to four years. If ESA agrees to India’s request, Indian engineers will have the unique opportunity of studying the working of highly sophisticated space communication systems but as the satellite has to be accommodated in another spacecraft, there would be a great deal of constraints on its construction. Meanwhile, over 35 private and public undertakings are involved in the SLV-3 project. The SLV-3 launch will signify a take-off stage in the country’s space technology, with “an Indian spacecraft shot into space by an Indian made rocket from Indian soil.”

◆ The President of India presented colours to three Indian Air Force units in mid-November at the Air Force Station, Hindan. No.16 Squadron, with Canberra B (I) 58s, which distinguished itself in several operational tours while No.23 Squadron was the first formation to be raised on the Gnat light fighter; the third formation is No.101 Squadron, originally flying Spitfire FR Mk.XVIIIIs for tactical photo-reconnaissance commitment but later re-equipped as a ground attack unit and currently flying the MiG-21M.

# 1977

◆ The Defence Minister has stated that the long awaited decision for a Deep Penetration Strike Aircraft (DPSA) for the Indian Air Force “was likely to be taken soon” which will allow the IAF to start replacement of the Canberra, Hunter and Sukhoi Su-7. Three possibilities still figure in the selection, the SEPECAT Jaguar International, the Dassault Mirage F.IE and the Saab AJ 37 Viggen.

◆ Substantial expansion and capability upgrading of Indian Naval Aviation is anticipated throughout the remainder of the decade and a major increase in maritime patrol effectiveness is expected towards the end of the year when a new squadron (INAS 315) completes working up on the Ilyushin Il-38 at Dabolim, Goa. Air and ground personnel of this unit have been undergoing conversion training in the Soviet Union since early this year, and initially the Squadron will have a complement of four Il-38s, but current planning calls for the acquisition of two additional aircraft later. While it was earlier assumed that the I1-38s would supplant the Lockheed 1049G Super Constellation maritime patrol conversions, five of which were transferred to the Navy from the IAF and currently operated by INAS 312, it is now confirmed that this unit will continue to operate its aged aircraft until at least 1981.

◆ Growth of the helicopter component of Indian Naval Aviation is continuing with the follow-on contract for five Westland Sea Kings. The Sea King is currently operated by two shore-based squadrons, INAS 330 and INAS 336, and the additional helicopters will be deployed aboard the three new frigates which are following on the Seacat-equipped *Leander*-class frigates in the Bombay shipyards. The IN is to also receive five Kamov Ka-25 helicopters for deployment aboard two Soviet *Kashin*-class ASW destroyers to be delivered to the Indian Navy during 1978.

◆ Negotiations for the purchase of seven-eight Hawker Siddeley Sea Harrier shipboard V/STOL multi-role fighters for operation from the carrier INS *Vikrant* have reached an advanced stage and are expected to be successfully concluded before end of the year. With deliveries likely from late 1979, the initial batch of Sea Harriers is

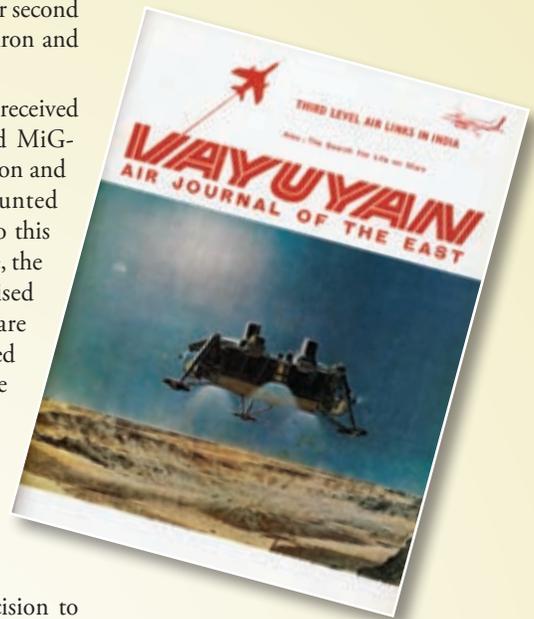
expected to be followed by a similar second batch to equip a 12-aircraft squadron and provide a three-aircraft reserve.

◆ The Indian Air Force recently received its first Tumansky R-25-powered MiG-21bis fighters from the Soviet Union and No 21 Squadron (formerly mounted on the Gnat) is now converting to this type. Apart from its uprated engine, the MiG-21bis has a completely revised avionics fit and two squadrons are to be formed with aircraft delivered direct from the Soviet Union, the second squadron, possibly one of those currently operating the Su-7, yet to be nominated. HAL production of the MiG-21bis will follow on the phase-out of the current MiG-21M from 1979.

◆ The IAF is pressing for a decision to meet its medium tactical transport aircraft (METTAC) requirement to replace and rationalise its current fleet consisting of C-119G Packets, DHC-4 Caribous, C-47 Dakotas and Il-14s. The DHC-5C Buffalo (re-engined with RR Darts) has re-emerged as the first contender while Hawker Siddeley have proposed the rear-loading HS-748 (RLTT) and Antonov An-32, the re-engined considerably overpowered aircraft for hot-and-high operations.

◆ After announcement that the US had approved sale of 110 A-7 Corsair II attack aircraft to Pakistan, there was renewed interest in the SEPECAT Jaguar by Pakistan with the possibility of purchase of upto 100 aircraft. Although foreign exchange problems have prevented finalisation of the Jaguar for India as well, there is an imminent change in the Government, with general elections announced. Meanwhile the US Government has given McDonnell Douglas permission to offer A-4 Sky Hawk II carrier-borne attack aircraft for the Indian Navy to replace the Sea Hawk.

◆ First prototype of the HAL HPT-32 primary trainer (X 2157) made its maiden flight at Bangalore on 6 January, flown by Wg Cdr Inder Chopra, CTP. Designed under the leadership of SC Das, current plans call for completion of the test programme by mid 1978, the HPT-32 intended as replacement of the HT-2 at the IAF Elementary Flying School. HAL expects to market both military and civil models throughout Asia and the Middle East.



◆ One of the first actions of the newly-elected Government under Prime Minister Morarji Desai was cancellation of orders for the VIP-configured and specially-equipped Boeing 737s to be operated by the IAF's Air Headquarters Communication Squadron. The Comm. Squadron will now continue to operate the three ageing Tupolev Tu-124s and six HAL-HS 748s.

◆ First prototype of the Dassault Breguet Mirage 2000 is to be rolled out at St Cloud in October, with first flight scheduled in early 1978 and first deliveries in late 1981. The Mirage 2000 will initially be powered by the Snecma M53-2, to be followed by the more powerful M53-5 after a year.

◆ Flight testing of the General Electric / Snecma CFM-56 is expected to begin in February, with a Caravelle used as a test bed as also on a YC-15 AMST prototype.

◆ There has been quiet Indian (HAL) interest in the privately developed Air-Metal AM-C 111 multi-purpose STOL transport aircraft of Germany. Air-Metal Flugzeugbau, with headquarters in Erding and works at Landshut, was forced into insolvency after the German government rejected repeated requests by the company for financial support, the final decision given at the end of 1976. Concept design of the HAL HAC-33 commuter passenger aircraft is reportedly based on the AM-C 111.

**The new image Vayu Aerospace Review hereafter superseded the Vayuyan which was eclipsed in order to ensure continuity and quality of content.**

# 1978

◆ On 6 October 1978, after years of evaluation, deliberation and final negotiations, the Government of India announced selection of the Sepecat Jaguar International as the strike aircraft to replace the aging Canberras and Hunters of the IAF. Explaining the rationale behind the selection, the GoI has stated that “firstly, the Jaguar, as also the other two aircraft, adequately meets the requirements of the IAF. Secondly, it is the most economical of the three options. Thirdly, it has the most favourable delivery schedule. Fourthly, the Jaguar has an edge over the other two aircraft in the important characteristics of survival capability.

◆ A British Aerospace mission, led by Sir Fredrick Page, the Chairman and Mr. Alan Keys arrived in New Delhi in mid-October for formal signing of the ‘Intention to Proceed’ (ITP) and this was followed by the visit to Britain of a high-level Indian team led by Dr. Sushital Banerjee, Secretary for Defence, to sign the MoU with the British Government on the policy aspects of this major and long term defence contract.

◆ Following the long anticipated decision on the Indian Air Force’s DPSA, the Government of India announced the procurement of yet another combat aircraft, this being the Sea Harrier VTOL fighter. The Sea Harrier has been selected to replace the ageing Sea Hawk fighter-bombers of the Indian Navy primarily for service on board the aircraft carrier *Vikrant*. The IN thus becomes the world’s fifth air service to get VTOL fighters.

◆ The Sea Harriers will operate alongside the Alize ASW aircraft and Sea King helicopters of Indian Naval Aviation and the *Vikrant* is shortly to undergo a major re-fit and modernisation programme to prepare for the deployment of Sea Harriers, under 10 of which have been initially ordered.

◆ After several rounds of meetings between senior executives of the companies, Hindustan Aeronautics Limited (HAL) and Dornier GmbH of West Germany have signed a MoU on 31 May to prepare feasibility studies on the joint design and development of the 19-24 seater Light Transport Aircraft (LTA). Chairman HAL Air Marshal SJ Dastur and Dornier Managing Director Dr. Bernard Schmidt

led their respective teams which met at Bangalore and Friedrichshafen.

◆ Air Chief Marshal Idris Hasan Latif took over as Chief of Air Staff of the Indian Air Force on 1 September, in the thirty-seventh year of his service.

◆ The Indian Coast Guard was formally established on 19 August, and its air component will comprise four Alouette III helicopters and 12 light twin-engined fixed-wing aircraft of an as yet unselected type. Studies have been made of the Dornier Skyservant, the Britten-Norman Maritime Defender and the GAF Nomad N22B Search Master. The aircraft will be operated from Bombay, Cochin, Madras and Port Blair.

◆ The Tri-National Tornado Training Establishment to be established at RAF Cottesmore will receive 22 of the two-seat Tornados ordered by the Luftwaffe and Marineflieger. The German Navy Tornados will be armed with the Kormoran anti-shiping missiles even as the German Air Force will equip four fighter-bomber wings.

◆ The Royal Australian Air Force are to refurbish their Mirage III0 fighters which still have a dozen more years of service at present utilisation rates. However, there will be installation of new avionics and perhaps new AAMs, such as the Matra 550 Magic.

◆ The USAF is to receive the first production GD F-16s with the formation of a 30-aircraft combat training squadron at Hill AFB. Production of the F-16 for the USAF Air will peak at 180 aircraft annual by the end of 1981.

◆ The Hawker Siddeley Hawk advanced jet trainer / ground attack aircraft has been ordered by the Indonesian Air Force which will receive an initial eight aircraft. Meanwhile, the Finnish Air Force is considering procurement of 50 Hawk AJTs for delivery from 1980 onwards.

◆ The Bangladesh Air Force has now received 24 Chinese-origin F-6 (MiG-19S) fighters which are based at Tezgaon and Jessore. These are to be augmented by another twelve F-6s as only a few MiG-21MF fighters remain in service.

◆ Iran has ordered a massive number of new aircraft from the United States including 70-more Grumman F-14 Tomcats, 140 more General Dynamics F-16s, six more Lockheed P-3F Orions, three more Boeing

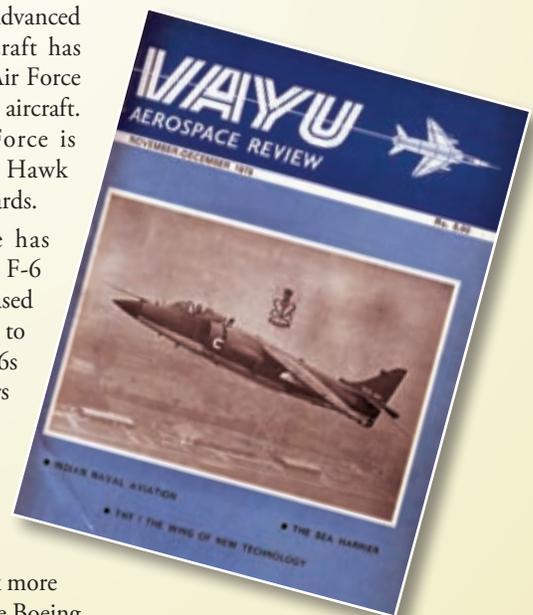
747s, 12 more Boeing 707s and 11 more McDonnell Douglas RF-4E Phantoms. Also included are an additional 15 Lockheed C-130H Hercules tactical transports.

◆ With the induction of two more A.300B2s in June/July, the Indian Airlines Airbus fleet has gone up to five. Indian Airlines have an agreement for three additional Airbuses for possible future requirements. Indian Airlines have introduced the Airbuses on the Bombay-Trivandrum route and now provide an additional daily frequency between Bombay-Bangalore and Bombay-Madras.

◆ The Boeing 737 is being deployed on the Calcutta-Silchar route and the Bombay-Cochin route will follow when improvements to the naval airfield at Cochin are carried out. After completion of the heavy civil engineering works now underway at Srinagar, Gauhati and Trivandrum airports, the Airbus will also operate on the Delhi-Srinagar, Calcutta, Gauhari and Delhi-Hyderabad-Bangalore sectors.

◆ Air India’s latest Boeing 747 ‘Emperor Kanishka’ arrived in Bombay on 2 July, 1978, with whose addition the Airline now has six Boeing 707s. In February was received Air India’s ‘Emperor Chandragupta’.

◆ In the 25th year of nationalisation, Air India made a record profit of Rs. 25 crore (US \$28 million), largely attributed to increased load factors, stable fuel process, increased operations to the Gulf and optimum utilisation of the fleet.



# 1979

◆ Formal agreement for acquisition of the Sea Harrier VTOL fighter for the Indian Navy was signed at New Delhi on 23 November between the Government of India and British Aerospace (Kingston Division). The initial contract, worth Rs. 150 crore which is inclusive of ground support equipment and spares, comprises 6 Sea Harrier FRS Mk. 1 fighters and 2 Mk. 60 twin-seat operational trainers. The Sea Harrier will replace the Sea Hawk on board the INS *Vikrant* which has operated the latter since the early sixties.

◆ The first two Jaguar International aircraft for the IAF were formally accepted by Mr. IP Singh, India's Acting High Commissioner in London from Sir Frederick W. Page, Chairman of British Aerospace at Warton aerodrome in Lancs, on 19 July. The two Jaguars, a two-seat operational trainer and a single-seater, were later ferried to India by Chris Yeo/Wg. Cdr. DR Nadkarni and Tim Ferguson respectively, arriving at Ambala Air Force Station on 26 July.

◆ The new Indian Defence Minister, C Subramaniam, has strongly defended acquisition of the Jaguar by the IAF, and has stated that any criticism against it is "ignorant and ill-informed" and that his predecessors are "patriotic and not ignorant in importing Jaguar technology". Further, he remarked that "though the credibility of politicians may be low, the capability of our scientists and technologists cannot be underrated". It is learnt that the IAF has very strongly stood up to its selection of the Jaguar as by far the best suited for the role envisaged. The mild flutter caused by wild pronouncements of the new party chairman Raj Narain have all but been ignored by the Defence Ministry and Air Force, the tirade being viewed as "entirely politically oriented". Meanwhile, the Jaguar acquisition and training programmes continue apace and ferry flights of the first eighteen (interim) aircraft remain on schedule.

◆ The second prototype HPT-32 primary trainer made its maiden flight at Bangalore in mid-March. Incorporating minor modifications and a faired over landing gear, the aircraft joins the first prototype in flight development which includes spin

trials. The HPT-32 is to supplant the HT-2s in the primary training role from 1982.

◆ Amongst the contenders for the IAF's Medium Tactical Transport Aircraft (METTAC) requirement, the Aeritalia G. 222, a demonstrator model of which was subjected to a three week evaluation in India in February/March, is considered as meeting most of the tasks desired but has three major factors that go against its selection; the high unit price, the uncertainty in supply of the US engine, and Aeritalia being a relatively "unknown" firm. Aeritalia have offered to re-engine with the RR Tyne but deliveries could then be delayed and operating costs/



pay load penalties higher than acceptable. The total METTAC requirement is for nearly 100 aircraft, with first squadron to re-equip by 1981-82, and license-production or assembly at Kanpur would form part of the contract.

◆ The joint Air Force/Navy requirement for an advanced light helicopter (ALH) has now been firmed around a twin-engine configuration, as distinct from the earlier powerplant. HAL will proceed on the revised ASR which specifies operation at hot-and-high conditions, hover ceiling of 6000 metres, seating capacity of 8 and a variety of armaments. Choice of the powerplant will

be either the P&W PT6 B-35B, RR Gem 4 or Turbomecca Astafou XX.

◆ In the 25<sup>th</sup> year of nationalisation, Air India made a record net profit of Rs 25 crores, largely attributed to increased load factors, stable fuel prices, increased operations to the Gulf and optimum utilisation of its fleet. Although the total operating revenue for the year ended March 1978 has exceeded Rs. 300 crores, the total increase in capacity was only 2% owing to the loss of a 747 in January, the delay in delivery of the sixth 747 and consequent curtailment of operations. Air India carried more than a million passengers for the first time as against 943,000 the previous year, a growth of 8%.

◆ A joint fleet-planning study by Air India and Indian Airlines is in progress and a decision should shortly be taken on the selection of a smaller long range wide-body aircraft for the gradual replacement of the 707 fleet. Studies are also in progress with regard to twin-engined wide-body medium range aircraft for meeting Air India's short/medium haul and regional operations.

◆ Indian Airlines' first scheduled Boeing 737 service on the Srinagar-Leh-Srinagar sector was made on 14 January. Commanded by Captain AM Kapur, with Captain Vishwanath, the flight to Leh carried 82 passengers including Chairman Mahesh Sarin plus 1.5 tons of cargo, whilst on the return; there were 108 passengers from Leh.

◆ Air India's latest Boeing 747 (VT-EFU) *Krishna Deva Raya* was rolled out in Seattle in July and is to be delivered to India in mid-August. The next 747 (VT-EGA) *Samudra Gupta* will follow in November and the next two (VT-EGB) *Mahendra Varman* and (VT-EGC) *Harsha Vardhana* in February 1980.

◆ Air India's net profit for 1978-79 was Rs. 34.09 crore, the highest ever made by the Corporation in its history and, unusually, even higher than the equity of Rs. 33.41 crore. This was "for the fourth year in succession... Air India has set a new record in profitability," as declared by Mr. BS Das, Air India's MD. In terms of passengers, Air India carried 1,125,908 revenue passengers or 7.9% higher than last year's total.

# 1980



◆ Defence Minister C Subramaniam has announced a number of decisions on the induction of modern equipment and weapons for the Air Force. Apart from induction of the Jaguar as a long range strike aircraft, the Government has also taken the decision for acquisition of new medium transport aircraft (Antonov An-32). Additional Mi-8 helicopters are also being acquired to replace the ageing Mi-4s whilst efforts were also being made to acquire new tactical support strike aircraft (hinted as the MiG-23BN) as well as modern air defence missile systems.

◆ To solve some of the poor promotional prospects and stagnation, particularly in the middle levels of the Air Force, the Defence Minister has announced that a number of upgrades had been sanctioned in the last three years in the ranks of Wing Commander, Group Captain and Air Commodore with “refinements made in the Deep Selection Policy.”

◆ The IAF is to phase out the last of its Gnat lightweight fighters by March 1981, the remaining squadrons (Nos. 2, 22 and 24) to convert to the Ajeet and MiG-21bis respectively. The IAF also plans to acquire two Boeing 737-200s for use as VVIP transports at a cost of Rs. 45 crore (US \$8 million), replacing the present Tu-124s in this role.

◆ There are reports that orders have been placed with HAL for the first phase production of Jaguar in India, comprising 45 aircraft. These will augment the 40 to be delivered as ‘flyaway’ by British Aerospace in Warton, in addition to the 18 ‘on loan’ from RAF reserves. Final clearance of the over-wing mounted Matra R.550 Magic air-to-air missiles on the IAF’s Jaguars is to be undertaken in India. Also, a number of HAL built Jaguars will incorporate the Thomson-CSF Agave multi-role radars, primarily for the maritime strike mission.

◆ Following evaluation in the Soviet Union of both the interceptor and ground-attack versions of the MiG-23 swing-wing fighter by senior pilots of the IAF, the MiG-23MF and MiG-23BN are to be procured to augment the all-weather air defences of India and replace the Su-7s and HF-24s in the ground-attack/strike squadrons. Meanwhile, the rumoured IAF interest in the ultra-high altitude MiG-25R reconnaissance aircraft has been translated into a firm order for eight aircraft, including two twin-seat operational conversion aircraft.

◆ The Indian Coast Guard have placed orders for six patrol vessels to be built in Indian dockyards, for delivery in 1981-82. Three of the 1000-ton offshore vessels, embarking a HAL-built Alouette III helicopter each, will be built by the Mazagon dockyards at Bombay whilst three of the smaller 200 ton inshore patrol vessels are being built by the Garden Reach Workshops at Calcutta. The Five-Year expansion programme (to 1983-84) involves a Rs. 100 crore budget for ships, aircraft and facilities. Also, the current Coast Guard district stations at Bombay, Cochin, Madras and Calcutta will be supplemented by regional stations at Porbandar, Haldia, Vishakhapatnam and Campbell Bay in the Nicobar Islands.

◆ A follow-on batch of three Sea King Mk.42A ASW helicopters has been delivered to the Indian Navy at INS *Garuda*, Cochin by Belfasts of TAC Heavy Lift. These augment the Sea King Mk.42s delivered in 1971 and 1973 and equipping Nos. 330 and 336 Squadrons on the INS Vikrant and shore-based at Cochin.

◆ An initial batch of 30 PAF Mirages are currently being updated by the installation

of the Litton LW-33 nav/attack system incorporating a Thomson-CSF head-up display. It is anticipated that the entire PAF Mirage fleet will be progressively modified in similar fashion. Unofficial French sources have stated that the Pakistan government is seeking to purchase 35 Mirage 2000 fighters for 1985-86 delivery.

◆ Even as Saab-Scania handed over the last production SF 37 Viggen photo-reconnaissance aircraft to the Swedish Air Force, the Supreme Commander has requested accelerated development of a new supersonic fighter/attack aircraft, tentatively designed JAS, as a follow-on to the Viggen.

◆ A major milestone in Air India’s expanding operations was reached when Air India inaugurated its first ever weekly all-cargo service from Bombay to New York via Europe. Air India has one stretched DC-8-63F freighter on wet lease from the US carrier, Seaboard World Airlines, and a second stretched DC-8-63F freighter is being wetleased from Cargolux, a European carrier, to step up all-cargo services. With the two DC-8s, Air India operates four weekly all cargo services from Bombay.

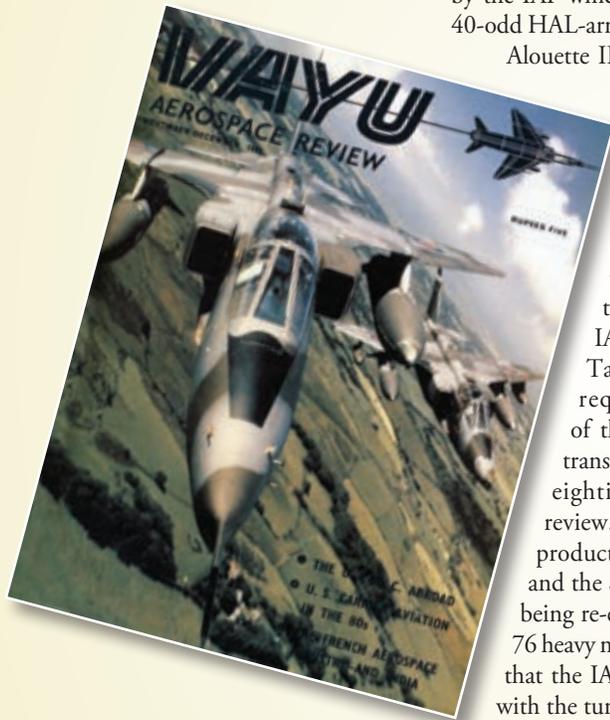
◆ Indian scientists have designed an advanced version of the Satellite Launch Vehicle which can put into orbit a payload weight up to 3,500 kg. The advanced version of SLV will enable the country to launch satellites to establish an effective communication network and also identifying natural resources by launching polar satellites. With success of the SLV-3 and the perfect functioning of the *Rohini*, the country has been able to gain the necessary experience and the competence in all major elements of launch vehicle design, development and mission accomplishment, including setting up and operation of the ground-based systems for telemetry, tracing and tele-command.

◆ With induction of all eight Airbus A300 and 17 Boeing 737s in its fleet, Indian Airlines are offering 1300 more seats per day from August. The A 300s are replacing B.737s on several sectors including the Delhi-Hyderabad-Madras service, Delhi to Bangalore and Bombay to Goa. Bombay to Bangalore services are stepped up to 14 services per week with the Airbus. In addition to the existing HS 748 service linking Delhi-Chandigarh-Jammu and Srinagar, Chandigarh will have a daily Boeing 737 service.

# 1981

◆ Air Chief Marshal Dilbagh Singh took over as CAS Indian Air Force on 31 August 1981, having earlier been Vice Chief of Air Staff and AOC-in-C Western Air Command. The retiring CAS, Air Chief Marshal Idris H Latif was given an appropriate farewell at Jodhpur, standing in the cockpit of a MiG-23BN (the latest fighter acquisition of the IAF) being pulled by a team of senior officers.

◆ The first Jaguar airframe components destined for final assembly in India left Warton in Lancashire by air on 5 May,



loaded aboard a Belfast freighter aircraft and airlifted out on the first stage of their journey to HAL in Bangalore. The first examples of these Jaguars to be assembled in India are due to enter service with the Indian Air Force in 1982.

◆ Singapore has requested India to continue assistance in training the Island's fledgling Air Force. The Indian Air Force started the training programme in 1979 and a 10-man IAF group has completed its tour of duty in July 1981. The programme ranges from the basic flying course to the advanced stage of operational flying and use of aircraft as a weapon system. Besides

training in flying, the IAF also helped the SAF organise maintenance of all types of aircraft.

◆ An advanced Boeing 737 in IAF colours with special interior configuration for flying VVIPs was officially received by the HQ Communication Squadron on 26 August. The modification was carried out by Indian Airlines engineers at Palam, taking just four weeks to modify the interior. The major maintenance work of the VVIP aircraft will be done by IA while the line maintenance will be by IAF.

◆ The Indian Air Force is to receive a batch of Mi-24 helicopter gunships from the Soviet Union, which will be the first dedicated COIN helicopters to be received by the IAF which service already operates 40-odd HAL-armed Chetaks (licence-built Alouette IIIs with SS 11B anti-tank missiles). A number of lightly-armed Alouette IIIs and Mi-4s had been employed as gunships in the 1965 and 1971 operations.

◆ With the selection of the Antonov-32 to fulfil the IAF's METTAC (Medium Tactical Transport Aircraft) requirement, replacement of the Antonov An-12 heavy transport aircraft from the late-eighties is now in process of review. With the An-12 out of production in the Soviet Union and the Soviet transport fleet itself being re-equipped with Ilyushin Il-76 heavy military freighters, it is likely that the IAF will supplant its An-12 with the turboprop powered Il-76.

◆ The first batch of MiG-25 reconnaissance aircraft, including the two seat operational trainer variant, have just been received by the Indian Air Force, as evidenced by the flight (on 25 August) in a two-seater by Air Chief Marshal Idris H Latif, the out-going Chief of Staff.

◆ The Indian Navy would soon acquire another aircraft carrier and choose an anti-submarine warfare helicopter according to the Chief of Naval Staff, Admiral RL Pereira, who has said that the "half-life modernisation" of the Indian Navy was a regular process and the Navy was equipping itself with necessary sophisticated vessels and armaments. The idea was to acquire a carrier

with a displacement of 15,000 tonnes to 20,000 tonnes. He hoped that the acquisition and commissioning of the country's second aircraft carrier would be completed by 1990 and the acquisition of eight more Sea Harrier VTOL fighter would soon be formalised. In addition, some 21 new ASW helicopters would be ordered to augment the present two squadrons of Sea King ASW helicopters.

◆ *Vindhyagiri*, the last of the six *Leander*-class frigates built by Mazagon Dock Limited was commissioned by Mr. Shivraj Patil, Minister of State for Defence at Bombay on 8 July. *INS Vindhyagiri* is a "class in itself", being the first ship of its size in the world to have such ASW and offensive capability. Built at a cost of Rs. 50 crores, nearly 75% of its components are indigenous and a great improvement over the first ship in the series manufactured at Mazagon, *INS Nilgiri*, which was commissioned in 1972.

◆ The Agriculture Ministry has confirmed the purchase of a further batch of eight HAL HA-31 Basant agricultural aircraft, manufactured by HAL at Kanpur. A total of 39 Basants have so far been built by HAL, 5 of which were bought by the Haryana Government and 24 by the Directorate of Agricultural Aviation, New Delhi.

◆ The Public Accounts Committee (PAC) have asked the Defence Ministry to prepare a perspective plan to meet the aircraft requirements of the Indian Air Force during the next 10 years and assign specific tasks to Hindustan Aeronautics Limited (HAL) without delay. The PAC's 33<sup>rd</sup> report concerning delays on the development and manufacture of the Gnat Mk. II (Ajeet) aircraft was presented to the Lok Sabha: it was "unfortunate that the MoD should have placed bulk orders for an aircraft which was still under development and which was intended to play an altogether different role than its predecessor.

◆ Indian Airlines has converted two options it held for A300s into firm orders, thus raising its total order to ten. The two aircraft will be delivered in the summer of 1982. The Indian domestic and regional carrier, which at present already operates eight A300s of the shorter range B2 version on its domestic network, has now selected the longer range B4-200 version which will allow the airline to operate the European twin-engined wide-body on longer regional distances and fulfil its expansions plans as a regional carrier.

# 1982

◆ During a meeting of the Parliamentary Consultative Committee for Defence in July, the Defence Minister Mr Venkataraman hinted that India was going to acquire “an advanced version of the MiG” which has been claimed by the Soviets to be superior to the F-16s being acquired by the PAF. Although the fighter’s identity was not revealed, this is likely to be the MiG-29 (NATO code: *Fulcrum*).

◆ Discussions have been held between the Government of India and Dassault of France on the possible selection of the Mirage 2000 for the IAF and final negotiations are imminent. It is learnt that IAF test pilots have test-evaluated the Mirage 2000 in France and high-level teams from Dassault have been engaged in detailed discussions with the Indian Government since then. According to these sources, the IAF may receive the first of 40 Mirage 2000s in late 1984, with manufacture of another 110 Mirage 2000s under licence at HAL under review.

◆ Deliveries of 80 MiG-23BN fighters (plus 15 MiG-23UM two-seat trainers) to the IAF for the equipment of Nos 10, 220 and 221 Squadrons will be completed during the course of this year, and earlier plans to procure the MiG-23MF air-air version have now been resurrected. As a ‘stop-gap’ pending availability of the Mirage 2000, 40 ‘improved’ MiG-23MF fighters with upgraded radar and the latest air-air missiles are being procured for the re-equipment of two squadrons, deliveries being scheduled to commence from late this year. Late last year, the decision was taken to licence manufacture the MiG-27 dedicated tactical strike fighter in India rather than the MiG-23BN as previously planned, and this type is now expected to be phased into production at Nasik as the MiG-21bis programme reaches completion in 1984. It is anticipated that the IAF will receive about 150 HAL-built MiG-27s.

◆ In the fiscal year that ended in March, the Nasik facility of HAL delivered 40 MiG-21M and MiG-21bis fighters to the IAF despite a three-month lock-out of employees suffered during the course of the year. The final HAL-built MiG-21M was completed at Nasik in November 1981,

when it was entirely superseded by the MiG-21bis, 150 of which are being built for the IAF with production scheduled for completion in 1984.

◆ The prototype tandem-seating Ajeet jet trainer made its first flight at Bangalore on 20 September, flown by Wg Cdr MW Tilak, HAL’s Chief Test Pilot. Designed and developed by HAL, the Ajeet trainer retains the essential armament and systems of the fighter version but incorporates a rear seat for the instructor in lieu of an internal fuel tank. The IAF has a requirement for (approx) 40 Ajeet trainers which would replace the Hunters at the Operational Conversion Unit.



◆ A grand effort is being made to celebrate the Golden Jubilee year of the Indian Air Force in befitting manner. As part of the celebration have been aerobatic displays by a nine-Hunter acrobatic team (*Thunderbolts*) which first performed over New Delhi during the Republic Day week in January, led by Wg Cdr ‘Ben’ Brar. The select aerobatic team has members chosen from various operational units, with pilots with varied background and experience but with the common factor of high proficiency ratings.

◆ From early January, Air India will operate two flights a week through Amritsar to Birmingham. This fills a long-felt need

for the large Sikh community settled in the British Midlands (Birmingham, Manchester and Leeds) who have to first travel to Delhi by surface means and again from Heathrow to the Midlands by road or rail. To be operated by Boeing 707s, the flight will operate twice a week to Birmingham via Moscow.

◆ With delivery of the fourth aircraft to it in Seattle in August, Indian Airlines have now received the additional Boeing 737-200s on order, taking the total of this type in service or order to 25. Two Airbus A300 B4-200 aircraft have also been delivered to Indian Airlines, which now has a fleet of ten of these wide-body transports. Air India has, meanwhile, received two A300 B4-200s and these have gone into service on the Gulf routes.

◆ Vayudoot commenced air services in Northern India from March, connecting Delhi with Ludhiana in the Punjab with a wet-leased HAL/BAe 748. Soon after, air services were initiated from Delhi to Dehra Dun and later, to Chandigarh and Kulu. In the East, Vayudoot launched F.27 services from Calcutta to Jamshedpur-Rourkela-Ranchi to service the steel coal belt, also extending a service to Patna and Muzaffarpur.

◆ Between 9 and 23 November, the Dornier 228-200 demonstrator aircraft (D-IDCO) was involved in strenuous and comprehensive flight test and technical evaluations under formal invitation from the GoI. IAF, Navy and DGCA pilots flew the Dornier 228 to the limits of its design performance, carrying out some 32 sorties, flying over 15,000 kilometres ranging from Srinagar to Kanpur to Bagdogra to Paro Valley (Bhutan), Vishakapatnam and over the Bay of Bengal.

◆ Air India’s third Airbus A300B4-200, arrived in Bombay on 15 November, 1982, with which arrival, Air India now has a fleet of ten Boeing 707s and three Airbus A300B4s. Powered by two General Electric CF6-50C2 engines with a thrust rating of 52,500 lb, Air India A-300s are configured to carry 22 first class and 216 economy class passengers.

◆ The Swedish Parliament has given its approval to development of the JAS multirole combat aircraft which calls for delivery of some 140 aircraft by the year 2000.

# 1983

◆ The first Sea Harrier FRS Mk 51 was officially handed over to the Indian Navy on 27 January at Dunsfold, Surrey. The Indian Navy's Sea Harrier Training Sqn which has been established at RNAS Yeovilton with the task of working up to operational status by late this year and, with all eight of the aircraft (six FRS Mk 51s and two T Mk 60s) will then be re-designated INAS 306 for operation from the carrier INS *Vikrant* and Goa-Dabolim as principal shore base.

◆ The Government of India has formally selected the West German Dornier 228 to meet the varied requirements of a Light Transport Aircraft (LTA) for India, the detailed contracts, covering transfer of technology for a progressive programme to manufacture the Dornier 228 versions in India, being signed at New Delhi on 29 November by Mahesh C Sarin, Secretary for Defence Production with Dr Fritz Mader (of Dornier GmbH) and Dr. John Fallon (of the Garrett Corporation). The aircraft, produced in India, will be operated by the regional airline Vayudoot, the Indian Navy, Coast Guard, Indian Air Force plus the calibration unit of the DGCA. Production of the first HAL-built 228 will be within 12 months and a production run of some 150 aircraft is envisaged.

◆ It has been officially announced that the Ilyushin Il-76 heavy duty military freighter and strategic airlift transport has been selected to meet the Heavy Tactical Transport Aircraft (HETAC) requirement of the IAF.

◆ According to the CAS Air Chief Marshal Dilbagh Singh, India is to develop an indigenous AWACS aircraft system, commenting that "no developed nation was prepared to provide AWACS aircraft and that as such a type was essential to safeguard national territorial integrity India was developing its own system".

◆ First booster launch of the Pilotless Target Aircraft (PTA) configuration, coded as the ELV (Experimental Launch Vehicle) 01, was successfully carried out at the Kolar range in late October. The PTA programme is intended for joint services air defence training for gun, missile and radar tracking and firing. According to the Director AVM

HN Krishnamurthy, its development for inter-services use is expected to be completed by 1985.

◆ The third *Kashin*-class guided weapon destroyers for the Indian Navy, INS *Ranjit* has joined its earlier sister ships, INS *Rajput* and *Rana* as part of the Indian Navy's 11<sup>th</sup> Destroyer Squadron. Embarked on board the *Kashin*-class destroyers are Kamov Ka-25 anti-submarine helicopters of INAS 333. The Ka-25 mounts search radar in the nose radome plus additional sensors in various housings.

◆ INS *Godavari*, the first of a series of Indian-designed and built multi-purpose frigates, was commissioned on 10 December, 1983 at the Naval Dockyard, Bombay by the Defence Minister Mr R Venkataraman. Unlike the *Leander*-class frigates, which were of British design but progressively modified with new and original features, the *Godavari*-class frigates are totally indigenous in design and construction, being some 30 per cent larger than the *Leanders*, and incorporating surface-to-surface missiles, surface-to-air missiles, rapid fire automatic anti-aircraft guns, long range anti submarine homing torpedoes and modern electronic warfare equipment. The frigates will be capable of operating two large ASW helicopters (Sea King) with hangar facilities.

◆ Vayudoot has signed a wet lease with Druk Air of Bhutan under which the latter started operations with its Dornier 228 from Calcutta to Aizawl in Mizoram on 1 November. Druk Air aircraft later extended Vayudoot's services from Calcutta to Rourkela, Ranchi and Bhubaneswar and thereafter to Patna and Dhanbad.

◆ An initial production order for 40 HAL HPT-32 primary trainers has been placed by the IAF against a total requirement of between 100 and 150 aircraft. These will replace the venerable HT-2s for primary flying training which have been in service since the mid-1950s.

◆ Equipment requirements in Pakistan's five-year defence plan include an additional 60 F-16 Fighting Falcons, although the question of funding these and other purchases remains to be resolved. The PAF has so far received six of the 40 F-16s currently on order, with the remaining aircraft to follow in the next year. The

PAF is also to purchase six Lockheed P-3B Orions, as also 10 AH-1S Cobra gunship helicopters.

◆ The DGCA-designed motorised glider (MG-1) was first flown on 30 May with Capt. Karminder Singh ('Ralph'), Civil Aviation Advisor Punjab at the controls.

◆ The MG1 had logged over 15 flights by the close of the year and its prime design goals were successfully achieved.

◆ British Aerospace has signed a "launching agreement" with Saab-Scania Aerospace Division covering collaboration in the design and construction of the carbon fibre wing for the JAS 39. Meanwhile, British Aerospace has been contracted to begin work on the Experimental Aircraft Programme (EAP) covering construction



of an experimental aircraft as a means of obtaining information that could "give a sounder basis for future decisions on combat aircraft for the RAF".

◆ The Indian Navy's first three BAe Sea Harrier FRs 51 VTOL fighters arrived at Dabolim naval air station, Goa on 16 December 1983. The Sea Harriers, led by Commander Arun Prakash, left RNAS Yeovilton in southern England on 13 December staging via Malta, Luxor and Dubai on their 8,000km flight. The remaining three Sea Harrier FRS 51s and two Sea Harrier T-60s will arrive in India between February and May 1984 whilst a further order for ten Sea Harrier fighters and one or two additional trainers are anticipated.

# 1984

◆ A new operational Air Command (Southern) was officially established with headquarters at Trivandrum, Kerala in South India, on 19 July 1984 with Air Marshal Terence D'Sa as first C-in-C. Comprising the entire Southern and Central Peninsula of India, plus the island territories of the Andaman and Nicobar (Bay of Bengal) and the Laccadives (Southern Arabian Sea), Southern Air Command will take over the responsibility for air defence, support of the land and naval forces, transport and communication support from Central Air Command, whose headquarters are at Allahabad in UP.

◆ An Indian Air Force test pilot is to shortly visit the Soviet Union to evaluate the enigmatic MiG-29 fighter aircraft that has been offered to India. The Government of India is considering both direct procurement as well as licence manufacture of the new generation MiG-29 in India, the Soviets having undertaken to supply this futuristic fighter to India in 1985-86.

◆ On 21 July, the Government of India and MBB of the Federal Republic of Germany formally signed the contract for joint design and development of an Advanced Light Helicopter to be undertaken by HAL and MBB. To be powered by twin turbo-shaft engines with an All Up Weight of around 4000 kg and seating six passengers, the ALH will be a multipurpose helicopter envisaged to replace the Chetak (Alouette III), Chetak (Lama) helicopters in service with the IAF, Navy and Army from the early nineties.

◆ The HTT-34, turboprop version of the HPT-32, made its initial flight at Bangalore on 17 June 1984, piloted by HAL's test pilots Wg Cdr Ashok and Apte. Powered by an Allison 250-C20B turboprop engine of 240 s.h.p, which replaced the piston Avco Lycoming AE 10-540-D4B5 engine of 260 h.p the HTT-34 prototype was in fact the HPT-32 third prototype and will be used for development trials.

◆ At a plenary session in the 71st Indian Science Congress on 5 January, Scientific Advisor to the Defence Ministry, Dr VS Arunachalam stated that amongst the major R&D area that Indian defence scientists

are engaged in are the Main Battle Tank (MBT), Light Combat Aircraft (LCA) and Airborne Early Warning (AEW) Radar. Dr Arunachalam also mentioned that the country was developing its own jet engines (a reference to the GTX family of turbofan engines).

◆ Squadron Leader Rakesh Sharma, test pilot of the Indian Air Force, became India's first man in space when he, along with two Soviet Cosmonauts orbited the earth in the USSR's Salyut 7 orbital station. Launched in the Soyuz T-11 ascent module atop the Soyuz booster from Baikonur cosmodrome in the steppes of Soviet Kazakhstan on 2 April, the Indo-Soviet cosmonauts returned to earth in a Soyuz T-10 nine days later, landing in the marshlands of Akalyk on 11 April.

◆ The USSR is to order HAL Chetak helicopters for employment in the Siberian region, as performance of the Chetak (and Cheetah) in the Himalayan regions by Indian armed forces is rated very highly by Soviet experts.

◆ After prolonged but intense techno-economic evaluations and even more intense commercial negotiations, Indian Airlines was given approval for buying Boeing 757s, powered by the Rolls Royce RB 533E4s, for its fleet re-equipment programme. The first of 12 Boeing 757s on order will be delivered in September 1985.

◆ Three new Russian-built inshore minesweepers of GRP construction were commissioned into the Indian Navy by Vice Admiral KK Nayyar, FOC-in-C, Southern Naval Command at Cochin on 10 May. The INS *Malpe* and *Magdala* join three earlier minesweepers of similar class as part of the Indian Navy's 20<sup>th</sup> Mine Counter-Measures Squadron which was formed in 1983.

◆ The Prime Minister of India inaugurated the country's first submarine construction facilities at the state-owned Mazagon Dockyard Limited (MDL) at Bombay on 6 May. The collaboration between HDW of Kiel, West Germany and MDL envisages comprehensive transfer of technology for the construction of Type 209 SSKs in India, including full know-how, training of Indian personnel at Kiel and deputation of German specialists to Bombay. The first MDL-built submarine is planned for delivery to the Indian Navy in July 1987 and the second in March 1988. In addition, two Type 209 SSKs are currently under construction for the Indian Navy at Kiel and would be handed over by the end of 1986. The Chief of Naval Staff, Admiral Oscar Stanley Dawson, has expressed that eight to twelve SSKs of the same design should be planned for construction to make the project cost-effective.

◆ Construction work on the Indian Navy's Academy at Ezhimala in North Kerala is to commence in 1985. Over two-thirds of the 1000 hectares of land earmarked for the Academy had been taken possession of and work on infrastructural facilities such as laying of roads and power lines would begin late in 1984.

◆ The first three of a total of 95 Antonov An-32s on order for the Indian Air Force were officially received in India on 10 July at Palam Airport (Delhi), enroute to their base at Agra, replacing the venerable C-119 Packets in service. The An-32, named *Sutlej* after the Punjab river, will replace C-119s, C-47s and Caribous of the medium transport squadrons of the IAF over the next two years. Although initially Hindustan Aeronautics Ltd. was to assemble/ progress the An-32 at Kanpur, it was decided to import the entire lot of 95 aircraft from the Soviet Union, albeit fitted with HAL- manufactured instrumentation and avionics.



# 1985

◆ The first batch of IAF Mirage 2000s were officially inducted into the IAF at Gwalior AFS on 29 June 1985 by Defence Minister PV Narasimha Rao, and Air Chief Marshal LM Katre. Wg Cdr Ajit Bhavnani assumed former command of No.7 Squadron. Tragically soon after, Air Chief Marshal Katre passed away on 1 July and was succeeded by Air Chief Marshal Denis Lafontaine on 3 July 1985. The second batch of Mirage 2000s for the Indian Air Force arrived at their base at Gwalior in central India during the second week of September, being ferried by IAF pilots from Bordeaux-Merignac in South Western France.

◆ The Defence Minister PV Narasimha Rao led a high-level delegation including the Defence Secretary SK Bhatnagar with senior officers of the three Services, to Moscow on 30 March, "to strengthen bilateral cooperation in various defence areas, including defence production". Supply of, and possible licence production of the MiG-29 is an important point in these discussions.

◆ The first MiG-27M strike fighter to be assembled by Hindustan Aeronautics Limited at the Nasik Division was officially handed over in January. The MiG-27M will supplement the MiG-23BN equipped grand attack squadrons of the Indian Air Force.

◆ An important milestone in the transfer-of-technology programme involving HAL's licence-production of the Dornier 228 light transport aircraft was recorded on 3 March, when the first Phase I kit was delivered to the Kanpur Division of HAL. The Dornier 228 in CKD form was airlifted from Dornier's Oberpfaffenhofen airfield by SFAIR Hercules to Chakeri Airfield, site of HAL's Kanpur Division and IAF Base Repair Depots.

◆ President Giani Zail Singh presented standards to Nos. 10 and 11 Squadrons of the Indian Air Force at a combined ceremony at Jodhpur air base on 18 March. Against a backdrop which included two MiG-23BNs, two HF-24 Maruts, a C-47 and a BAe 748, the ceremony included a march past and fly past preceding the awarding of standards.

◆ First scheduled flight by a Vayudoot Dornier 228 was on 2 January, from Delhi to Rae Bareilly and on to Lucknow and Dehra Dun and return. The second Dornier 228 started scheduled air services from Bombay's Santa Cruz airport to Surat-Bhavnagar-Ahmedabad from 4 January. With the third Dornier 228 arriving on 24 February, Vayudoot started operations from Hyderabad on 6 April, inaugurating airlinks to Rajahmundry and Cuddupah. Later, air services to Tirupathi and thence to Mysore-Bangalore began.

◆ The Government has proposed establishment of a Helicopter Corporation of India (HCI), with the primary objective of providing air transport support to the petroleum sector for tasks including oil exploration and inspection of pipeline in difficult terrain. The other tasks of the HCI would be operations in hilly terrain, tourist charters, passenger transport from airports to central points in cities and relief operations during natural calamities.

◆ Defence expenditure during 1985-86 has been put at Rs. 7686 crore, which is Rs. 511 crore more than the revised estimates for the current year. While the Army is provided Rs. 4787 crore, the Air Force and Navy get Rs 1730 crore and Rs 603 crore respectively. HAL, which is the largest MOD public sector undertaking,

gets Rs 20 crore budgetary support and its total value of production is anticipated at Rs. 639.57 crore.

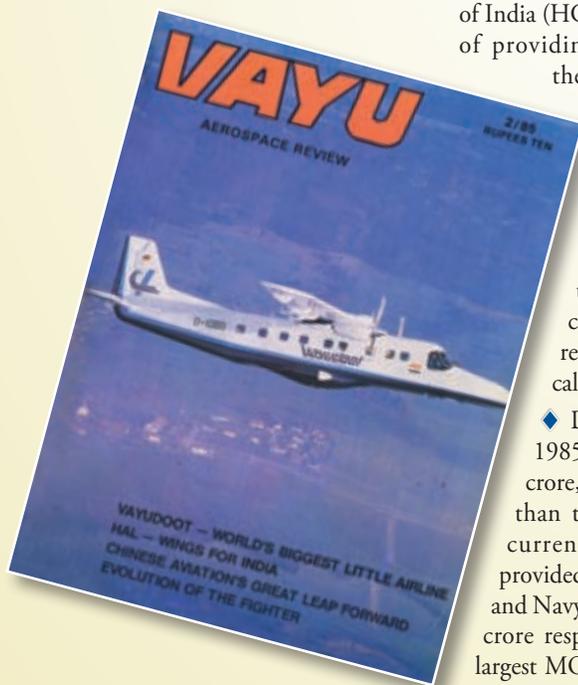
◆ The Ilyushin Il-76 long range heavy transport aircraft has been christened the *Gajraj* (or King Elephant) in Indian Air Force service. The first Il-76 MDs were formally inducted into the IAF at a ceremony at Palam air base on 16 July. Able to transport 225 troops or 43 tonnes of cargo over long ranges, the Il-76s re-equip No.44 Squadron commanded by Gp. Capt. Ashok K Goel.

◆ A new engine test bed, designed, developed and fabricated by Hindustan Aeronautics Ltd., for the Garrett TPE-331 turboprop engine was inaugurated at the HAL Bangalore complex on 31 August by the Chairman of HAL, Air Marshal MSD Wollen (Retd). The sophisticated facility for testing gas turbine engines to stringent international cost much less than similar imported ones. The test bed, developed by a team of engineers at HAL, led by R Ramakrishnan and guided by TV Vareed, Advisor, Engine Design, was capable of testing turbo-prop engines which power the Dornier 228 light transport aircraft being built by HAL. It cost Rs. 1.5 crore and was designed and built in 10 months.

◆ In a surprise announcement made during Parliament's Consultative Committee for Civil Aviation meeting on August 12, the GOI have recommended early establishment of air taxi services mostly "to benefit a large number of affluent foreigners who come to India for short term visits."

◆ On 22 September, Indian Airlines has announced the decision to place letters of intent for the new Airbus A.320, powered by the IAE V2500 turbofan engine. The LOI is for 31 A.320s (of 162-seat configuration) of which 19 are to be procured between 1988-90 while 12 remain on option. The project cost is Rs. 2000 crore (US \$1.6 billion) to be raised by IA from its own resources.

◆ The Polar Satellite Launch Vehicle (PSLV) four stage, 260 tonne, 44 m high space rocket, programmed to place IRS satellites in 900 km polar sun-synchroniser orbits from the late 80s, has completed system configuration versions (SCR) and preliminary design versions (PDR) and also entered the development phase at the Vikram Sarabhai Space Centre (VSSC) at Trivandrum.



# 1986

◆ Formal agreement for the sale to India of HMS *Hermes* was signed on 19 April 1986, with the aircraft carrier to be delivered to the Indian Navy in spring next year. The *Hermes* will be bought at a base price of 15 million, and extensively refurbished at 60 million, so as to make the carrier ride through to the 21st century. Though the acquisition of the *Hermes* from Britain will be sufficient for the Navy's needs till the year 2000, India seeks modern aircraft carriers to be operational in the 21st century to replace the *Vikrant*.

◆ The Government of India and the Soviet Union have finalised an MoU for the supply of MiG-29s for the IAF. "More than two squadrons" of MiG-29s would be purchased in flyaway condition, and "substantial" numbers are likely to be assembled and produced indigenously by HAL.

◆ Addressing members of the consultative committee attached to the Defence Ministry, Prime Minister Rajiv Gandhi has defended the Light Combat Aircraft (LCA) and said that "if India did not invest in the project now, it might not be possible to develop the multi-mission tactical fighter aircraft which would be required for the IAF from the mid-nineties". The MoS for Defence, Arun Singh, refuted allegations that the Air Force was not enthusiastic about the LCA project; the Air Force fully supported the LCA project as it was aware of the astronomical cost of importing aircraft as an alternative.

◆ The first of five HAL-built Dornier 228 light transport aircraft were handed over to Vayudoot, the regional airline at HAL's Kanpur Division on 22 March. These are to be followed by HAL-Dornier 228s for the Indian Air Force, Coast Guard and other operators in India and abroad. Selection of the 228 as India's standard light transport aircraft was unique in that not only a single aircraft type would be used by a number of services but the programme is to be considered as the foundation for future transport aircraft designs.

◆ HAL's Korwa Division was formally inaugurated by Prime Minister Rajiv Gandhi on 3 April. Part of HAL's Accessories Complex and situated in Amethi district, this will manufacture advanced navigational

and other systems and avionics under a series of licences from France and Britain. These include laser based ranger and target seekers, Head Up Displays (HUD), Weapon Aiming Computers (WAC), moving map and electronic displays, inertial navigation and attack systems, Flight Data Recorders and auto stabilising systems.

◆ The Helicopter Corporation of India (since named Pawan Hans Ltd.) has ordered 27 Aerospatiale 365 Dauphin helicopters, the deal signed on 31 March between the HCI and France shall be financed out of French Government credit, worth Rs 82 crores. India will get 6 helicopters "free"



and the rest under a special reduction rate of Rs. 1.99 crores per helicopter.

◆ Indian Airlines have ordered 19 Airbus Industrie A320s in a deal worth Rs. 1,238 crores, which brings a modern fuel efficient 160 seater shorthaul jet aircraft capable of operating from most current airports in India. The agreement of purchase was signed by Capt. Kamni Chadha, MD Indian Airlines and Mr. Ranjit Jayarathnam, Vice-President of Airbus Industrie. The A320 will enter the IA fleet by mid-1989 and the total delivery of aircraft will be over by March 1990 by which time IA will fulfil its traffic demands by leasing Boeing 737s and A300s from Airbus.

◆ The United States has reportedly granted licence to India for General Electric F-404 engines for the Light Combat Aircraft (LCA). The deal envisages a further transfer of high tech equipment to India. Meanwhile, work on the indigenous GTX-14U engine is continuing at the Gas Turbine Research Establishment (GTRE) Bangalore. This flat-rated turbojet has been run at 75% rpm for 50 hours on test bed. About 10 prototypes are estimated to be developed by 1990, and delivery of production engines by 1993-94.

◆ The first two Dornier 228 Coastal Surveillance Aircraft, fitted with special sensors, were formally handed over to the Government of India by Dornier GmbH at their Oberpfaffenhofen airfield southwest of Munich, on 7 July. Managing Director of Dornier GmbH, Dr. Fritz Mader, officially handed over the keys of the two aircraft to the Ambassador of India.

◆ The Indian Air Force is acquiring Mi-26 heavy-lift helicopters from the Soviet Union, the "heaviest and most powerful helicopter in the world". The IAF has already acquired two Mi-26s to test their operational feasibility both in the high mountains and the plains.

◆ The foundation stone for India's largest future naval base was laid on 24 October 1986 at Karwar, in Northern Karnataka on India's western coast by Prime Minister Rajiv Gandhi. *Project Seabird* as the Karwar naval base project is coded, will involve an expenditure of Rs. 350 crores (\$290 million) over the Seventh and Eighth Plan periods and includes a shipyard for the fabrication and maintenance of certain classes of naval vessels.

◆ A follow on the Sea Harrier order comprises seven FRS Mk. 51 and one 2 seat Mk. T.60, taking the total acquisition of the VTOL fighter by the Indian Navy to 27 aircraft. INAS 300 Squadron is operating the Sea Harrier embarked on board the carrier INS *Vikrant* with the second carrier INS *Viraat* expected in India by the middle of 1987. Meanwhile, the Indian Navy has ordered three more Sea King Mk. 42Cs at a cost of some £21 million. This Commando assault version of the helicopter can transport 28 fully-equipped troops and sling loads of heavy military equipment.

# 1987

◆ The Indian Navy's second aircraft carrier, the INS *Viraat* (R-22), formerly the Royal Navy's HMS *Hermes*, arrived at its home port at Bombay on 22 August. Entering the inner harbour at 0930 hours, the *Viraat*, which was flying the Chief of Naval Staff's flag, received a 17-gun salute from the naval battery at Middle Ground Island and in turn fired a 15-gun salute for the FOC-in-C Western Naval Command.

◆ The advanced performance MiG-29 air superiority fighter was formally inducted into the Indian Air Force by the Defence Minister, KC Pant, during a ceremony at Lohegaon AFS (Poona) on 6 December. The MiG-29, christened as the 'Baaz' or Falcon, has reequipped the IAF's Nos. 28 *First Supersonics* and 47 *Archers* Squadrons, both these units formerly flying the MiG-21FL.

◆ During the Republic Day Parade, there was no flypast by the Indian Air Force. Official reasons given include the danger of bird-hits on the low flying aircraft in formation but it is unofficially known that the IAF was extensively involved with preparations for Exercise *Brass Tacks* along the western border. Apart from the Mi-17s which preceded the parade flying the national and tri-service insignia, the only aircraft doing a flypast were five Cheetah and Chetak helicopters of the newly formed Army Aviation Corps.

◆ A senior Soviet Delegation led by the Aviation Industry Minister AS Systov was in India during early February, visiting New Delhi, Nasik, Hyderabad and Koraput in early February had meetings with the Indian Defence Minister, Department of Defence Production and HAL to review present production of the MiG-27M and MiG-21bis but the feasibility of licence manufacture of the MiG-29 by HAL. He also discussed civil transport aircraft, airport equipment and ground navigation aids.

◆ The Indian Foreign Secretary, AP Venkateswaran has stated that in the event of the US providing AWACS to Pakistan, India would be forced to seek similar capability from the Soviet Union. He argued that the sale of AWACS to Pakistan made "no sense" if it was meant to monitor air attacks by the Afghan Air Force as "even the reach of the most sophisticated Boeing

(E-3 A) AWACS was not going to be very effective in the mountainous terrain of the Pak-Afghan border. On the contrary, it would be extremely effective on (to survey) the plains of India."

◆ Swedish aerospace company Saab-Scania have offered transfer-of-technology to India on the Light Combat Aircraft project. A leading Delhi daily has reported that the Swedish offer is particularly relevant for the Indian project as the overall concept of the Saab JAS-39 Gripen, under development in Sweden since the early '80s, "is very close to that of the LCA".

◆ France has offered "help" to India on the Light Combat Aircraft (LCA) and Avions Marcel Dassault-Breguet Aviation had carried out an independent study, according to Arun Singh, MoS for Defence (R&D). The French firm has also offered to provide consultancy assistance during the project definition phase of the LCA programme currently under progress. India has signed a contract with General Electric for eleven F.404-F2J3 engines along with associated hardware.

◆ In July, a four member team of Ministry of Defence R&D officials including the SA to RM, Dr. VS Arunachalam visited the US to discuss critical matters regarding the Light Combat Aircraft (LCA) project. The acquisition of the IBM 3090 computer system for CAD work on the LCA was among the most crucial agreements reached.

◆ JRD Tata has criticised the Government move to merge Air India and Indian Airlines. "The cons of a full merger would outweigh the pros that would be fraught with very serious consequences." He suggested that the Government could consider a more modest and gradual scheme which would retain the separate identity of the two airlines and, without cost or loss of international competitiveness, would achieve the same savings expected from a merger proposal.

◆ The Aviation Research Centre (ARC) of the Research and Analysis Wing (RAW) has acquired two of the five remaining Air India Boeing 707s for Rs. 9 crores, including spares and landing equipment. The Boeing 707s will supplement the ARC fleet of other transport aircraft and helicopters.



◆ Vice Admiral IJS Khurana, DGCG has said that the Indian Coast Guard will shortly place orders for three modified offshore patrol vessels (OPVs) in shipyards abroad to ensure their induction by 1990. To monitor activities of shipborne adventurers, the Coast Guard is acquiring fast reaction vessels and 18 Dornier 228 maritime patrol aircraft, also due by 1990.

◆ An expenditure of Rs. 12,512 (US \$9.8 billion) has been provided for in the 1987-88 Budget, which is Rs. 2,318 crores more than the revised estimates for the previous financial year. The original provision for 1986-86 has been Rs. 8,728 crores. The outlay is estimated at a little over 31% of all non-plan expenditure and about 20% of the total expenditure. An official figure issued by the Finance Ministry is that of every rupee the Government spends, 17 paise is on Defence.

◆ The first batch of Dornier 228-201s for the Indian Air Force was completed by Hindustan Aeronautics Limited, Kanpur Division by the end of March 1987. Incorporating a 'wide door' modification, designed and manufactured by HAL, the IAF Dornier 228s will be operated for a variety of logistic support and utility tasks and are to replace the DHC-3 Otters in the squadron for communication purposes.

◆ Air India has finalised purchase of one Boeing 747-200 from Singapore Airlines, for \$48 million. This replaces the B-747 which was lost off the Irish coast in 1985.

# 1988

◆ Prime Minister Mister Rajiv Gandhi inducted the first Soviet-origin SSN nuclear propelled submarine *INS Chakra* into the Indian Navy at Vishakhapatnam naval base on 3 February. With a displacement of 1,500 tonnes while submerged, the 'INS *Chakra*' has the capability of firing 24 torpedoes through six 21 inch torpedo tubes.

◆ *INS Ranvijay*, the fifth and last of the modified *Kashin*-class destroyers acquired by the Indian Navy from the Soviet Union, has arrived in Bombay. The missile destroyer was formally received by the C-in-C, Western Naval Command. The 5,000 tonne vessel, is an improvement over the original Soviet version and has been built to Indian Navy specifications.

◆ The Tupolev Tu-142M (*Bear-Foxtrot*) long-range MR/ASW aircraft was formally inducted into the Indian Navy on 16 April at a ceremony held at INAS *Hansa* Goa. Defence Minister KC Pant commissioned the re-activated Indian Naval Squadron 312 now equipped with the Tu-142M, five of which were ferried non-stop from Sevastapol, in Soviet Crimea, to Goa in India's western coast, a distance of some 7000km.

◆ First of the final Phase Jaguars representing indigenous standard aircraft to be built under licence by HAL at their Bangalore Complex was formally handed over to the IAF by Defence Minister KC Pant on 28 January. The Jaguar, christened as the 'Shamsher' was officially accepted by the CAS Air Chief Marshal Denis Lafontaine.

◆ First test-firing of indigenous Prithvi, tactical surface-to-surface missile, took place at Sriharikota space station in Andhra Pradesh on 25 February. Based totally on design and development efforts of the DRDO, Prime Minister Rajiv Gandhi said that India planned to induct the Prithvi in large numbers with the Defence Forces.

◆ The IAF's fleet of heavy lift Soviet-built Mi-26 and Mi-17 helicopters is being augmented by further numbers in order to support the ground forces deployed in the Siachen glacier area. The IAF's helicopter fleet, including HAL-built Cheetahs and Chetakas as well as the Soviet Mi-26s and Mi-17s have been strenuously engaged in providing the lifeline to the Indian Army deployed in this arctic zone. The

helicopters have been operated to record altitudes, with loads beyond certified limits, airlifting men and material, including field artillery, vehicles, fibreglass shelters as well as daily rations, fuel and ammunition plus evacuating casualties in extremely difficult conditions of weather and terrain.

◆ Mi-25 helicopter gunships of the IAF rocketed and destroyed by cannonfire a major camp of the LTTE in Eastern Sri Lanka on 15 October, the LTTE base at Mawila on the Trincomalee-Batticaloa road a major transit point for LTTE militants infiltrating into the east from the north and had been kept under observation for some time. The aerial strikes, followed up by a heliborne commando assault were ordered by headquarters Indian Peace Keeping Force (IPKF) after some major movements were detected.

◆ The existence of a new Soviet helicopter model, the Mi-35, has recently been confirmed with the agreement between India and the USSR for supply of a number of these gunships to the IAF. According to press reports from New Delhi, an agreement for the supply was finalised during the visit to India of the Soviet Defence Minister Mr. Dmitry Yazov.

◆ India and the United States have signed a 'Letter of Offer and Acceptance' (LOA) opening up the possibility of US cooperation in the projected Rs. 2,000 crore Light Combat Aircraft (LCA) project. With the Project Definition Phase (PDP) of the Light Combat Aircraft completed, the LCA is moving into the detailed design and development phase.

◆ The IAF will begin to phase out its MiG-21 fighters from 1992, indicated by the CAS 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 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.

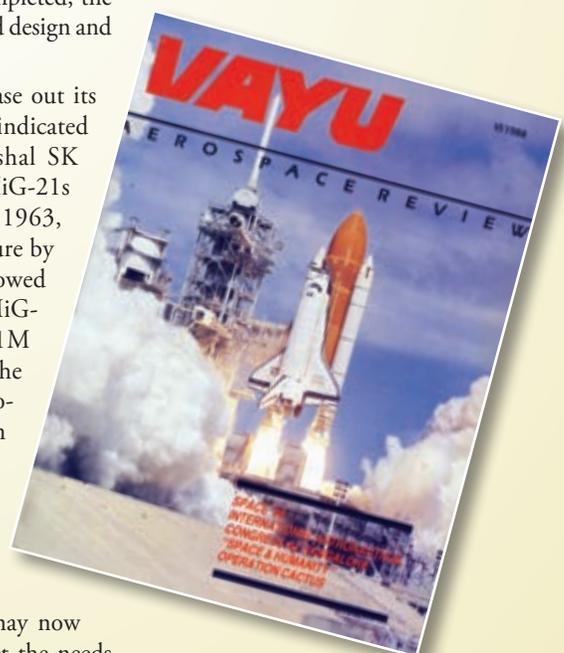
◆ Indian Airlines, which expects the delivery of 19 Airbus A.320s during the 11 months ending April 1989, may now also purchase 12 more to meet the needs

of the ever-increasing low of traffic. From the total fleet of 52 aircraft, ten turboprop aircraft would be phased out by the end of 1988. The pilots thus released would be made available for Boeing 737s, or could be sent for training on A.320s.

◆ The Agriculture Aviation Wing was formally taken over by Vayudoot, on 18 January following its transfer to the Aviation Ministry as directed by the Union Cabinet. The Aviation Ministry has decided to entrust the running of this wing to the third level airline as it is the one "with maximum experience of running small aircraft and also has low overheads as the entire operation is managed on a shoestring budget.

◆ The Polar Satellite Launch Vehicle (PSLV) is to cost the exchequer Rs 104 crore more than the original cost of Rs 311.57 crore. The 33 per cent increase since June 1982, when the project was sanctioned, is ascribed to "changes in foreign exchange rates, certain price escalations which have occurred since original framing of estimates in the early 1980s and certain design changes found necessary to realise mission objectives.

◆ The INSAT-1C satellite, designed by ISRO to complement the earlier INSAT-1B, was launched into geostationary orbit above the Indian Ocean on 21 July. Hoisted by an Ariane-3 rocket from Kourou in French Guiana, on the north-eastern coast of South America, the launch itself was the 24th flight of the Ariane.



# 1989

◆ A contract has been signed with a French Government-owned design bureau to carry out project studies on development and construction of the third aircraft carrier for the Indian Navy. The carrier, when built, will be the first to be constructed in an Indian ship-building yard, the first two (INS *Vikrant* and INS *Viraat*) being British in origin and procured as second hand. Expected to be between 30,000 to 35,000 tonnes, the third aircraft carrier would need between six and seven years to build after the detailed design.

◆ India has entered into an agreement with the French for the carrier's design concept, which is expected to be completed by end-1989 and this would be then subjected to detailed design by the Indian Naval Design Organisation. Construction would be entrusted to the Cochin Shipyard who had hitherto only been involved with building of smaller warships and survey ships for the Navy. The new aircraft carrier is expected to be commissioned by 1997.

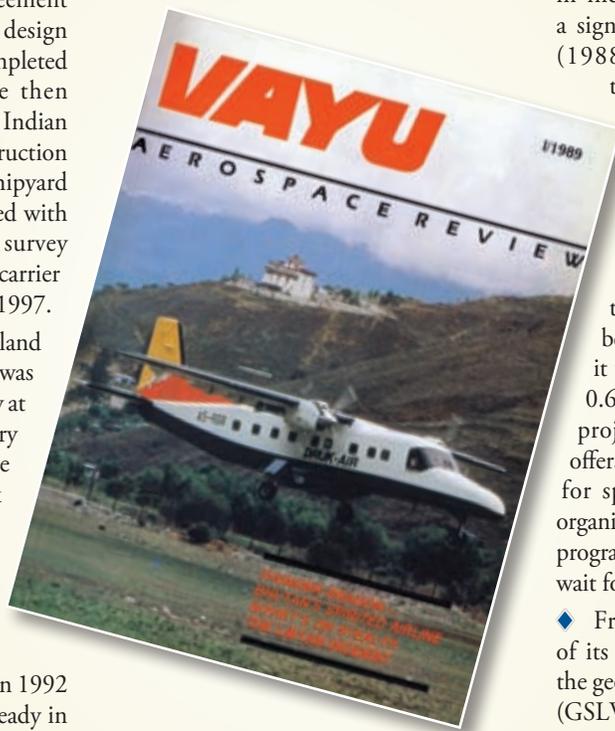
◆ The first of a batch of 20 Westland Sea King Mk.42B ASW helicopters was formally accepted by the Indian Navy at Yeovil in West England in mid-January 1989. Apart from the Mk.42 Bs, the Indian Navy has contracted for six Mk.42C Commando helicopters and is evaluating the Mk.42D airborne early warning variant of the Sea King.

◆ "The first prototype of the light combat aircraft (LCA) will fly in 1992 and its production version will be ready in 1996", according to Dr Kota Harinarayana, LCA programme director, ADA. Describing the LCA project as a national programme, he said that it would be the smallest fighter on the drawing board belonging to the same generation as the French Rafale, the European Fighter Aircraft (EFA) and the Swedish Gripen. The LCA would be light in weight and could be exported, he said. "It should be better than the F-16", he added.

◆ A 'navalised' variant of the Light Combat Aircraft (LCA-N) is under consideration, with Naval headquarters interacting with the Aeronautical Development Agency on the LCA which will have virtually the same systems as the land-based fighter but with suitably modified landing gear and the ability

of launch by catapult. However, the Navy retains the option of having a naval version of the MiG-29 to operate from the indigenous aircraft carrier now under development. The project definition phase of the aircraft carrier was in its final stages and detailed design is to commence shortly, the project having been somewhat delayed owing to lack of funds and a protracted period when the design concept was being finalised.

◆ The Planning Commission has constituted a Committee to work on the feasibility HAL undertaking the manufacture of commercial aircraft. Meanwhile, HAL has been visited by representatives from both Boeing and



Airbus Industrie, who examined the feasibility of component production at the various divisions of HAL. In late-April, a 13-member Soviet team from the Yakolev design bureau were visiting India to discuss possibilities of the production of the Yak-42 by HAL, albeit with some modifications.

◆ Second test flight of the Prithvi surface-to-surface missile was successfully carried out on 15 September. Director of the IGMDP, Dr APJ Abdul Kalam, has said that the Prithvi, now designated SS-250, incorporates many innovative technologies including advanced inertial navigation systems and on-board computers "which compete favourably with contemporary

missiles of this class in the United States and the Soviet Union." The Prithvi was first test-launched in February 1989.

◆ On 30 September, as the first SSK Type 1500 submarine was undocked and put to sea at Bombay, India joined a select group of ten other technologically advanced countries in the world who build their own submarines. Christened INS *Shalki*, the submarine was built for the Indian Navy by Mazagon Dock Limited (MDL) in technical collaboration with Howaldtswerke Deutsche Werft (HDW) of West Germany.

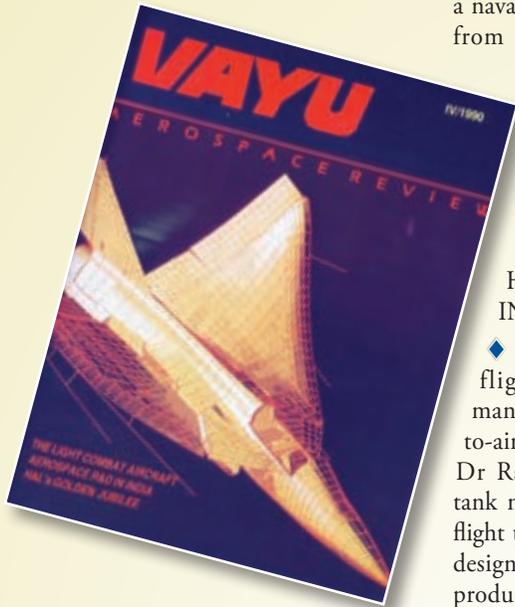
◆ National Aeronautical Laboratory (NAL), which plays an important role in indigenous aerospace efforts, has, in a significant achievement last fiscal year (1988-89) commissioned its second transonic tunnel, designated H3. It is the largest high-speed facility designed and built entirely within the country.

◆ Because of the rising demand for tunnel time, especially in the transonic speed regime, the need to augment the testing capability at trisonic speeds became self evident. Considering this, it was decided to design and develop a 0.6 metre transonic tunnel. The entire project, completed indigenously, now offers substantial additional tunnel time for sponsored projects of various user organisations, as well as many other research programmes that, in the recent years had to wait for lack of tunnel time.

◆ France has offered India the technology of its HM-7 cryogenic rocket engine for the geosynchronous satellite launch vehicle (GSLV) which is expected to be ready for tests some time during the second half of the '90s. The Space Commission Chairman, Prof. U.R. Rao while confirming the French offer said that the financial terms were yet unacceptable. However, he added: "We are negotiating". ISRO has a Rs. 3,500 million budget and another Rs. 3,000 million for the rest of the rocket programme.

◆ The Ministry of Finance have approved a Japanese loan worth \$250 million towards the purchase of 19 Airbus A-320 aircraft by Indian Airlines. The sources point out that both the finance ministry and the Airline are keen to go ahead with the borrowings. Air India has also negotiated a Japanese loan worth \$160 million for the purchase of the two Boeing 747s.

# 1990



◆ The first Demonstrator aircraft of the Aerospace Surveillance Warning and Control System (ASWAC) Project has been test-flown in Bangalore. With its distinctive saucer-shaped rotodome the specially modified HAL/BAe 748 demonstrator was first flown by pilots of the Aircraft and Systems Testing Establishment (ASTE) Bangalore, piloted by Air Vice Marshal AS Lamba, Commandant of the ASTE, and Group Captain Ravish Malhotra, Chief Test Pilot at ASTE.

◆ India and the Soviet Union have completed discussions on the continued production and upgradation of the MiG series of fighter aircraft and a protocol is likely to be signed shortly. Talks focused primarily on upgradation of MiG-27, is presently assembled at HAL Nasik. One of the crucial decisions which was to be taken was the licence-production of the MiG-29. A joint Indo-Soviet working group is to conduct a high level review of the two countries' cooperation on defence, and the aviation protocol will be signed after conclusion of the working groups meetings.

◆ The IAF are equipping two of its squadrons with the HAL-Dornier 228, being Nos. 41 and 59 Squadrons earlier flying DHC Otters in the light logistics support and communications role. A new Coast Guard squadron (CGAS 744) has meanwhile been commissioned at

Meenambakam Airport, Madras with the HAL-Do228.

◆ The Indian Navy is currently considering a navalised version of the LCA to operate from the proposed indigenous aircraft carrier now in the final project definition phase. The Navy is also considering as ship board version of the MiG-29 as an option to the LCA variant abroad the new carrier. Meanwhile the Indian Navy have received the second batch of BAe Sea Harrier Mk.51s to be deployed aboard INS *Viraat* (ex-HMS *Hermes*).

◆ The DRDO will soon undertake flight-testing of the indigenously manufactured medium-range, surface-to-air missile *Akash*. MoS for Defence, Dr Raja Ramanna said that the anti-tank missile *Nag* had already undergone flight trials and under the programme the designs, development and limited series production of four missile systems was making progress. They were short-range missile *Trishul*, *Akash*, surface to surface missile *Prithvi* and *Nag*, he said.

◆ The DRDO has started research into air-to-air missiles with the Indian Ministry of Defence claiming to have completed a pre-feasibility study into an air-to-air missile known as Astra, which investigates the design of a beyond-visual-range missile, but this falls outside India's five missile Integrated Guided Missile Development Programme (IGMDP).

◆ In a deal worth US \$ 236 million, the Pakistan Air Force has ordered 50 ex-Royal Australian Air Force Dassault Mirage IIIOs. Air Chief Marshal Hakimullah has reportedly stated that the package deal also includes 45 additional new engines and spare parts which would help establish a Mirage III plant at Karachi. The aircraft are scheduled to be shipped to Pakistan late this year but will not be available for immediate service.

◆ The Comptroller and Auditor General's (CAG) has reported that the Mirage 2000 in IAF service has been without its key weaponry for two years after induction. As for the damage caused to eight Mirage 2000s, when part of the hangar collapsed on them at the Gwalior Air Force Station last year, Air Chief Marshal SK Mehra clarified that the damage was minimal. "The necessary repairs were carried out and the fighters are back in flying service".

◆ In a major development with great security implications for India, the Chinese and Soviets have reportedly made progress on the matter of advanced-technology combat aircraft supplies to the PLA Air Force which currently has a large, but obsolescent, fleet of fighters and attack aircraft. A senior Chinese military delegation, led by General Liu Huaqing, Vice Chairman of the powerful Central Military Commission, which oversees the PLA modernisation programme, has had high-level discussions with Soviet Defence leaders over the purchase of MiG-29 air superiority aircraft.

◆ Former East German Air Force aircraft will now not be completely scrapped or phased out by the new joint Air Force of Germany. According to reports, one squadron will continue to operate the MiG-29 but all the MiG-21, MiG-23 and Su-22 Fighter Wings are to be disbanded. Supporting the MiG-29s on combat air patrol duties will be the F-4 Phantoms of the Luftwaffe.

◆ British Secretary of State for Defence Tom King has outlined proposals for reduction in RAF strength under the overall 18 per cent reduction of the armed forces over the next five years approved by the Government. Overall personnel strength, which is currently some 6,000 below its present establishment of 89,800 will decline to 75,000. The primary reductions will affect RAF Germany, which is to lose six squadrons, comprising its two Phantom squadrons; two of the latter will be mothballed, together with one similarly equipped UK-based squadron. Two of the UK-based Phantom squadrons will be disbanded, but the number of Tornado FMk.3 squadrons is to be increased from six to seven.

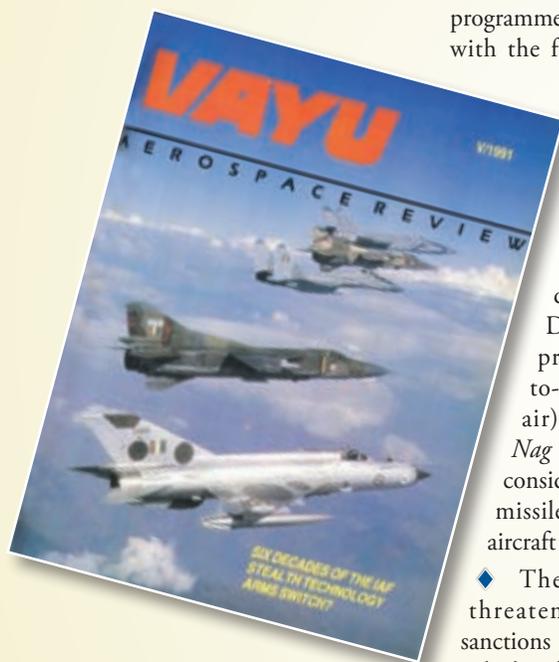
◆ After 32 months of development work, the Chinese Government has terminated its Agreement with the US company Grumman Corporation for upgrading its Shenyang J-8II all-weather fighters including the fire control systems, radar, computers displays, a power system and environmental control systems. Meanwhile, the A-5K attack aircraft upgrade programme with French assistance has also been terminated.

◆ CAS of the Pakistan Air Force has announced that 95 Chinese-built F-7P Skybolt fighters will be received by them alongwith a small number of FT-7 operational convention trainers.

# 1991

◆ The LCA will be ready for its first test flight in 1995 according to Dr VS Arunachalam, SA to RM and DG DRDO. He said that advanced technology posed some problems and the experience of solving these was invaluable whatever the time spent. He asserted that the country had adequate amounts of crucial materials which should be used as much as possible.

◆ The launching of INS *Delhi*, first indigenously designed guided-missile destroyer marks progress in the Navy's ambitious Project-15, which includes the induction of the heaviest warships with the most modern weapon-systems to date into



the Navy. Three more ships in this class have already been sectioned, including the INS *Mysore* which awaits launching next. The 6,500 tonne ship is to be equipped with surface-to-air and surface-to-surface guided missiles, but the weapon fit is yet to be finalised.

◆ INS *Dega*, the Indian Navy's new Naval Air Station, was commissioned at Vishakhapatnam on 21 October by the Chief of Naval Staff Admiral Laxminarayan Ramdas. A brief ceremony involved reading of the Commissioning Order of INS *Dega* hoisting of the ensign and unveiling of a plaque marked the formal commissioning of the Air Station.

◆ India made a record purchase of more than \$21 billion worth of arms, largely from the Soviet Union, in the 1980s, registering a massive increase in the volume of its arms deliveries from 1983-1986 to 1987-1990 rising from \$8.3 billion in 1983-1986 to over \$13 billion in 1987-1990. Afghanistan made \$3.7 billion arms agreements, Iran made nearly \$2.9 billion and India made nearly \$2 billion. The Soviet Union was the major supplier of all three nations. Besides India, from 1983-1986, these countries were: Iraq, Saudi Arabia, Syria, Iran, Libya, Vietnam, Cuba, Egypt and Angola. However, Libya dropped out of this list after 1986 and its place was taken by Afghanistan which bought arms worth \$11.2 billion between 1987 and 1990.

◆ On 7 August, India's guided missile programme, crossed yet another milestone with the fifth successful launch of the surface-to-surface missile Prithvi from the Sriharikota space complex. The Prithvi forms a part of the country's integrated guided missile development programme headed by Dr APJ Abdul Kalam, director of the Hyderabad-based DRDL. The other missiles of the programme are *Agni* (surface-to-surface), *Trishul* (surface-to-air), *Akash* (surface-to-air) and *Nag* (anti-tank missile). Also under consideration is the *Astra* (air-to-air missile) to equip the light combat aircraft (LCA).

◆ The Bush Administration has threatened to intensify economic sanctions against China if it goes ahead with the planned sale of M-11 missiles to Pakistan. Commenting on the statement to this effect by the Chinese ambassador to the US, the State Department spokesperson said "we are now trying to verify whether China has sold or transferred a missile to Pakistan with capabilities that exceed the missile technology control regime (MTCR) guidelines."

◆ The Pakistan Air Force is to receive an additional batch of 40 F-7P fighter aircraft from China. Pakistan's air defence planners had pinned their hopes on the second package of 60 F-16s from the US, which General Dynamics was to supply to Pakistan under an agreement signed between Pakistan and the United States during

former Prime Minister Benazir Bhutto's visit to Washington in 1989. But following the enactment of the Pressler Amendment, the US administration has not only stopped the supply of new F-16s, but also withheld the provision of spare parts for the fleet of F-16s already in service with the PAF. It is learnt that Pakistan has already made the phased payment of \$200 million to General Dynamic as part of the agreement.

◆ It is now confirmed that the Chinese Air Force has received a first, small quantity, of Sukhoi Su-27 long-range air superiority fighters from the Soviet Union. Reportedly eight Su-27s were in the first batch, they are being stationed on Hainan Island, and will undoubtedly be followed by large quantities in the period ahead. The Su-27 deliveries represent a major watershed in Sino-Soviet defence relationships, being revived after over 30 years. The last modern Soviet fighter to be supplied to China was the MiG-19 which, after the political rift was copy-produced (without licence) in very large numbers by the Chinese as the Shenyang F-6 and the Pakistan Air Force received over 200 of this fighter in the post-1965 period.

◆ Aerospace industry of the USSR is undergoing massive changes, following the macro-pattern changes in the Soviet Union itself, now desperately attempting to adapt to the new political and economic realities of the last decade of the 20<sup>th</sup> century. According to reliable sources, orders for military aircraft have been reduced by 30 per cent compared with the average production runs and the Soviet's prime air defence fighter, the MiG-29, will be phased out of production for the Soviet Air Force by end 1992. Although the MiG-29 will remain available for export, the effect of non-domestic production will certainly have negative results. The Indian Air Force, as an example, has three squadrons of MiG-29s in its inventory and the type was earlier regarded as a candidate to replace at least some MiG-21 squadrons in the '90s even as delays continue with the LCA programme.

◆ The world's longest range airliner, the Airbus 340, made its maiden flight at Toulouse, France, on 25 October, in a highly successful mission lasting four hours and 47 minutes. This flight marks a further step towards completion of the Airbus family, with the A340 also being Airbus Industries' largest aircraft and its first with four engines.

# 1992

◆ The IAF's Diamond Jubilee was marked by ceremonial parades and other functions but the Service faces inevitable reduction in force levels unless its pressing requirements are urgently addressed and the picture appears "even more bleak when one considers the aspect of continuous obsolescence and the need to keep up the ongoing process of re-equipment and modernisation".

◆ The inordinate delay in meeting the IAF's well stated, and urgent requirement for advance jet trainers (AJT) has evoked much criticism. The AJT has been accorded Priority Number One and that the lack of such an aircraft would critically affect the output of new combat pilots by the year 1992. Dire predictions for the IAF unfortunately seem to be coming true as the IAF is being forced to send young pilots straight from the Kiran basic jet trainer to MiG-21 Mach 2 operational aircraft "which fracture in the training process is bound to show up as a serious deficiency in the professional capability of pilots at some crucial moments later in their career."

◆ Prototype of HAL's Advanced Light Helicopter will be test flown "positively" by September 1992 according to Chairman HAL. Development of the ALH has suffered a year's delay owing to "some technical discrepancies in the gear box" but these have now been sorted out. The projects German technical collaborator, MBB, was now part of the Franco-German Company Eurocopter. First prototype of the ALH was formally rolled out at Bangalore on 29 June.

◆ Indian Naval Air Squadron 310 *Cobras* has recently been re-equipped with the Dornier 228 Maritime Patrol Aircraft. INAS 310 was formed on the Breguet Alize carrier-borne ASW aircraft which was operated for some 30 years. The Alize has been supplanted by the HAL built Dornier 228 maritime patrol aircraft.

◆ Nine women flight cadets will enter the portals of the Indian Air Force Academy at Dundigal, near Hyderabad, on 6 July, 1992. These pioneering women had secured top ranks among a total of 275 women who were chosen after a rigorous selection

process during which they underwent the same physical obstacle course and mental aptitude tests as men.

◆ "In fact, the response from women was overwhelming. About 24,000 applications from all over the country were received. About 3,000 of them were shortlisted and finally 275 were selected," according to the AFA. These women would don IAF uniforms on 19 June, 1993, when they graduate to become ground duty officers in the administrative and educational wings.

◆ There is confidence that the women would not face any problem in adjusting to the male-dominated world of the IAF. While in countries like Britain, women



have achieved the distinction of becoming fighter-pilots, it might take some years for Indian women to reach that milestone. The question of inducting women into the pilots training course was under the Government's consideration.

◆ In a significant development, France has agreed to sell 40 Mirage 2000E multi-role fighters for the Pakistan Air Force. The Defence-sales agreements also include the sale of submarines, minesweepers and air defence radars to Pakistan and is seen as a direct consequence of the suspension of all US economic and military aid to Pakistan since October 1990.

◆ The Bush Administration believes that Pakistan holds essential parts for at

least two nuclear weapons and has told Islamabad that the parts must be destroyed before resumption of US aid. Democrat Senator Larry Pressler said that the US was convinced that Pakistan had a nuclear device it could use. "There is a fear of an Islamic bomb either here or in the Central Asian republics" of the former Soviet Union, he said.

◆ The PAF is seriously discussing the procurement of Sukhoi Su-27 long-range fighters from the CIS, as the earlier reported intent to buy Mirage 2000s from France is unlikely to be followed through. Essentially the Mirage 2000s are considered as "too expensive" and this not "cost-effective" for the PAF while the Su-27 is being offered at substantially lower prices.

◆ The Rafale Marine 01 prototype for the French Aeronavale, made its maiden flight at Istres on 12 December. The differences between the M01 and the Rafale C01 involve the reinforced landing gear, the installation of an arrestor hook for deck landing and of a special nose gear to accommodate catapult operations.

◆ The Eurofighter consortium, including the UK, Italy and Spain, formed in 1986, had plans to develop and build some 764 EFA but subsequent cuts by Germany, Spain and Italy had reduced this to 667. The unit cost of the EFA (being developed as a single-seat, highly agile air superiority fighter with the secondary ground attack role) is estimated at nearly \$80 million. In an apparently linked move, Germany is believed to have considered Sweden's JAS-39 Gripen as a possible alternative to the EFA.

◆ Nearly 9 years after the light combat aircraft (LCA) programme was launched, there has been varied reactions to development delays, these varying from cautious optimism to outright adverse commentary. Two main factors would appear to be the performance and sophistication demands "which have been pitched too high" with the second being "an excessive stress on high technology and ambitious claims of capability to produce the best of everything".

◆ The disappointing performance of India's 3<sup>rd</sup> level airline Vayudoot has been attributed to "lack of professional management, tilt towards individuals self interests, supported by the bureaucracy and the politicians to advance their personal interests at the cost of the State".

# 1993

◆ Indian Naval Aviation finds itself at cross roads for the fourth time in as many decades. Sooner rather than later, the Government must take a decision on whether the Navy's current, but elderly, aircraft carriers are to be replaced by newer ships when they retire by the end of this decade or is this asset of the Navy, so assiduously maintained for so long, be finally docked? The decision has not just massive financial overtones but must address the very fundamental policy on whether the Indian Navy needs to have a "blue water" or "brown water" ability under further, needs a "sea control" capability as against only a "sea denial" one. Aircraft carriers are the very core of such a calculus.

◆ Dr Abdul Kalam, SA to the RM, informed the Committee that the "first roll out" of the Light Combat Aircraft was expected in June 1996, "about six months ahead of schedule". However, he admitted that the LCA programme could be severely hit if restrictions were imposed on the funding.

◆ Second prototype of the Advanced Light Helicopter (ALH) was test flown at Bangalore on 8 April 1993 in the presence of General SF Rodrigues and Dr APJ Abdul Kalam SA to the RM. Once plans were approved, the first production ALH would roll out from the assembly line in 18 months from the "go-ahead".

◆ First production JAS39 Gripen made its first flight in Linköping, on 4 March. The five test aircraft have made 873 flights to date and the first production batch will be for 30 aircraft to be delivered to the Swedish Air Force between 1993 and 1996.

◆ 40<sup>th</sup> anniversary of the Indian Naval Air Arm was marked by parades and flypasts at INS Garuda at Wellington Island, Cochin. The fixed-wing component comprised pairs of Islanders and Dornier 228s, three Sea Harrier V/STOL fighters and finally a lone Ilyushin Il-38 ASW/MR aircraft.

◆ Dassault has delivered the first 2-seat Rafale (B01) to the Istres Flight Test Centre for various tests which will be followed by ground run-ups and taxiing tests before the first flight scheduled for the spring of 1993. Meanwhile the SNECMA M88-2 turbojet which powers the Rafale obtained initial Conception Qualification

on 30 September 1992, as issued by the Defence Ministry and officialised by letter on 7 October 1992.

◆ The Raytheon Company of Lexington, Massachusetts (USA) have formalised a \$106 million order for the supply of equipment for modernisation of Palam and Santa Cruz airports. The turnkey projects, with the National Airports Authority, were finalised some months earlier for installation of state-of-the-art short-range and long-range surveillance radars as part of the Delhi and Bombay airport modernisation plans, aimed at facilitating the handling of upto 40 aircraft per hour (as against 10 at present).

◆ The CAG has revealed the poor record of the MiG-29's RD-33 engines in that 74 per cent of the engines had "failed prematurely". This had resulted in fleet availability being reduced by 15 to 20 per cent and led to the critical decision to restrict flying of the most advanced aircraft in the inventory of the Indian Air Force, thereby compromising the operational and training commitments.

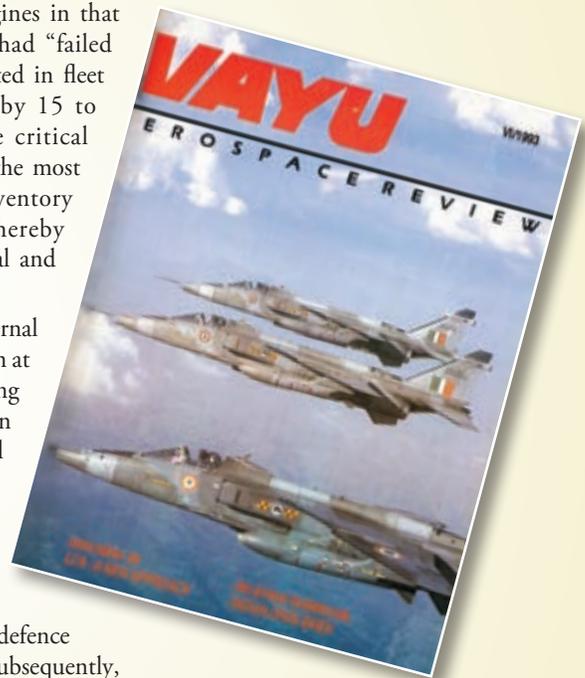
◆ India's defence-related external debt stood at nearly \$11 billion at the end of March 1993, having come down from \$13.6 billion at the conclusion of fiscal year 1990-91. This has been disclosed (for the first time) in an official publication recently released by the Ministry of Finance and provides data relating to the defence debt for the last four years. Subsequently, the figure came down to \$10,837 million at the end of 1991-92 before going up marginally to \$10,689 million the next year. The data provided clearly indicated that the bulk of the country's defence-related debt was obtained from the erstwhile Soviet Union, and these figures are certain to come down further in the years ahead.

◆ Pakistan PM Benazir Bhutto has stated that in view of the continuing impasse concerning supply of the additional 71 F-16 Fighting Falcons long contracted for but withheld by the United States Government under the Pressler Amendment, the Pakistan Government would have to implement new plans to enhance its defence potential. The PAF has four frontline squadrons operational on the Chengdu built F-7P/

F-7MP and is reportedly to receive another batch of F-7MPs to reequip the last two of its squadrons still flying the venerable F-6.

◆ After a decade of existence, the Indian 'experiment' with commuter, or third-level or regional services has been terminated, with merger of the 'worlds biggest little airline' with Indian Airlines. The union Cabinet, under chairmanship of the PM, approved the merger proposal and the Civil Aviation Ministry directed to take suitable transitional measures and complete the necessary legal formalities.

◆ Air India has declared net profit of Rs. 333.14 crore for the financial year 1992-1993, which represents a 128 per



cent increase over the previous year's figure of Rs 145.29 crore. The operating revenue increased by 24 per cent from Rs 1965 crore to Rs 2436 crore, while the operating profits touched Rs 289 crore. "Air India carried 2.2 million passengers, ten per cent more than the previous year."

◆ Air Chief Marshal Swaroop Krishna Kaul took over as CAS IAF on 1 August 1993. He was previously AOC-in-C, Western Air Command.

◆ The first ever International Air Show in India (Avia India '93) took place at Yelahanka Airfield Bangalore 15-18 December, organised by Convex, a private sector company with considerable experience and expertise in such expositions.

# 1994

◆ India has “displayed considerable interest” in the Sukhoi Su-30 combat aircraft, but has not so far made any official request for these aircraft. Several Indian military delegations had visited Russia recently and had “unofficially” discussed the possibility of India acquiring the Su-30. According to Tass, India is also interested in enhancing bilateral cooperation between the aviation industries of the two countries and this was evident at the recent session of the Indo-Russian joint working group on aviation.

◆ There are confirmed reports that an Indian Air Force team has evaluated the new generation Sukhoi Su-30 air defence fighter in Russia. According to the Russian news agency Itar-Tass, Russia has offered India 20 Su-30s, in “flyaway” condition on credit, with licence-manufacture of a follow-on batch of 60 Su-30s by Hindustan Aeronautics Limited (HAL) at their Nasik facilities.

◆ In a significant move, the Foreign Secretary of India, Mr K Srinivasan called a special press conference in New Delhi on 30 November 1994, at the time that a Russian defence delegation was visiting Pakistan. It was stated that India was aware of the Pakistani bid to buy high performance Su-27 fighters from Russia, but hoped that Moscow would do nothing that would alter the regional security balance.

◆ It has been officially announced that upgradation of the IAF’s MiG-21bis fleet will be responsibility of the MiG-MAPO Bureau of Russia, thus setting to rest much speculation about the possibility of Israeli or US companies being given the task. A letter of intent has been given to the Russian Company for upgrading 100-odd aircraft and negotiations stand completed. In addition, India is interested in buying 10 additional MiG-29s.

◆ India and Pakistan have not agreed to pull back their forces from the Siachen Glacier, the world’s highest battlefield. The accord on demilitarisation of the glacier was likely to be reached during the talks between the Foreign Secretaries of the two countries, beginning in Islamabad on 1 January, 1994 “but nothing happened”. At present, the

Indian forces are entrenched around 21,000 feet of the glacier while the Pakistanis are at 18,000 feet. Most of the casualties on both sides take place due to frostbite.

◆ The Clinton administration has urged India to consider the “dangerous consequence” of deploying its indigenously developed medium-range surface-to-surface ‘Prithvi’ missile. The US ambassador to India said that the US hopes “India will consider very carefully the wisdom for deploying the missile.” Replying to a question about the intermediate range ‘Agni’ missile, the ambassador-designate said, “Agni is an experimental rocket system. Whether it will go into a new experimental stage and into production, I cannot answer. I do not know what the Indian government’s plans are.

◆ The UK and Swedish Governments have signed a MoU which will form the framework for British Aerospace and Saab to co-operate on defence projects, initially concentrating on Saab’s JAS39 Gripen fighter. With the Gripen, BAe is poised to market the aircraft in return for manufacturing and development work. Other areas of co-operation which may emerge include providing weapon systems for the Gripen.

◆ Unit cost of the Eurofighter, according to an estimate by Germany’s Federal Audit Office (BRH), has increased by about 10%

to DM 150 million (\$100 million). The report recommends a cut in Germany’s order from 250 to 100 aircraft. But the German Defence Minister Volke Ruche has queried the estimate as “exaggerated”.

◆ Maiden flight of the Eurofighter 2000 took place on 27 March 1994 at the Deutsche Aerospace Flight Test Centre at Manching in Germany. The second Eurofighter 2000 development aircraft made its maiden flight on 6 April 1994 from the British Aerospace facility at Warton in the UK.

◆ The United States have decided to repay Pakistan the \$ 658 million deposited as advance for 71 additional F-16s. This could well lead the Pakistani’s to ‘afford’ the alternative Russian Su-27s on offer to it, which would in turn ‘queer India’s pitch in far more complicated manner’.

◆ Jet Airways, the start up airline headquartered at Bombay has gone global with interline agreements with 31 leading international airlines to fly their passenger and cargo in India. The airline’s Real-Time Reservations system, which is served by the biggest American reservation system ‘Sabre’, has also linked up with the world’s major seven computerised Real-Time Reservations systems.

◆ The Tata Group and Singapore Airlines are planning to established a new airline in India, which is likely to start off with an initial capitalisation between \$150 million and \$300 million. The final figure, however, hinges on a joint feasibility study as also the process of government approvals, to be finalised in the next six months

◆ The Government will neither allow foreign airlines to operate in the domestic circuit nor will it allow air taxi operators (ATOs) to fly on international routes, as per the Minister of Civil Aviation and Tourism. He said the 1953 Air Corporation Act was being repealed after 40 years. “There is every chance that the new Act too might have to stand the test of time and hence we don’t want to do anything in a hurry,” the minister said, who also ruled out the immediate merger of Air India and Indian Airlines. However, Ministry sources said their merger to create a mega airline will not be hurried through as it might strain the relationship with unions of both airlines.



# 1995

## Editorial

*In its 21st year of publication, this Journal will henceforth strive to prepare its myriad of readers for the 21st century. As will be seen, from the very masthead of this first issue of 1995, the Vayu Aerospace Review has assumed a new mantle for the last years of the 1900s, with the appellation '2000' added to the title reflecting such tilt towards the new millennium. Retaining the now classic flavour of reporting on and analysing matters concerning aerospace affairs in their entirety, nevertheless the journal's bias will be on the high technologies which are revolutionising global air travel, national air defences and the multi-disciplines and complexities of aerospace management. There is now a flurry of specialist writers contributing a new style of exclusive features, and much researched articles maintaining, indeed concretising, Vayu's place amongst the foremost of specialist media in the world.*

*The Society for Aerospace Studies, publishers of Vayu, is entering into editorial and publishing alliances with some of the world's leading international aviation and space journals. The spirit and strength of these will be apparent in the immediate future. We have every hope that our readers will share our enthusiasm over this exciting new visage.*

## Other news of significance :

◆ In a severe criticism of the DRDO, Parliament's Standing Committee on

Defence has called for a "review" of the Light Combat Aircraft (LCA) project, which, according to it, was taken up without proper ground work. "The Committee is not aware of level of competence built up in DRDO before it embarked on this ambitious project." The Committee, chaired by Mr. Indrajit Gupta, has recommended that the LCA project be reviewed after the completion of prototype trials.

◆ The question of replacement of the aircraft carrier INS *Vikrant* still looms large, and revolves around a set of factors variously identified as the role, vulnerability, cost, and acquisition opportunity, for warships of this kind. The INS *Viraat*, is already 42 years old, and is itself in need of decommissioning in the next seven or eight years. The question of the replacement of the *Vikrant* therefore assumes far greater importance as it will basically determine whether the Indian Navy will continue to possess a carrier arm or not by the year 2002-2003.

◆ The Minister for Defence has stated that the Indian Navy would receive greater financial allocations to make up for reduced effectiveness owing to obsolescence and serviceability problems. The Indian Navy's force of Sea Harrier V/STOL fighters will be retrofitted with newer generation airborne radar, avionics and a "more potent missile". Similarly, the Navy's maritime reconnaissance aircraft (Tupolev Tu-142Ms and II-38s) would get upgraded sensors and a new generation anti-ship missile. The Navy's air-arm will also be augmented by another 10 Dornier 228-201 MPAs.

◆ "It will not be an exaggeration to state that India, as a strategic partner, is most important for Russia (even more so) than during the existence of the USSR." This was underlined repeatedly by Mr. Andrei Kokoshin, Russia's first deputy Defence Minister during his week-long visit to India between 20-26 March 1995, leading to a delegation comprising senior officers of the Russian armed forces, Government and defence industry. The Russians reportedly desire a joint approach in areas of space research, aircraft manufacturing, science and technology, engineering natural and social sciences marketing techniques in areas of defence and electronics.

◆ India plans to be the third partner (along with China and South Korea) for development of the 100-plus seater 'Asian Express' jetliner. On 27 August 1995, at a ceremony in Shanghai, the Chairman of HAL, Mr. RN Sharma, signed a MoU with Mr. Zhu Yuli, President of the Aviation Industries of China (AVIC) on the US \$2 billion project with India likely to invest \$200-500 million as its share.

◆ The Indian Air Force has notched another "Asian first" when the first batch of nine women helicopter pilots were commissioned on 16 December, 1995. Pilots, ground duty officers, navigators, short service commission women pilots and women ground duty officers also graduated at the ceremony. The batch was imparted training in basic aero-sciences as well as ground duty subjects, besides 30 hours of flying experience on HPT-32 basic training aircraft. Conversion training later took place at the Helicopter Training School at Hakimpet on rotor wing aircraft (Chetak), completing 110 hours if such flying.

◆ Following the American volte face on the F-16 deal, the Pakistan government is now considering the Swedish JAS 39 Gripen as a possible replacement. According to reports, the Pakistan government has already sent a letter to Sweden, and intends to follow it up shortly with an evaluation of the type. Pakistani interest in the project is expected to be cautious, in view of the External Trade Minister's recent declaration in Parliament, on following a restrictive policy on the export of war material to Pakistan.

◆ The US Air Force has declared its 17<sup>th</sup> Airlift Squadron at Charleston AFB, South Carolina, equipped with 13 McDonnell Douglas C-17 Globemaster IIIs, as fully operational. Later in 1995 a C-17 will undertake a circumnavigation of the globe during which it will re-enact a flight across the Himalayas to commemorate the operations flown during the Second World War 'over the Hump' between India and China.

◆ Hyderabad-based VIF Airways will expand its regional services with additional six airliners in the below 50-seater capacity. VIF has already contracted for five new generation Dornier 328 regional airliners with the first aircraft flying on scheduled service out of Begumpet (Hyderabad) airport in May 1995.



# 1996

◆ Sources in Moscow indicate that India and Russia are “on the brink” of a deal covering the sale of 40 Sukhoi Su-30MK multi-role fighter aircraft. The Russian media quoted Defence Minister Mulayam Singh Yadav as having said that negotiations to buy the aircraft are approaching “the final stage”. There have been suggestions from Russia that a canard-configured variant of the Su-30 being manufactured at the Irkutsk production site is the ‘MK’ intended for the Indian Air Force. Some claim that the bulk of the funding for the development and construction of this aircraft has been provided by India. Interestingly, it has been pointed out that a substantial production order for the Su-30 MK will provide Irkutsk plant with a life-line while it is “teetering on the verge of bankruptcy.”

◆ Senior BJP leader Atal Behari Vajpayee has sharply criticised the outgoing Congress government’s reported decision to buy an initial eight Sukhoi Su-30s at a staggering cost of Rs 1,200 crores and darkly hinted at the possibility of “huge commissions” in the deal. The BJP memorandum presented to the President detailed that the deal for eventual supply of 40 Sukhoi Su-30MKs worth Rs 6310 crores (US \$1.8 billion) was made in “indecent haste” and that an advance payment of Rs 500 crore (US\$145 million) may already have been transferred to Russia.

◆ “Two prototypes of the Light Combat Aircraft (LCA) Technology Demonstrators will fly in the middle of next year” according to Dr Kota Hari Narayana, LCA Project Director. He said that the integration phase of the first prototype had been completed, with the structural testing being completed as recently as 19 September. “Testing of the electrical and avionics will begin shortly, and then we will move on to the flight control system. The critical thing is to prove beyond doubt that the aircraft is safe,” he said.

◆ The Government disclosed that the Indian Air Force lost 82 aircraft during the last three-and-a-half years since April 1993, resulting in a loss of 475.5 crore. This loss accounts for nearly four-and-a-half squadrons worth of aircraft, almost all of which were fighters. The IAF has been

losing on an average between 22 and 24 aircraft annually since 1993, but this is the first time the government has tabled precise figures in Parliament.

◆ Boeing has qualified the HAL for supply of several essential spare parts for its aircraft and carry out the overhaul of 737 series of airliners. Detailing its plans regarding such tie-ups and creation of facilities in the Indian subcontinent, Boeing officials said the company proposed to start generic maintenance training for 747-400 aircraft in coordination with the DGCA.

◆ “Expenditure on Indian aircraft purchases will exceed Rs 50,000



crores (\$14.7 billion) in the next 20 years,” according to Mr BR Somashekhar, head of the structures division at the National Aerospace Laboratory (NAL). He referred to the proposed acquisition by Air India of medium capacity long range aircraft, while private airlines had extensive plans expansion and modernisation.

◆ The Government of India has ruled out licensing of any new foreign or domestic airline except for operations on short-haul routes, at present. The Minister of Civil Aviation has stated that the freeze on issuing licences would continue till infrastructural requirements like modernisation of air traffic control, network computerisation, expansion of airports and runways were completed.

However, on short-haul routes where the requirements would be of up to a 50-seater aircraft, operations could be permitted.

◆ Pakistan has confirmed that the ‘mid-tech’ Super-7 fighter will be produced in a joint venture by China and Pakistan, and is meant to replace all Chinese-origin aircraft on the inventory of the PAF. Besides, Pakistan intends on buying 32 ‘high-tech’ Mirage 2000-5 aircraft from Dassault of France and the induction of front line new aircraft “will make the Pakistan Air Force more potent and cohesive”.

◆ Pakistan may have acquired 15 Scud ground-to-ground ballistic missiles captured by the Taliban in Kabul, which can be equipped with nuclear warheads. The missiles, supplied by former Soviet Union to Najibullah’s Government in the late eighties, were “more or less in battle readiness” and could be transported to Pakistan. Besides the Scud missiles, Taliban have also captured an unspecified number of short range ‘Luna-M’ tactical missiles, supplied by the former Soviet Union, which may also be taken away by Pakistan.

◆ An Airbus Industrie survey estimates that airlines in India will acquire some 275 aircraft worth \$20 billion between now and 2014, whilst 78 ageing aircraft will be retired and replaced.

◆ “If Air India has to expand its market position and profitability, it must acquire medium-capacity long-range aircraft without delay”. According to Adam Brown, Vice President of Airbus Industrie, Air India ought to opt for direct non-stop flights between New Delhi and Los Angeles and Mumbai and Los Angeles to increase its international market share. Airbus Industrie of India president Kiran Rao hopes that the French aviation major’s fierce competition with Boeing for making sales to Air India would not prevent introduction of direct, regular flights between India and the USA.

◆ Indian Airlines have stalled plans to acquire 50-seater turboprop airliners to select for the north-eastern sector. The technical evaluation committee were unable to justify selection of the three types short-listed: Saab 2000 has airfield limitations, Fokker are closed down and DHC (Bombardier) are very casual. The ATR-42-500 looks the most promising but there are new regional airliners now available which the committee cannot overlook.

# 1997

◆ The first four Sukhoi Su-30Ks for the IAF, disassembled and in crates, have been flown to Poona by special Antonov An-124 aircraft, arriving during the second week of March 1997. To be supplemented by another five Su-30s in CKD form, which will be transported by end-March, the first 8 of an eventual 40 Su-30s for the IAF are being assembled by Russian engineers and technicians at site and will be test flown and cleared for service before the official handing over in late April/early May 1997 by which time the IAF team will have returned from Russia. The first Su-30s for the Indian Air Force are essentially the 'K' variant and there is to be an ongoing and intricate programme for gradual receipt of the Su-30 MK variant and finally the special standard of preparation of Indian version, the Su-30MKI, the last of these to be delivered ten years hence, in 2007.

◆ Formal contract for the Su-30s (worth US \$ 1.8 billion) was signed by Mr TK Banerji, Secretary for Defence with representatives of the Irkutsk Aviation Industrial Association on 30 November 1996 which also provided for licence production of the Su-30 in India by Hindustan Aeronautics Limited.

◆ The new *INS Delhi*, guided missile destroyer being indigenously built under 'Project 15' was commissioned at Bombay on 15 December. Within a short while the ship, commanded by Captain Anup Singh, sail to Malaysia to take part at the Langkawi International Maritime and Aerospace Exhibition.

◆ According to authoritative sources, India is negotiating purchase of Airborne Early Warning (AEW) helicopters from Russia while negotiations for purchase of three Type 1136 frigates and two Type 977 EKM submarines are already under advance negotiations with Moscow.

◆ The Ministry of Defence is negotiating purchase of four Kamov Ka-30 AEW helicopters, these seen as an alternative to the earlier planned Westland Sea King (Mk. 42D) AEW helicopter. The Indian Navy has also recently placed orders for a second batch of 10 HAL built Dornier-228s equipped with maritime surveillance radar and other sensors to equip additional units with the type. The first squadron,

INAS 310 has been operating the Do 228 since 1992.

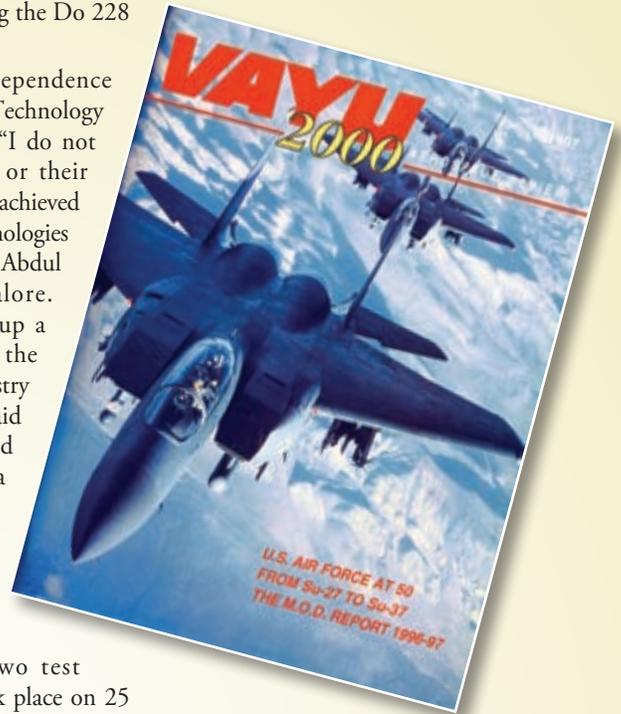
◆ India has declared independence from the regressive Missile Technology Control Regime (MTCR). "I do not need any outside material or their supercomputer now. We have achieved self-reliance in all critical technologies in missile technology, Dr APJ Abdul Kalam declared in Bangalore. It is also proposed setting up a national body to facilitate the growth of the aerospace industry in the country. Dr Kalam said the government has cleared development of the new Astra air-to-air missile which will be the prime close combat weapon for the LCA.

◆ Developed under the Integrated Guided Missile Programme (IGMDP), two test firings of Trishul SAMs took place on 25 November from the Chandipur Interim Test Range (ITR). In fact, these were the second and third Trishuls launched during the week, the first missile launch having taken place on 22 November.

◆ The Chinese Government is reportedly considering acquisition of Dassault Rafales, having visited Dassault in 1996, while, more recently, French representatives including those from Rafale's engine manufacturer Snecma, have spent time in Beijing. Dassault and Snecma confirm that there is Chinese interest in the French fighter, as also the associated M88 engine. It is suggested that the Chinese main interest may not be in the Rafale, but in acquiring the M88 engine. The J-10 (being developed with Israeli co-operation) and the FC-1 are initially intended to be powered by Russian engines, the Klimov RD-93 and the Lyulka/Saturn AL31F respectively and China's aim may be to find an alternative source of combat aircraft engines.

◆ Dassault has been very keen to find an export customer for the Rafale, given the limited orders it has so far had from the French armed services. Some estimates suggest that, between 2005 and 2014, the air force will receive around only 140 Rafales. A Chinese order would give the programme a great boost.

◆ Three regional airliner manufacturers have submitted commercial bids to Indian Airlines, with the airline set to purchase six



aircraft initially and 12 more at a later date. The acquisition is expected to cost \$360 million. The Franco-Italian ATR-42-500, Canadian Bombardier Dash-8 and the Swedish Saab 2000 are the three contenders in the race, and the aircraft are to be operated by IA's subsidiary, Alliance Air, for its feeder route operations.

◆ With effect from 16 October 1997, Jet Airways has shed its foreign equity in implementation of the Government of India's directive and decision issued on 17 April. Earlier 40 per cent (20% each) equity was held by Gulf Air and Kuwait Airways (According to the directive, no foreign airline can hold equity in domestic airlines registered in the country).

◆ Maiden flight of the first Boeing F-22 Raptor (billed as the "USAF's air dominance fighter for the 21<sup>st</sup> century") took place on 7 September 1997. The USAF is slated to get 339 Raptors at a cost of US \$43 billion, to replace the present F-15C Eagles and F-117 Stealth fighters.

◆ On 8 October, the German *Bundestag* finally cleared procurement of 180 Eurofighter 2000s for the Luftwaffe. First delivery of the 140 EF 2000s will begin in 2002, to be used for re-equipping JG-73 at Laage, and this squadron will be followed by JG-74, JG-71 and JG-72. The further 40 EF 2000s will be delivered after 2012 to replace a wing of Tornado strike aircraft.

# 1998

◆ Russian sources indicate the possible (or probable) transfer of the *Kiev*-class Russian aircraft carrier *Admiral Gorshkov* to the Indian Navy as replacement of the just-decommissioned INS *Vikrant*. Yet another Indian naval team had visited the Russian naval base at Severmorsk near Murmarsi during the last week of January 1998 for detailed on-the-spot inspections. The *Admiral Gorshkov* has been the subject of discussions and negotiations for at least the last three years.

◆ “Non-availability of an Advanced Jet Trainer (AJT), coupled with unsuitability of MiG-21 combat jets for transitional training role for Air Force pilots and paucity of simulators continue to take a heavy toll of training-related accidents,” according to a recently tabled Report of the Comptroller and Auditor General. The IAF lost 147 aircraft and 63 pilots in 187 accidents during 1991-97 while during the same period, there were 2,729 incidents, many of which could have caused accidents, according to CAG’s latest report tabled in Parliament.

◆ India’s integrated ballistic missile programme had received a major boost with the BJP Government taking a decision to develop and produce a full-fledged missile system based on the Agni technology. Until now, the Agni project was termed as “a re-entry technology as the demonstrator,” which had been successfully completed with all the objectives met. It is learnt that the 2500 kilometre range Agni missile is now being accorded the highest priority by the Ministry of Defence.

◆ The Pakistan Air Force, which has been desperately looking for a new fighter aircraft to replace the obsolescent fighter-types in its inventory, has been keen on Russian aircraft for some time, particularly the MiG-29 and Su-27. In his forthcoming three-day official visit to Russia in April, Pakistan’s Prime Minister Nawaz Sharif will make an official request for the purchase of the new-generation Russian fighters as also the T-series of main battle tanks.

◆ General Anatoly Kornukov, Chief of the Russian Air Force, has ordered massive cuts in the number of aircraft and personnel in the air force. The re-organised force will be renamed as the *Air Force and Air Defence*

*Armies* with headquarters at Balashikha, some 20 km. from Moscow. A staggering 40 per cent of the aircraft in inventory are to be scrapped and 45 per cent of the personnel will be retired. The combat aircraft fleet will be rationalised (with all the MiG-21s and MiG-23s scrapped) and will consist largely of MiG-29s and Su-27s.

◆ Naval version of the *Trishul* surface-to-air missile was tested from an Indian naval establishment near Cochin on 3 June. test-fired hours from INS *Dronacharya*. The land based version of the *Trishul* was also test-fired from Chandipur-on-sea launch pad in Orissa on 11 May, the day of nuclear tests in Pokhran.

◆ In its observation, the Defence Ministry stated that Hunter and MiG-21 aircraft were not specially designed as advanced trainers and had some limitations for imparting air combat and weapon delivery. The Ministry also maintained that acquisition of an AJT would enable the IAF to impart better operational training at the stage-III level.

◆ Russia is currently executing an order to build six frigates for the Indian Navy, a submarine programme is underway and some maritime reconnaissance/attack helicopters are also understood to have been ordered.

◆ The Indian Navy is to acquire 50 more Russian-made Kh-35 anti-ship missiles for its three new 6,700 tonne INS *Delhi*-class destroyers at a cost of \$150 million. The missiles would add to the 48 already in the inventory of the Indian Navy, with tests of the helicopter-launched version to arm the Kamov Ka-28s already completed by the manufacturer. The missile deal would form part of the new 10-year defence cooperation agreement between Russia and India, which has been finalised and is to be signed during President Boris Yeltsin’s intended state visit to India later this year.

◆ The first MiG-21bis of the Indian Air Force (MiG-MAPO designation MiG-21-93) made its first flight at Enizhny Novgorod (formerly Gorky) on 7 October 1998. Flown by Sokol’s test pilot, Oleg Antonovich, the IAF-loaned MiG-21 was airborne for 40 minutes.

◆ 40 “surplus” MiG-21s and MiG-23s from this Central Asian Republic. The aircraft were “inherited” from

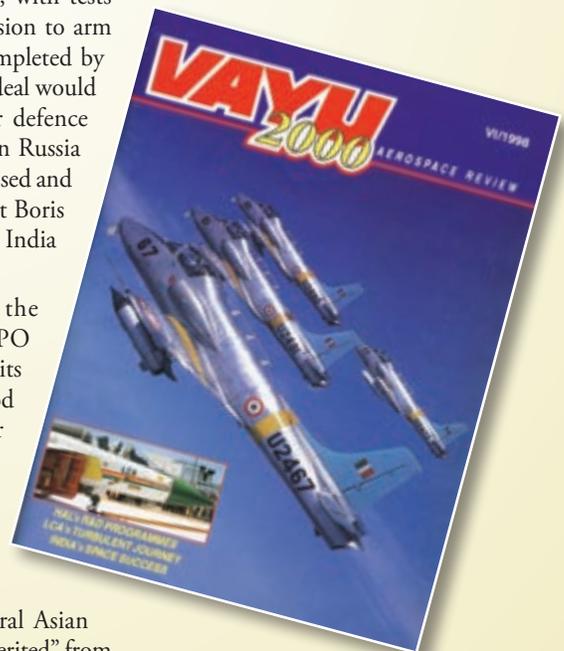
the Soviet Union after the USSR collapsed in 1991 and the present Kazakhstan authorities do not such a large aircraft inventory.

◆ Belgium has agreed to sell 24 Mirage 5s to Pakistan, these aircraft being in varying storage conditions after being phased out of service. The aircraft will be sold on an “as-is, where-is” basis for a very low total price of only \$6 million but refurbishing and updating will cost about \$ 2.5million more each.

◆ Between April and May 1998 Jet Airways will induct four additional aircraft enhancing its total fleet strength to 22 new generation Boeing 737 aircraft. With induction of these additional aircraft, Jet Airways will connect four new stations and provide six new links on its network and also increase frequencies on some of its existing routes to meet traffic demands.

◆ Lufthansa Cityline, is on the verge of ordering 60 Fairchild Dornier 728JET regional airliners with another 60 as option. According to their CEO “the market needs a new aircraft family to meet economic and environmental demands”. It is learnt that Jet Airways could be the 728JET launch customer in Asia, with a requirement for upto 24 aircraft.

◆ Air Chief Marshal Anil Y Tipnis, currently AOC-in-C WAC will take over as next Chief of the Air Staff IAF from 1<sup>st</sup> January 1999.



# 1999

## Editorial

*As Vayu marks its Silver Jubilee, with the Journal launched 25 years ago, naturally much has changed but a lot has not. This startling fact will surely be ascertained by readers who have the interest, or curiosity, to wade through the first section of this Special Issue (A Chronology of Aerospace Events in India : 25 years). Faces (of people) and models (of aircraft) have surely changed but attitudes have not much. Sadly, there has been increasing procrastination in decision taking : major programmes both in defence and civil aviation, have dragged on without direction and various Chiefs, Secretaries and Ministers have come and gone but actions have remained "on ice". In the decade 1978-1987 many major decisions were taken; not so during the last dozen years. This "freeze" could be attributed to political instability, turbulence in the wake of scandals, mediocre (or even unprofessional) leadership at the top ... or all of them.*

## News of significance :

◆ Indian defence deals with Israel worth near \$200 million are in the offing, with the visit to Israel by Brajesh Mishra, National Security Advisor to the Vajpayee Government, in the first week of September to endorse Indian requirements. The main equipment identified as priority on India's need list includes more Searcher 2 UAVs, battlefield radar systems and high calibre artillery. Various Israeli avionics have been selected for the Indian Air Force's Sukhoi Su-30MKI plus the MiG-27ML and Jaguar upgrade programmes, while Israeli companies are providing equipment for upgrading the Mi-25 attack helicopter and T-72 main battle tanks.

◆ Air Chief Marshal AY Tipnis said that "induction of the Advanced Jet Trainer must be accorded the highest priority to ensure operational preparedness of the IAF." The Air Chief said human resource development was the greatest operational asset and it would be one of the key result areas in the next millennium. The other key result area identified was infrastructure upgradation. He said while technology updates had been most evident "on our aircraft, systems and equipment, our basis infrastructure had not kept pace in tandem."

◆ IAF fighter-bombers and helicopter gunships went into action on 26 May 1999, with strike missions launched against heavily armed, Pakistani-led infiltrators occupying the higher reaches of Kashmir's Dras and Kargil sectors. The strikes were carried out against eight different locations well inside the Indian side of the Line of Control (LOC). Over 200 strike missions were launched from airbases at Srinagar and Avantipur (both in the Kashmir valley) the aircraft involved identified as MiG-21s, MiG-23BNs, MiG-27MLs, with air cover being provided by MiG-29s. The helicopters used in action are the Cheetah and Mi-17 assault helicopters fitted with rocket pods and air reconnaissance is being carried out by Canberras and Jaguars.



◆ In the second half of June, four more Su-30Ks were airlifted to India and another six are to follow even while more *Tungushka* air defence systems have been shipped, along with T-90 tanks for field trials. The first 3 T-90s were airlifted to India in May for field trials in Rajasthan desert and the Jammu region of J&K state and "proved successful".

◆ In a major setback to India's own Airborne Early Warning development programme, the HAL (Avro) 748 Airborne Surveillance Platform (ASP) technology demonstrator aircraft had a fatal crash some 2.5 km short of the runway at INS *Rajali*,

near Arrakonam. It is unofficially learnt that part of the rotodome structure on the top fuselage of the aircraft may have detached and hit the tail, which led to loss of control.

◆ Defence Minister Geroge Fernandes has stated that the Light Combat Aircraft (LCA), being developed as a replacement for the aging MiG-21 fleet of the Indian Air Force, "is likely to have its first flight in 1999." He said the LCA; "the world's smallest, lightweight, multi-role combat aircraft" had been designed to meet the stringent requirements of the Indian Air Force (IAF).

◆ Mr George Fernandes accepted the fact that the LCA programme had suffered a setback after the US had imposed sanctions "but the great Indian spirit has prevailed" and the country will find a solution to the embargo on avionics, flight-control systems and the power plant, he stated.

◆ In addition to the Sukhoi Su-27s already in service with the PLAAF, China has reportedly sought the multi-role version, Su-30 which is essentially being developed to meet an Indian Air Force requirement. Reports have it that the first lot would be for Su-30s, armed with the latest long-range air-to-air missiles, the decision having been taken during the visit of Chinese Premier Zhu Rongji to Moscow in late February.

◆ The Chinese have shown marked resentment to the raising of the Indian Army's XIV Corps which will be headquartered in Leh and exclusively concerned with the Ladakh region, also including the Kargil sector to the west, which "violates the spirit of the Sino-Indian bilateral Peace and Tranquillity Accords signed in 1993 and 1996".

◆ Seven more Dornier 228 MPAs have been ordered by the Indian Coast Guard, equipped with state-of-the-art mission sensors required for maritime patrol operations and the surveillance of India's 3500 km long coastline. HAL has the world-wide rights for the manufacture, supply and maintenance of Dornier 228, 73 of which aircraft, in various role variants have so far been delivered by HAL to the Indian Navy, Indian Air Force, Airports Authority of India, Indian Airlines (Vayudoot), ONGC and UB Air apart from the Indian Coast Guard.

# 2000



Advanced Jet Trainer to meet its Stage III combat pilot training needs in the eighties, all the Options available at that time were Considered and finally the Franco-German Alpha Jet and British Aerospace Hawk were short listed as meeting the IAF's ASR, their proposals invited and the aircraft test evaluated.

◆ The Indian Navy plans to enhance its maritime surveillance and strike capabilities by upgrading its existing fleet of Tupolev Tu-142M (*Bear Foxtrot*) and Ilyushin Il-38 maritime patrol / ASW aircraft and acquiring "some numbers" of supersonic Tupolev Tu-22M3 bombers on lease from Russia. Such enhancement of its maritime surveillance and strike capabilities is in line with the Navy's plans to transform itself into a "blue water" force in the coming decades. Significantly, the Navy does not yet have any warships or aircraft capable of performing the nuclear strike role.

◆ The Indo-Russian programme to upgrade the Indian Air Force's MiG-21bis fighters, already behind schedule by about 18 months, is now likely to be completed by late 2003. Test flights of the two MiG-21s which were upgraded in Russia as prototypes, have been progressing well, and the two aircraft had completed about 70 hours of test flights each by January 2000. The Light Combat Aircraft (LCA), being developed by the Defence Research and Development Organisation, was scheduled to replace the MiG-21bis in the late 1980s but delays with the LCA and prohibitive cost of modern aircraft such as the Su-30 and Mirage 2000, forced the IAF to start a programme to upgrade 125 MiG-21bis fighters. An agreement was signed with MiG-MAPO in early 1996 to upgrade the aircraft at a total cost of Rs.1,200 crores (US \$ 280 million).

◆ Eight more ships of the Indian Navy would be commissioned during the year according Defence Minister George Fernandes, the first in the series being the fleet tanker INS *Aditya* which was commissioned in Calcutta recently, followed by another first in the series, *INS Brahmaputra* guided missile frigate. This apart, the first indigenously- built aircraft carrier and a "slate of the art"

submarine were being built at Cochin and Mazagon Docks respectively. Speaking at the commissioning ceremony of *INS Brahmaputra*, the indigenously-built guided missile frigate of the Indian Navy at the Garden Reach Ship Builders yard, George Fernandes said that the Indian Navy was to be expanded as recent developments had shown that there was an urgent need for a strong and vigilant defence force.

◆ "Fishing in troubled waters" is how the French offer to provide the Dassault Rafale fourth-generation fighter to the Indian Air Force is being described by knowledgeable defence analysts in New Delhi. This refers to the various reports on the French Company's efforts to market the Rafale in India and their increased interaction with the IAF, MoD and GoI, even as reports on the confusion and extended delays on the Sukhoi Su-30 programme get more frequent.

◆ An agreement was signed on 28 December 2000 between the Irkutsk Aircraft Production Organisation (IAPO) HAL for licence-production of Sukhoi Su-30MKI multi-role combat aircraft in India, the programme to span 17 years according to the Interfax news agency of Moscow. The deal provides for production of 140 Su-30MKIs which has taken such defence cooperation "far beyond" a "buyer-seller" relationship. The Sukhoi Design Bureau (OKB) has also expressed its willingness to jointly develop a "fifth generation fighter" with India for the Russian and Indian Air Forces if the political leadership of the two countries so decide.

◆ Air India aims to double its fleet size from the current 24 aircraft over a five-seven year period. There were two candidates in the SCLR category: Airbus Industrie's A.330-200 or 330-300 and the Boeing 767-300 or 767-400 while for the SCSR the airline would consider the A.320 and the Boeing 737 (Series 900).

◆ After six years of introspection, the GoI has decided to privatise Indian Airlines by 31 March 2001 by selling 51 percent of its equity. Of this, a block of 26 percent will be sold to a strategic investor in the joint venture. According to Arun Jaitley, the Minister concerned, the Cabinet Committee on disinvestment approved the case on 24 January, which conclusively overturns the earlier policy of selling only minority stakes in public sector undertakings.

◆ Air Chief Marshal AY Tipnis has said that the IAF is considering an alternative to the Light Combat Aircraft (LCA), including purchase of new aircraft. Continuing delays with development of the LCA, which has still not flown, means that a stop-gap is needed to make up for an expected deficiency of ten squadrons projected over the next five years.

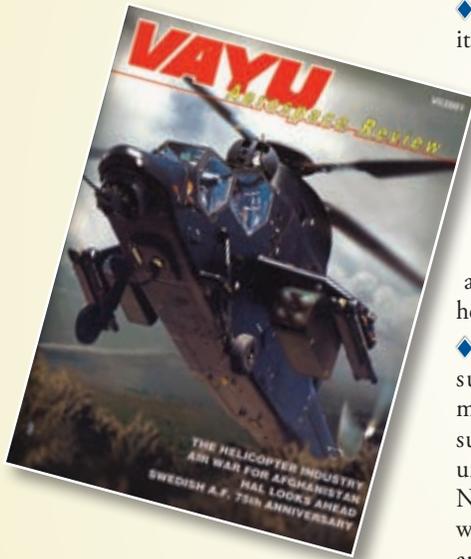
◆ The MoD's Standing-Committee has tabled reports on the *Demands for Grants* (2000-2001) on 19th April. The foremost is for the Advanced Jet Trainer (AJT), 66 of which are to be acquired for the IAF. The MoD have stated that "as a single vendor situation has reached", the steps required now will be to look at the British Aerospace offer (for the Hawk) quickly and negotiate on flyaway aircraft" (upto 24) that BAe will be able to give "because the need for them is badly felt".

◆ The already long-dragged out programme of the IAF for an AJT may have run into new and unexpected problems with the newly constituted Parliamentary Standing Committee on Defence demanding that the Government virtually "throw open" the competition to aircraft manufacturers world-wide. When the IAF first issued its Air Staff Requirement (ASR) for an

# 2001

◆ The first Technology Demonstrator (TD-1) of the Light Combat Aircraft (LCA) made its maiden flight at 1018 hrs on 4 January 2001 from HAL's Bangalore airport. Piloted by Wg Cdr Rajiv Kothiyal of ADA's National Flight Test Centre, the flight lasted 18 minutes and was "uneventful". The LCA was shepherded by two Mirage 2000 fighters as "chase planes" while an SAR helicopter was airborne earlier.

◆ As part of protocols signed at Moscow on 6 June was one to "jointly develop fifth generation fighter" which would fly by 2006 and be ready for induction by 2009. Observers feel that this new fighter could



be an attractive option for India, which has a definite requirement for such a new generation fighter to replace its large, and obsolescent, fleet of MiG-21s and whose indigenous LCA has experienced lengthy delays. Other defence production and supply agreements include the joint development of a multi-role transport aircraft (MTA) which is essentially based on the Ilyushin 11-214T and an air defence system, with an early warning system integrated with S-300MV and S-300MUZ missiles.

◆ Flight tests of the two IAF MiG-21bis fighters, upgraded to MiG-21bis or UPG standard (earlier Russian designation was MiG-21-93) have now been completed by RSK MiG, the Sokol aircraft plant of Nizhny Novgorod, Phazotron-NIIR and

the State Scientific Institute for Aviation Systems after which another 123 MiG-21bis in the programme will be upgraded over the next four years at HAL Nasik. The upgradation has focused on creation of a modern avionics suite, particularly a new fire control system, built around the Phazotron-NIIR's *Kopyo* coherent multi-mode radar.

◆ The Agni II 2000-km. range ballistic missile (IRBM) with a one-tonne payload was successfully test launched on 17 January 2001 from the Interim Test Range at Inner Wheeler Island. The Agni II was "in its final operational configuration", suggesting that series production of the definitive Agni III (with a 3000 km range) and then induction were on the cards. The Hyderabad-based Bharat Dynamics Ltd. (BDL) will produce the Agnis, at a cost of Rs. 40 crore each, according to MoD sources.

◆ Israel Aircraft Industries is offering its tactical upgrade package for the IAF's Mil Mi-8/17 utility helicopters. The tactical upgrade package includes modular avionics systems with a glass cockpit, an electronic warfare suite and an improved weapons package using subsystems based on equipment developed by Lahav for the Mil Mi-35 and the Kamov-designed Ka-50-2 attack helicopters.

◆ India has embarked upon a major submarine building programme to manufacture 24 'Hunter' and 'Killer' submarines as part of efforts to make underwater, surface and air wings of the Navy more potent by equipping them with long-range missiles. Negotiations are in an advanced stage with France and Russia for collaboration in Project 75, which will commence production later this year said CNS Admiral Sushil Kumar. The Admiral said the government's go-ahead for the project would entail re-activating the submarine building lines at Mazagaon docks in Mumbai.

◆ Antonov is proposing a series of potential upgrades for the IAF's fleet of more than 100 An-32 transport aircraft. The Ukrainian company plans to offer the upgrade along with Hindustan Aeronautics (HAL). The modernisation proposals will include an extension in the service life of the aircraft's Motor Sich AI-20D engines or their replacement with Rolls-Royce AE2100D turboprops with Dowty propellers; an increase in maximum take-off weight from the current 27t to 28.5t; the

installation of a two-crew flight deck in place of the existing three-crew arrangement; and the modification of some IAF aircraft to enable them to be operated as maritime patrol aircraft.

◆ India's plan to launch an unmanned mission to the moon has received a boost with scientists at the Ahmedabad-based Physical Research Laboratory (PRL) supporting the convention that the country has the technological capability for the project. The three options could be considered for the moon mission, a 'flyby mission', a 'landing mission' and using a 'low altitude polar orbiter', the last-named appears a realistic option.

◆ Addressing the Combined Commander's Conference on 26 November, Prime Minister Atal Behari Vajpayee advised the armed forces to "frame a long term National Defence Policy, envisaging the constant upgradation of technical and human capability and to anticipate unexpected threats". Referring to the on-going reforms in Defence Management, the Prime Minister expressed confidence that the integration of Service Headquarters with the Ministry of Defence would promote de-centralisation of decision making and institutionalise long term perspective planning.

◆ ADA "is studying accelerated development of the LCA after the US Government lifted sanctions on 22 September". The LCA development had been severely hampered by the sanctions imposed in 1998 after India and Pakistan tested nuclear weapons. General Electric and Lockheed Martin were prevented from continuing participation. GE was barred from supplying further F.404 engines for the test flight programme. Lockheed Martin Control Systems was aiding flight control system development, and India was prevented from recovering two flight control computers and test equipment that had been sent to the USA.

◆ Four IAF MiG-29s, including a two-seat operational trainer took off from Leh airfield and carried out aerial manoeuvres for a select audience which included Defence Minister George Fernandes and senior army and air force officers. Although, the IAF has earlier positioned other combat aircraft at Leh including MiG-27s and Jaguars (apart from the Hunter), the excellent airfield take off and landing performance of the MiG-29 gives it an added operational advantage.

# 2002

◆ The Cabinet has given “go-ahead” for the country’s nuclear arsenal to be placed under a new Strategic Nuclear Command (SNC), which will function under the Integrated Defence Staff set-up, with the first C-in-C of the SNC likely to be from the Indian Air Force.

◆ “The most pressing need of the Indian Navy today is replacement of the aircraft carriers INS *Vikrant* and *Viraat*”, stated Admiral Madhvendra Singh, on 16 January. The INS *Vikrant* has already been decommissioned and the INS *Viraat*, despite its recent upgrades has “only a limited amount of time left.”

◆ With successful test-flight of the supersonic missile BrahMos at the Interim Test Range at Balasore on 28 April, the Indian Navy is all set to launch this from a surface ship in a few months. The missile could be tested from a *Kashin*-class destroyer, probably the INS *Ranjit* in September, but a final decision is yet to be taken. The *Dhanush*, naval version of the *Prithvi* surface-to-surface missile, will also be tested shortly.

◆ An Airborne Early Warning (AEW) capability will enable the Indian Navy to “see early and look far,” with the acquisition of nine Kamov Ka-31 shipborne AEW helicopters. The first two of these will be delivered by June, to enhance the operational capability of the naval fleet to counter low-level threats by enabling long-distance detection of enemy aircraft, surface ships and even cruise missiles.

◆ Ninth test flight of the Light Combat Aircraft (Technology Demonstrator II) was successfully conducted on 29 August at the National Flight Testing Centre at Bangalore Airport. TD-2 was piloted by Squadron Leader Suneet Krishna. A review meeting of the LCA project was later held at Bangalore with representatives of the ADA and IAF.

◆ Parts related to the Light Combat Aircraft project denied earlier owing to US sanctions would now be available at “competitive prices” from various sources including those from USA after lifting of the sanctions. There has been no serious impact on the project other than time delay. The first block of flight test phase involving 12

flights had been completed successfully on LCA Technology Demonstrator 1 (TD1).

◆ India ranked second only to the United Arab Emirates (UAE) in arms transfer agreements made by developing nations during 1998-2001, according to a report prepared for the US Congress. The UAE concluded \$10.8 billion worth of arms transfer agreements during the period while India ranked second at \$7.2 billion followed by China with \$6.7 billion as stated in the Conventional Arms Transfers to Developing Nations 1994-2001 report.

◆ To secure surveillance of the Line of Control (LoC) in J&K, the Indian Army is importing man-portable radars capable



of detecting movements across the border. Under a recently signed deal with Israel, worth about \$70 million, India has received the first of these 1,022 man-portable radars, which are capable of detecting human movement 10 km away. Officials said that the deal with Israel also covered acquisition of 600 Elbit thermal-imaging-stand-alone systems to equip the Indian Army’s 300 R-72 main battle tanks and 300 BMP II armoured personnel carriers.

◆ The medium range surface-to-air missile *Akash* was test-fired from the interim test range (ITR) at Chandipur-on-Sea, the *Akash*, which is one of the five missiles under various stages of development by the DRDO, has a

range of 25km and the capability to carry a payload of 55kg, supported by state-of-the-art radar named *Rajendra*, which can keep track of 64 aircraft simultaneously within a range of 40 to 60km.

◆ Even as India goes ahead with its plans to construct six submarines based on the French *Scorpene* design at the Mazagon Docks, France has renewed its offer of technology transfer for manufacture of Mirage 2000-5 and carrier-borne Rafale fighters in India. This offer comes at a time when the first squadron of Russian origin Sukhoi Su-30MKI fighters has just been formed by the IAF, and HAL is preparing for manufacture 140 of these under license production.

◆ Air Chief Marshal Arjan Singh was honoured by the Supreme Commander of the Indian Armed Forces with the rank of ‘Marshal of the Air Force’ at an impressive ceremony at Rashtrapati Bhawan in New Delhi on 23 April, 2002. The Marshal, impeccably smart and most impressive at 83 years, was honoured in the presence of serving and retired Air Marshals, Generals, Admirals and special guests.

◆ In a complete reversal of its existing policy, the Indian Government will allow entry of foreign airlines into domestic aviation with a foreign equity of up to 49 per cent. An immediate result could be the revival of the Tata-SIA interest in entering domestic aviation. The new policy also seeks to permit 49 per cent foreign equity in airlines operating on international routes with specific approval from the Government.

◆ Air India has finally earned a profit after a gap of six years. Buoyed by the net profit of Rs 25 crore for the current financial year, Air India is going to lease 10 A.310 aircraft and two Boeing 747-400 aircraft. While the Boeings will be leased for long haul flights, the Airbus will be flying on short routes. The Indian space programme took another leap forward on 24 January with successful launch of the third generation communication satellite INSAT-3C.

◆ A ‘multi-purpose space system’, the satellite is expected to sharply boost telecommunication and broadcasting facilities in the country. With an operational life of 12 years, INSAT-3C is carrying 24 C-band, six extended C-band and two S-band transponders and a mobile satellite service transponder.

# 2003

◆ Over four years after India declared itself a state with nuclear weapons, the Cabinet Committee on Security (CCS) on 4 January 2003 adopted and made public the key elements of its nuclear doctrine and command structure. The National Command Authority (NCA), in which a political council headed by the Prime Minister will be the “sole” authority for ordering a nuclear strike, has been announced. Though India sticks to the “no-first-use” policy announced in an earlier draft policy, it has now been made more flexible to extend the scope for using nuclear weapons. The CCS also approved an all-service Strategic Forces Command (SFC) to “manage and administer” all strategic (nuclear) weapons and delivery systems.

◆ Absence of Advanced Jet Trainers (AJTs) was the key reason for frequent crashes of MiG-21s. “It is penny wise and pound foolish to not go in for the AJTs,” was stated by an MP, while pointing to a statement of Defence Minister George Fernandes that “mysterious elements” were preventing the purchase of the jet trainers.

◆ At a ceremony in Tashkent on 28 February, the first of six Il-78s equipped mid-air refuelling, was officially handed over to the Indian Air Force. Defence Minister George Fernandes, was accompanied there by several IAF officers. Later, the Il-78 was ferried to its base in India (Agra) where it becomes part of the newly raised No.78 Squadron (‘MARS’).

◆ Go-ahead for the naval version of the Light Combat Aircraft and the “clearance” for weapon-locating radars were major issues before the Cabinet Committee on Security in mid-March. The naval version of the LCA was planned several years ago and now that the basic version is under test flight development, a government go-ahead and funds were necessary before work could begin on the variant. Officials said though the powerplant remains the same, there will be essential changes from the basic LCA, especially the landing gear. Besides, the aircraft has to be ‘marinised’ against salt environment because of regular deployment on the aircraft carriers.

◆ Even as the Tejas LCA (TD-1) scored a century of test flights on 6 September, being flown by Gp. Capt. Rakesh Bhadura,

the former ADA Director responsible for its development Dr Kota Harinaryana has mooted development of its spin-off, the Medium Combat Aircraft (MCA) which being projected as a replacement for the Jaguar and Mirage 2000 which the IAF operates and which will be phased out by 2020. Optimised for strike missions, the MCA is envisaged as a complement to the LCA and Sukhoi Su-30MKI.

◆ On 1 August, the LCA achieved a major milestone, accelerating to Mach 1.08, thus going beyond the ‘sound barrier’ for the first time. Flown by Wg. Cdr. Vikram Singh, seconded to the NFTC and flying TD-1 (KH 2001), the LCA was shepherded by a Mirage 2000 chase plane flown by Air Cmde Parvez Khokar, Project Director, LCA Flight Testing. This was the LCA’s 94th flight.

◆ INS *Trishul*, commissioned at St. Petersburg last June, has arrived in India. Like its stablemate the 4,000 tonne guided missile frigate, INS *Talwar*, these can undertake various naval warfare missions-air, surface, sub-surface, littoral and blue waters-and can operate as a single unit or consort ship with a task force. Several designs make it difficult to detect, making them “stealthy”.

◆ In the largest scale naval exercises held between India and Russia, major warships from the former’s Western and Eastern Naval Commands and frontline warships from the Russian Pacific and Black Sea fleets, began manoeuvres off the Yemeni island of Sokotra in the Western Arabian Sea during the fourth week of May.

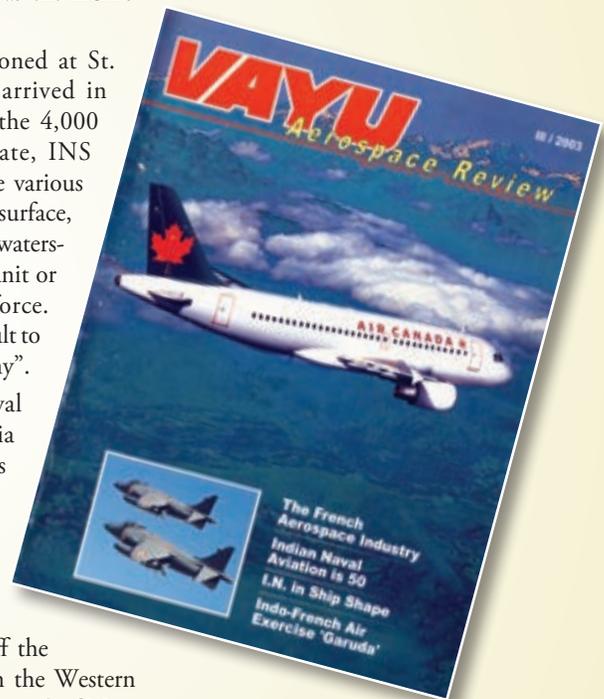
◆ HAL has crossed the Rs. 3000 crore turnover for the first time, having achieved an all time high turnover of Rs. 3005 crores (provisional) and a profit of Rs. 451 crores (provisional) which is also an all time high for the company. The year 2002-03 has been eventful and memorable for HAL, highlight being the recent successful flight of the Intermediate Jet Trainer, HJT-36 *Sitara*.

◆ Successful launch of the three stage 49 second Geosynchronous Satellite Launch Vehicle (GSLV-D2) took place on 8 May. D2 carried an experimental communication satellite, designated G-Sat-2, weighing 1,800 kg. As the rocket reached a supersonic

speed of 9.78 km/sec and exactly 1013 seconds after it lifted off, the G-Sat-2 satellite was successfully placed in the geostationary transfer orbit.

◆ HAL and Russia’s Stankoimport have signed a \$300 million deal for supply of equipment to be installed in the Sukhoi Su-30MKI multirole fighters to be built at HAL’s Nasik plant. The contract has been signed within the framework of the Indo-Russian deal for the licenced production of 140 ‘fourth plus’ generation Sukhoi multirole fighters in India which follow the earlier pattern of MiG-21 and MiG-27 licence-production by HAL.

◆ Air India has announced its biggest one-time plan to acquire 28 new aircraft as part of fleet expansion at the cost of over



Rs. 10,000 crore. This would enable AI to increase flights to new destinations across the globe, including those in Europe and the USA. Air India proposes to purchase 10 Airbus A.340 long-range and 18 Boeing 737-800 short-range aircraft..

◆ Boeing projects that India will require 290 airlines worth \$22 billion over the next 20 years, India has an annual gross domestic product growth of approximately 5 per cent and an overall traffic growth that will average 6.7 % annually over the next 20 years. Traffic increases within the region will average 8.7 %, one of the world’s highest growth rates.

# 2004

◆ Admiral Arun Prakash has taken over as the new Chief of Naval Staff. In December 2002, he was appointed as FOC-in-C of the strategic Western Naval Command and within a year was back at Naval Headquarters to take over as Vice Chief of the Naval Staff in October 2003, a position he served in till his appointment as Chief of Naval Staff.

◆ The much awaited MoU between the Governments of India and the of UK was signed in New Delhi on 19 March 2004, “for the effective and uninterrupted implementation of the contracts regarding acquisition of 66 Hawk Advance Jet Trainers (AJTs) from BAE systems and other equipment manufacturers of UK.”

◆ With design of the indigenously developed Air Defence Ship now confirmed, the Indian Navy could have two aircraft carriers by 2011. Defence Minister George Fernandes stated, “The indigenously built ADS is out of the drawing board and the first steel is likely to be cut by this year-end. The aircraft carrier is likely to be inducted into the Indian Navy by 2011”. The Government of India has already finalised procurement of the *Admiral Gorshkov* and the Russian aircraft carrier was likely to be inducted into the Navy ‘in some years’.

◆ The Indian Air Force has begun work on developing an Aerospace Command to bring the country’s space-based assets under one umbrella. “Any country on the fringe of space technology like India has to work towards such a command as advanced countries are already moving towards laser weapon platforms in space and killer satellites,” the CAS stated in New Delhi.

◆ The stealth frigate INS *Tabar* was commissioned in mid-April, the third of the *Talwar* class of guided missile frigates being built by Russia for the Indian Navy. The warship is fitted with Indian and Russian sensors and indigenous advanced sonar *Humsa*. The INS *Tabar* is armed with eight vertical launch Club-N anti-ship and anti-submarine missiles, the *Shtil-I* medium range multi target missile system two *Kashtan* rocket cum artillery guns, and 100mm automatic guns firing 80 rounds a minute.

◆ Mismatch between decommissioning of old ships and induction of new vessels could result in reduction of force levels which could adversely affect the Navy’s commitments, according to CNS, Admiral Madhavendra Singh. “If the Navy decommissions ships as per schedule, then the force level would come down from about 140 ships to 120 ships over the next three years.”

◆ First prototype of the NAL *Saras* light transport aircraft powered by twin PT6A-66 turboprop pusher engines, flatrated to 850 s.h.p. each, made its maiden flight at HAL Airport Bangalore on 29 May 2004, piloted by test pilots from the ASTE, who flew the *Saras* for 22 minutes and reached an altitude of 7,000 feet.

◆ The Airports Authority of India (AAI) is planning to upgrade many of its airports through transfer of technology in areas like terminal design and passenger flows, airport commercialisation, architecture, design and land and apron side planning. Outlining AAI’s initiative to attract private players, AAI Chairman said that to encourage civil aviation and tourism, AAI had done away with airport charges for aircraft having a seating capacity of less than 80 passengers and had also reduced landing charges by 15 per cent.

◆ The Indian Navy commissioned its latest Guided Missile Frigate INS *Betwa*

on 7 July 2004 at Kolkata. Built on the Garden Reach Shipbuilders and Engineers (GRSE), INS *Betwa* is the second of the series of the P-16A class, which included the last commissioned INS *Brahmaputra*. INS *Betwa* joins a series of successful projects like the *Delhi*-class destroyers, *Godavari*-class frigates and the *Kora*-class corvettes.

◆ Over a year after its induction into the Indian Army, the Agni II intermediate range ballistic missile (IRBM) was test fired from the launch site on Wheeler Island in the Bay of Bengal on 29 August 2004. Developed by the DRDO, the Agni II uses solid propellant and has a range of up to 2500km, carrying conventional or nuclear warheads of up to 1 tonne.

◆ An improved version of the Prithvi-II missile, having higher accuracy, was launched from the Interim Test Range (ITR), Balasore in mid-March. The shore-based and down range tracking system like radar, EOTS and telemetry of ITR at Balasore tracked the flight path of the missile till impact, validating the accuracy of the missile guidance.

◆ DRDO engineers have trained with Army technicians to carry out rapid installation of warheads on their *Prithvi* missile and to maintain them. The army has reportedly raised two Missile Groups (333 and 355) with the *Prithvi* tactical ballistic missile (TBM) while the Air Force has recently ordered 54 *Prithvi* IIs to be delivered to two Missile Squadrons being raised at Hyderabad. With a range of 200-250km, the *Prithvi* II could be effective against air bases or high-value targets.

◆ Indian Airlines and its subsidiary, Alliance Air, plan to induct 15 Airbus airliners on lease by November 2004. As part of the process, an empowered committee of the airline has approved the proposal allowing AA to dry-lease five Airbus A.319 aircraft which will be direct replacement for the existing fleet of Boeing 737s being operated by the airline, and scheduled to arrive in November 2004, in time for the winter schedule operations of Alliance.

◆ Air Marshal Shashindra Pal Tyagi, earlier AOC-in-C Western Air Command has been appointed as the next Chief of Air Staff.



# 2005

◆ In a major defence deal announced on 12 September 2005, the Government of India confirmed acquisition of French *Scorpene*-class submarines worth \$3 billion. French President Jacques Chirac disclosed India's decision to buy the *Scorpene*s while welcoming the Prime Minister, Dr Manmohan Singh at the Elysee Palace where the two leaders had wide ranging discussions on Indo-French defence cooperation, India's bid for permanent membership of the UN Security Council and trade and economic cooperation. The *Scorpene* would be manufactured under technology transfer by state-owned Mazagon Docks, Mumbai and to be delivered to the Indian Navy between 2010 and 2015.

◆ The GoI has approved construction of an Air Defence Ship (ADS) at Cochin Shipyard Ltd. (CSL), which has signed two contracts with Ficantieri, an Italian shipyard for undertaking design, integration, installation, and commissioning of the propulsion system for the ADS at a negotiated cost of 22 million euro and for consultancy in detailed engineering and documentation at a negotiated cost of 6 million euro.

◆ "The Indian Air Force has decided to upgrade a significant portion of its combat aircraft fleet, helicopters, transport aircraft

and some surface-to-air missiles", the VCAS, Air Marshal Ajit Bhavnani stated, adding that present fighters being upgraded include Jaguars, MiG-29s and Mirages. Apart from these, the Mi-17 medium lift helicopter and An-32 transport aircraft are also being fitted with new avionics to extend service lives. The upgradation process is expected to take at least five years and will be carried out in phases.

◆ Production of *BrahMos*, supersonic cruise missile co-developed by India and Russia, has begun in the country and the Indian Navy has placed orders for it, the Navy had identified such vessels on which the *BrahMos* missiles would be integrated. About 20 industries in India and 10 from Russia were taking part in the production of various components for the missile (which would be assembled in India).

◆ On the eve of Indian Prime Minister Dr Manmohan Singh's visit to Moscow in early May 2005, the Russian Government confirmed its offer to replace the first batch of 18 Sukhoi Su-30Ks with new build Su-30MKIs of the definitive standard selected by the Indian Air Force. The original batch was to have been returned to Russia after the IAF had received 32 of the follow on batches but Russian designers and industry have found it nearly impossible to upgrade them to the MKI standard with canards in the forward fuselage section and TVC at the engine exhaust end.

◆ There is increasing interaction between Indian and Russian defence officials on various issues, including the offer of MiG-29Ms to meet the IAF's medium-multi role combat aircraft (MMRCA) requirement for which RFIs were sent out to four companies in November 2004. It is understood that detailed talks took place between Indian National Security Advisor MK Narayanan and his Russian counterpart Igor Ivanov after Prime Minister Manmohan Singh had returned from Moscow.

◆ InterGlobe Enterprises Limited has launched the new low-cost airline IndiGo and has committed for 100 A320 family of aircraft with Airbus, the venture being jointly promoted by InterGlobe Enterprise Limited and Rakesh Gangwal, globally recognised for his management skills and expertise in the airline industry.

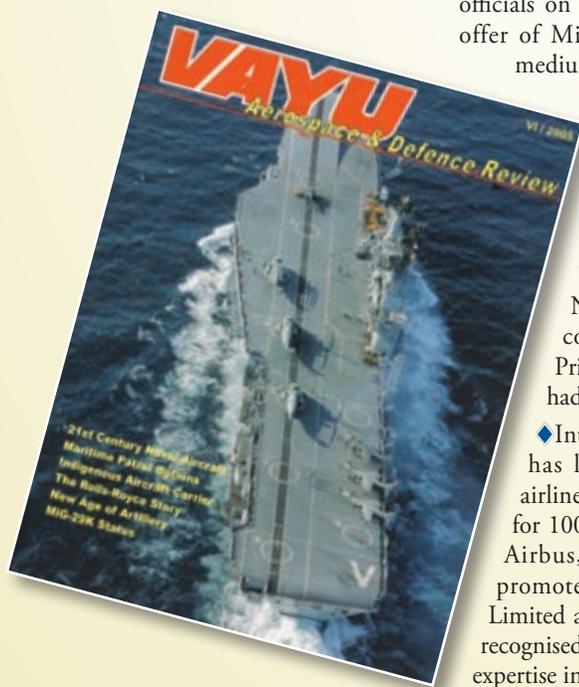
◆ Ashok K Baweja, Chairman Hindustan Aeronautics Limited and Marc Ventre, Chairman and CEO of Snecma, a SAFRAN group company, France, signed a 'Shareholders Agreement' of the new Joint Venture Company on 20 July 2005 at Bangalore. The objective of the Joint Venture Company is to become a "Centre for Excellence" for the manufacture of key components and assemblies of aero-engines.

◆ The Indian Government informed the United States Government that proposed American arms sales to Pakistan could impact on the position sentiment and goodwill for the US in India. US Defence Secretary Rumsfeld said that the US did not see its relations with India and Pakistan as a "zero sum game", which in simple language means that Washington looks at its bilateral relations with India and Pakistan as two separate sets of relationships.

◆ The bifurcation of the world's largest battle formation, the Indian Army's XVI Corps based at Nagrota on the outskirts of Jammu city, has been completed. A new IX Corps, carved out from the XVI Corps is now headquartered at Yol and been nicknamed the "Rising Star" formation. The Corps will be responsible for "large areas in Himachal Pradesh, Punjab and Jammu and Kashmir." The raising of this Corps seen yet another step in the restructuring of formations based along the Indo-Pak international border.

◆ India and Israel have entered into military purchases worth Rs. 11,882.54 crores. The two countries are usually reluctant to put a figure on their dealings but, in a written reply in the Rajya Sabha, the Ministry of Defence revealed the total value of purchase contracts concluded during the last three years. The policy of pursuing active defence ties with Israel is being followed by the UPA government, which continues to maintain close contacts with the Israeli military industry. Visits by Israeli delegations to India and Indian officials to Tel Aviv are being kept a closely guarded secret, but Israel has emerged as one of the biggest suppliers of military equipment to India, having already become the second largest supplier after Russia.

◆ Jet Airways' first Boeing 737-800 with winglets was delivered in late November, making it the first regularly scheduled commercial airplane with winglets to operate in the country.



# 2006

◆ In one of the biggest defence deals with the US since 2002 the government has approved purchase of the amphibious transport warship USS *Trenton* to bolster the Indian Navy's strategic sea-lift capabilities. Along with the *Trenton* will be six SH-3 Sea King helicopters. At a cost of \$48.23 million, a displacement of 16,900 tonnes and a length of 173 metres, the *Trenton* will be the second largest warship in the Navy's fleet after the aircraft carrier *Viraat*.

◆ Air Chief Marshal SP Tyagi has shared his concerns on any alteration in the military balance of power in South Asia. He was commenting on reports on supply of substantial numbers of F-16s to the Pakistan Air Force which should have been "taken into account" while planning for the future. The present combat squadron strength of the IAF has plunged to 33 against the authorised 39.5 and it is expected to reduce further to 29 during the Eleventh Plan period (2007-12).

◆ Release of RFPs for Medium-Multi Role Combat Aircraft (M-MRCA) has been further delayed. Six companies have expected for receive an invitation to tender for the 126 aircraft fighter requirement and the document had reportedly been scheduled for release 6 months back. The

RFP is expected to be sent for the Boeing F/A-18E/F Super Hornet, Dassault Rafale, Eurofighter Typhoon, Lockheed Martin F-16, RSK-MiG-29 and Saab Gripen.

◆ CNS Admiral Arun Prakash commissioned INAS 342, the Navy's first UAV Squadron at Cochin on 6 January 2006. "After three years of intensive flying trials, we are now among the pioneers in the esoteric art of the UAV operations at sea. INAS 342 is going to be an asset, which will enhance our maritime awareness manifold".

◆ On 9 March 2006, the Cabinet Committee for Security cleared the proposal for acquisition of 12 HJT-36 intermediate jet trainers by the Indian Air Force from HAL at a cost of Rs. 486.82 crore.

◆ Almost exactly nine years after the first batch of Sukhoi Su-30Ks were received by the Indian Air Force from Russia to re-equip No.24 Squadron at Poona, these 18 aircraft are to be returned to their country of origin for transfer and further service within the air arm of Belarus. During 2006, all 22 of the Su-30MKI Mk.1 and Mk. 2 aircraft from the first and second batches will be upgraded to the later Mk. 3 standard by HAL.

◆ Four Kaveri jet engines are currently on the test bed at the GTRE in Bangalore, while another two are being manufactured. Reliability and safety tests are being carried out to demonstrate compliance to the "strictest standards." One prototype and one core engine were tested at high altitude test facility of the Central Institute of Aviation Motors, Russia.

◆ At the Unified Commanders Conference at New Delhi on 18 May 2006 Defence Minister Pranab Mukherjee released the Joint Doctrine prepared by Headquarters Integrated Defence Staff, which is considered a "landmark" for the three armed forces for developing a truly 'joint' capability.

◆ The Navy has successfully integrated anti-missile defences into its operational capability and now wants to have Baraks on additional warships, starting with the INS *Brahmaputra* missile frigate. Barak launchers are currently installed on the aircraft carrier INS *Viraat*, two *Delhi*-

class destroyers, two *Godavari*-class frigates and two *Rajput*-class destroyers. The three indigenously built Brahmaputra class guided missile frigates will be armed with Barak launchers and missiles over a period of three to six months.

◆ Vice Admiral Sureesh Mehta has been appointed as the next Chief of Naval Staff, taking over from Admiral Arun Prakash, who retires on 31 October 2006. Earlier, he commanded the Western Fleet, during *Operation Parakram* in 2002. In the rank of Vice Admiral, prestigious appointments included being the Chief of Personnel, DG Coast Guard and Deputy Chief of Naval Staff at Naval Headquarters.

◆ Reports from the National Aerospace Laboratories (NAL) at Bangalore have it that the IAF's MiG-21bis fleet have been given a life extension of 1000 hours. NAL has been engaged in full-scale fatigue testing of the aircraft type, using a specific aircraft for the purpose. This MiG-21bis had completed its OEM-specified life span of 2400 hours before being subjected to fatigue tests by NAL, the key issue being preserving structural integrity against fatigue failure was to get precise data on when and where fatigue cracks appear in the airframe, which "if undetected in time could lead to catastrophic structural failure.

◆ Low Cost Carriers (LCC) have revolutionised the way Indian travel domestically and the terminals of five major Airports- travel domestically and the terminals of five major Airports- Mumbai, Kolkata, Delhi, Chennai and Trivandrum- have recorded unprecedented growth in passenger traffic at 42.9% for the period April-June 2006 compared to the 19.8% achieved during the corresponding period in the previous year. However, it is stated that the country's aviation industry is losing Rs. 2,000 crore annually on account of underpriced tickets and mounting fuel costs. Increased competition has drastically pulled down prices. Increased competition has forced even the big players to cut tariff by almost 50 per cent on certain sectors.

◆ Jet Airways has concluded negotiations to buy Air Sahara for Rs. 2500 crore (\$560 million) thus creating the largest airline in India in terms of fleet, turnover and evaluation. The merged entity will command over 50 per cent share in the domestic market with a fleet of more than 90 aircraft.



# 2007

◆ Defence Minister AK Antony has dispelled misgivings about acquisition of 126 MMRCAs for the IAF, an RFP for which is yet to be issued, this assurance to be seen in light of the concerns addressed by the CAS in July 2006 to the then Defence Minister on the depleting force levels of the IAF and urging expeditious remedial steps. According to the Defence Minister, the Acquisition Council has also put the acquisition of 40 additional Su-30MKIs from Russia on the fast track. However, this has to be finally approved by the Cabinet Committee on Security (CCS).

◆ The Indian Navy is in the process of finalising the selection of Maritime Patrol Aircraft (MPA) equipped with modern avionics; the CNS has said that four aircraft types, including the P-3C Orion, Boeing P-8 Poseidon and Ilyushin Il-38SD had been shortlisted. Inclusion of the MPAs would significantly add to the Navy's ability in protecting Indian economic interests, he added the Navy would also go in for rotary wing unmanned aerial vehicles (UAV) for better surveillance.

◆ Maiden flight of the Indian Navy's first MiG-29KUB took place in January at the Gromov Flight Research Institute, Zhukovskiy. Flown by RAC MiG test pilot Mikhail Belyaev and Chief Test Pilot Pavel Vlasov, the flight lasted some 25 minutes, the Navy aircraft escorted by a two-seat MiG-29UB.

◆ Air Marshal Fali Homi Major has taken over as Chief of the Air Staff, Indian Air Force prior to which he was AOC-in-C, Eastern Air Command.

◆ HAL will increase production of the ALH in phased manner. Company officials have said that 18 ALHs were expected to be delivered in 2007, with targets for 2008 and 2009 as 24 and 33 respectively; some 65 Dhruvs are already in service with the defence forces, including the Coast Guard.

◆ The Indian Air Force has embarked upon acquisition of longer range air-to-air missiles, its dominance in offensive air superiority operations presently being "dented" by the supply of similar performance BVR missiles to Pakistan by the USA. The acquisition of such missiles with ramjet propulsion, will make the IAF

one of the only in Asia to have such "an unparalleled capability."

◆ The first Tejas LCA of the Limited Series Production batch (LSP-1) with tail number KH2010, made its maiden flight from HAL's Bangalore airfield on 25 April 2007, flown by Go Capt AP Singh of the ASTE. The chase aircraft, another Tejas LCA (TD-2) was flown by Wg. Cdr. N Tiwari of the National Flight Test Centre (NFTC).

◆ Second prototype Saras light transport aircraft (PT-2) with registration VT-XRM (for 'Raj Mahindra') made its maiden flight on 18 April 2007 from HAL Airport, Bangalore. With Wg Cdr RS Makkar as chief test pilot in command, (from the ASTE), PT-2 flew for about 40 minutes, climbing to an altitude of 9000 feet and reaching a speed of 150 knots.

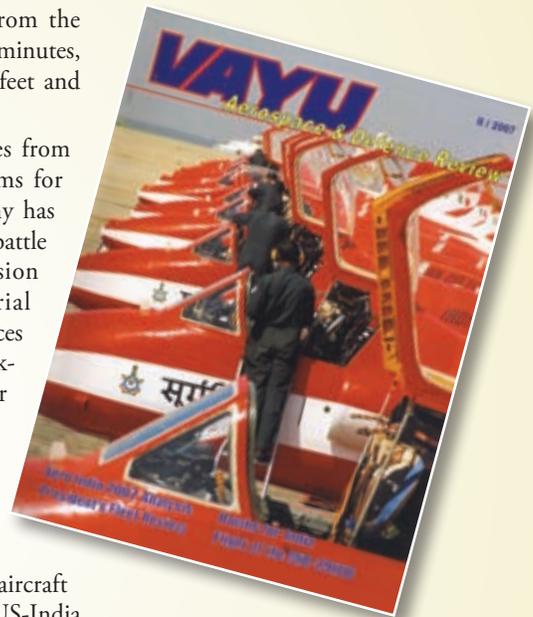
◆ Defence equipment purchases from Israel include Barak SAM systems for the Indian Navy, the Indian Army has been equipped with Israeli land battle electronic equipment, night-vision devices besides unmanned aerial vehicles operated by all three Services while the IAF is to procure 18 quick-reaction Spyder missile systems for Rs. 1,800 crore from Israel and are awaiting induction of the Phalcon airborne early-warning systems.

◆ The USS *Nimitz* docked in Chennai in early July, the first ever port call in India by a US aircraft carrier and a "landmark event in US-India bilateral relations." The US and Indian navies have recently conducted increasingly elaborate joint exercises on the high seas over the past several years, regularly cooperating in a bilateral and multilateral framework known as the *Malabar* series of joint Indo-US exercises. The USS *Nimitz* is a nuclear powered multi-mission aircraft carrier that was commissioned into the US Navy in 1975.

◆ Russian Aircraft Corporation (RAC) MiG and JV Indo-Russian Aerospace Limited (IRAL) have signed a contract for establishing a MiG aircraft consignment depot in India. The depot will support the large numbers of Russian-origin IAF aircraft by storing the specific spares and materials required for their maintenance. Reference list of spare parts was developed on the basis of Russian MiG-29 aircraft reliability indices, as well as based on IAF indents' analyses and recommendations.

◆ An upgraded *Kilo*-class submarine fitted with Russian Klub-S sub-surface launched missile has been handed over to the Indian Navy by a Russian shipyard for sea trials in the White Sea. INS *Sindhujay* was recently undocked for sea trials at a ceremony in the Severodvinsk-based Zvyozdochka nuclear submarine repairs shipyard.

◆ Jet Airways is to acquire 20 more Boeing 737-800 aircraft and has executed a purchase agreement with Boeing. The aircraft that are being ordered will expand the airline's international and domestic operations and would be delivered between



October 2012 and December 2014. The agreement also allows the airline the option of purchasing another 10 Boeing 737-800 aircraft required. These additional aircraft would be delivered by August 2015. The Government has recently given Jet Airways permission to operate 70 flights a week between India and Kuwait, Oman, Qatar and Bahrain from January 2008.

◆ In its tenth flight conducted from Satish Dhawan Space Centre (SDSC) at Sriharikota on 10 January 2006, ISRO's Polar Satellite Launch Vehicle PSLV-C7, successfully launched four satellites (India's CARTOSAT-2 and Space capsule Recovery Experiment SRE-1, Indonesia's LAPAN-TUBSAT and Argentina's PEHUENSAT-1) into a 635km high polar orbit. For the first time, a Dual Launch Adopter (DLA) was used with the PSLV to accommodate two primary satellites in tandem.

# 2008

◆ The first step towards meeting the IAF's requirement for 126 medium-multi role combat aircraft, (MMRCA) which has excited much international interest, was taken on 28 April when representatives of six companies supported by respective Government officials, submitted their proposals in response to the RFPs received in August 2007. "Tens of thousands" of pages formed part of the proposals given to the Air Force Headquarters at Vayu Bhawan in New Delhi.

◆ Dassault have reportedly made an offer to supply the IAF with 40 Rafales as "a short term measure to augment its combat force." The IAF currently operates 52 Mirage 2000 H/THs and Dassault has proposed an extensive, if expensive, upgradation plan.

◆ The government has ruled out any plans for "a strategic partner" of the Tejas LCA programme, a total of Rs. 4806.312 crore having been spent till date on development. The indigenous programme has completed around 880 flights and is progressing "as per schedule", Defence Minister AK Antony told the Lok Sabha.

◆ PS Subramaniam, Programme Director Aeronautical Development Agency, (ADA) has said that the Light Combat Aircraft (LCA) Tejas will soon be fitted with its primary mission sensor, the multi-mode radar (MMR). The Elta-designed and developed MMR, EL/M-2302 which will be an interim option, has already undergone tests on the flight test bed and ground rig in Israel.

◆ Subsequent to an engine switch midway through its development phase, the delivery of the HAL Intermediate Jet Trainer will be delayed by upto two years from the original schedule. Between the Indian Air Force and the Indian Navy, some 225 HJT-36s are eventually to be acquired.

◆ The Cabinet Committee on Security has approved procurement of 159 Dhruv ALH at a cost of over Rs. 14,000 crore, for the Army and the Air Force. Kept on hold for almost nine months in the face of some criticism from the armed forces, which cited issues primarily relating to the poor serviceability of the helicopter.

◆ After decades of marginal presence in the defence sector, India's private industry is determinedly foraying into this

arena in substantial manner. M&M, Tata Sons, Ashok Leyland and L&T are firmly getting into the manufacturing of defence equipment. With India's military budget, which was \$20 billion in last fiscal, expected to grow steadily over the next 5 years, Indian firms are going to compete for a major share, along with foreign opportunities. The Government has permitted 26 per cent FDI in the defence sector.

◆ Tata Industries Limited and Boeing will form a joint-venture company that will initially include more than US \$500 million of defence related aerospace component work in India for export to Boeing and its international customers. Boeing and Tata intend to utilise the latter's manufacturing capability and also develop new supply sources throughout the Indian manufacturing and engineering communities for both commercial and defence applications.

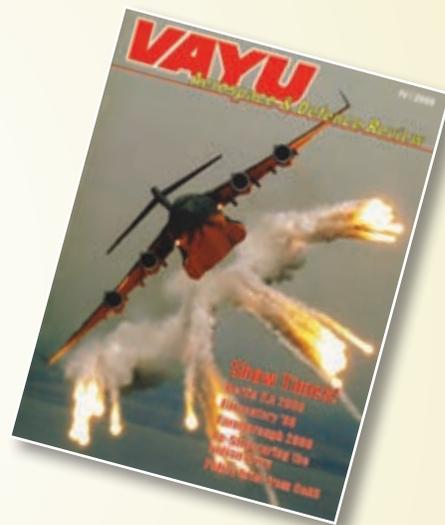
◆ The IAF has undertaken trials of the Augusta Westland AW101 and Sikorsky S-92 in January 2008, these types competing for the IAF requirement for a new medium-lift and VIP transport helicopter. Four full-passenger configured medium lift helicopters will be acquired, together with eight for VIP operations with 12 passenger seats and equipped with advanced, open architecture encrypted communications equipment. Requirements include all-weather, day/night capability, low noise and vibration, protection against missile threats, modern sensors and jammers.

◆ The Agni-1 strategic missile launched on 23 March 2008 from the Island Launch Complex in Orissa had "textbook performance" in terms of range, accuracy and lethality. Agni-1 was developed by ASL, the premier missile development laboratory of Defence Research & Development Organisation (DRDO) in collaboration with Defence Research and Development Laboratory, Hyderabad and Research Centre Imarat, Hyderabad and integrated by defence Public Sector Undertaking, Bharat Dynamics Limited, Hyderabad.

◆ The PSL V-C9, India's versatile Polar Satellite Launch Vehicle, launched ten satellites including the country's latest remote sensing satellite CARTOSAT-2A, from ISRO's Satish Dhawan Space Centre on 28 April. Its thirteenth flight, the PSLV-C9 had a perfect lift off from the second launch pad.

◆ The IAF has initiated processes for inducting the medium-range Akash SAM and is expected to place an order soon, initially for "two squadrons" worth. The missile has an effective range of 25 km, and can intercept cruise missiles and unmanned aerial vehicles.

◆ The Indian Navy has issued RFPs for the procurement of an initial batch of six medium range maritime reconnaissance (MRMR) aircraft, with delivery of the first aircraft four years from the signing of the contract, the last batch by the end of another two years. The aircraft would be configured for both maritime reconnaissance and anti surface warfare tasks and capable of carrying anti-ship missiles, markers and also air-droppable rafts for air-sea rescue.



◆ Arguably the world's highest airstrip at 16,665 ft (5050 metres) above sea-level, Daulat Beg Oldi (DBO) was reactivated on 31 May 2008 when an An-32 of No.48 Squadron landed at the ALG, located in the Aksai Chin area near the strategic Karakoram Pass.

◆ The Indian Navy has re-issued RFPs for shipborne helicopters of the 10-tonne class to companies including EADS, Augusta Westland and Sikorsky, to fulfil both ASW and ASV tasks. The helicopters, which would supplant the present fleet of Sea King Mk.42 helicopters, which have been in service for several decades, are to be equipped with modern anti-ship missiles and lightweight torpedoes and be capable of in-flight refuelling. The Navy's requirement is likely to be enhanced by a further 44 helicopters of the chosen type.

# 2009

◆ First of the six contenders for the IAF's M-MRCA tender began flight trials at Bangalore on 17 August 2009, being a pair of F/A-18F Super Hornets. Nominated IAF test pilots flew back seat on the aircraft in some dozen sorties from Bangalore, the aircraft later flying to Jaisalmer for hot weather trials before flying north to Leh in Ladakh for high altitude trials. Three Lockheed Martin F-16s (on loan from the UAE Air Force) thereafter arrived at Bangalore in early September for similar trials and will be followed by the Rafale, MiG-35D, Typhoon and Gripen in that order, the FET phase to be completed by March 2010.

◆ India's first indigenously built nuclear-propelled strategic submarine INS 'Arihant' ('Destroyer of Enemies') was launched on 26 July 2009, at the Ship Building Centre, Visakhapatnam. India has thus joined a select group of nations which have the technological capability to design and build nuclear propelled submarines.

◆ The GoI have cleared the largest ever indigenous defence contract, worth Rs. 45,000 crore, for the production of seven advanced stealth frigates for the Navy at Shipyards in Kolkata and Mumbai. The P17A warship project, which will be India's most advanced and stealthy frigates, has recently been cleared by the Defence Acquisition Council (DAC). The DAX has decided that all seven warships be manufactured in India by Mazagon Dock Limited at Mumbai (MDL) and Garden Reach Shipbuilders and Engineers (GRSE) at Kolkata.

◆ The Government of India has selected Boeing IDS to provide eight P-8(I) long-range maritime reconnaissance and anti-submarine warfare aircraft to the Indian Navy. The P-8(I) is a variant of the P-8A Poseidon that Boeing is developing for the US Navy and India is the first international customer for the P-8. Boeing will deliver the first P-8(I) within 48 months of the contract signing, the remaining seven by 2015.

◆ The Government has appointed Air Marshal Pradeep Vasant Naik (presently the Vice Chief of Air Staff) as the next Chief of Air Staff with effect from 31 May 2009.

◆ Even as Russia's ongoing inspection of structural defects in its largely grounded

MiG-29 fleet is being closely monitored by India, the Indian Air Force will not ground its own MiG-29 squadrons for the moment. We have our own method of regular maintenance and other technical checks, which are underway," a senior officer stated.

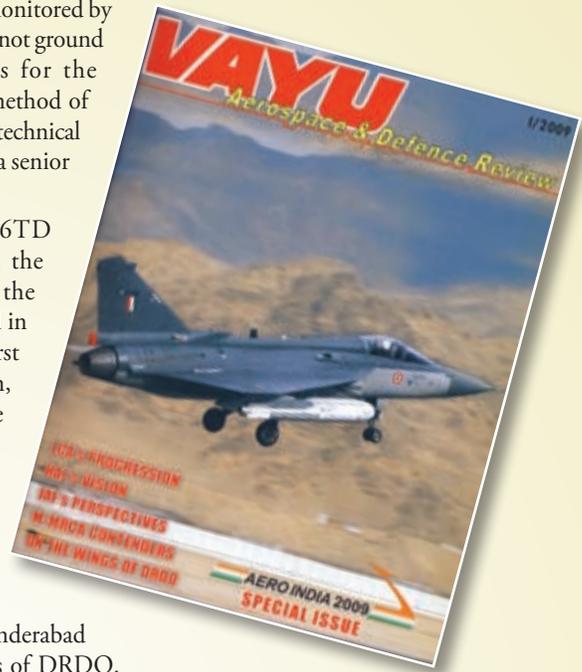
◆ The first of three Il-76TD AWACS aircraft fitted with the Israeli 'Phalcon' system for the Indian Air Force (IAF) arrived in India on 25 May 2009, with first landing at the Air Force Station, Jamnagar. These will form the equipment of the newly raised No.50 Squadron.

◆ The first Prithvi-II was successfully test fired on 15 April from Balasore, tested by the 'Special Missile Regiment' from Secunderabad under supervision of scientists of DRDO. Trajectory of the missile was tracked by a series of radars and electro-optic telemetry stations positioned at different locations for post-launch analysis.

◆ Even as Tejas LCA development flight trials have continued at Bangalore, with the 1100th sortie being flown in end-April 2009, bomb dropping trials were successfully conducted by three aircraft at the Jamnagar ranges during the period 25 February – 17 March 2009. The detachment included Tejas PV-2, PV-3 and LSP-1 (the latter for crosswind landing trials), the test pilots involved being Gp Capt N Tiwari, Capt. JA Maolankar and Wg Cdr Raj Tyagi.

◆ A 27-member multi-disciplinary team from Russia arrived in India on 6 May to assist in investigating the 'bizarre' cause of an IAF Sukhoi Su-30MKI crash near Pokhran on 30 April 2009, following which the entire Su-30 fleet had been grounded. A senior IAF officer said the Air Force was, 'confounded' by the manner in which the fighter crashed after going out of control. The Su-30MKI was part of a four-aircraft formation, flying at over 20,000 feet when it started 'oscillating violently' and went into an 'uncontrollable spin'.

◆ India's low cost airlines are increasing market share, taking over from premier carriers such as Air India, Jet Airways and Kingfisher Airlines, whose debts and losses continue to pile up owing to falling revenues and high ATF rates. State taxes imposed on jet fuel are high at an average of 26 per



cent. Fuel costs are also 70 per cent more expensive than the average paid by airlines globally. Such factors have combined to leave Air India, Jet and Kingfisher with a combined debt of \$8 billion, with \$6 billion more expected to be added by 2012.

◆ The first batch of 10 indigenously manufactured T-90 'Bhishma' MBTs were flagged out on 24 August 2009 from the Heavy Vehicles Factory by the RRM, Dr Pallam Raju. The HVF took up manufacture of T-90 tanks in collaboration with Russia, the HVF planning to produce 100 such tanks per annum.

◆ The Tejas LCA development programme is now accelerating and by mid-December 2009 should have cleared the initial operational clearance 'flight envelope' for service entry. On 30 November, four aircraft (PV-1, PV-2, PV-3 and LSP-2) with the test pilots, test engineers and supporting staff from the National Flight Test Centre (NFTC), Bangalore would be positioned at Dabolim airfield, Goa for sea-level trials and complete all remaining points.

◆ Russian shipyards have begun full-scale construction of three more Krivak-class stealth frigates to be armed with anti-ship version of BrahMos cruise missiles for the Indian Navy, the new warships to be delivered to India in 2011-2012. The new Project 1135.6 frigates have been named as *Teg* (Sabre), *Tarkash* (Quiver) and *Trikand* (Bow).

# 2010

◆ On the eve of President Barack Obama's visit to India, the Government has acquiesced to the IAF's request for increasing the number of Boeing C-17 Globemaster III heavy airlift aircraft required, from ten to sixteen. In what is the largest defence programme between India and the USA thus far, the \$4.1 billion deal for 10 C-17s would be augmented by another six C-17s under the US Foreign Ministry Sales (FMS) programme.

◆ The Governments of India and Russia have signed several agreements to deepen co-operation on the T.50 (or PAK-FA) fifth-generation fighter. Alexander Klementiev, vice president and deputy director general at Sukhoi Aviation Holding stated, "The joint venture is going very well. Both parties are happy now". His comments counter reports which had it that Indian scientists and engineers were "unhappy" about the level of access they had been given on the programme and about future technology transfers.

◆ In what has virtually become a pattern, the Indian Air Forces' steadily expanding fleet of Sukhoi Su-30MKI fleet of 'air dominance' fighters is to be augmented by another batch of these aircraft, increasing contracted numbers by another 42 aircraft. This was reportedly agreed to during Russian Prime Minister Vladimir Putin's visit to New Delhi in early March 2010. The IAF has justified this requirement so as to fill the gaps in its combat force strength which has been winding down with the phasing out of MiG-21s and MiG-23s, with at least another half dozen MiG-21 and MiG-27 squadrons to be 'stood down' by 2015. With this additional order, the IAF's inventory of Su-30MKIs will exceed 270 aircraft by 2017, equipping 14-15 frontline combat squadrons.

◆ The IAF intends to equip its Sukhoi Su-30MKIs with air-launched BrahMos supersonic anti-ship missiles even as the development of a BrahMos Mk.II has been announced which will be hypersonic (Mach 5-7).

◆ The Tejas Light Combat Aircraft (LCA) programme is to get an additional funding of Rs. 8,000 crore, which till the end of 2009 had cost Rs. 4,800 crore. Defence Minister AK

Antony has strongly defended the LCA programme. "Today I can assure you with confidence... I can declare is at last LCA going to be a reality," he said. Dismissing criticism about the project having already taken close to three decades, Antony said that all agencies involved "strongly believed in the LCA."

◆ Admitting that the Tejas still has a long way to go, he expressed confidence that it will get final operational clearance by end 2012. The Indian Air Force has ordered 20 LCAs and expressed intent to order another 20 aircraft. Antony also said that the Government is in talks with parties abroad for the development of an engine for the LCA Mk.II.

◆ Defence Minister AK Antony has approved a series of measures that will "transform and revitalise" the Defence Research and Development Organisation (DRDO), in form and substance. The key measures include establishment of a Defence Technology Commission with the Defence Minister as its Chairman, de-centralisation of DRDO management, making DRDO a leaner organisation by merging some of the DRDO laboratories with other public-funded institutions with similar discipline, interest and administrative systems, engagement of an eminent Human Resource (HR) expert as consultant to revamp the entire HR structure and establishment of a commercial arm of DRDO.

◆ The Government of India has confirmed a \$2.2 billion deal with France to upgrade

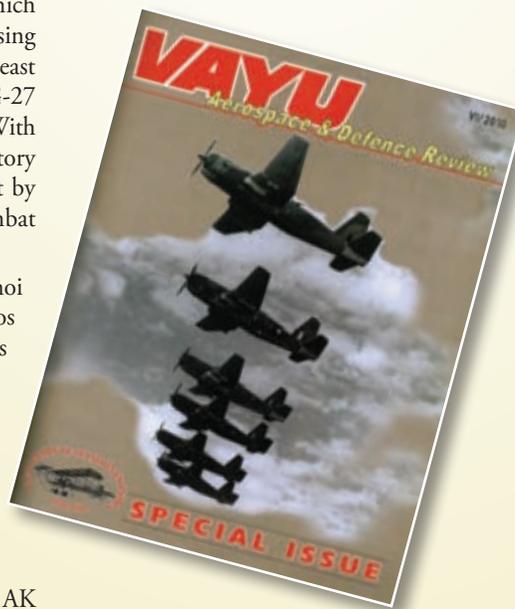
the fleet of 51 Mirage 2000 fighters, "to enhance their combat capabilities and increase service life." Upgradation of the Mirage 200s involves new avionics, new weapons and sensor suites. The first four Mirages will be upgraded in France and the balance in India by HAL under transfer of technology. India first inducted 40 Mirages in the mid-1980s and procured over 20 more in later years.

◆ "India has agreed to buy 250-300 advanced stealth fighters from Russia, to be jointly developed and manufactured," stated Defence Minister AK Antony on 7 October. Apart from the FGFA, he also referred to 45 multi-role transport aircraft (MRTA) being ordered from the Indo-Russian Joint Venture Company.

◆ After the European manufacturers of attack helicopters did not respond to the RFPs, only US and Russian-origin helicopters are left in the competition to meet the Indian Air Force attack helicopter requirements. Eurocopter's Tiger/Tigre and Augusta's A129 Mangusta have pulled out of the estimated \$600 million programme, whose unexpected exit will leave the field to Boeing's AH-64D Apache Longbow, which will compete with the Russian's Mi 28 'Havoc.' They will be positioned in India by September 2010 for field trials.

◆ An additional four Boeing P-8I long range maritime patrol/anti-submarine warfare aircraft will be acquired by the Indian Navy to supplement the 8 similar aircraft ordered earlier, for \$2.1 billion. The clearance for the next four P-8Is was taken at the Defence Acquisition Council meeting headed by Defence Minister AK Antony on 8 October 2010.

◆ The Indian Army has placed orders for 124 additional Arjun main battle tanks, this latest order being in addition to a previous order for 124 units. The army already has a regiment of 45 Arjuns that were delivered by the Heavy Vehicles Factory in mid-2009. The new Arjun order is seen as a much needed vote of confidence in the indigenously designed and manufactured tank that has faced closure several times over development costs and performance. Doubts on performance in the field were cleared in March 2010 when the Arjun underwent a month of desert field tests in Rajasthan alongside the T-90S imported from Russia.



# 2011

◆ During his visit to India, French Air Force Chief General Jean-Paul Palomeros appeared very confident of the Rafale and its selection “as the M-MRCA of choice”. He stated that the “Rafale was designed to be the next generation aircraft using the best technologies and integrating them to achieve an operational goal which was to get a true multi-role aircraft”.

◆ At the function for ‘Initial Operational Clearance’ of the Tejas LCA at HAL in Bangalore on 10 January 2011, the Minister for Defence handed over the ‘Certificate of Release to Service’ to the Chief of Air Staff. The ceremony was preceded by addresses and briefings by Director ADA and Chairman HAL.

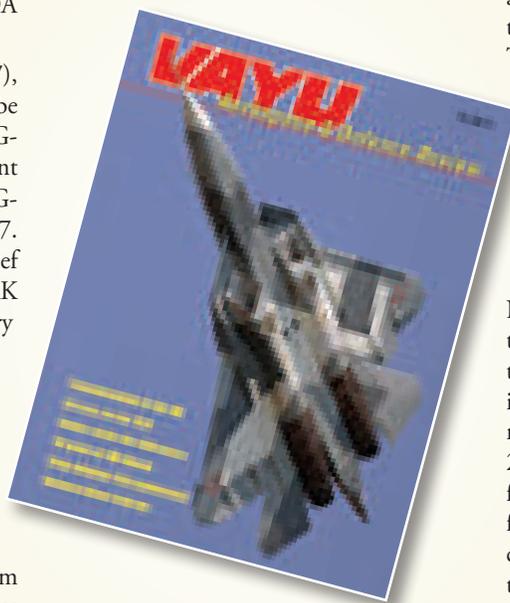
◆ Even as the last MiG-21FL (Type 77), in service with the IAF since 1996, is to be retired by 2012, the remaining five MiG-21MF squadrons will follow into retirement two years later, with the last of the six MiG-21 bison squadrons phased out by 2017. This was initially stated by the Air Chief and repeated by the Defence Minister AK Antony at the Rajya Sabha on 23 February 2011.

◆ General Electric’s CEO has said the company was frustrated at the “slow pace of decision making in India” and considered this the biggest challenge, “even ahead of corruption”. However, the company lists India as an extremely important market. Apart from the aero-engine business, where GE has been selected for the LCA MK.II’s engine.

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

◆ The Government has announced that Air Marshal NAK Browne (popularly ‘Charlie’ Browne) will take over as the next Chief of Air Staff on retirement of the present incumbent Air Marshal Pradeep Naik on 31 July 2011.

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



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

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

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

◆ The third and fourth of six Lockheed Martin C-130J Super Hercules for the Indian Air Force departed the company’s facility in Marietta en route to Air Force Station Hindon in mid-June. The remaining two C-130Js on order will be delivered subsequently.

◆ The IAF installed its first *Arudhra* medium power radar on 3 June 2011 at Naliya, “which strengthens air defence in the Saurashtra-Kutch region and forms an important component in the IAF’s plan to achieve network centric operations”. The IAF has already inked contracts for 19 LTTRs (low-level transportable radars), four MPRs (medium-power radars) and 30 indigenous medium-range *Robini* radars, among others.

◆ The CAG has been critical of the manner in which 16 MiG-29Ks were ordered in January 2004 for the Indian Navy at Rs. 3,405 crore, “without finalising the weapons packages for them, that led to the delivery of six jets without any weapons in December 2009.” Subsequently, five more MiG-29Ks were delivered in May 2011. Moreover, the Rs. 98 crore contract for 40 BVR (beyond visual range) missiles for the MiG-29Ks were concluded without consulting the IAF, which found them to be “unsatisfactory” with “unreliable serviceability.”

◆ The Government has cleared acquisition of eight LCUs (landing craft utility) capable of ‘hard beaching’ on shores, to improve the Navy’s amphibious warfare and island projection capabilities. The MoD is also finalising another project to acquire four large Landing Platform Docks (LPDs) for ‘standing off beaching’ at a cost of about Rs. 16,000 crore. The LCUs and infantry combat vehicles over considerable distances away from the Indian peninsula.

◆ IndiGo has signed a MoU for 180 eco-efficient Airbus A320 aircraft of which 150 will be A320neos, for a total cost of \$15.6 billion, the largest single firm order number for airliners in commercial aviation history, which also makes IndiGo a launch customer for the A320neo.

# 2012

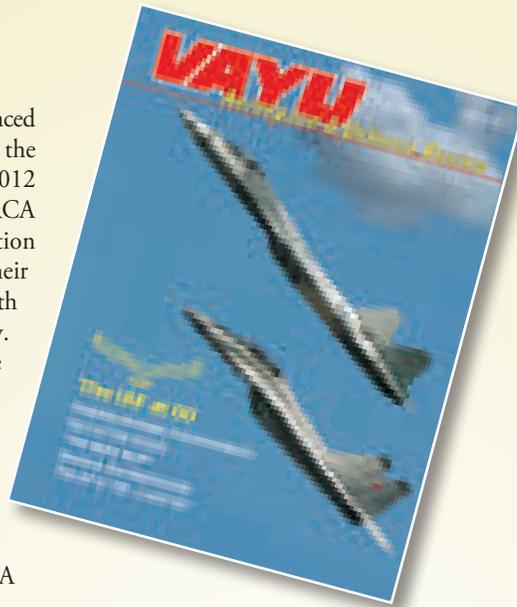
◆ Defence Minister AK Antony announced that acquisition process had begun for the Dassault Rafale which on 31 January 2012 was selected to meet the IAF's MMRCA requirement. The Contracts Negotiation Committee (CNC) reportedly began their deliberations on the programme at South Block in New Delhi on 13 February. The Minister also added that "the entire process will stretch over months and that transparency would be maintained over the eight stages in the acquisition process." The Minister also cautioned local officials and foreign vendors against "any malpractice in the process which can derail the MMRCA contract."

◆ The Cabinet Committee on Security (CCS), chaired by Prime Minister Manmohan Singh, cleared the acquisition of 500 MICA air-to-air missiles from European firm MBDA, as part of the previously announced package to upgrade the IAF's 51 Mirage 2000 fighters. The overall \$2.4 billion Mirage upgradation package was approved in July 2011, with the French firms Thales and Dassault Aviation contracted for the work. The first two Mirage 2000s of the IAF have already been flown to France while the balance would be upgraded by HAL in India.

◆ The indigenously-developed advanced lightweight torpedo (TAL) and the Akash surface-to-air (SAM) missile system were handed over to the Navy and the Indian Air Force respectively at a ceremony in Hyderabad on 3 March 2012. Bharat Dynamics Limited (BDL), Hyderabad, is production agency for both the torpedo and the missile. The Naval Science and Technological Laboratory (NSTL) Visakhapatnam, has designed and developed the TAL while the Defence Research and Development Laboratory (DRDL), Hyderabad developed the Akash surface-to-air missile.

◆ Lt. Gen Bikram Singh, presently GOC-in-C Eastern Command, has been appointed as the next Army Chief from 31 May 2012 to succeed General VK Singh.

◆ Air Chief Marshal NAK Browne, stated on 19 April 2012 that the IAF was enhancing its strength "in the face of unresolved differences over international borders with



Pakistan and China which continue to cause security concerns." Elaborating upon the plans to strengthen capabilities of the IAF in the northern frontiers the CAS said that the two airfields in Ladakh (Nyoma and Kargil) would be made fully operational soon.

◆ On 3 May, 2012 the Cabinet Committee on Security (CCS), gave approval for procurement of 75 Pilatus PC-7 Mk.II basic training aircraft from the Swiss company. The approval has been delayed by nearly a year owing to various allegations concerning flaws in pricing calculations. The IAF has faced acute flying training difficulties after its HPT-32s were grounded in July 2009 following a series of fatal accidents. The IAF has over the past three years adopted what may be termed an 'ad hoc approach', giving 20-25 hrs of flying in Kiran Mk.I jet trainers before trifurcation of pilots to various streams.

◆ Formal approval has been given for the acquisition of nine medium-range maritime reconnaissance (MRMR) aircraft for the Indian Navy. On 20 February the Defence Acquisitions Council offered the MRMR acquisition "to be operated in the maritime patrol, anti-submarine and anti-surface warfare roles." The mandatory Request for Information (RFI) for the MRMR had been sent to Airbus (A319), Alenia Aeronautics (ATR72MP), Boeing (P-8), Bombardier (Dash 8-Q400), Dassault (Falcon 900MPA), EADS CASA (C295MPA), Embraer (EMB-145MP), Lockheed Martin (C-130) and Saab (Saab 2000).

◆ The Defence Acquisition Council has cleared 14 additional HAL-built Dornier 228 light transport aircraft for the Indian Air Force. The Service currently operates 41 Dornier 228s, which equip No. 41 and 59 Squadrons as also Communication Flights and serve as multi engine trainers at the Air Force Station Yelahanka.

◆ Air Chief Marshal NAK Browne confirmed a number of decisions taken by the GoI which concerned IAF modernisation and expansion. These include the decision on procurement of 22 Boeing AH-64 Apache attack helicopters and induction of more Sukhoi Su-30MKI air dominance fighters. The IAF also plans to order two Mirage 2000 trainers in direct replacement of the two aircraft lost earlier this year.

◆ As a prelude to the acquisition of Boeing Apache helicopters by the Indian Air Force, the US Government is offering 245 Stinger missiles and 56 launchers to India as part of the weapons package. The Stinger complements advanced performance of the Apache in providing critical air-to-air defence capability. The Air Chief has confirmed that the Apache contract is in its final phase, and negotiations are ongoing.

◆ Maiden flight of the first Jaguar strike fighter modified to DARIN III standards took place on 28 November, 2012 at HAL's Airport Bangalore. This will incorporate Elta radar in the nose as standard. The other changes include system requirement capture, specification preparation, software, hardware, electrical, mechanical design and development as carried out by HAL at its Mission and Combat System Research & Design Centre (MCSRDC). Aircraft modifications were done by HAL's Overhaul Division.

◆ Agni 1, the 700km range ballistic missile was successfully launched on 13 July 2012 at 1006 hours from the Wheeler Island off the Odisha Coast. "It was a textbook launch meeting. All mission objectives were met and the missile reached the target point in the Bay of Bengal following the prescribed trajectory", said Avinash Chander, CCR&D (Missiles & Strategic Systems).

◆ The first modified EMB 145 aircraft of the indigenous AEW&C programme being led by CABS, arrived at HAL airport, Bangalore on 23 August and was received by Dr K Tamilmani, Chief Executive, CEMILAC officials of CABS, its work centres and IAF officers.

# 2013

- ◆ The Airbus A330 MRTT (Multi Role Tanker Transport) has been selected to provide six in-flight refuelling tankers to the Indian Air Force, chosen instead of the Ilyushin Il-78MKI, six of which are already operated by the IAF. The RFP for the new tankers was reissued in September 2010 after nine months after a similar contract featuring the same competing aircraft was withdrawn. Final contract is expected during the FY 2013-14. year.
- ◆ Test flights by MiG-29K/KUB fighters have been carried out by Russian test pilots from the carrier *Admiral Gorshkov*, before its commissioning as the INS *Vikramaditya*. The INS *Vikramaditya* will deploy 16 MiG-29K/KUB fighters on board, with a total of 45 aircraft ordered by India in two batches.
- ◆ The Indian Air Force received its first Boeing C-17 Globemaster III in-country when the first of this new heavy transport aircraft landed at Air Force Station Hindan on 18 June 2013. The second C-17 was handed over to the IAF at Boeing's Long Beach facility on 22 July. The C-17s are to equip the newly raised No. 81 Squadron which will receive four more C-17s this year and another five in 2014.
- ◆ Some 90 aircraft, mostly helicopters, of the Indian Air Force, Army and civilian

operators evacuated thousands of stranded pilgrims and local inhabitants from the Uttarakhand hills during the 'Himalayan Tsunami' in June. These included 37 Mi-171V/Mi-17V5s, 14 HAL Dhruvs, 3 HAL Cheetahs and a lone Mi-26 heavy-lift helicopter of the IAF. Three C-130J Super Hercules of No. 77 Squadron carried out spectacular operations from extremely short ALGs in the mountains to fly in fuel and essential supplies.

- ◆ Defence Minister AK Antony has stressed on need for DRDO to become competitive, saying the only choice left to DRDO was to "perform or perish". In particular, he referred to the indigenous LCA programme, which has been marred by continual delays, and said that it was vital that the agency adhered to deadlines.

- ◆ 17 July 2013 the Cabinet Committee on Security (CCS) chaired by Prime Minister Manmohan Singh cleared the creation of the XVII Mountain Strike Corps of the Indian Army at an estimated cost of Rs 65,000 crores over a period of seven years. The IAF is also to base a second C-130J Super Hercules squadron at Panagarh for special operations, even as several existing ALGs are being upgraded in both the north east and Ladakh.

- ◆ MiG-21 variants currently equip 12 frontline squadrons of the Indian Air Force (including six with the MiG-21 bison) and according to the RRM making a statement in Parliament in 2012, the last MiG-21 squadron would be phased out in 2017.

However, the CAS has made a public statement that, in fact, MiG-21s will continue in service till 2018-19, or even a year beyond.

- ◆ On 19 June 2013, a Dornier 228 maritime patrol aircraft of Coast Guard Air Squadron 750, based at Daman, was operated with an all-woman crew comprising of Asst Comdt. Neetu Singh Bartwal (captain of the aircraft), Asst Comdt. Neha Murudkar (pilot in command) and Asst Comdt. Shristi Singh (co-pilot). During this mission, the crew flew a maritime mission for over an hour and landed back to a warm welcome by the Station

Commander, officers and men of Coast Guard Air Station Daman.

- ◆ The Agni 5, India's long range inter-continental ballistic missile and designed to deliver nuclear warhead with high precision, was successfully launched on 15 September 2013, from DRDO's Launch Complex at Wheeler's Island, and impacted on its target "with expected precision". The missile is powered by three stage solid rocket motors and followed its entire trajectory in textbook manner, dropping the three stages at predefined points in the ocean.

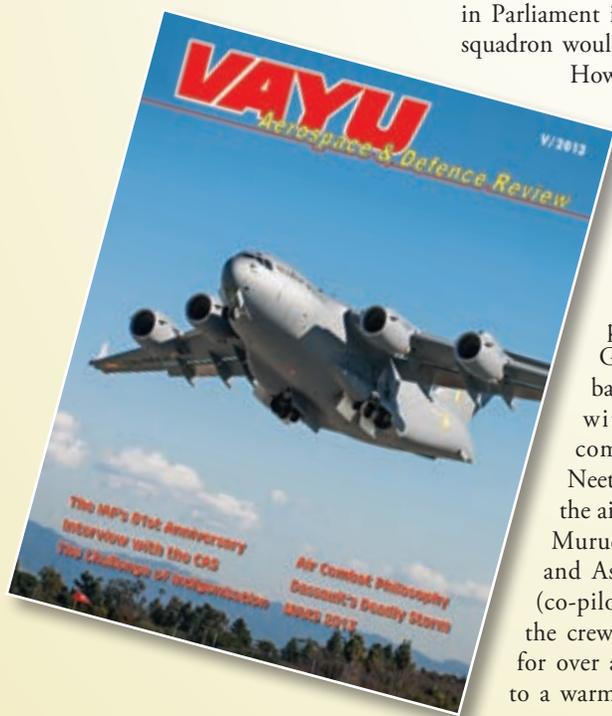
- ◆ The first Boeing P-8I LRRM/ASW aircraft of INAS 312 arrived at INS Utkrosh airfield in Port Blair on 6 August 2013. Piloted by the Squadron Commander (designate), Cdr. HS Jhajj, the aircraft under call sign 'IN 321' was welcomed to the islands by C-in-C, A & N, Command, Air Marshal PK Roy, at an event that was attended by senior officers of the Unified Command. The aircraft is the first of eight P-8Is being procured under a contract signed in 2009 and is based at INS Rajali, Arakkonam.

- ◆ The Pilatus PC-7 Mk.II basic trainer aircraft was formally inducted into IAF service at the AFA, Dundigal on 31 May 2013. The ceremony had three PC-7 Mk.II aircraft airborne in a 'vic' formation putting up a brief flying display which was followed by handing over of technical documents of the aircraft.

- ◆ The Indian Air Force's first upgraded Mirage 2000 made its maiden flight at Istres-Le Tubé air base in France on 5 October 2013. The aircraft was a two seat Mirage 2000TH 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 standards.

- ◆ 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.

- ◆ 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.



# 2014

◆ Following the dramatic resignation of Admiral DK Joshi on 26 February 2014, claiming moral responsibility for a spate of accidents affecting the Navy's warships, the Indian Navy functioned without a chief for close to two months. Admiral RK Dhowan, who was previously Vice Chief was appointed Chief of the Naval Staff on 17 April 2014. The succession order also saw the resignation of Vice Admiral Shekhar Sinha, FOC-in-C, Western Naval Command, then the senior-most officer after Admiral Joshi.

◆ Lt. Gen Dalbir Singh has been appointed as the next Army Chief, to succeed General Bikram Singh, due to retire on 31 July. The appointments Committee of the Cabinet, led by former Prime Minister Manmohan Singh, cleared the appointment on 13 May 2014.

◆ On 5 January 2014, the Indian Space Research Organisation marked a major success with the launch of its GSLV-D5, powered by an indigenous cryogenic engine which injected a telecommunication satellite, the GSAT-14 into orbit. With precision, the satellite reached its targeted perigee (nearest point from Earth) of 179km and 36,000km apogee (farthest point from Earth).

◆ A large scale attack on Russia's communication systems by anonymous hackers has led to much sensitive Indo-Russian correspondence being leaked. The breach, which was detected by Indian agencies on 8 March, released a large number of documents that dealt with the purchase, overhaul and repair deals for Su-30MKIs and MiG-29s.

◆ On 7 March 2014, INS *Sumedha* was commissioned into the Indian Navy at Goa. *Sumedha* is the third ship of the indigenous Naval Offshore Patrol Vessel (NOPV) Project to be inducted into the Indian Navy. Its induction is aimed at meeting the increasing ocean surveillance and patrolling requirements of the Indian Navy and to undertake EEZ surveillance, anti-piracy patrols, fleet support operations and providing maritime security to offshore assets.

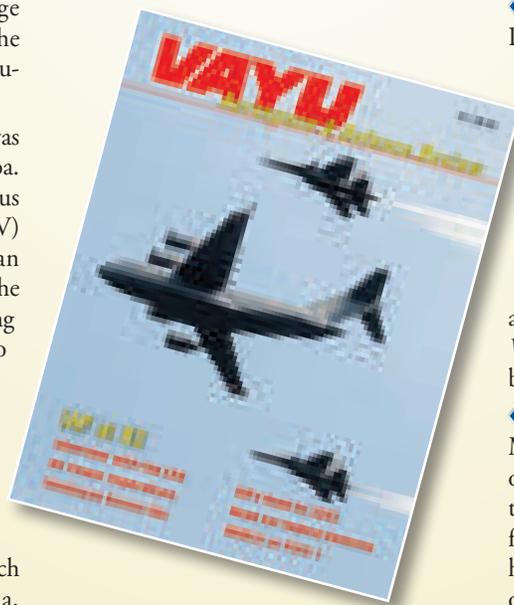
◆ Five modernised Antonov An-32s arrived at Kanpur from Ukraine on 29 March 2014, being the seventh batch of upgraded An-32s delivered to India,

bringing the total number to 35. The last five An-32s to be upgraded in Ukraine will be delivered in summer 2014.

◆ Astra, the indigenously developed Beyond Visual Range (BVR) Air-to-Air missile was successfully test fired on 4 May 2014 from a Su-30MKI at a naval range off Goa. Designed and developed by DRDO, the Astra possessed high Single Shot Kill Probability (SSKP), being an all-aspect missile with active radar terminal guidance, ECCM features, smoke-less propulsion and process improved effectiveness in multi-target scenarios.

◆ Boeing has delivered the fifth P-8I maritime patrol aircraft to the Indian Navy "on schedule", fulfilling the first half of a contract for eight aircraft. The aircraft had departed from Boeing Field in Seattle and arrived on 9 September 2014 at Naval Air Station *Rajali*, where it joined an earlier four P-8Is. Based on the company's Next-Generation 737 commercial airplane, the P-8I is the Indian Navy variant of the P-8A Poseidon that Boeing has developed for the Indian Navy.

◆ The Border Security Force (BSF) is to procure eight more helicopters from Russia to enhance mobility of the troops engaged in anti-Maoist operations. BSF DG said "The BSF Air Wing already has 17 aircraft, including Cheetahs, Mi-17 1Vs and Dhruv ALHs" and the eight Mi-17V5 helicopters will arrive from September 2014. "We will also see if the new helicopters can be used along the India-Myanmar border".



The Indian Government has signed a £250 million contract with European missile manufacturer MBDA to equip the Indian Air Force's Sepecat/HAL Jaguar strike aircraft with the company's ASRAAM short-range air-to-air missile. While the exact number of missiles to be acquired has not yet been disclosed, the contract is understood to over 350-400 missiles.

◆ A software upgrade has rectified a major flight safety issue in the Indian Air Force Su-30MKI fleet. Reports of cockpit screens and head up displays (HUDs) going 'blank in flight' had emerged earlier this year along with scattered instances of faulty mission computers. HAL Chairman has recently confirmed that software upgrades have "solved the display issues and that the mission computer problem has been addressed by replacing faulty computers where necessary."

◆ On 29 August 2014, the Government's Defence Acquisition Council (DAC) approved the procurement of 22 Boeing AH-64E Apaches and 15 CH-47F Chinooks, for an estimated US \$2 billion. Deliveries of the Apaches would take place during the 2016-2020 period while the Chinooks would be delivered by 2018.

◆ In keeping with announced economic reforms, the Cabinet has cleared a long-mooted proposal to raise the FDI limit in defence to 49 per cent, from the previous 26 per cent. The hike is aimed at inviting greater participation from foreign companies and "boosting domestic industry and reducing import reliance."

◆ A major announcement made during PM Narendra Modi's visit to Japan was the decision to acquire ShinMaywa US-2i amphibian aircraft for the Indian Navy and build the type in India. Around 15 aircraft are to be acquired, the first delivered around 2017.

◆ The new Tata-SIA joint venture airline *Vistara* 'limitless expanse' marks the return of Tata's in the airline industry after 1953 when Air India was nationalised. *Vistara* will have five A320-200s in its fleet by the end of 2014.

◆ On 24 September ISRO's Mars Orbiter Mission (MOM) exited the 'dark side' of the Martian planet and sent its first transmission towards Earth. India is the very first country in the history of spaceflight to have successfully sent a spacecraft to Mars on its first attempt.

# “Maximum Mission and Operational Readiness”



Defence Minister Arun Jaitley at Palam Airport Technical Area after ‘inspection’ of IAF C-17s

## Boeing DS&S expands footprint in India

As the modernisation effort of India’s armed forces make progress with the acquisition of new platforms and upgradation of existing ones, a major focus is on ensuring operational readiness through a product’s lifecycle by means of affordable support and services. Typically, operating costs are drastically reduced if long term training and programme based logistics contracts are in place so as to deliver personnel training, infrastructure, spares, and maintenance.

Dennis Swanson, vice president of Boeing Defence, Space & Security in India, says that Boeing, which has recently delivered military platforms such as the C-17 Globemaster III airlifter and P-8I maritime surveillance and anti-submarine warfare aircraft to the Indian Air Force and Indian Navy respectively, is ramping

up its services business in India to deliver “maximum mission and operational readiness” to the forces.

Boeing is supporting the IAF’s C-17 Globemaster III fleet through the *Globemaster III Integrated Sustainment Programme* (GISP) Performance-Based Logistics contract. The GISP ‘virtual fleet’ arrangement ensures mission readiness by providing all C-17 operators access to an extensive support network for worldwide parts availability and economies of scale. The C-17 GISP is a system-level partnership designed around PBL concepts, where the customer pays for readiness, rather than specific parts or services.

Training of C-17 crews was conducted by the US Air Force at Joint Base Charleston in South Carolina in 2012 where 100 Indian Air Force personnel received instruction

from the 373rd Training Squadron Detachment 5 on how to operate the C-17 Globemaster IIIs. The training included classroom time as well as hands-on work where the students apply the skills they learned in the classroom on simulation training aircraft. The first group graduated in November 2012.

Boeing has built and delivered every C-17 aircrew training system in the world and delivered considerable experience with nearly 20 years of C-17 training experience. Boeing is the C-17 training provider of choice for customers from the United Kingdom, United Arab Emirates and Qatar, the training having consistently ensured more than 99 percent availability of its C-17 aircrew training devices.

P-8I training for Indian Navy pilots, mission system operators and maintenance



*An IAF Boeing C-17 Globemaster III of No.81 Squadron*

technicians that will operate and maintain P-8I aircraft concluded in Seattle last year. The programme included a combination of flight, classroom and lab training as well as real-world simulation experiences that can reduce total ownership costs. Between February and September 2013, Boeing trained more than 110 Indian Navy professionals, including five pilot crews, five mission crews and a number of flight signallers and observers.

As the original equipment manufacturer, Boeing is uniquely positioned to provide training devices that most accurately simulate P-8 aircraft and mission systems and stay current with aircraft configuration. Boeing's training provides a full range of equipment, software, courseware, personnel and logistics. The benefits of training include a reduced number of training flights, lower cost of operation (less fuel and maintenance required for live aircraft), and reduced use

of limited aircraft. Training provides high level of crew readiness and proficiency for multiple mission profiles.

Boeing anticipates other training opportunities for aircrew and maintenance courseware development for platforms such as the AH-64 Apache and CH-47 Chinook, opportunities which are being pursued.

*Courtesy : Boeing*



*Fifth Boeing P-8I takes off at Seattle, enroute India to join INAS 312A*

# Rolls-Royce : India's partner of choice



Sea Harrier FRS Mk.51 of INAS 300 (photo : Angad Singh)

A global provider of integrated power systems and services to the aerospace and marine/industrial power systems market, Rolls-Royce has been associated with India for the past eight decades and is contributing significantly towards the modernisation of the armed forces.

The Indian Navy and Rolls-Royce have been partners since the inception of India's naval arm and a great example is INAS 300, where we have worked alongside the squadron for over 50 years, and this partnership continues today. Rolls-Royce is committed to bringing high technology-oriented ecosystems to the Indian Navy. In the short term, our priority is to support the existing fleets – in particular the Sea Harrier as it plays a vital role in India's maritime security. In the medium term, we will continue to support the operation of the Sea King, a critical military asset. We will also help the Indian Navy maximise its use of the Rolls-Royce powered Hawk advanced jet trainer, which is crucial to the Navy's combat aircraft capability. In the longer term, we believe a number of Rolls-Royce powered aircraft will be of interest to the Indian Navy. The most obvious of these is the US-2i amphibious aircraft which shares largely common engines with the Indian Air Force's C-130J fleet.

Rolls-Royce continues to build a solid installed base in India. The Navy has in excess of 30 ships utilising Rolls-Royce motion control equipment and many of our other products are also operated in the Navy and Coast Guard fleets. For new equipment the Indian Coast Guard (ICG) has proven, historically, to be an excellent entry point into the Indian Navy. We have recently managed to win CPPs and shafting for ships of the Indian Navy (5 Naval OPVs) and also RAS



Steven Gillard, Vice President, Customer Business – Defence, Rolls-Royce

gear for the prestigious Indigenous Aircraft Carrier project. Other successes have been the sale of the new S3 series waterjets (a total of over 140 Rolls-Royce stainless steel water jets are with Indian Coast Guard), propellers, RAS/FAS equipment and steering gear for the new Fleet Tankers, Shiplift for ABG Shipyard and the three Pollution Control Vessels design and equipment through ABG Shipyard.

With the Indian Navy having a fleet of about 145 warships and the Indian Coast Guard having a fleet of over 100 ships and boats, India's is the fourth largest Navy in the world. As of 2014, the Indian Navy has about 40 ships under construction including aircraft carriers, destroyers, frigates, stealth ASW corvette, and nuclear powered submarines. The Indian Navy has stated their intention of increasing the fleet to over 150 warships by 2027, which will include many existing ships which are due for progressive retirement. The Coast Guard has indicated that they require a total of 160 vessels over next seven years. All this presents tremendous opportunities for growth.

Rolls-Royce remains committed in contributing to India's infrastructure and modernisation needs and will continue supporting the Indian Navy for further growth.

*Courtesy : Rolls-Royce*

# Checklist to Reality

## Professor Prodyut Das writes on the direction India's private sector may take to build up an Indian Military Industrial Complex (MIC)

It appears if one puts a bee in an empty glass jar and the glass jar is put in a dark room with its bottom facing a strong source of light the bee – logically equating light with an opening – will repeatedly try to ‘fly out’ through the bottom until it dies of exhaustion. Interestingly, a fly, being illogical, will zip around in all direction and very quickly fly out from the open end of the jar. Indian private sector defence firms, I feel, are emulating the bee. They are being ‘logical,’ and the hope of a logical big launch order is blinding them against an invisible and possibly an extremely resilient obstacle.

Am I being unduly pessimistic? A practicing engineer always has an ingrained sense of dour pessimism regarding the cost of money and unlike the PSUs the private sector cannot run on infinite delays and overdraft.

What we wish to analyse is the role that the Indian private sector can profitably play and if it may be more fruitful if some apparently radical lines of thought are pursued. First, the illogic of ‘latest and best’ Western weaponry must be accepted. Take the case of the so called mine–proof vehicles. This was a Western ‘latest and best’ idea that has been less than successful. Is this the best option for counter insurgency? Its weak point is that it is confined to motorable roads. Maoists therefore know they are safe in the jungles. Would not an armed and lightly armoured (STANAG Level 1) all terrain vehicle such as the old Bren Gun Carrier or *Kettenkrad*, which can get off-road and give hot chase, be more practical?

Second, there are limitations in the capabilities of the Indian Industry and we have to carefully study these contradictions and anomalies to produce weapons which are different, marketable and yet within our capabilities. Considering a country at random, for instance, the Republic of Salvador. Its GDP is around \$ 50 billion, and its armed forces about twenty thousand personnel who are engaged in (what else?) counter insurgency. We can presume that its defence budget is around \$2 billion annually, of which perhaps \$ 300 million is for new acquisitions. Now there are



eighty similar countries around the world, which represent an annual arms market of approximately \$24 billion. Is this not worth looking into?

Salvador's armed forces are equipped with guns of 120 mm calibre maximum, light armoured vehicles, and the Air Force uses 40 Vietnam-era helicopters, 10 Basler modified Dakotas and 16 Cessna T-37 jet trainers for their strike duties. Their heavy truck is a MAN, similar to the Indian Shaktiman. What kind of equipment can we

supply to Salvador to upgrade their combat capabilities? For example, when we talk about tanks we think automatically of super-power MBTs. What about the old concept of the ‘infantry tank?’ Surely the Abrams or Arjun– good as they are – are not best suited for Salvador! A modernised Stuart – that did so well in the Burmese terrain – which can be afforded in large numbers, may be more suitable than the incomparable Leopard or Abrams in a country where the max vehicle load for bridges is thirty tons. It should be possible for Indian industry to develop very simple but modernised replacements without risk of great additional investments. The best part is there are dozens of countries like Salvador and even trickle orders can keep the lines busy and profitable

Because weaponry is *per se* ‘useless’ no country supplies more than ‘venture capital’ for any weapons development programme. That venture capital, too, comes from the earnings of previous successful weapons programmes. No previous exports, no new programmes. China was in the past a possible exception but then the Chairman was spending thirty times more on his MIC alone than what he was spending on his urban development. Such deprivation is not an option for us.





The HF-24 Marut was ahead of its time and potentially superior to other multirole combat aircraft being developed in the world at the time

We therefore have to plan for weapons export as an integral plan right from the start. The idea of funding development of weaponry with the sole objective “to save foreign exchange” is naïve or an eyewash. As a corollary, the constant moaning about lack of funding is appalling. Free funded weapons development is unsustainable. Earn it first!

It is nobody’s argument that the selling of weapons is a national effort. Every President or Premier that visits New Delhi comes with an appendage of Hawks or Howitzers to sell. So ideally we should have a situation where the Cabinet, the PMO, North Block, DRDO, the PSUs, the Armed Forces and the private sector should be working in close co-operation and harmony creating a national effort to build and export weaponry. One will instinctively notice how long the chain is.

It is this *idée fixe* that ‘somehow everyone should work as a team’ that I am sceptical of and it is this idea that the Industry must sideline if it is to succeed. Two primary factors come to the fore in any success : the quality of the decisions taken and the quantity of the orders expected.

Let us examine the quality of decision making in matters related to defence, which are in the public domain:

- ➔ The failure to wake up to the Chinese threat even after the Chip Chap Valley incident in 1959. The troops had to face Chinese PPSs with bolt action SMLEs in 1962.
- ➔ Failure to fund development of the Orpheus B.Or.12 at the rate of 1 million GBP a year for two years. This later hobbled the Marut project. Mind you, we found money to buy an aircraft carrier and its complement of aircraft around the same time (1957).
- ➔ Though the Orpheus was for two decades numerically the most important engine in the IAF (powering the Marut,

Gnat, Kiran and Packet) no attempt was made to develop/improve the engine in terms of thrust, SFC or TBO. One ‘science lab’ afterburner programme was closed down with alacrity when the daring test pilot was killed in what may well have been a pilot error situation. Money was of course made available for a GTX project which had no immediate application.

- ➔ Repeated efforts by HAL to develop the HF-24 (HF-73, GAF, ASA, and HF-25) at costs of around Rs 70 crore were not funded in circa 1971-1976. In 1983 we funded a *Rahu* organisation —the ADA — to the tune of Rs 565 crore for the crucial MiG-21 replacement programme (for Non Indian readers, *Rahu* in Indian astrology is a dissatisfied head without a body). At that time, the earlier HAL proposals were not revisited and refunded to keep as a ‘second string’ given the obvious and glaring weaknesses of the venture.
- ➔ The somewhat arbitrary manner in which both the Gnat/Ajeet and the Marut were retired even though it was clear that Hunters, particularly the T.66s were going to the scrapper’s yard very soon.
- ➔ The incredible seventeen year delay in ordering AJTs.
- ➔ The delay in following up the HDW Type 209 submarine programme, resulting in all the skilled manpower retiring out, before taking up the *Scorpene* programme.
- ➔ Someone sat on the Bofors 155/39 drawings for *twenty years*.

Given such a litany, why should one be optimistic?

The *reasons* for such contrariness in decision-making are not the present issue. The issue is that the Indian ‘techno-structure’ (read: Raisina Hill), will not provide the private sector speedy logical

decisions. The private sector cannot afford delay. Has there been any reliable indication that things are about to change and change very dramatically, for the better?

To be sure, the *new government* has been remarkably sure footed in its pronouncements so far but caution suggests that we do not plan on the basis of anticipated change for the better. There are two very important reasons for ignoring, as of the present, a ‘helpful’ government. The first is from the past. One will note that many of the weird decisions listed above were taken during the Nehru/ Krishna Menon era, where sincerity of aims was unquestionable. The other reason is pragmatic. You may have noticed it is remarkably easy to change one’s plans when the circumstances suddenly change for the better. So whilst optimism about the new government is to be retained, such hope must not find a place in the private sector’s plans. Better prepare as if Raisina Hill will be ready with the spokes and spikes.

### Bottom of the Pyramid

The second area we must look at is the value of the order – particularly the annual production order. Presuming the private sector has survived the first hurdle noted above, what would it get anyway? What have been the procurements over the past 30 years or so? 3-500 combat aircraft, 2500 tanks, 500 field guns, a million rifles in several varieties and so on. The Navy’s procurements have been better but again the annual value would still probably be sub-profitable.

Whilst the figures look impressive *prima facie*, they work out miserable production rates, which is what the industry will have to factor in. Production rates of the Chinese, for instance, make for sober thinking. In 1961 they were producing thirty MiG-17s *a month!* Their current production rates – witness the line ups of J-10s – means they have not lost the habit!

Between the long delays pending a (possibly) weird decision it is quite possible that the private sector will realise the wry truth of Northkote Parkinson's dictum that "delay is the deadliest form of denial." I may add, that according to Parkinson, we may find that strong support and enthusiasm at one level of Government is often replaced by ridicule and harassment at the next level.

To sum up this part, we may conclude that:

- ➔ The Indian decision making process is unreliable for business planning
- ➔ The Indian market is too small to tailor our products solely to the needs Indian Armed Forces
- ➔ And finally, the Indian private sector is still not ready to produce competitive weapons, i.e. products that can match the Big Five (USA, Russia, China, Europe, France). It has the potential to do so, but potential is so different from reality.
- ➔ So what would be a summary?
- ➔ What the present Government is promoting ('Make in India') is extremely welcome but still remains a 'hygiene' — it will improve the situation, it will create a base, but it will not transform our capability.
- ➔ Our present capabilities in the private sector are not still sufficient to 'create' new weapons. It is still some time away



Camels of the BSF overlooking 'Beating of the Retreat' at Vijay Chowk

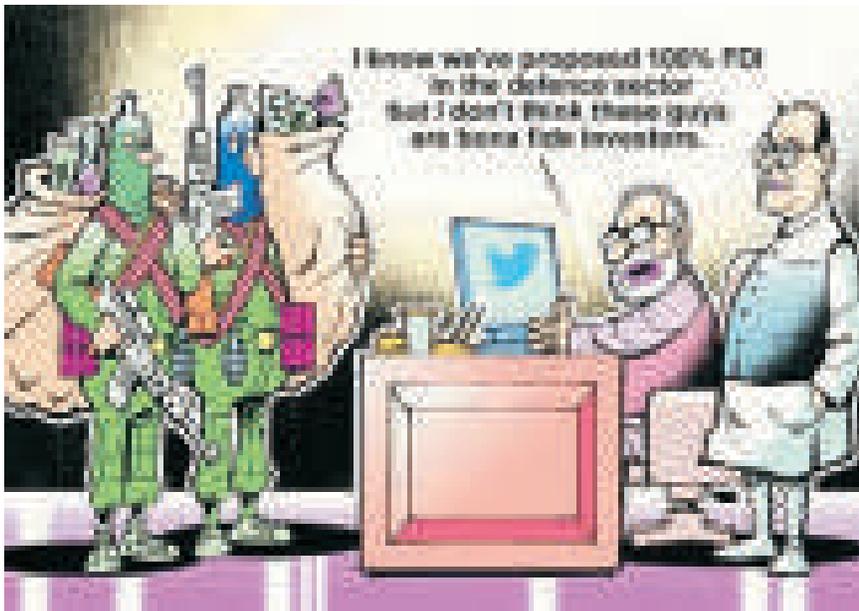
from making competitive 'big league' equipment.

- ➔ Fortunately there is a vast untapped equipment market worth, at a conservative guess, about USD 10 billion per annum for 'appropriate' equipment, which the private sector *can* certainly supply.
- ➔ The CII and similar such bodies must resolve to do what the Government has failed to do i.e. to develop a comprehensive set of weaponry and equipment which is specifically suitable for fighting the Third World's wars.

Today the Third World is equipped with expensive unsuitable equipment developed for fighting the White Man's wars or making do with 'Grandfather's Generation' equipment!

- ➔ Do an analysis of the economic conditions of these countries and how much money they are spending on defence and what are they getting for it, what we can buy from them and what can they buy from us.
- ➔ Accept as an axiom that an Indian-designed weapon, built with Indian or local labour, to Indian standards, and Indian materials will be two to five times cheaper.
- ➔ Set up a think tank of independent experts who would be able guide what kind of equipment should be developed.
- ➔ Do some really professional market research
- ➔ Set up test and certification standards that realistically reflect third world warfare conditions rather than the global market's temperate and Arctic zone conditions.

Can the private sector develop a MIC without any government aid? I am reminded that the Germans — after the First and the Second World Wars — formed offshore enterprises in Denmark, Sweden and Spain to keep their MIC intact under the noses of the victorious Allied Commissions. I have absolute confidence that, given our ancient mercantile skills, we can do better.



Jokes aside, the Modi-led Government is determined to create an indigenous Indian defence industry with major involvement of the private sector

# SPIKE : the Israeli Tank Buster

On 26 October 2014, at a meeting of the Defence Acquisition Council (DAC), chaired by then Defence Minister Arun Jaitley, clearance was given for 8,356 Spike family of lightweight fire-and-forget anti-armour weapons ( using electro-optical and fibre-optic technologies) manufactured by the procurement of Rafael Advanced Defence Systems along with 321 launchers. This would be followed by transfer of technology (ToT) to defence public sector unit Bharat Dynamics Limited (BDL) for subsequent large-scale manufacture. The systems will be used by infantry soldiers, special rapid reaction forces and (possibly) helicopter aircrew.

The Spike family includes Spike-SR with a range of 800-m, Spike-MR (*Gill*) with range of 2,500-m, Spike-LR with 4,000-m range and Spike-ER (formerly known as NTD *Dandy*) with a range of 8,000-m. Spike-LR and Spike-ER can also be fitted on light combat vehicles and a package for mounting Spike-ER on helicopters is also available. In October 2003, the IDF awarded a production contract for Spike C4I, the Spike-ER system fitted with networking capability demonstrated to and fired (in simulation) by this *Vayu* observer during Defexpo 2014. The modified Spike launcher is fitted with a variant of the Azimuth Comet Global Positioning System (GPS), laptop computer and Very High Frequency (VHF) data link.

The rapid firing (preparation time less than thirty seconds) Spike-MR and Spike-LR have the same firing post consisting of the Command Launch Unit (CLU), the thermal imaging sight and a tripod. The



soldier acquires target and lays crosshairs of the sight on an aim point on the target using either the day sight with a 10× magnification and 5-degrees field of view or the clip-on thermal imaging night sight with wide and narrow fields of view. In fire-and-forget mode, the soldier activates the missile, locking the tracker on the target and pushes the fire button to launch. The missile automatically propels itself towards the target without any additional interaction and this fire-and-forget capability allows the soldier the option of relocating to a new firing position or to reload (takes less than 15 seconds) immediately for the next engagement.

After launch, the missile's four rectangular fins for aerodynamic control at the rear and four wings at just over halfway from nose to tail on the length of the body unfold as the missile leaves the launch canister and follows a lofted trajectory. As it approaches the target it dives down to impact

the relative vulnerable top portion of the target. The lofted trajectory and the tandem high explosive warhead enable the missile to penetrate tanks equipped with Explosive Reactive Armour (ERA). The guidance system in the nose of the Spike missile comprises a Charge-Coupled Device (CCD) and Imaging Infra-Red (IIR) seeker. The IIR provides higher sensitivity and improved thermal background rejection characteristics for all weather day and night operation.

Spike-MR (range up to 2,500-m) and Spike-LR (range of up to 4,000-m) can have the option of the additional fire-and-forget mode and in fire, observe and update mode using the fibre-optic data link. The fibre-optic data link guidance system sends commands to the missile from the launch system and receives, into the gunner's field of view, images from the seeker permitting the gunner to update his aim point while the missile is in flight using the fibre-optic link. As well as update target information, the





data-link allows the gunner to switch targets and also receive real-time intelligence and perform Battle Damage Assessment (BDA). The Spike system can also work in Non Line-of-Sight (NLOS) mode allowing the gunner to operate from a covered position.

The Spike-ER (range 8,000-m) has a larger warhead and is designed for mounting on light combat vehicles. The vehicle package includes the missile in its canister, a remotely controlled turret with target acquisition system and electronics and gunner's station with multifunction display, control panel and handgrip. A bi-directional fibre-optic data-link provides Spike-ER with a fire and steer mode, in addition to the two other modes. This means that the gunner does not need to lock-on to the target before launch, but can choose the target after launch and steer the missile to the target's most vulnerable point or hand over to fire-and-forget. Rafael has developed a version of Spike-ER with a Penetration, Blast & Fragmentation (PBF) warhead which explodes after penetration of the target. The Spike-ER four-round helicopter launcher requires no modifications to the helicopter, other than software integration. The Spike NLOS can impact targets within range of 25-km.

*Sayan Majumdar*



*Spike MR-LR*

# VAYU at Exercise

## Yudh Abhyas 2014

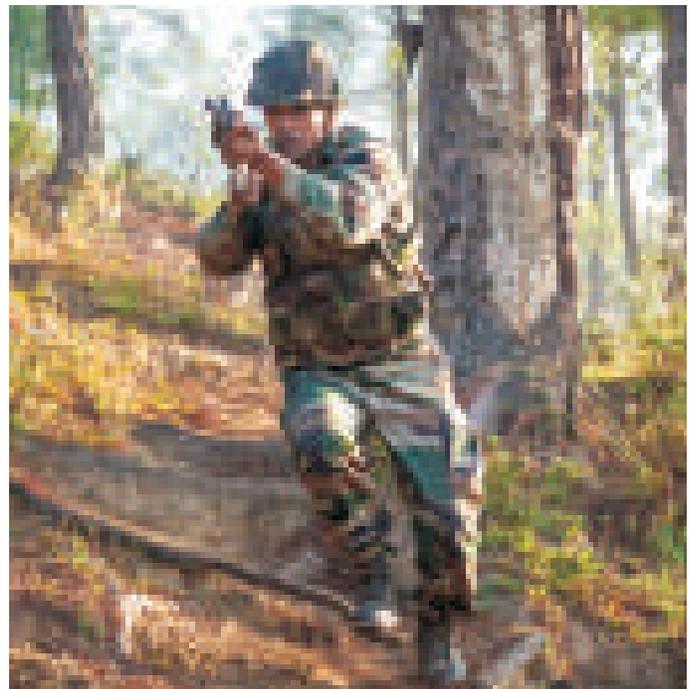
*Indian soldiers take position as the rising sun illuminates the misty valley*

The 14-day Indo-US combined military training exercise 'Yudh Abhyas 2014' commenced on 17 September at Ranikhet and Chaubattia in the hills of Uttarakhand with the broad objective to strengthen and broaden interoperability and cooperation between the two Armies. The journey to the training site entailed a daylong flight from Fairbanks, Alaska, to New Delhi, India, followed by a 12-hour bus ride up meandering mountain roads to Ranikhet Cantonment located at 6,000 feet in the foothills of the Himalayas.

*Yudh Abhyas*, which literally translates as 'preparing for war,' is a bilateral exercise between US Army Pacific (USARPAC) and the Indian Army now in its tenth year. It has grown from platoon-level operations to brigade-and battalion-level operations. This year, the training focused on combined training events within three key elements; a command post exercise, a field training exercise and expert academic exchanges. Over the years, *Yudh Abhyas* has been held at various locations ranging from the sunny beaches of Hawaii to sub-zero temperatures of Alaska to the hot, dusty and dry deserts of Rajasthan, and now the Himalayas.

Simulating a peacekeeping mission in a fictional East African nation in which the US and Indian soldiers integrated into a single brigade tasked to provide stability and security to the region, both the US and Indian soldiers trained on various tasks that they were likely to encounter in a peacekeeping operation, such as issues with crowd control, cordon and search and responding to terrorist threats. The focus of the exercise

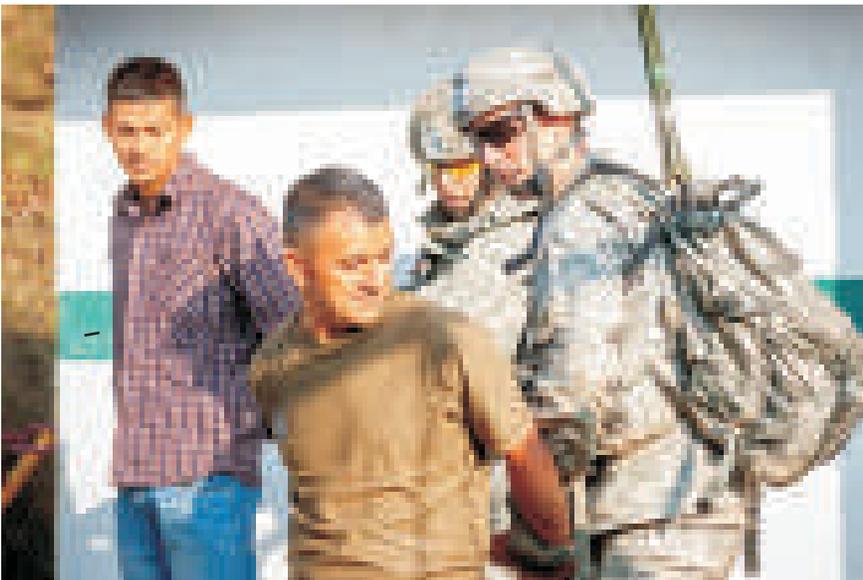
was to carry out counter insurgency and counter terrorist operations in mountainous terrain under United Nations (UN) Charter. State-of-the-art equipment for surveillance and tracking, specialised weapons



*An Indian jawan sprints down hillside as the final field exercise commences*



*Indian troops monitor exercise proceedings from behind cover*



*US soldiers secure mock prisoners during a search mission*



*The combined Brigade HQ during the exercise was staffed by a mix of Indian and US officers*

for close quarter battle with terrorists, explosives and IED detectors, as well as the latest communication equipment was deployed by both sides.

US participants included the 1st Stryker Brigade Combat Team, 25th Infantry Division; 5th Squadron, 1st Cavalry Regiment; 3rd Battalion, 1st Group, US Army Special Forces and 12 soldiers from the California National Guard along with the Indian Army's 2nd Battalion, 9th Gorkha Rifles. California National Guard soldiers played the role of the United Nations Force Headquarters for the exercise.

Faculty from Centre for Civil-Military Relations (CCMR), Multinational Exercises and Leader Development and Education for Sustained Peace (LDESP) programmes led academic discussions and facilitated training for a combined US and Indian army brigade staff of over 60 personnel. The CCMR team was led by Scott Moreland, Deputy Programme Manager of Multinational Exercises. Since *Yudh Abhyas* 2012, the US and India have shared scenario design and exercise management responsibilities. Moreland worked directly with his Indian counterparts through the planning, design and execution phase to ensure that the exercise was an integrated effort that focused on building relationships. He observed that "India is emerging as a strong regional partner in Indo-Pacific Asia. The relationship of trust between our militaries continues to grow. This sort of training prepares our forces to work together effectively in areas where we have common security interests."

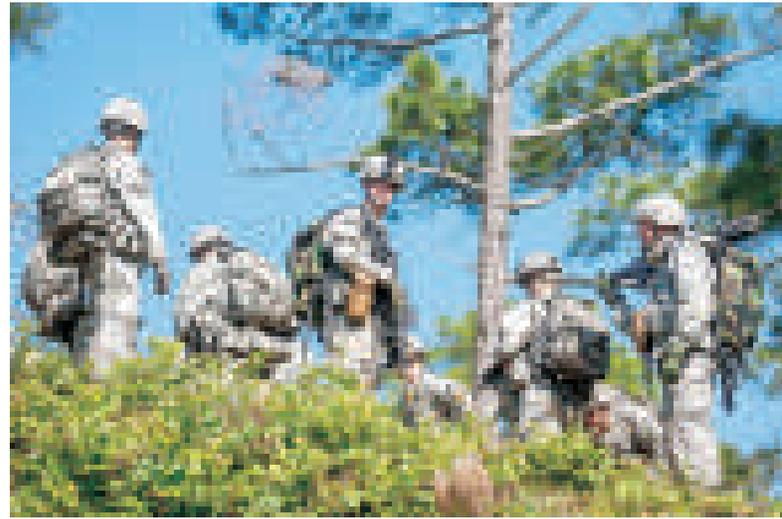
The LDESP programme provided cultural awareness training to the 1-25th Stryker Brigade Combat Team prior to their deployment to India. LDESP's Dr Vino Roy joined the CCMR exercises team to facilitate training on military interactions with the media. In addition to providing direct support to the exercise, Dr Roy aimed to validate the outcomes of LDESP training in the field. Major General, from the Central Command, (Ashwani Kumar) stressed upon "free exchange of ideas and concepts between the troops and the necessity to learn from each others' experiences." California National Guard Capt Yusef Parker played the role of a United Nations Force Headquarters staff officer. During the exercise, he worked side by side with his Indian Army counterpart creating situational updates, threat assessments and analysing



*Indian and American soldiers prepare to launch a combined assault during the final field exercise*

reports from the brigade level. “The training value of this exercise is that it gives US Army personnel a basic understanding of United Nations peacekeeping operations,” Parker said. “The additional training value is more in the form of relationships built with our Indian Army counterparts. The majority of the US Army personnel in this exercise have an Indian Army counterpart and most of our counterparts have some form of UN peacekeeping operation experience in countries such as Sudan, the Democratic Republic of Congo, Haiti and Lebanon,” he added.

The two armies trained alongside and then each of the specific training modules built up to the culminating event which was the field training exercise conducted on 30 September 2014. This included an operation with an area domination drill late in the night where soldiers trekked some 6–8 kilometres through unforgiving terrain comprising dense forests, cliffs and streams. Soldiers approached the identified trouble spot from two different directions and by 4 o’clock in the morning, had managed to form an outer perimeter. Thereafter, the



*US soldiers atop a hill after completing the final field exercise on 30 September*

teams formed an inner perimeter and just before the sunrise, successfully concluded the search. The final field exercise was reviewed by Major General Lawrence Haskins of the US Army and Major General Ashwani Kumar of the Indian Army. “We’re training off of each other; in fact, we’re learning how we function,” said Sgt Michael Higginbotham, a cavalry scout with 5-1 Cavalry.

The *Vayu* team met with Major General Lawrence Haskins and discussed the similarities and dissimilarities between the

US soldiers and their Indian counterparts, particularly the fact that the US forces depended strongly on equipment and technology vis-a-vis the Indian soldier, who typically relied on experience and raw strength. “I would say that technology and systems are enablers and that the US army considers them important when going into a war zone be it Police enforcement or a battle zone. However, the basic skills of a soldier remain the same. We train our soldiers on both aspects, with our systems as well as without such systems in order to cover all possible case scenarios. Having the opportunity to work with another military that may not have the same or similar equipment or style of training forces us to look at ourselves to work out a system where there will be interoperability and



*A US Army soldier training at the range with an M4 carbine fitted with blank-firing adapter (BFA)*



*An Indian soldier familiarises himself with an American M240 machine gun*



*Indian and US soldiers at the closing ceremony*



*US and Indian Army personnel in a group portrait at the closing ceremony*

that was one of the most valuable lessons we acquired during *Yudh Abhyas 2014*.”

The joint exercise was well summarised by Colonel Achariya, Exercise Director, *Yudh Abhyas 2014*, who stated, “We started this exercise with an initial planning conference and both sides agreed to the issues that we wanted to highlight and get the brigade HQ to execute. So, getting the issues into a larger story and making sure that these issues were relevant to the present day was initially our job. Thereafter, we engaged in getting down to the workable aspects, translating these aspects in the military language, rules of engagement and other issues of military tactics. Finally, we established a combined brigade HQ, which included the presence of Indian as well as American staff and to ensure joint learning, every American had an Indian counterpart and likewise every Indian had an American counterpart. We were able to join this together and arrive at a solution based on common experiences; common values and we were able to successfully execute tricky missions such as search and rescue, convoy protection, humanitarian aid and such like issues to the battalion level. What we also successfully managed to do was to channelise our strengths and arrive at a common goal, which led to the successful closure of this joint training exercise.”

*(All photos by Angad Singh)*

# An Indo-Chinese Army Exercise



Indian and Chinese flags on parade at the opening ceremony

## ‘Hand-in-Hand 2014’

The fourth annual Indo-Chinese joint training exercise, *Hand-in-Hand 2014*, commenced at Pune on 17 November 2014 with an impressive opening ceremony at the Aundh Military Cantonment. The exercise aims to acquaint both Armies with each other’s operating procedures in a counter-terrorism/counter-insurgency operating environment. The 12-day schedule is focused upon training on crossing of obstacles, special heliborne operations, firing of various weapons, handling and neutralisation of improvised explosive devices (IEDs) and conduct of cordon and search operations.

The Chinese contingent was from the 13 Group Army, Chengdu Military Region and comprised one infantry company along with supporting staff. They landed at the

Lohegaon airfield in two Il-76 aircraft directly from China on 16 November.

The opening ceremony for the exercise was held at the parade ground in Aundh Military Camp. Lt Colonel Tian Jeiwen, Commanding Officer of the PLA contingent, led the parade, and the ceremony was attended by Lt General Bobby Mathews, GOC XII Corps, and Lt General Shi Xiangyuan, Deputy Commander of Chengdu Military Command of the People’s Liberation Army (PLA), along with many senior Army officers from both nations. Both Mathews and Xiangyuan addressed the assembled contingents before Lt General Xiangyuan declared the Joint Exercise open.

The opening ceremony concluded with an enthralling display of Indian martial

arts — Kalaripayattu, Khukri dance and Malkhamb — by Indian Army soldiers and a massed martial arts display by the Chinese contingent. The ceremony was followed by both contingents displaying their weapons, which included assault rifles, grenade launchers and other sophisticated equipment.

The objective of the training is enhancing confidence and trust between the two armies, which may be called upon to grapple with anti-terrorism operations even under a UN mandate. The conduct of joint military exercises is also an important step to uphold the values of peace and stability in the region by jointly eradicating terrorism. The exercise concluded on 25 November 2014.

*(photo courtesy : PRO Indian Army)*

## Pakistan "interest" in J-31 stealth fighters



The J-31

Pakistan and China's joint ventures were prominently discussed at the Zhuhai Air Show 2014. On display was the JF-17 Thunder fighter, jointly designed and manufactured by the Pakistan Aeronautical Complex and Chengdu Aircraft Corporation, a subsidiary of Aviation Industry Corp of China (AVIC). Additionally, according to authoritative sources, the Pakistan Government is actively considering procurement of 30-40 J-31 next generation stealth fighters from China. The J-31 made its first public display at China's largest air show which was witnessed, amongst others, by Rana Tanveer Hussain, Pakistan's Minister for Defence Production.



The JF-17

Meanwhile, the Pakistan Air Force is in the process of retrofitting its 50 Chengdu/Pakistan Aeronautical Complex JF-17 fighters to an improved Block II configuration. The new configuration features improved avionics and better software, and adds a fixed air-to-air refuelling probe, stated Air Cdre Khalid Mahmood, chief executive of JF-17 sales and marketing. The JF-17 Thunder fighter is among several aircraft China is seeking to export, with Pakistan taking the lead. The partners are in "advanced talks" with clients in Africa, Asia, the Middle East and South America for jet sales, Mahmood said, who however declined to identify any of them. Prospective orders will be for the third block of 50 planes, with the Pakistan Air Force having ordered the first two blocks of 50. Additional improvements are foreseen in the planned Block III upgrade.

## Brazil signs for Gripen NG

Saab has signed a contract with the Brazilian Ministry of Defence through the Aeronautics Command, COMAER, covering the development and production of 36 Gripen Next Generation (NG) fighters for the Brazilian Air Force. The total order is worth approximately SEK 39.3 billion. Saab and COMAER have also signed an Industrial Co-operation contract to deliver substantial technology transfer from Saab to Brazilian industry. Lennart Sindahl, Deputy CEO of Saab's aeronautics business confirmed that the single-seaters will be similar to the E-model Gripens under development for the Swedish Air Force. As part of a technology transfer plan, the two-seaters will include some Brazil-specific design features. Co-design with Saab of some aspects of the two-seaters will open a new phase of development, especially Embraer's, military aircraft capabilities.



A year earlier, on 18 December 2013 Brazil had selected the Gripen NG through the F-X2 evaluation programme. Since then the parties have negotiated to finalise the contract which (initially) comprises 28 single-seat and eight two-seat Gripen NGs. Saab and COMAER have also signed a contract for industrial co-operation projects, including technology transfer to Brazilian industry, to be performed over approximately ten years.

Gripens are currently in operational service with the Swedish, Czech, Hungarian, South African and Royal Thai Air Forces, and also with the UK Empire Test Pilots' School (ETPS). The Gripen NG for Brazil and Gripen E for Sweden share attributes of the next-generation Gripen design, but are also tailored to each country's specific national requirements.

## 1st retrofitted Rafale 'Marine'

On 3 October, Dassault Aviation delivered Rafale M10 to the French defence procurement agency (DGA), first of a tranche of ten retrofitted Rafale Marine (Navy) aircraft. These ten Rafale aircraft (M1 to M10) were produced from the late 1990s to replace the F-8 Crusader aircraft that provided air defence for the French navy since 1964. As this replacement could not wait for the service entry of the versatile F2 and F3 standards, the ten Rafale Marine were completed to the designated basic F1 standard, limited to



superiority and air defence missions only. All other French Navy (and Air Force) Rafale aircraft are currently built to the F3 standard. The aircraft that were produced to the F2 standard have been converted to the F3 standard.

The F3 standard provides the Navy and Air Force Rafales with complete versatility to carry out interception and air-to-air combat with air-to-surface weapons and nuclear deterrence with the ASMP-A missile.

### More F-35s for Israel

Israel will increase its acquisition of Lockheed Martin F-35 Lightning II fighters by another 25 aircraft, bringing its fleet to 44 of this fifth-generation type. This was recently approved “in principle” when Israeli Defence Minister Moshe Ya’alon met with his US counterpart, Defence Secretary Chuck Hagel, in Washington DC. Israel has already purchased 19 of the aircraft at a cost of \$2.75 billion, the first two F-35s due to arrive in Israel by early 2017 and the rest to be delivered by 2018. The F-35’s wings will be built in Israel by Israel Aerospace Industries (IAI), which will begin delivery of these to Lockheed Martin in mid-2015. The decade-long contract for F-35 wing production is part of Lockheed Martin’s plan to share manufacturing costs and responsibilities among its partner nations. IAI has invested substantially in the advanced systems and technologies required to produce the wings since signing the contract in April 2013.



### France orders A330 MRTT

The French Government has confirmed selection of the Airbus A330 multirole tanker transport (MRTT), with 12 of the type to replace its Boeing C/KC-135s from late this decade.



Announced on 20 November, the development will lead to the French air force receiving a first A330 MRTT in 2018 and a second in 2019, according to Airbus Defence & Space. “The contract agreed between the French [DGA] procurement agency and Airbus Defence & Space is now ready for official award,” the company stated. Once produced, the French aircraft will be the first to be produced in an improved next-generation standard, outlined by Airbus earlier this year. In addition to the 12 tanker/transport, the deal with France will also cover development and qualification activities, personnel training and an initial five-year package of in-service support services, Airbus says.

France follows Australia, India, Qatar, Saudi Arabia, Singapore, the United Arab Emirates and the UK in selecting the type, although India and Qatar have yet to conclude their planned respective orders for six and two of the aircraft.

### Japan selects Osprey, Global Hawk and Hawkeye

The Japanese Government has officially decided to procure the V-22 Osprey for its military tilt-rotor requirement, as well as the Global Hawk unmanned surveillance system and E-2D Hawkeye command and control aircraft. The choice of the Osprey, while widely expected ever since the country laid out a requirement for 17 such aircraft in its National Defence Programme



Guidelines, released in April, may have political ramifications for the government of Japanese Prime Minister Shinzo Abe.

Navy spokesman Billy Ray Brown said the service will work with Japan on a foreign military sales process. "Japan's announcement of the selection is validation that the V-22 meets its requirements," Brown said in a statement. "As the first production tiltrotor aircraft, the V-22 has proven itself capable in a number of roles. We look forward to continuing our support of the long-standing allied relationship between the US Government and Japan."

Meanwhile, the Japanese have also selected the Global Hawk, designed by Northrop Grumman and currently in use by the US Air Force, while Northrop's E-2D Hawkeye was also chosen to augment maritime command and control over the sea. Japan has been focused on building up its surveillance assets in the region as neighboring China has become increasingly aggressive. The two nations are locked in a cold war over the Senkaku islands, claimed by both China and Japan as part of their territory.

### Mexico orders more Airbus C295 aircraft

Mexico has signed a contract with Airbus Defence and Space for the acquisition of two additional Airbus C295 medium transport aircraft for the Mexican Navy. The agreement takes to 22 aircraft the total Airbus Defence and Space fleet in operation in the country, the biggest in Latin America. The Mexican Navy, which is already flying four C295, six CN235 and two C212 aircraft, will operate these two new aircraft on a diverse range of transport missions for military, civil protection and humanitarian purposes.

### F-35C makes first aircraft carrier landing

The F-35C made its first aircraft carrier landing on 3 November aboard the USS *Nimitz*, off the coast of San Diego. The F-35 Joint Strike Fighter is the most expensive weapons programme in American history and has been plagued by technical glitches and budget issues, but the successful landing at sea hailed as "a major step forward" by the Pentagon. The test flight saw the Joint Strike Fighter touchdown successfully, with the pilot guiding the plane so its tailhook snagged on the ship's arresting wires.



### Additional Apaches for US Army

An additional 21 Boeing AH-64E Apache attack helicopters will be ordered as part of the US Army's Aviation Re-structure Initiative (ARI), the Apaches as direct replacement for the same number of OH-58D Scout helicopters. The latter are being retired under the ARI and Apaches are taking on the armed scout role



previously assigned to the Kiowa Warriors. The additional aircraft will also 'help the Army reach its acquisition objective earlier, contribute to manned-unmanned teaming and reduce overall unit costs by increasing production efficiencies.' The Apaches would be ordered during Fiscal 2015 along with 25 AH-64Es requested by the President.

### A-29s for Afghan Air Force

The US Air Force base at Moody, Georgia will serve as the training location for Afghan Air Force Embraer A-29 pilots and maintenance personnel. For the 20 A-29s on order, 17 USAF instructor pilots and 24 maintenance and support personnel will train 30 Afghan pilots and 90 Afghan maintenance personnel over a four-year period, following which, the multi-role Super Tucanos will be delivered to Afghanistan.



## Czech L-159 for Iraq



Aero Vodochody has confirmed the purchase of L-159 ALCA light combat aircraft from the Czech Air Force for re-sale to Iraq. Aero will re-purchase 15 aircraft (11 retired and four active examples), and will then deliver 12 to Iraq (10 single-seaters and two twin-seaters).

## Upgraded F-16s for PAF



The final four F-16s modernised by Turkish Aerospace Industries (TAI) for the PAF were handed over to the Pakistan Air Force during a ceremony at TAI's facilities in Ankara on 2 September. The F-16s were upgraded by TAI on behalf of the PAF under the Pakistan F-16 Modernisation Programme, which involved 41 PAF F-16s with upgraded avionics and structural enhancement.

## Gripens for Slovakia



The governments of Sweden, the Czech Republic and Slovakia have signed a letter of intent paving the way for co-operation on the Saab Gripen fighter. The objective is to provide bilateral, common airspace surveillance and protection for Slovakia and the Czech Republic and involves Gripen fighters to be operated by the Slovak Air Force after 2016.

## Israeli Air Force inaugurates Flight Training Centre for the M346

The Israeli Air Force has inaugurated its new Flight Training Centre for the M346 Trainer at Hatzetim Air Force Base. Elbit Systems, the prime contractor, developed and delivered the new 'Lavi' Ground Based Training System (GBTTS) centre together with AleniaAermacchi (Finmeccanica Group), CAE and Sellex ES (Finmeccanica Group), following a selection by 'TOR - Advanced Flight Training', which is responsible for the operation of the trainer aircraft. Elbit Systems will provide the GBTTS centre with logistics services for twenty years. This comprehensive training solution was selected by the IAF, so the pilots and WSOs will be ready and qualified to progress directly to 4th and 5th generation fighter aircraft (F-16, F-15, and F-35).

## IAI's Heron UAS in Australia

Israel Aerospace Industries' (IAI) Heron unmanned aerial system (UAS) will return to Australia from Afghanistan, as part of a plan "to ensure that Royal Australian Air Force (RAAF) pilots maintain the necessary skills to operate unmanned aerial systems until the introduction of the future UAS, Triton." Once back in Australia, the Heron UASs will be used for training purposes, providing Australia with greater opportunities for training, and developing robust tactics, techniques and procedures for operating complex UAS platforms. This will also aid integration (of the UASs) into Australian airspace. The Heron can also be used at the request of state governments for civilian roles, such as assistance during natural disasters.



## Mi-17V-5s delivered to Afghanistan

The delivery of Mi-17V-5 military-transport helicopters to the Afghan National Army was completed in October 2014. Since the contract between Rosoboronexport and the US Department of Defence was signed in 2011, 63 helicopters produced at Kazan Helicopters, part of Russian Helicopters, have been delivered to Afghanistan.



Rosoboronexport has proven itself to be a reliable supplier of military helicopters and in implementing the contract to supply Mi-17V-5 helicopters to Afghanistan and vigorously evaluated by its US partners. Mi-8/17 helicopters have shown that they perform well in Afghanistan, with its challenging climate and mountainous areas. The helicopters supplied assist with the successful support of the Afghan National Security Forces (ANSF).

## Special Operations Chinook MH-47G

Boeing has completed initial flight and delivery of the first new build MH-47G configured Chinook helicopter for the US Army Special Operations Aviation Command, a month ahead of schedule. The new build MH-47G configuration incorporates a number of production improvements to include the digital advanced flight control system, more robust, improved monolithic machined-frames and improved air transportability. The entire programme, valued at approximately \$300 million, calls for eight aircraft deliveries through 2015.



## 300th CH-47F Chinook for US Army

75 days ahead of schedule, Boeing has delivered the 300th CH-47F Chinook helicopter to the US Army. The CH-47F has a modernised airframe, Common Avionics Architecture System (CAAS) cockpit that improves crew situational awareness and the Digital Automatic Flight Control System (DAFCS), which offers



enhanced flight-control capabilities for the multitude of conditions in which the helicopter is used. Since the completion of the first CH-47F Chinook in 2006, 18 US Army and National Guard units have been trained and equipped with the aircraft.

## Decade of Sikorsky's S-92 Helicopter

September marks the 10-year anniversary of delivery of the first production S-92 helicopter. The first S-92 helicopter was delivered to PHI, Inc. in September 2004 and since then; Sikorsky has delivered more than 200 S-92 helicopters to operators throughout the world. The fleet has reached more than 750,000 flight hours, with nearly 90 percent of those hours providing offshore oil and gas worker transportation. S-92 helicopters also perform search and rescue missions, heads of state missions, and a variety of transportation missions for utility and airline passengers.

For the US President, 'Marine One' will be based on the S-92 helicopter, increasing the number of countries that fly heads of state missions using the S-92 aircraft to over ten.



## Thailand orders EC645 T2 and EC725



Thailand's navy and air force will receive two mission-ready Airbus Helicopters rotorcraft types: the light-utility EC645 T2 and the 11-ton-class EC725. The Royal Thai Navy has signed for five EC645 T2s to be deployed on transport duties and other missions, with deliveries scheduled to begin in 2016. Its purchase represents the first export order of this militarised version of the EC145 T2, which is the newest and most powerful model in Airbus Helicopters' proven EC145 light twin-engine helicopter family.

## Indonesia acquires 11 AS565 MBe Panthers



Eleven Airbus Helicopters' AS565 MBe Panthers have been ordered by Indonesia, to be used in naval anti-submarine warfare (ASW) missions. Scheduled for deliveries within three years, the AS565 MBe helicopters will be supplied by Airbus Helicopters to PT Dirgantara Indonesia, which will outfit these rotorcraft in-country with mission equipment before delivery to the Indonesian Navy. The mission equipment includes the Helicopter Long-Range Active Sonar (HELTRAS) dipping sonar and torpedo launching system, providing a truly effective mission system for operations from land bases and ships.

## China's Sea Eagle Z-18F

The new anti-submarine helicopter apparently intended to serve aboard the Chinese aircraft carrier *Liaoning* and Type 071 amphibious warfare ships, the Z-18F Sea Eagle, is a version of



the modernised Changhe Aircraft Industry Group (CAIG) Z-8F. At least two Z-18F prototypes are known to be under testing. The helicopter is equipped with a large surface search radar under the nose and a sensor turret on the starboard side. A dipping sonar is likely deployed through a hatch beneath the fuselage. Four hardpoints on the fuselage sides will carry torpedoes and anti-ship missiles. A sonobuoy dispensing system is found in the rear loading ramp. Previously identified military versions of the Z-8F comprise the Z-18YJ for maritime airborne early warning and the Z-18 White Heron utility/VIP transport.

## J-11 "jinks around" P-8 Poseidon

The US Department of Defence has strongly reacted to the "interception" of a US Navy Boeing P-8A Poseidon by a Chinese PLANAF J-11 fighter, the incident taking place over international airspace in the Pacific Ocean, approximately 135 miles (217km) to the east of Hainan Island. According to the US, the patrol aircraft was on a routine mission when intercepted by an armed PLANAF Shenyang J-11BH. Pentagon officials stated that the Chinese fighter made several passes and crossed under the aircraft, one pass having only 50-100 ft of separation. "The Chinese jet passed the nose of the P-8 at 90 degrees with its belly toward the P-8 Poseidon, we believe to make a point of showing its weapons load-out, according to Rear Admiral John Kirby. "They flew directly under and alongside the P-8, bringing their wingtips to within 20 ft and then conducted a roll over the P-8, passing within 45 ft."



Meanwhile, China's Ministry of National Defence described the intercept as "routine identification and verification" and requested the US stop its "close-in reconnaissance activities against China".

### Pakistan and Russia in military cooperation

On 20 November, the Governments of Pakistan and Russia signed a landmark military cooperation agreement to strengthen their defence ties and lay out future avenues of cooperation. The agreement took place during the Russian defence Minister Sergei Shoigu's visit to Islamabad, the first of any Russian defence minister in nearly forty five years.



“During the meeting we agreed that bilateral military cooperation should take on a more practical orientation and enhance the combat capability of our armed forces,” said Shoigu. While the exact terms of the agreement are not publicly known, Shoigu added that naval exercises will be a key feature of future cooperation with Pakistan, as well as arms sales, military officer exchanges, and counternarcotics and counterterrorism cooperation.

The meeting is seen as an important step in strengthening bilateral ties, especially in light of Pakistan's close military ties with the US and India's with Russia. Moreover, with the withdrawal of US troops from Afghanistan, shared security concerns between the two nations have come to the fore. The sale of Mi-35 attack helicopters was highlighted during the defence minister's visit.

“The signing of the Military Cooperation Agreement between the two significant countries of the region is a milestone. Both sides will translate this relationship in tangible terms and further strengthen military-to-military relations,” said Pakistan's defence minister Khawaja Asif, further reiterating the need for building stability in the region.

### First A320neo in maiden flight

The first A320neo made its first flight from Toulouse-Blagnac Airport France on 25 September. This aircraft, MSN6101 with registration F-WNEO, is powered



by Pratt and Whitney's Pure Power engines and started assembly in March of this year, followed by roll-out in July.

### CFM's LEAP engine

CFM International's LEAP engine was airborne for the first time on 6 October on a modified 747 flying testbed at GE Aviation Flight Test Operations in Victorville, California, launching the next phase of testing for the advanced engine programme.



The engine “behaved well and completed multiple aeromechanical test points at various altitudes during the nearly three-hour first flight.” Over several weeks, the engine will complete a comprehensive test schedule that will gauge engine operability, stall margin, performance, and acoustics. The LEAP-1A/-1C variants are on track for engine certification in 2015.

### Eastern Air Lines sign for 40 MRJs

Mitsubishi Aircraft Corporation has signed a definitive agreement with Eastern Air Lines Group, Inc. for the purchase of twenty firm MRJ90 aircraft with purchase rights to an additional twenty MRJ90 aircraft. A definitive agreement was reached on 22 September and deliveries are scheduled to commence in 2019.

Thus far, 335 MRJ (171 firm, 160 option, 4 purchase rights) are on order, including 25 (15 firm, 10 option) from All Nippon Airways Co. Ltd., 100 (50 firm, 50 option) from Trans States Holdings, Inc., 200 (100 firm, 100 option) from SkyWest, Inc., 10 (6 firm, 4 purchase rights) from Air Mandalay Limited. This order brings the current number of orders for the MRJ to 375 aircraft (191 firm, 160 option and 24 purchase rights). In addition, Mitsubishi Aircraft signed a Letter of Intent (LOI) with Japan Airlines (JAL) to order 32 MRJ aircraft.

### 50 Bombardier CSeries aircraft ordered



Bombardier Commercial Aircraft has announced that a wholly owned affiliate of Macquarie AirFinance has signed a firm purchase agreement for 40 CS300 jetliners and taken options on an additional 10 CS300 aircraft. Macquarie AirFinance, which currently owns or manages 136 jet aircraft leased to 73 operators in 43 countries across six continents, will lease the CS300 aircraft to airline operators around the world. Delivery of the aircraft will be on a phased basis from 2017 to 2019.

### Design Award for Recaro

Recaro Aircraft Seating has been awarded the 'German Design Award 2015' for their design of the business class seat CL6710. This award is given to products whose design exhibits particularly noteworthy solutions. "We are very pleased that we were able to convince the high-profile panel of experts from the 'German Design Council' of our highlight product CL6710," said Dr. Mark Hiller, Chief Executive Officer and Shareholder of Recaro Aircraft Seating. With the establishment of the design department nearly 20 years ago, Recaro Aircraft Seating launched a multi-year process in which the areas of design, ergonomics, prototyping, and engineering were continuously built up.



### AW139 for Samsung



AgustaWestland has handed over two AW139 helicopters to Samsung Techwin Co. Ltd. of the Republic of Korea to be used for corporate transport. The delivery includes the 700th AW139 setting a major production milestone coming approximately ten years after its introduction into service in which time it has set the new standard in its category and "become the bestselling aircraft in the intermediate twin category."

### Beijing Automotives orders 50 AW helicopters

AgustaWestland has signed a contract with Beijing Automotive Industrial Corporation (BAIC) of China for the purchase of 50 AgustaWestland helicopters of various models for parapublic missions. The contract, signed in the presence of Italy's Prime Minister Matteo Renzi and China's Prime Minister Li Keqiang, marks the first step towards a strategic partnership between Fimeccanica - AgustaWestland and BAIC to provide also training, spare parts, technical support and customisation. The contract, that includes training, spare parts and technical support, excludes customer selected options and mission equipment.



## EC-135 for China's air ambulance

A new era in Chinese air ambulance operations began with Airbus Helicopters' delivery of a twin-engine EC135 as the first rotorcraft outfitted for dedicated helicopter emergency medical services (HEMS) missions in the country. During a ceremony at Airbus Helicopters' Donauwörth, Germany engineering and production site where the aircraft was assembled, the milestone EC135 was provided to the 999 Emergency Rescue Centre (999 Centre), which is a Beijing Red Cross Foundation subsidiary.



## 10 A320ceo aircraft for Eurowings

Lufthansa Group's supervisory board has approved the purchase of ten A320ceo aircraft for its subsidiary Eurowings. The new aircraft will become the backbone of the new low cost business model announced by the Lufthansa Group in July 2014, which foresees Eurowings operations on direct connections within Europe.

## SWISS orders 25 A320neo

Lufthansa Group's supervisory board has announced that SWISS, a member-airline of the Group, will expand its A320 fleet with a firm order for 15 A320neo aircraft, plus an additional ten of the type to be confirmed at a later stage. The fuel-efficient NEO fleet will gradually renew and replace SWISS' existing fleet of A320 Family aircraft.



## First A380 for Qatar Airways



Akbar Al Baker, Qatar Airways Group Chief Executive, and Fabrice Brégier, Airbus President and CEO, were together at Hamburg for ceremonies marking delivery of the first of its 10 Airbus A380 aircraft on order. All seats are equipped with the latest entertainment systems, and Qatar Airways' A380 will accommodate a total of 517 people – 461 in Economy, 48 in Business and eight in First Class, featuring the widest first-class seats in the industry. The aircraft has two full-length passenger decks: First and Business Class cabins will both be located on the aircraft's upper deck, along with a special lounge area for premium passengers.

## SriLankan Airlines A330-300s



SriLankan Airlines has taken delivery of its first A330-300 becoming a new operator for the type. The wide-body aircraft joins the airlines' existing fleet of A320, A321, A330-200 and A340-300 aircraft. SriLankan will take delivery of a further five A330-300s.

## China orders 70 A320 Family aircraft

China Aviation Supplies Holding Company (CAS) and Airbus have signed for the purchase of a total of 70 Airbus A320 Family aircraft, reflecting the strong demand from Chinese carriers for the



leading Airbus single-aisle Family for domestic, low cost, regional and international operations. At present, the in-service Airbus fleet with Chinese operators comprises over 1,000 aircraft (around 140 A330 Family and over 920 A320 Family aircraft). In the 20 year period between 2014 to 2033 Airbus forecasts a demand in China for more than 5,300 new commercial aircraft with over 100 seats plus freighters.

### Airbus A350-900 receives EASA Type Certification

The A350-900 received Type Certification from the European Aviation Safety Agency (EASA) on 30 September 2014, the certified aircraft powered by Rolls-Royce Trent XWB engines. Federal Aviation Administration (FAA) certification will follow shortly. "Receiving the A350-900 Type Certification from EASA is a great achievement for Airbus and for all our partners who have contributed to designing, building and certifying this fantastic, new generation aircraft. The A350-900 is now ready to fly from the nest and be enjoyed by airlines and passengers," said Fabrice Brégier, Airbus President and CEO. "The A350 XWB embodies many extra innovative technologies which make all the difference in passenger comfort and airline efficiency."



### Airbus A400M in airdrop tests

The Airbus A400M new generation airlifter has demonstrated its ability to airdrop multiple containers of the type used in military and humanitarian operations.

In tests conducted at Cazaux, France, the aircraft dropped 24 x 1 tonne Container Delivery Systems (CDS) in a single pass. This test



demonstrates the maximum capacity of the A400M for this type of container and is a key contractual requirement for the A400M. Meanwhile, the first Airbus A400M new generation airlifter for the Royal Malaysian Air Force is taking shape at the Airbus Defence and Space final assembly line in Seville, Spain. This aircraft will be delivered in the first quarter of 2015, followed by two more later in the year and the fourth and final aircraft in 2016. The first Airbus A400M new generation airlifter ordered by the German Air Force has made its maiden flight, marking a key milestone towards its delivery. The aircraft is the first of 53 ordered by the German Air Force and will be known in-service as the A400M Atlas.

## New Generation Saab Surface Radar "on track"



The first of Saab's new generation of Giraffe radars is in production and on track for delivery in 2016. Saab has also recently completed a further round of testing with the Giraffe 4A radar that again validated the system in a series of real-world operational scenarios. With the introduction of five all-new complementary Giraffe radars for land and sea, there is now a Giraffe option for all kind of needs in air

surveillance and air defence. Production of the first Giraffe 4A system for an undisclosed customer is ongoing at Saab in Gothenburg, Sweden.

## Raytheon and Rafael on Iron Dome

Raytheon has received a contract award from Rafael Advanced Defence Systems Ltd to provide products for the Tamir interceptor used in the defensive Iron Dome Weapon System. Raytheon will utilise its extensive technology resources and supplier network to provide a second source of supply for essential Iron Dome interceptor components. With more than 1,000 successful intercepts, Tamir is the only combat proven counter rocket, artillery, and mortar interceptor available for US and coalition partners extant.

## Textron Systems G-CLAW



Textron Systems Weapon & Sensor Systems G-CLAW precision guided weapon successfully completed a live-fire demonstration at the US Army's Yuma Proving Ground in Arizona. The GPS-guided G-CLAW struck within four metres of the designation spot and detonated on the target as intended, proving the weapon's guidance, warhead and its fuzing capability. G-CLAW is a lightweight precision guided glide weapon with a scalable blast fragmenting warhead designed to be highly effective against vehicle and personnel targets. The Textron Systems team demonstrated G-CLAW by dropping it from an altitude of 10,000 feet out of a Cessna Caravan aircraft equipped with a US Special Operations Command (USSOCOM) Common Launch Tube (CLT) dispenser.

## IAI's new Counter IED system

Israel Aerospace Industries (IAI) has unveiled its new Counter IED and Mine Suite (CIMS) - an integrated suite of sensors, for protection of tactical manoeuvring vehicles. Although mines and IEDs (Improvised Explosive Devices) are not new to the war scene, the use of these devices has become a matter of concern for modern armies both in regular and asymmetric warfare. The CIMS suite was designed under the premise that no single sensor can provide the adequate probability of detection and low false-alarm rate required by today's operational needs. The CIMS suite detects both surface and underground IEDs, mines, and roadside bombs, and consists of an ADS (Above-surface Detection System), and MIDS (underground Mine and IED Detection System). The ADS includes a groundbreaking side-looking SAR radar, high-resolution optical detection system and an infrared multispectral investigation system. MIDS comprises a Ground Penetrating Radar (GPR) and a magnetic detector.



## Green light for Turbomeca Arrius 2B2plus

Turbomeca (Safran) has announced EASA certification of the Arrius 2B2plus turboshaft engine which is specifically developed to power light single and twin helicopters: the 2B2plus powers the Airbus Helicopters EC135 T3. The 2B2plus is the latest member of the Arrius family, which recording 7 million flight hours and making it the most used engine family of its class on the

market. In addition to its unmatched reliability, it offers a number of advantages over existing models: the engine delivers a 6% power increase in hot and high conditions compared to the previous 2B2 version, strongly contributing to the T3 ability to carry more than 200 kg extra payload at the same altitude.

## Elbit Systems' 1,500<sup>th</sup> Enhanced Vision System

Elbit Systems' wholly owned subsidiary in the US, Elbit Systems of America LLC, has delivered its 1,500th Enhanced Vision System (EVS). Leading the industry in innovative vision systems, the Kollsman EVS is a key component of an aircraft's Enhanced Flight Vision System (EFVS) which is certified for full operational credits. When combined with a certified Head-Up Display (HUD), this system provides low visibility 'approach ban' relief and landing credits in North America and Europe.



The Kollsman EVS system is certified for use by both the Federal Aviation Administration (FAA) and European Aviation Safety Agency (EASA) on business and air transport aircraft in accordance with published EFVS regulations. It is currently installed on all aircraft models manufactured by Gulfstream Aerospace and is certified on B-757, B-767, B-777, and MD-10/11 wide body aircraft for the FedEx air transport fleet.

## Rolls-Royce Advance and Ultrafan CTi fan blades

The Rolls-Royce composite carbon/titanium (CTi) fan blade for the Advance and UltraFan engine designs has flown for the first time, marking another milestone for the programme. A set of the CTi fan blades successfully completed a first flight incorporated into a Trent 1000 'donor' engine, on a Rolls-Royce 747 flying test bed at Tucson, Arizona, USA. The Advance engine design will offer at least 20 per cent less fuel burn and O<sub>2</sub> emissions than the first generation of Rolls-Royce Trent engine and could be ready for entry into service from 2020. UltraFan, a geared design with



a variable pitch fan system, is based on technology that could be ready for service from 2025 and will offer at least 25 per cent less fuel and CO<sub>2</sub> emissions against the same baseline. CTi technology delivers lighter fan blades while retaining aerodynamic performance.

## MBDA Milan ER begins series production

On 15 October, MBDA completed the firing campaign to validate the series production of the Milan ER, as jointly scheduled with export customers. Four totally successful firings against fixed and moving targets confirmed the performance capabilities of the firing post, of the missile as well as of the warhead. This final technical step follows the qualification of the Milan ER weapon system that was achieved during the first half of 2014. MBDA will now be able to finalise the production work and deliver the first units in the spring of next year, as planned.



### MBDA's new light antiship missile

Sagem (Safran) has announced a contract with long-standing partner MBDA to develop and produce the infrared seeker for the upcoming light antiship missile, the ANL/Sea Venom, a joint French-British programme launched within the scope of the Lancaster House treaty signed in November 2010.

Developed by MBDA, this new-generation tactical missile will be deployed by a number of different helicopters, including the Royal Navy's AW159 Wildcat, and the French Navy's Panther Marine and NH90 and will replace current missiles such as the Sea Skua and AS15TT. Sagem, as prime contractor for the ANL/Sea Venom seeker, also chose the British company Selex ES Ltd to participate in its development and production.

Sagem's seeker for the ANL/Sea Venom is based on uncooled detectors. Operating in demanding environments, the seeker will support the acquisition and tracking of surface targets (fast landing craft, light combat vessels) and land targets.

### Mi-38 production prototype makes first flight



The fourth prototype of the new multirole Mi-38 helicopter has carried out a series of ground runs and completed its first flight at Russian Helicopters' (part of State Corporation Rostec) Kazan Helicopters' test flight centre. The Mi-38 fourth prototype differs from that of the third prototype in its shock-resistant fuel system and larger windows. Like the third prototype, the fourth prototype of the Mi-38 is equipped with twin TV7-117V turboshaft engines manufactured by Klimov. The engines' power shafts are in a forward position and are located behind the main gearbox, which significantly reduces the level of noise in the cabin.

### Mi-171A2 with KBO-17 avionics

Russian Helicopters and Concern Radio-Electronic Technologies (KRET), both part of State Corporation Rostec, have started testing the Mi-171A2 helicopter fitted with the KBO-17 on-board avionics suite, developed at the Ulyanovsk Instrument Manufacturing Design Bureau (part of KRET). For additional flight safety, the Mi-171A2 is fitted out with GPS/GLONASS



satellite system displays, mapping, flight-plan navigation systems (VOR/ILS), meteorological information and automated obstacle warning systems.

### Sikorsky's S-97 Raider presented

Sikorsky Aircraft has unveiled the first of two S-97 Raider helicopter prototypes, signalling the start of activities in the programme's test flight phase and a major step toward demonstrating the new – and first – armed reconnaissance rotorcraft featuring X2 Technology designed for military missions. Based on Sikorsky's



rigid X2 rotor coaxial design, the S-97 Raider helicopter features next-generation technologies in a multi-mission configuration (armed aerial scout or light assault), capable of carrying six troops and external weapons. Sikorsky will offer the Raider aircraft as replacement for the US Army's OH-58D Kiowa Warrior helicopter fleet based on the Army's future operational and financial priorities, and for the special operations platform.

### Elbit Systems using SkyVis

Elbit Systems completed a series of successful helicopter flight tests in Zurich, using the SkyVis Day/Night Head Mounted Display (HMD) onboard an AW-109SP helicopter of the Swiss air rescue company Rega. By improving flight safety and situational awareness, SkyVis enables flight in limited visibility conditions, increasing the total number of rescue missions that can be safely executed and potentially saving more lives. Elbit Systems teamed with Rega to demonstrate this capability.



### Airbus DS and DCNS in cooperation

Airbus Defence and Space and DCNS have signed a cooperation agreement to develop the TANAN, a ship-based helicopter UAS capability. Airbus Defence and Space will produce the entire certified unmanned aerial system, the vehicle with its payloads, the datalink and the UAS control station, while DCNS will carry out the integration of the UAS on the ship and into its combat system.

“Flexible and versatile, with a powerful tried-and-tested diesel engine and state-of-the-art equipment, TANAN is a perfect addition to ship-based helicopters.” By integrating UAS onto combat ships, the latter’s detection range and ability to accurately identify threats can be increased, while simultaneously ensuring operational availability.



### The A321 PTF programme

Airbus Group’s EFW is seeking authorisation to start offering an Airbus A321 passenger-to-freighter conversion programme, which could be formally launched in January 2015, with a view to undertaking conversions from 2017. The conversion cost target is projected at \$4million. According to sources, many aircraft are available, especially from operators that have ordered the A321neo variant, orders for the current-generation A321 having surpassed 1,500. The latest A321 conversion plan comes after California-based modifications specialist PacAvi Group announced a new programme for A320/A321 aircraft passenger-to-freighter conversions, with initial deliveries set for 2017.



### The MRJ 70 and 90 will “stay regional”

Mitsubishi Aircraft will not build a commercial aircraft beyond 100 seats so as to avoid competition with long-time partner Boeing. MHI’s chairman of the board Hideaki Omiya said, “We prefer to work together with them, so we are not going into the more than 100-seater market.” MHI, which is manufacturing the airframe and conducting final assembly of the MRJ at its Komaki South site near Nagoya has long been a supplier for Boeing and has workshare on almost all its programmes, from the 737 to the 777 and 787. Mitsubishi will roll out its MRJ70 after the larger MRJ90 has entered service in 2017 and also plans to produce a 100-seat version of the regional jet, but has so far been non-committal on when the project will be launched.



### New contract will maintain Gripen E momentum

Saab has received its latest contract from Sweden’s Defence Materiel Administration linked to the development of the Gripen E multirole fighter. Valued at AKr5.8 billion (\$804 million), the deal covers the provision of undisclosed role equipment, as well as support and maintenance equipment from 2016. This is the fourth such award to have been placed so far for the Gripen E, following others associated with development and production activities. “Work with Gripen E goes according to schedule and budget,” stated Lennart Sindahl, head of the company’s Aeronautics business area. Saab will fly three prototypes of the single-seat type from the second half of next year. It will deliver a minimum of 60 new-build Gripen Es to the Swedish air force between 2018 and 2026, although the Service has expressed a desire to eventually increase its fleet to 80.



## Overhaul of the HMS Halland

Saab has received an order from the Swedish Defence Materiel Administration (FMV) to overhaul the submarine HMS *Halland*, which includes all the necessary measures to ensure the submarine's operational availability. As per HMS *Halland*'s standard maintenance plan, this type of overhaul is conducted every six years. One provision of the contract is to define future needs for maintenance, which could result in additional work being contracted separately during the period.



## Successful firing of MdCN

The French DGA (*Direction Générale d'Armement*) has successfully carried out the final qualification firing of the MdCN system (Missile de Croisière Naval, also known as NCM or Naval Cruise Missile). The firing, which took place on 27 October at the DGA's Missile Test Centre at Biscarosse (Landes) on France's



Atlantic coast, represented a missile launch from a frigate. The firing enabled the full scope of flight objectives to be satisfied, particularly regarding the demonstration of the missile's range performance. This success was a result of the intense and coordinated efforts of a number of state participants (notably the DGA's test and evaluation centres and the French Navy) as well as industry (MBDA France). MdCN will equip the French Navy's FREMM (multi-mission frigates) during 2015 and its *Barracuda* submarines around 2018.

## LM delivers the 200th Romeo to US Navy

The US Navy received its 200th submarine-hunting MH-60R 'Romeo' helicopter from Lockheed Martin following a patch signing with Helicopter Maritime Strike Squadron Seven-Two (HSM-72). The cornerstone of the US Navy's anti-surface and anti-submarine operations, MH-60R helicopters have flown more



than 250,000 hours in operation with the Fleet, providing increased surveillance and situational awareness.

Manufactured by Sikorsky and provided with advanced mission systems and sensors by Lockheed Martin, the MH-60R employs a modular design, which refers to the ability to modify weapon systems to match specific mission requirements. The US Navy is projected to acquire 291 MH-60R helicopters.

## Diehl and Elbit to supply DIRCM for German A400Ms

Elbit Systems has been awarded a contract from Diehl BGT Defence to provide J-MUSIC Multi-Spectral Directed Infrared Counter Measure (DIRCM) systems for the first phase of the German Air Force's Self-Protection programme for its new Airbus A400 aircraft. The contract will be performed over approximately one-year and is in an



amount that is not material to Elbit Systems. Designed to protect large military and commercial aircraft against attacks by ground to

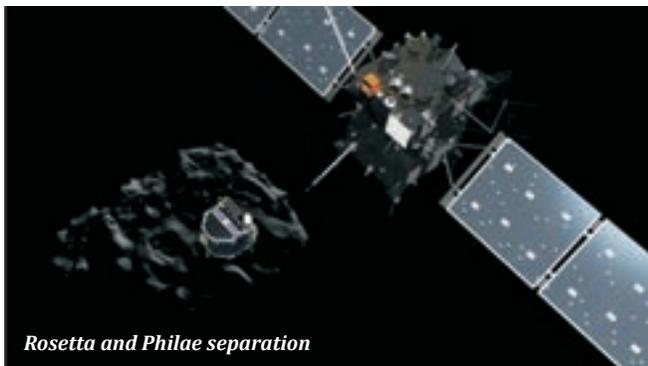


air heat seeking man-portable missiles (MANPADS), the J-MUSIC systems, will be integrated into a multi-turret DIRCM system, ensuring 360° protection of the aircraft. Elbit Systems has completed extensive testing of the J-MUSIC system and has already delivered systems to equip several types of aircraft to various customers. The C-MUSIC DIRCM system, another member of Elbit Systems DIRCM family, was developed for the Israeli National “Sky Shield” program, for the protection of the Israeli large commercial aircraft fleet.

## Aegis Combat System in latest flight tests

The Lockheed Martin, US Navy and Missile Defence Agency team’s Aegis Combat System, on USS *John Paul Jones* (DDG-53), successfully completed two flight tests in three weeks. This is the first time the Aegis Ballistic Missile Defence (BMD) weapon system employed the Baseline 9 configuration to detect, track and engage targets. Aegis Baseline 9 is the latest combat system evolution that increases the number of BMD ships and provides the surface fleet the most advanced air defence capability ever. Under the Baseline 9 configuration, Aegis moves toward commercial-off-the-shelf and open architecture technologies and merges BMD and anti-air warfare into its integrated air and missile defence capability. The central component of the Lockheed Martin-developed Aegis BMD Combat System is the SPY-1 radar. Deployed on more than 100 ships worldwide, it is the most widely fielded naval phased array radar in the world. The Aegis system and SPY-1 radar provide the US and allied nations with advanced surveillance, anti-air warfare and missile defence capabilities.

## Rosetta’s comet lander ‘Philae’ on comet



*Rosetta and Philae separation*

On 12 November 2014, the European Space Agency’s Rosetta mission successfully landed on the surface of comet 67P/Churyumov-Gerasimenko. Descending at a speed of about 2 mph (3.2 kilometers per hour) the lander, called *Philae*, first touched down and its signal was received shortly after.

Partially due to anchoring harpoons not firing, and the comet’s low gravity (a hundred-thousand times less than that of Earth), *Philae* bounced off the surface and flew up to about six-tenths of a mile (1 kilometre) both above the comet’s surface as well as downrange. Almost two hours after first contact, *Philae* again touched down. A second, more modest bounce resulted, again sending it airborne. *Philae*’s third contact with the comet’s nucleus was the charm: the Rosetta mission’s *Philae* lander became the first spacecraft to soft-land on a comet.



*Philae touches down on comet*

Rosetta mission controllers believe that *Philae* alighted in a hole, or crevice, about six feet (two metres) in diameter and six feet (two metres) deep and that it is lying on its side. While the lander remains unanchored to the surface, it remains stable and eight of its 10 instruments already sending back data..

“*Philae* is on the surface and doing a marvellous job, working very well, and we can say we have a very happy lander,” said Paolo Ferri, ESA’s head of mission operations at the European Space Operations Center, Darmstadt, Germany. Teams are still working to confirm the location and the overall power and thermal situation on board. The lander did receive power from some of its solar panels. It appears that some parts of the lander were in shadow during the time that last night’s surface telemetry data were being transmitted.

Launched in March 2004, Rosetta was reactivated in January 2014 after a record 957 days in hibernation. The mission consists of an orbiter and lander. Its objectives since arriving at comet 67P/Churyumov-Gerasimenko have been to study the celestial object up close in unprecedented detail, and prepare for the landing. The orbiter will hopefully continue tracking the comet’s changes as it sweeps past the sun.

## Recaro CL3710 seat takes off for the first time!

KLM Royal Dutch Airlines has ordered more than 6,000 CL3710 seats for its airliners. The seats will be successively installed in five new Boeing 777-300 aircraft. In addition, a total of 15 Boeing 777-200 aircraft of the existing fleet will be retrofitted with the CL3710. The seat will be used both in Economy Class as well as in Economy Class Comfort, where passengers can enjoy a wider seat pitch of 35 inches. One of the new features is the unique, ergonomic, six-way adjustable headrest with an extremely wide height adjustment range to easily accommodate passengers of different heights. It also provides optimised neck support that can be tipped horizontally.

## HMAS 'Canberra' handed over to the Royal Australian Navy

The newly built Landing Helicopter Dock (LHD) HMAS Canberra, built by Navantia, has been handed over to the Royal Australian Navy (RAN) by the Defence Materiel Organisation (DMO). This afloat vessel is the biggest naval vessel the RAN has, followed by a second LHD that will be finished and delivered to the RAN in 2015. This vessel has been acquired to aid with operational support for the ADF when on defence related missions and humanitarian missions. HMAS Canberra was 85% built in Spain by Navantia and finished in Australia by BAE Systems. Navantia was responsible for the construction of the hull, including the installation and integration of all the systems on board in the hull up to the fly deck.

## MBDA's Sea Ceptor selected for Brazil

The Brazilian Navy has selected MBDA's Sea Ceptor to provide the local area air defence for its next generation *Tamandaré* class corvettes. After the UK's Royal Navy (RN) and the Royal New Zealand Navy (RNZN), Brazil's is now the third navy to have chosen Sea Ceptor. With discussions also well advanced with other leading navies around the world, Sea Ceptor is rapidly establishing a significant user community. A production contract was awarded by the UK MoD in September 2013 for Sea Ceptor to provide the next generation Air Defence capability and so replace the Seawolf system on the Royal Navy's Type 23 frigates from 2016 onwards. Sea Ceptor will subsequently be transferred to the Royal Navy's new ships as they start entering service, when the Type 23s are replaced by the future Type 26's.

Sea Ceptor provides all-weather, night and day, 360° local area air defence coverage against multiple simultaneous targets including sea-skimming anti-ship missiles, helicopters and fast combat jets.

## Airbus Group sells part of its stake in Dassault Aviation

Airbus Group in an off-market block trade has sold to Dassault Aviation a total of 810,072 Dassault Aviation shares at a price

of € 980 per share, representing a total amount of around € 794 million pre-transaction costs. The French State has agreed to waive its rights under the shareholder agreement with Airbus Group, which provides in particular a right of first offer to its benefit, for this block trade, which represents approximately 8 percent of Dassault Aviation's share capital.

After this transaction, Airbus Group will hold 38.32 percent of Dassault Aviation's share capital and associated voting rights and then following the cancellation by Dassault Aviation of 9 percent of treasury shares, Airbus Group will own 42.11 percent of the Dassault shares with associated voting rights. Dassault Aviation has committed to support the implementation of these efforts and will place an order on 50 percent of the size of such placements, within a global limit of 5 percent of Dassault Aviation's share capital, at a maximum price of € 980 per share. Airbus Group has committed to serve Dassault Aviation with 50 percent of the shares sold and within the same global limit of 5 percent of Dassault Aviation's share capital, at the price of the relevant placement.

## Five Airbus DS Eagle Vision stations for USAF

Airbus Defence and Space has been awarded a contract for a system evolution and maintenance of the US Air Force's five Eagle Vision stations until 2019. Eagle Vision is the world's first lightweight deployable, commercial satellite imagery downlink ground system. It provides the users with a combination of optical, Synthetic Aperture Radar (SAR), medium and very high resolution capabilities supporting wartime operations, natural disaster relief operations and homeland defence preparations. The use of commercial satellites allows the data to be freely shared among the allied forces.



Today, the system is in its 4th generation and receives imagery from SPOT 6/7, TerraSAR-X/Tandem-X constellations operated by Airbus Defence and Space together with Radarsat and RapidEye. Upgrades of Eagle Vision are planned for receiving and processing data from WorldView and Pleiades satellites. Eagle Vision is sponsored by the US Air Force ISR Innovations office at the Pentagon and the programme management office at Hanscom Air Force Base.

# σε επιφυλακή\*



## The Kotroni Guards of Greece

Since 1986 the Kotroni Naval Air Base in Greece has been the heart of Hellenic Naval Aviation. Based at the small airport situated south of the town of Marathon is home to the fleet of Sikorsky S-70s and Agusta-Bell AB-212ASWs currently in operation by the Hellenic Naval Aviation (*Elliniko Polemiko Naftiko*). The two Alouette IIIs of the Hellenic Navy have been withdrawn from use since mid-2013 and are currently awaiting a decision on their fate. In 2012 additional flight training was conducted on this type to bridge the gap for 2013-2014 in which no new student pilots will be trained. In 2015 either flight training on the Alouette III will re-commence or the decision will be made co-ordinate with the Hellenic Army Flight School at Stefanovikio Air Base for initial flight training.



*Airbus Helicopters AS365 Dauphin of the Coast Guard*

\* (For those curious, the title stands for 'On Guard' in Greek)

In the early days of Hellenic Naval Aviation, helicopters were based at Hellinikon International Airport, Athens. With completion of the Naval Air Station Amphiali in 1977, all operations moved to this airfield. Amphiali consists of one helipad, one ramp and one hangar and would therefore be too small after arrival of the AB-212 helicopters in 1979. To facilitate the new helicopters, a new airfield was built in the Marathon area northeast of Athens. Naval Air Station Kotroni was completed in 1986 and with the arrival of all thirteen AB-212s, the Navy Aviation School was founded here in 1992 to train aviation professionals with special focus on Naval

operations. Further modernisation started in 1994 with delivery of the first S-70B-6 'Aegean Hawk' helicopters. Deliveries continued until 1998 and in 2007 an additional three S-70Bs were delivered to the unit.

Currently COMHELNAVHEL (Command Hellenic Naval Helicopters) is the overall organisation for all naval aviation operations and is also based at Kotroni. Under its command are three divisions and two squadrons. The first division is Naval Air Station Kotroni, responsible for all logistic and technical support. Then there is Naval Air Station Amphiali, which is available as a back-up airfield. The third

division is the Navy Aviation School (*Scholi Elikopteron Nafitikou*, SEN). The majority of student pilots start their training on the Alouette III, and this type is also used for the conversion to the AB-212 or the S-70B-6. Some students are imparted their initial flight training at the Army Camp at Stefanovikio.

Helicopter sensor operators are also trained at SEN, along with maintenance personnel and all shipboard helicopter teams. First Squadron (*1st Mira Elikopteron Nafitikou*, 1 MEN) provides personnel, facilities and assets for the AB-212s, while the second Squadron (*2nd Mira Elikopteron Nafitikou*, 2 MEN) does the same for the S-70B-6s. COMHELNAVHEL also has operational and administrative command over the Coast Guard Helicopter Squadron although this is an independent organisation belonging to the Hellenic Coast Guard General Staff.

"The First Squadron is responsible for the operational training of aircrew and maintenance of the eight AB-212ASWs currently on strength," said Commander Stavropoulos of the Hellenic Navy Helicopter Command. "The Second Squadron is responsible for the operational training of aircrew and maintenance of eight S-70B-6 and three S-70B helicopters.

"Our helicopters are capable of performing multiple tasks. Hunting enemy submarines and surface targets (ASW/ASuW) is high on our tasks lists."



Agusta-Bell AB212



Sikorsky S-70 firing Penguin ASM

ASW tasks can be performed by both the AB-212ASW as by the S-70s, both being equipped with medium frequency variable depth sonars. Three S-70Bs are equipped with the Low Frequency Helicopter Long Range Active Sonar (HELTRAS). Further, both helicopter types can deploy Mk44 and Mk46 torpedoes. For ASuW tasks, both AB-212s as well as S-70Bs are equipped with surface surveillance radar and AIS tracking system for detection of enemy surface targets. Additionally the S-70s can conduct passive electronic warfare, attack surface targets with Penguin or Hellfire missiles for which target acquisition is supported by an infra-red system. Other capabilities in which crews are trained are night flying (without NVGs), search and rescue, VERTREP (Vertical replenishment), fast roping and MEDEVAC missions.

“With decommissioning of the AB-212EW some years ago, electronic warfare capabilities were taken over by the S-70 fleet as of 2005. These are equipped with advanced electronic intelligence capabilities and provide valuable information to the Naval Forces at sea. Also the S-70 is able

to quickly provide an EOB (Electronic Order of Battle) which is crucial for the Naval Forces at sea,” observes Commander Stavropoulos.

“Currently one of the AB-212s has been equipped with an experimental in-house developed system which consists of a moving map and GPS to show the position of the helicopter. Inputs are received from sonar, radar and AIS in order to combine a holistic view of the battlefield. Furthermore a new Star Safire II FLIR (Forward Looking Infra-Red) system has been installed,” stated 1 MEN Commander ‘Vas’ Savvatis.

“The main difference in training, compared with the Air Force or Army is that our Naval Aviators are specialised in operations in a maritime environment. This particularly includes shipboard operations and special training in ASW and ASuW operations. The first stage of training doesn’t differ from training in the other two branches of the armed forces. The shipborne operations focus on land-launch operations, hoisting, fast roping, VERTREP and ASW and ASuW operations, especially at night. To conduct these exercises we are using a

SOPs (Standard Operational Procedures) manual,” explains Kotroni Naval Air Station Commander Bekiaridis. He is the first non-pilot to command the Station, having previously served as ASO/TSO on the S-70. The helicopter units are operated from the MEKO 200 HN frigates, which can accommodate one helicopter, or from the *Elli*-class frigates, which can host either one S-70 or two AB-212s. According to Commander Savvatis, as of March 2014, one of the MEKO frigates with a S-70, two pilots, two co-pilots, four SENSOs (Sensor Operators) and ten maintenance crewmen were involved in ‘*Operation Atalanta*’ to combat piracy off the coast of Somalia.

“Currently there are about eighty pilots attached with the units at Kotroni. In practice this means we have two flight crews per helicopter available. In order to meet our operational requirements we train on average two to three new pilots each year, except for 2013-2014 in which we had no Alouette IIIs available for initial training,” concluded Commander Stavropoulos.

“The training path consists of two stages,” continued Commander of 2 MEN



Close up of the Penguin ASM mounted on the S-70



*Pair of Sikorsky S-70s*

Theodoros Tsiros. “All Naval Aviators start with Basic Pilot Training on the Alouette III. Upon successful completion, the training will continue to the next stage with either the AB-212 or S-70. Both stages consist of a ground school element and flight training. Especially in the second stage, the student pilot receives advanced naval operations training on every type of warfare being conducted. This training is conducted both during day as well as night. The naval pilots are mainly trained for night flying under multiple threats and high level of stress in a VFR (Visual Flight Rules) environment. Students train 80 hours on the S-70 in order to qualify as a co-pilot. After around 500 flying hours a co-pilot can transfer to the status of pilot after an additional 80 hours of training. Based on our requirements we can then further train pilots to become instructors.”

Every six months a mandatory training exercise has to be conducted by all pilots for night operations. These exercises cover 20 hours of night operations, such as hoisting exercises, dipping (ASW) operation and so on. The level of difficulty is adjusted to match the experience of the pilot undertaking the exercise. Training of

the S-70 pilots starts on the older S-70B-6 variants, and to achieve operational status on one of the three S-70Bs an additional 50 hours of training is required. Furthermore, both helicopter units cooperate on a regular basis with their foreign counterparts: with the Spanish Navy (SH-60s at Rota) and with Dubai and Sweden (AB-212). According to Commander Savvatis, “this has proven to be a cost effective manner of training pilots.”

The sole Coast Guard helicopter squadron was established in 2006. While it is subject to the Hellenic Navy Helicopter Command for administrative and operational control, it actually constitutes an independent organisation belonging to the Hellenic Coast Guard. The unit currently operates six Airbus Helicopters AS365 Dauphins nicknamed ‘Aegean Dolphin.’ Because there was no previous experience concerning helicopter operations in the Coast Guard, the Hellenic Navy is providing training to flight crews and maintenance personnel for the time being.

The Coast Guard squadron’s main tasks are search and rescue, pollution control, fishery protection and prevention of illegal

immigration. The first Aegean Dolphin arrived in February 2004 at Tatoi-Dekelia air base, and the Hellenic Coast Guard (HCG) Helicopter Squadron was commissioned here and was fully operational by June 2004. In December 2005 the HCG squadron moved to Marathon and was placed under the operational command of the COMHELNAVHEL in order to expand its operations with the expertise of the naval counterparts. There is a combined training programme installed to ensure that the HCG Helicopter Squadron is ready to take full advantage of the Dauphin’s capabilities.

“The plan of the Hellenic Naval Aviation is to establish a broadened Hellenic Naval Aviation Command under the Fleet Command. This will include both helicopter and fixed wing operations. Furthermore, there is an ongoing procedure for the acquisition of new training helicopters. The plan for the next five years is to maintain and boost operational availability and integrate fixed wing aircraft into a squadron under Naval Aviation Command,” concluded Commander Stavropoulos.

*Carlo Kuit & Paul Kievit/ Bronco Aviation*

# Believe it or not !



## C-130 Carrier landing trials

*Image taken from video of the KC-130F coming in for a landing on the USS 'Forrester' in the fall of 1963. The US Navy aircrew in this KC-130 tanker would make twenty-nine touch-and-go landings and twenty-one full stop landings at increasingly heavier weights on three flights to the carrier*

In early March 2005, a crew from Marine Refueler Transport Squadron 352 (VMGR-352) at MCAS Miramar, California, picked up a new KC-130J—the fourth new aircraft for the squadron—from the Lockheed Martin facility in Marietta, Georgia. The unit's ongoing conversion meant that the time had come to retire the squadron's older aircraft.

Like nearly every other tanker in the US Marine Corps fleet, Bureau Number 149798 had seen its share of action in Vietnam, Iraq in Operation *Desert Storm*, Afghanistan, and Iraq again in Operation *Iraqi Freedom*.

Unlike most other aircraft that have served out its career, the final destination for this specific tanker was not to be the aircraft graveyard in Arizona. This aircraft was a little different. When the VMGR-352 crew shut this KC-130F's engines down for the last time on 1 March 2005, the aircraft was parked at Forrest Sherman Field, NAS Pensacola, Florida, where it was to be enshrined in what was then known as the National Museum of Naval Aviation.

"The fact that aircraft was finally retired in 2005 is proof that I didn't bang it up too badly," joked retired Rear Adm. Jim Flatley. In the fall of 1963, Flatley was the pilot who first landed this particular Hercules on an aircraft carrier.

### "This idea won't go anywhere"

"There were engineers taking measurements on a Hercules and saying it was going to land on an aircraft carrier," recalled Ed Brennan in a 1998 interview. "I didn't believe them. Later my commanding officer came around and said the same thing. I still didn't believe it, but I raised my hand to volunteer anyway. I had no idea what I was getting into."

Brennan, then an Aviation Machinist Mate First Class (ADR-1), was attached to Transport Squadron One (VR-1) at the Naval Air Test Centre at NAS Patuxent River, Maryland, when his commanding officer made that startling announcement—the Test Centre was indeed developing a programme to land a Hercules on an aircraft carrier. And Brennan, along with ADR-1 Al

Sieve, was to be the flight engineer assigned to the project.

The idea of taking a big aircraft with a 132-foot wingspan and landing it on what is frequently described as a postage stamp did seem farfetched. However, there was a legitimate operational requirement to test the carrier suitability of the Hercules.

There was an emergency need to resupply a carrier operating in the middle of the Indian Ocean, a common operation today but an unanticipated requirement forty decades ago. The Grumman C-1 Trader, then the Navy's carrier onboard delivery (COD) transport, did not have the required range nor could it carry an oversize payload like a General Electric J79 jet engine, which powered both the North American A-5/RA-5 Vigilante attack/reconnaissance aircraft and the McDonnell Douglas F-4 fighter bomber populating flight decks at the time. The C-130 had both range and cargo-carrying ability so the idea of a Super COD was born.

Once the project went forward, the Test Centre staff had to decide whether to

have pilots with multi-engine experience learn to land on a carrier or to have test pilots with carrier landing experience learn to fly multi-engine aircraft. Carrier experience won out.

“Either I was in the right part of the line or the other pilots said, ‘Give this one to Flatley. It isn’t going to go anywhere,’” said then-lieutenant Flatley, the newly minted test pilot chosen to lead the project. “In flight test, you have to earn your spurs. I had just reported to the Carrier Suitability Branch at Pax River and this was my first project as a test pilot. It was a rather unique assignment.”

Lt Cmdr WW “Smokey” Stovall, the lead test pilot on another project at the time, volunteered to be copilot on the C-130 trials.

The trials aircraft, 9798, was in service at MCAS Cherry Point, North Carolina, and was chosen at random. The aircraft was flown back to what was then known as the Lockheed-Georgia Company in Marietta on 8 October.

Only minor modifications were made to the aircraft: the wing refueling pods were removed, a precision airspeed indicator was installed in the cockpit, and the antiskid system was replaced with the type used on commercial 727s. The aircraft was also fitted with a smaller nose landing gear orifice, which allowed for slower metering of the hydraulic fluid and made for smoother touchdowns.

“The most critical guy on the crew was the flight engineer because he knew far more about the airplane than the two fighter pilots assigned to this short-term project ever would,” Flatley noted. “That sounds a little cavalier for a test pilot, but, at that point, we were not required to learn the aircraft, just to learn to fly it.”

## Practice, Practice

Lockheed test pilot Ted Limmer monitored Flatley and Stovall as they made their first flight from Marietta to check out the modifications. Limmer then gave the Navy pilots their check ride on the way back to Pax River. “The aircraft is so beautiful to fly and so simple to operate and it handles so well,” Flatley recalled. “Checkout was a piece of cake, especially with Petty Officers Brennan and Sieve doing all the work and worrying.”

Flatley and Stovall paid a lot of attention to the ground handling characteristics of the C-130 and then focused on the slow-speed



*On 8 November 1963, after making the three warm-up touch-and-go landings, Lt. Jim Flatley was cleared for the first full stop landing. The aircraft stopped in 275 feet, actually short of where the number four arresting cable would have been lying. Here, the aircraft is readied for takeoff on the deck of the ‘Forrestal’ after a full stop landing*

manoeuvring characteristics of the aircraft in its landing configuration. The crew began practicing landings at Pax River almost immediately. Engineers from the Carrier Suitability Branch set up multiple cameras and came out to observe the first practices and take extensive measurements. “For most of the next fifty-five flight hours, all we did was go around the field practicing short field landings and takeoffs,” Flatley said.

High on the list of things to be accomplished during the practice landings was to determine the optimum carrier approach speed for the C-130. While the normal approach speed for a Hercules is 115 to 120 knots, a decision was made to fly the carrier approaches at five to six knots above stall speed for the planned landing gross weight.

A second landing parameter that concerned the pilots was the aircraft’s sink rate at touchdown. Flatley and Stovall were used to flying carrier-based fighters that have a sink rate of about fifteen to twenty feet per second, so they were apprehensive about the C-130’s design limit of eleven feet per second. Even though the test data collected during the field trials indicated that sink rate was not going to be a problem, the pilots were not convinced until they actually made the test flights to the carrier.

One of the major challenges in the final stage of a carrier approach is mastering the so called rooster tail, the turbulent air that is the carrier equivalent of the ground effect encountered when an aircraft crosses the approach end of a runway. “If the rooster tail is not handled well, more often than not, your aircraft feels like it is being sucked into a hole right at the deck rounddown,” added Flatley. “So being able to fly the desired glidescope, right to touchdown, is critical.”

The crew found that they could easily fly the required 3.5- to 4.0-degree glidescope on a standard approach. “It became evident very quickly that landing a C-130 on a carrier was not going to be a problem. Even the engineers stopping coming out to watch us practice,” Flatley recalled.

A side trip to the Naval Air Rework Facility in Norfolk, Virginia, was made so engineers there could figure out how to get the Hercules off the ship if, for some reason, it got stranded aboard the ship during the trials. It was determined that the most practical solution would be to run a steel I-beam through the crew door and punch a hole on the other side of the fuselage and run another I-beam through the paratroop doors in the back. Those two I-beams would then be connected to a third I-beam suspended over the fuselage and a crane would be used



*The KC-130 weighed 85,000 pounds on the first landing. Thereafter, landings were made in progression up to a gross weight of 121,000 pounds. One landing at a weight of 109,000 pounds required 495 feet to stop and that was in a heavy squall. On the last takeoffs, the crew didn't even back up—they simply took off from the point on the deck where the aircraft stopped!*

to lift the aircraft off the deck if the carrier could make port conveniently.

“If we had broken down at sea, the deck hands would have lifted the plane up with the deck crane and tossed it overboard,” Brennan mused. “Hopefully, they would have let us get out first.”

### **To the boat**

On 30 October, the USS Forrester (CVA-59) was steaming off the Florida coast near Jacksonville. One wag at Pax River had painted, “Look Ma, No Hook,” under the copilot windows of the KC-130 because there wasn't one. An arresting hook, a normal piece of equipment for a carrier landing, wouldn't have helped either because the Forrester's flight deck had been cleared—the arresting wires had been removed to save wear and tear on the tires

of the Hercules. The deck was completely empty as the air wing's aircraft were either flown ashore or parked on the hangar deck.

“It was a blustery, squally day with a forty-knot wind gusting to sixty knots and huge ocean swells. The deck was heaving twenty feet up and down,” Flatley recalls. “Here is where a carrier pilot with knowledge comes in handy. Every two and one-half minutes or so, no matter what the sea state, the ship will steady out. Because of the excessive wind and sea state, we did forty-two approaches to ship just to get nineteen touch-and-go landings.” Those touch-and-goes revealed that there were no sink rates in excess of five feet per second, a fact that amazed even the Lockheed engineers.

The Hercules crew first made touch-and-goes on the ship's 682-foot-long angled

deck and then went down the 1,017-foot-long axial deck, where, on the next trip, the actual landings would be made. The first flight lasted five and a half hours, two of which were spent in the Forrester's landing pattern. Cameras placed all around the flight deck recorded the touch-and-goes from every angle.

“We had a skull session the next day with the flight test engineers back at Pax River, and all the data looked good,” Flatley notes. “It was then just a matter of rescheduling the ship.”

On 8 November, Flatley, Stovall, Brennan, Sieve, and Limmer approached the Forrester underway off Cape Cod, Massachusetts. A broad dotted white line painted down the middle of the axial deck greeted them on their first approach. The Forrester's skipper put the carrier into the

wind and added ten knots, which gave the flight crew a forty- to fifty-knot headwind over the bow.

After making the three warm-up touch-and-go landings, Flatley was cleared for the first full stop landing. The first approach made at seventy-nine knots indicated airspeed.

The Forrester's landing signal officer gave Flatley the traditional "cut" signal as the aircraft crossed the rounddown at ten to fifteen feet in the air. Flatley lifted the throttles over the gate and put the propellers into reverse pitch as he settled down on the deck. At the same time, he and Stovall stood on the aircraft's brakes so that, when the aircraft touched down, the KC-130 was in full reverse with full braking applied. It stopped at 275 feet, actually short of where the number four arresting cable would have been lying.

"We stopped so short it kind of startled me," said Brennan. "It was like landing on a normal runway, but that big metal island on the side of the ship just beyond the wingtip was a bit scary." It was the first time he had ever been on an aircraft carrier.

"Normally on a carrier, sailors and tractors move aircraft," Flatley says. "We simply backed up with reverse thrust to set up for takeoff. You should have seen the looks on the faces of the deck hands."

### Heavyweight landings

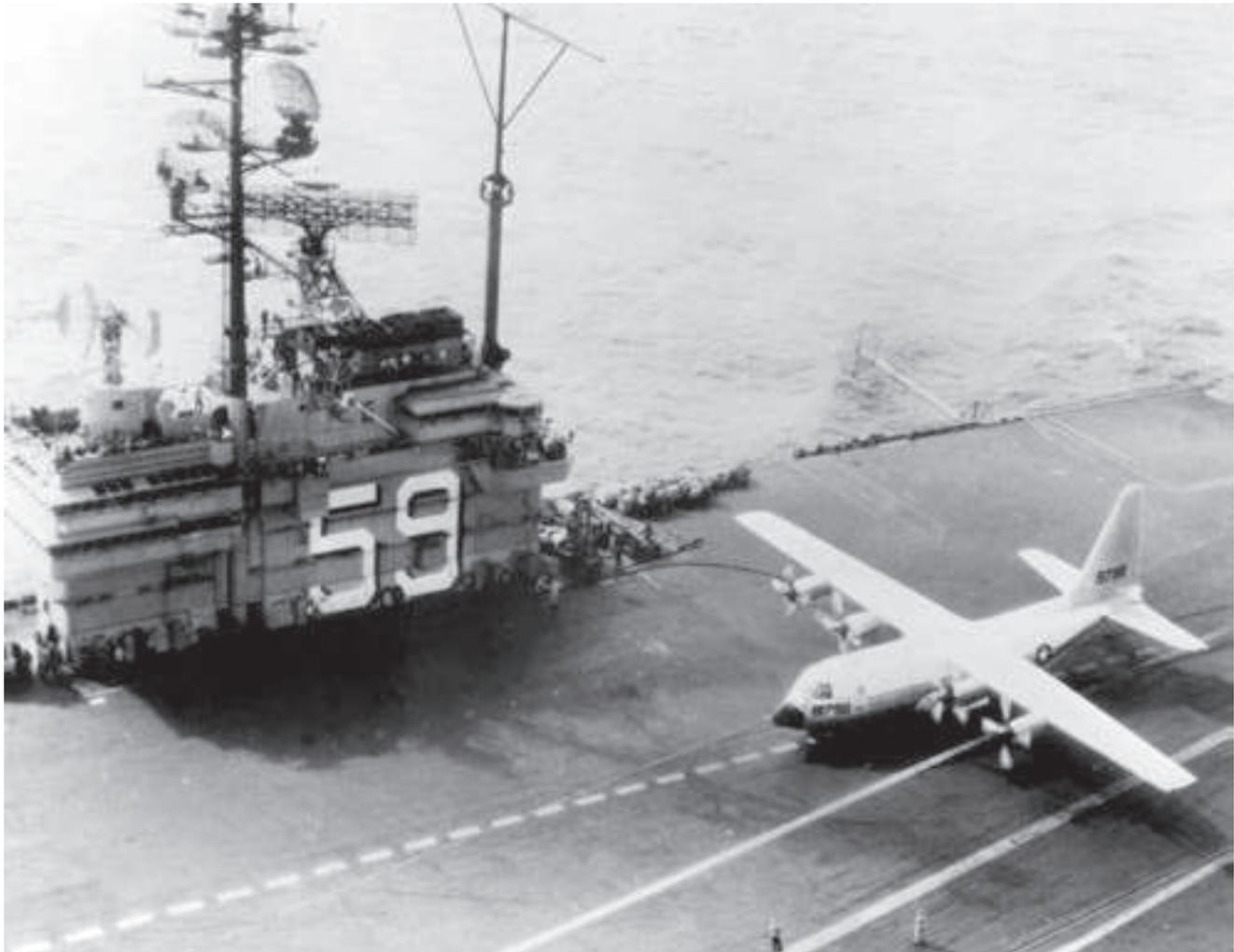
In addition to testing the basic feasibility of landing a Hercules on an aircraft carrier, the project was also designed to make landings at increasingly heavier weights to determine how large a payload a C-130 might safely bring aboard. Because the aircraft was a tanker, simply adding additional fuel increased the gross weight of the aircraft.

After taking on more JP-4 to go to the next higher gross weight, the crew revved up the aircraft's engines, set the flaps at seventy-five percent, and took off. There was only fifteen feet clearance between the KC-130's wingtip and the island.

The only restriction placed on the crew during takeoff was not to rotate the aircraft until the wingtip passed the forward end of the ship's island. "Otherwise we could have been looking down on the captain on his bridge when we took off," Flatley adds.

Three more full stop landings were made the first day, followed by ten landings on 21 November and seven more the next day. Stovall made three of the landings on the last day. A total of twenty-nine touch-and-goes were made on the four trips to the carrier.

The KC-130 weighed 85,000 pounds on the first landing. Thereafter, landings



*Engineers at the Naval Air Rework Facility in Norfolk, Virginia, figured out how to get the Hercules off the ship if, for some reason, it got stranded aboard the ship during the trials. The most practical solution would be to use I-beams and a large crane. "If we had broken down at sea, the deck hands would have lifted the plane up with the deck crane and tossed it overboard," crewman Ed Brennan mused*

were made in progression up to a gross weight of 121,000 pounds. At maximum weight, which set the record for the largest and heaviest aircraft landing on a US Navy aircraft carrier, Flatley and Stovall used only 745 feet for takeoff and 460 feet for landing. One landing at a weight of 109,000 pounds required 495 feet to stop and that was in a heavy squall. On the last takeoffs, the crew didn't even back up — they simply took off from the point on the deck where the aircraft stopped.

The crew completed the carrier qualification tests around noon on 22 November. "We got back to Pax River and started writing the final report and collecting the statistical data. We wrote the recommended procedures so anyone else wanting to land on a carrier had the information available. We went about our business and were told not to talk about it," noted Flatley. The project remained classified officially for a year, although word got out quickly to the flying community.

The feasibility of landing a C-130 with a useful payload on a carrier was

clearly demonstrated, but eventually it was simply impractical. "A carrier with no tactical aircraft on deck makes a skipper antsy," Brennan noted. "The captain of the Forrestal gave us two hours — to the minute — per trip and then we had to go home." The Grumman C-2 Greyhound, a more practical COD aircraft, entered fleet service in 1966.

### The rest of the story

Stovall was later awarded the Air Medal for his work on the project. He went on to command a carrier fighter unit during Vietnam and attained the rank of captain. He died of leukemia in 1973.

Brennan was also awarded the Air Medal. He went on to become a flight engineer on P-3 Orions, accumulating nearly 7,000 hours flight time. He retired in 1976 as a chief petty officer after twenty-two years in the Navy. Four hours after his retirement ceremony, he was on a plane to Iran to work as a Lockheed field service representative on the P-3F programme. He later went back to working with C-130s,

this time with Coast Guard HC-130Hs as a Lockheed field service representative at CGAS Elizabeth City, North Carolina. He retired in 1998 and passed away a short time later.

Sieve shipped out immediately after the programme concluded to fly Lockheed WV-1s a.k.a. Willie Victors Warning Star airborne early warning aircraft in Argentina, Newfoundland. Flatley lobbied for years to recognise Sieve's contribution to the carrier landing and Secretary of the Navy Gordon England approved the Air Medal for Sieve in the summer of 2004. It was presented by the Vice Chief of Naval Operations, Adm. Mike Mullins in Sieve's hometown of Cincinnati, Ohio. A crew from VMGR-352 flew 9798 to the ceremony.

Flatley was awarded the Distinguished Flying Cross, a difficult award to earn anytime but especially in peacetime. He spent the rest of his Navy career in fighters. Even though he didn't have a tail hook on the KC-130F, he counts his eighteen landings in a Hercules among his 1,608 traps, which puts him in the top ten of



*The KC-130 crew completed carrier qualification tests around noon on 22 November 1963. "We got back to Pax River and started writing the final report and collecting the statistical data. We wrote the recommended procedures so anyone else wanting to land on a carrier had the information available. We went about our business and were told not to talk about it," noted Lt. Jim Flatley, the lead pilot. The project remained officially classified for a year, although word got out quickly to the flying community*



*In addition to testing the basic feasibility of landing a Hercules on an aircraft carrier, the project was also designed to make landings at increasingly heavier weights to determine how large a payload a C-130 might safely bring aboard. Because the aircraft was a tanker, simply adding additional fuel increased the gross weight of the aircraft. Here, the deck crew adds fuel to the KC-130's fuselage tank*

the Navy's all-time carrier landing list. He retired as a rear admiral in 1987. He served as the chief executive officer of the Patriot's Point Naval and Maritime Museum in Charleston, South Carolina, the state's most popular tourist attraction, for seven years before retiring again. Between his twenty-one grandkids and his work charity work in Charleston, he stays active. "I stay busier than I can stand to be," he noted.

After a thirty-eight-year career, the *Forrestal* was decommissioned 11 September 1993 and was struck off the Navy Register the same day. In February 2014, she was towed from Philadelphia to Brownsville, Texas, for scrapping. The Navy sold the carrier to All Star Metals, a ship and oil rig recycler, for one cent.

KC-130F BuNo 149798 went on to a full career, receiving a service life extension upgrade and a new centre wing box in the late 1970s. It spent most of its career with VMGR-352, first at MCAS El Toro, California, and later at Miramar

after El Toro was closed and the Raiders, as the squadron calls itself, moved. In November 2001, 9798 was the first aircraft to land at Expeditionary Air Field Rhino during Operation *Enduring Freedom* in Afghanistan. It was used on a low-altitude night helicopter refueling mission and to insert elements of the 15th Marine Expeditionary Unit's battalion landing team near the Pakistan border. A little over a year old during the carrier qualifications, 9798 was retired to what is now called the National Naval Aviation Museum forty-two years later and right at 26,220 flight hours.

Basically relegated to the status of a footnote to aviation history, the Hercules-on-a-carrier idea came back to the forefront in 2004. The CBS television series *JAG* featured an episode in which Cmdr. Harmon Rabb (David James Elliot) quit his position as a Navy lawyer to fly missions for the CIA. He rescues an agent and his family in a C-130 and then, after being attacked by Libyan MiGs, makes an emergency landing

on the deck of the fictitious USS *Seahawk*. As the credits roll, real footage of Flatley's landing in the KC-130 (which can be found here) is shown along with a brief summary of the feat.

At that same time, the joint Army-Navy-Marine Corps concept of Sea Basing, or pre-positioning supplies and equipment near potential areas of operation around the world, was being discussed. One idea involved a movable facility the size of a small island with a 3,000-foot flight deck. Lockheed Martin actually received a government contract to study the concept of C-130J operations from this floating runway. But, the Sea Basing concept was later shelved.

"I am always running into people who say they were there when we landed, although I don't recall seeing that many people on the deck," Flatley observed. "This has always captured people's attention. There are still folks who don't believe it."

*Courtesy Lockheed Martin 'Code One'*

# HMS Hermes and Sea Harriers in the South Atlantic

Vitality of the Royal Navy's two aircraft carriers during the Falklands Conflict of April-June 1982 is now legendary. Humiliated by the Argentine *coup de main* against the Falkland Islands (2 April 1982), the British Government reacted with what can only be described as a "strategic rush of blood to the head." The only two operational British carriers, HMS *Hermes*

and *Invincible* – the latter already sold to Australia as part of the surface fleet reductions of the earlier 18 months – were rushed off to the South Atlantic as the core of an amphibious 'Task Force.'

Judged by every lesson of carrier history, this was an act of utter risk. Operating at an awesome 8,000 miles from their home base, with a frantically-improvised 'fleet train' including

converted civilian tankers, bulk carriers and luxury liners, the two carriers between them could put up no more than 20 Sea Harriers. This tiny air group had to handle all reconnaissance, combat air patrol, interceptor, bombing and tactical strike missions – all in the face of superior Argentine land-based air power, with odds of over three to one. Admittedly, on paper the Argentine Navy fleet was



HMS Hermes sailing out from Portsmouth as part of the Falklands Task Force

heavily outmatched by the British Task Force, with only one elderly carrier: *Veinticinco de Mayo* (ex-*Karel Doorman*, ex-*Colossus*-class *Venerable*). But given the assurance of land-based air cover, the odds against the Argentine fleet were far less than the odds against the US Pacific Fleet on the eve of Midway 40 years earlier. The despatch of the British Task Force, moreover, was rushed ahead as though the Soviet Navy did not exist. It effectively denuded the United Kingdom of any viable air/sea defence, and promised a grievous long-term weakening of NATO forces. And yet the Falklands campaign of April-June 1982 revealed how misleading paper strengths and theoretical disadvantages can be.

As soon as they arrived within striking range, the British carriers should have been the supreme Argentine objectives, to be destroyed or incapacitated at whatever cost. With HMS *Hermes* and *Invincible*

sunk or rendered incapable of operating aircraft, the British would have been unable to land on East Falkland (22 May), or ‘leap-frog’ the follow-up consignment of RAF Harriers ashore to operate at close range against the Argentine garrison troops. A succession of massed land-and carrier-based air strikes could easily have swamped the Sea Harriers and eliminated the British carriers.

Instead, the Argentine persistence with ‘penny-packet’ air attacks on the Task Force, though inflicting grievous losses on the skimpy screen of frigates and destroyers, allowed the *Hermes* and *Invincible* to fulfil their vital role of covering the troop landings.

The Falklands conflict revealed the consequences of the run-down of the Royal Navy’s Fleet Air Arm over the previous two decades; but the most telling reaction came from the United States – not Britain. On 14 May, a week before

the British landings on East Falkland, the US Senate approved a massive \$178,000 million defence budget – to include the cost of two new CVNs. In Britain, the Thatcher Government contented itself with furtively postponing the imminent Defence Statement with its burden of further fleet reductions. There was fulsome governmental praise for the magnificent achievements of the Task Force – against odds which need never have been so high but for sustained and willful political delinquency.

Once again the unique versatility of the aircraft carrier, enhanced as never before by the superb all-round qualities of the Sea Harrier, had been demonstrated to the world.

In India, at the other end of the globe, the Indian Air Force and Indian Navy followed the war with bated breath – for different reasons!

(Extracts from *CARRIER*)



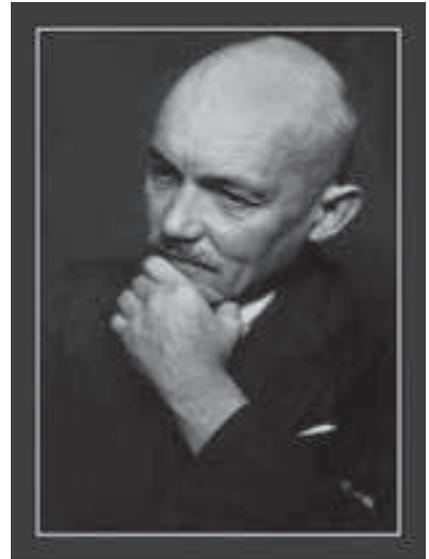
A very long life ! As HMS *Hermes*, this aircraft carrier with its complement of Sea Harriers and Sea Kings was key to Britain’s retaking of the Falklands in 1982. Three decades on, this carrier, now the INS *Viraat*, also embarking Sea Harriers and Sea Kings, if in different colours, is central to the blue water aspirations of the Indian Navy

# 100 years of Dornier

## 2014 marks centenary of the first Dornier aircraft ever built

**G**enealogy of the Dornier company can be traced through the story of its legendary founder, Claudius Dornier. He joined *Luftschiffbau Zeppelin* in 1910 and soon began research on improving the strength of light metal sections even as he began investigating the development of rigid airships. In 1913, Count Zeppelin appointed Dornier as his personal scientific advisor. In cooperation with the Count, Claude Dornier began laying the ground work on preliminary design of a steel-structure airship for transatlantic services.

In 1914, the 'Do' Department was formed as part of *Luftschiffbau Zeppelin* and Dornier was provided with better facilities for his research. He began work with an assistant engineer and two or three technicians and draftsmen on the possibilities of rigid airships even as he looked towards aircraft engineering. Upon the outbreak of the Great War in 1914, Count Zeppelin decided to build aircraft and he established the Seemoos shops near Manzell for



*Claude Dornier, founder of the company Dornier*



*Zeppelin-eye view of Seemoos and surrounding areas along the Bodensee where Count Zeppelin engaged young Claude Dornier to begin work on metal aeroplanes in 1914. Six decades later, HAL designers worked here with their Dornier counterparts on studies which resulted in development of the 228 light transport aircraft*

this purpose. Count Zeppelin's first floating hangar was refurbished to provide a location for Dornier's specific developments. The Count decided to disregard the wood, piano wire and linen designs of contemporaries and instead gave Claude Dornier the task of building giant metal flying boats at the new dockyard. This was a crucial step in the evolution of metal aircraft. The research done by Dornier in this period was a guide for later development of the aircraft industry. His understanding of the components based on stress loads and the way they worked together greatly influenced the future of the industry.

In 1915, Claude Dornier designed the Rs I flying-boat which was the largest aircraft of its time. It featured a novel, nearly exclusive all-metal structure with only the wing, empennage and hull covered with fabric. The upper and lower wings of the biplane were braced by struts and the complete wing unit was pivoted on the

boat. The angle of attack of the fuselage was adaptable in flight by means of a strut extending from the upper wing into the hull. Outboard floats on the lower wing were used to increase overall stability. The three Maybach engines were mounted on a joint stand, which drove pusher propellers and were accessible for maintenance during the flight. The radiators were installed without panelling against the engine nacelles. The wooden propellers, equipped with metal edges, had a diameter of 3.5 m. Unfortunately, Rs I was destroyed before its first flight during a storm at its Friedrichshafen-Seemoos buoy on 21 December 1915 when it sprang a leak and was shattered to pieces by the waves. Dornier continued development of large seaplanes with the Rs II.

The design and construction drawings of the Rs II had been prepared during 1915 and the airframe was completed swiftly. The Rs II was the first autostable such craft in

history, and first took off on 30 June 1916. Initially the aircraft was powered by three engines mounted inside the hull driving three pusher propellers via gearboxes and shafts. After extensive testing, it was rebuilt with a four-engine configuration (Rs IIb). During the years of the war, metallic structures were developed and applied to smaller aircraft. The stressed-skin design developed by Claude Dornier was used to develop the C I two-seater biplane. The principle behind the design was further corroborated by the first flight of the D I a few years later in 1918. Other projects were under production; however, the end of the war abruptly halted all work. The Rs IV was converted to scrap metal even as it helped create the later famous "Dornier sponson".

With the war ending in 1918, the German aviation industry was left in the lurch. The Zeppelin plants near Lindau were closed and almost all the staff discharged. The Seemoos facility was converted into



*Dornier Wal flying boat takes off from the Bodensee (Lake Constance) in Southern Germany*

a factory for household goods. Claude Dornier, however, continued his work against the seemingly bleak prospects of the future. He suffered another setback after the Versailles Treaty when aircraft manufacture was prohibited by law in Germany and the Seemoos facility had to be shut down. He decided to resume activities outside the country and moved to Rorschach, across Lake Constance in Switzerland. In this period, the 'Libelle' was constructed. Even as the 'Wal' was on the drawing board, Dornier made the decision to move to a more spacious facility. *Costruzioni Meccaniche Aeronautiche SA* was established at Marina di Pisa, Italy in 1922. The Spanish Army Administration recognised

Claude Dornier. A flight with 169 people on board was made on 21 October 1929 and it took 20 years to break this record.

The company continued to expand and established a firm reputation during the 1930s with civil and military flying boats. During the Second World War, the company concentrated on flying boats and bombers and its Do-17 and Do-217 'flying pencils' formed a large body of the Luftwaffe's bomber force, and saw much service during the early part of World War II including extensive use in the Battle for Britain. It was later developed into a nightfighter to protect Germany from the RAF bomber offensive. The Do-17 was also used by Rebel forces in 1937 during

quickly re-established itself with highly successful small STOL transports such as the Do-27 and Do-28, taking elements from the Do-25 but with more powerful engines. A contract from the German Armed Forces resulted in 400 Do-27s being procured and many more being delivered to other customers. The Do-28 was similarly successful, being used by the German Armed Forces where they served until the introduction of the Dornier Do 228 in the early 1980s which was the subject of a major transfer of technology and licence production agreement with India, formalised on 27 November 1983.

Today, 31 years after that defining moment, Dornier 228s continue to be



HAL-built Indian Air Force Dornier 228 (Photo: Angad Singh)

potential of 'Wal' aircraft and ordered six. The 'Zeppelin Werke GmbH Lindau' was renamed 'Dornier Metallbauten GmbH' and the company's offices moved from Lindau to Friedrichshafen.

In 1923, the company purchased the neighbouring facilities of 'Flugbau Friedrichshafen GmbH' in Manzell, and the small dockyard at Seemoos was finally closed. In the period that followed, a number of Dornier-built aircraft broke various world records, including the Do X – a milestone in aviation history which is a still admired pioneering achievement of

the Spanish Civil War. The only fighter project was the Do-335, claimed in its time as the fastest propeller driven aircraft in the world, but introduced too late to enter combat service.

In 1945 after WWII, aircraft production was once again forbidden in Germany and the enterprise relocated to Spain where the Do-25 general purpose liaison aircraft built by CASA was the result of a design effort for the Spanish Air Force requirements. The Do-25 was not, however, selected for production. After the ban was lifted in 1954, Dornier

built by Hindustan Aeronautics Limited at their Transport Aircraft Division in Chakeri, Kanpur with well over 100 aircraft built and delivered even as the original factories at Oberpfaffenhofen, near Munich have long gone silent since the insolvency of Fairchild Dornier in April 2002. In fact, the only new aircraft to carry the banner of Dornier are built in India and as the Defence Acquisitions Council recently decreed, more are to follow, exemplified by the order for twelve more Dornier 228s for the Indian Navy (*see article in this issue*).

# 25 Years Back

## From Vayu Aerospace Review Issue VI/I 1989

### USAF Chief visits India

General Larry D Welch, Chief of Staff of the USAF, paid a 5-day official visit to India from 26 November 1989. He called on Air Chief Marshal SK Mehra CAS, IAF where the two Chiefs of Staff discussed matters of mutual interest and importance.

On 26 October at Washington, the US Assistant Secretary of State had told the Congressional Sub-Committee that the US would continue to cooperate with India in selected defence projects such as the Light Combat Aircraft, "within prudent limits", adding that "there is potential for further military co-operation with India".

### A320 meets IA expectations

Ever since IA inducted eight A 320s upto the end of September and pressed them into service to eleven destinations in 38 sector-trips, the overall performance of the Airline has started showing signs of "vibrancy". The sector/length has averaged 836 kilometers and the fleet logged an average utilisation of six hours and 30 minutes per aircraft per day, which compares favourably with many other operators of the type.

### Air Taxi a "non starter"

Although announced only in 1988, the air taxi service scheme remains a "non starter". The civil aviation ministry has not received any serious applications from Indians or NRIs. The six licenses issued so far are from Companies which have already converted their private aircraft into air taxis. The fast clearance for licenses accorded by the civil aviation ministry to the six operators will enable these companies to start off shortly but it is admitted by the civil aviation ministry officials who were very enthusiastic about the air taxi scheme, that India lacks both the required infrastructure and sustained traffic to justify such schemes.

### LCA Naval Variant

A 'navalised' variant of the Light Combat Aircraft in under consideration, Naval headquarters interacting with the ADA on the LCA which will have virtually the same systems as the land-based fighter but with suitably modified landing gear and the ability of launch by catapult. However, the Navy retain the option of having a naval version of the MiG-29 operate from the indigenous aircraft carrier now under development. The project definition phase of the aircraft carrier was in its final stages and

detailed design is to commence shortly, the project having been some-what delayed owing to lack of funds and a protracted period when the design concept was being finalised.

### PAF and 'Zarb-e-Momin'

Most elements of the PAF were involved at all levels during this largest joint-service exercise ever conducted by the Pakistan Armed Forces. The exercise involved some 200,000 troops belonging to three Army Corps, with seven infantry and one Armoured Divisions, four independent brigades, the Special Service Group (SSG), an air defence brigade, elements of the Army Aviation Corps and the PAF. Aircraft types involved included the Chinese-built F-7P as also A-5s, F-6s, F-16s and Mirage III/5s.

### Chinese fighter developments

The Chinese-development J-8/II multi-role fighter, a prototype of which was displayed at the Paris Air Show, has not entered service with the Chinese Air Force, although there were some inspired allegations to the contrary. Four prototypes plus two static test specimens and "several pre-series aircraft" have so far been completed and production is running at "about one per month", with IOC anticipated in 1991-92.

### 95 F-7Ps for the PAF

The CAS of the PAF Air Chief Marshal Hakimullah has said that the PAF would induct 95 F-7P fighters acquired from China by April, 1990. CAS stated that 40 F-7Ps had already been inducted and the remaining 55 would follow by the end of March or early April. Describing the F-7 as "considerably superior" to the F-6 that it replaces, he said that the former had more sophisticated avionics, a more reliable engine and a structural life some 25% better than that of the latter. "This is translated into a three-year longer operation life for the F-7". The additional F-16s being acquired from the United States had a span of 8000 flying hours and "would be good for 25 years service".

### Medium term expansion by IA

Indian Airlines has drawn up a medium term fleet expansion plan under which (during 1990-95) it proposes to acquire 33 aircraft at a cost of Rs 2,500 crores. The Airline is currently evaluating the MD-91, Boeing 737-500, BAe 146, Fokker 100, Boeing 767-300, Airbus A 300-600, Airbus 330 and Airbus 320. Evaluation of some of these aircraft is underway and the final choice will be made within the year. At the same time, both Air India and Indian Airlines are also interested in new Soviet airliners, including the Tu-204 and Il-96-300.

### 9th Antarctica expedition

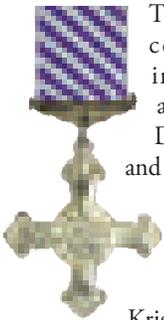
The 9th Indian scientific expedition to Antarctica sailed from Mormugao port on 1 December. The team had 28 scientists, 17 members from the Indian Navy, 27 members from the Indian Air Force and a doctor from the Armed Forces Medical Service. The Indian Air Force and Navy will provide logistic air support with specially equipped Mi-8s and Chetaks.

## Indian fighter on the Eastern Front



In *Vayu's* Issue V/2014 there was reference to 'India's first combat aircraft'. This was the Maurice Farman M.F.7 biplane, a handful of which served with the Indian Expeditionary Force in Egypt. We have since 'discovered' a photograph of one such biplane, with British officer in cockpit, with Sikh soldier steadying the fragile wing before take-off roll.

## Preserving History ?



There has been righteous concern – and some indignation – over the attempt to auction the Distinguished Flying Cross and Bar to the DFC of one of the IAF's most legendary fighter pilot of World War II, the late Wing Commander Karun Krishna 'Jumbo' Majumdar.

The auction which was conducted by Morton and Eden Ltd. London on 26 November, failed in the first attempt as the best offer (£ 15,500) was below the reserve price.

Without commenting on the reasons for Jumbo's son putting up these historic medals for sale, the indifferent attitude of the Indian Government and its air arm in this episode hardly augers well for the preservation of military history in the country.

## Push, Oye !



Yes, this really happened ! Passengers left their seats to give their frozen airliner a push at a snowbound airport in Siberia. With temperatures at minus 50 Celsius, the Tupolev Tu-134 aircraft had to be actually pushed to get it going. There were cries of "Let's go !" as passengers, dressed in heavy coats and thick gloves, each took a wing and apparently began shoving and pushing the aircraft into position. "We all want to get home," shouted the burly volunteers as the passengers succeeding in their mission, despite biting winds and freezing temperatures.

Thankfully there was no need for further pushing as the temperature at their destination was a balmy minus 11 Celsius.

## Russo-Chinese border raid

A daring cross-border raid by one of the Amur tigers gifted by Russian President Vladimir Putin to the Chinese leaders earlier this year may yet sour Sino-Russian relations. According to Chinese state media, *Ustin*, one of Amur tigers gifted by the Russian leader earlier this year, attacked a herd of goats on Heixiazi Island in the northern province of Heilongjiang, which shares a border with Russia's far-eastern Amur region.

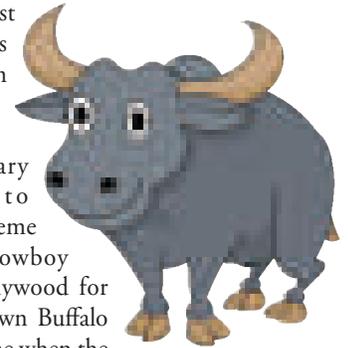
There are other cross border relationships in the Amur region where one of Russia's



biggest aircraft manufacturing plants is located : Komsomolsk-na-Amur from where Sukhoi Su-27s and 30s are supplied to the People's Liberation Army Air Force.

## Buffalo Bill

One of the most colourful figures of the American Wild West was 'Buffalo Bill' whose legendary tales were to become the theme of countless cowboy movies at Hollywood for decades. Our own Buffalo Bill came to fame when the pilot-in-command of a Boeing 737-800 at Surat airport pushed the throttle quadrant forward to begin the take-off roll. Aghast, he saw a stray buffalo on the runway but managed to save the situation although the buffalo's fate is unknown.



Pilots are always wary of foreign object damage and even clusters of birds as they get airborne - but a buffalo on the runway is, well, the stuff legends are made of !

## Defenders of the Faith



With Centenary of the First World War being commemorated in England and Western Europe (and somewhat low key in India) this drawing of a Sikh sentry keeping guard as British officers attend church service in Flanders in December 1914 is most evocative.

## Afterburner

Recaro

Shinmaywa