

VAYU

VI/2016

Aerospace & Defence Review



The Indian Navy Today

**Interview with the CNS
Time to Look Forward
Euronaval 2016**

**New Maritime Challenges
'Black Holes in the Ocean'
Doctrine of 'Sea Denial'**



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Cover : Indian Navy MIG-29K of INAS 303 pulling into the vertical at Dabolim, Goa (Photo: Angad Singh)

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Aerospace & Defence Review

VI/2016

36 Interview with CNS



On eve of Indian Navy Day 2016, Vayu interviewed with Admiral Sunil Lanba, CNS, on a host of issues. "The Indian Navy remains fully prepared for the defence of the nation..."

44 New Maritime Vistas and Challenges



Admiral Arun Prakash (ret'd), looks forward from the 1971 War when imaginative leadership boldly employed the full range of maritime capabilities, and analyses 'out of the porthole' the 15-year 'perspective plan', underpinned by a *Maritime Doctrine*. The Indian Navy shows full promise of becoming a maritime force of substance, in keeping with the country's future economic strength and technical prowess.

49 'The Navy (Should) Get the Gravy'



In his two part article, (including that on *India's next Aircraft Carrier*), Ajai Shukla reminds the country's leaders that the Indian Navy needs far more support to discharge its multiple responsibilities, that of being a regional security provider. These include not only new warships, submarines but also multirole helicopters, AEW and ASW aircraft plus fleet support ships. As for India's next aircraft carrier (*INS Vishal*), this would be a technologically cutting edge warship on par with world's most advanced carriers.

54 "One of our best ships ever"



Vice Admiral SPS Cheema (ret'd) recalls with pride his command of *INS Viraat*, the Indian Navy's second aircraft carrier which began life as the Royal Navy's *HMS Hermes*.

62 Doctrine of 'Sea Denial'



The Pakistan Navy's doctrine of operations against India has always been centered on employment of its forces for 'Sea Denial'. Captain HPS Sodhi writes on the rival Navy's Submarine Arm and their recent decision to acquire eight new AIP and ASCM-equipped submarines from China simultaneously conducting a mid-life update of their Agosta 90Bs.

65 Time to Look Forward



For decades, the Soviet Union, later Russia, has been the most reliable supplier of state-of-art armament for India's defence forces, including Su-30MKIs, guided missile destroyers as also main battle tanks and other systems. Lt Gen Phillip Campose (ret'd) writes on challenges in Indo-Russian Defence Cooperation and suggests the road ahead.

68 'Black Holes in the Ocean'



In his third, and concluding series on '110 Years of Russian Submarine Prowess', Vladimir "Vovick" Karnozov, examines Russian underwater warfare capabilities as they have evolved through the Cold War and through to the present day.

77 Euronaval 2016

In this *Vayu* on-the-spot report, Sayan Majumdar visited Paris to cover this premier maritime trade Show of Europe, which biennial event continues to confirm its position as world leader of naval defence exhibitions. His report is augmented with several breaking news items on various new Naval systems and concepts.

118 Recalling fateful days in Kashmir : 1947 and 1999



Major General Rajendra Prakash (ret'd.) was a teenager at Badgam, in the Kashmir Valley in October 1947 when raiders from across the border were being battled on the outskirts of Srinagar airstrip. Over half a century later, there was this 'Lost' Operation in Chorbat La in the formidable Ladakh heights, recalled by Lt Gen Harcharanjit Singh Panag (ret'd).

Also: Pakistan's Tactical Nuclear Warheads; RR and the Indian Navy; Saab's Swordfish MBA; Rafael's Protector USV; Elbit's Seagull; MR-SAM/LR-SAM; Russia's MC-21 airliner; 'The Russian Knights'; Exercise 'Atlas 2016'; 'Sea Breeze' and 'South Wind 2016'; Return of the Black Sea Knights.

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Countering China's big-money diplomacy

Xi Jinping has visited Dhaka, the first Chinese president to do so in 30 years. Beijing and Dhaka will henceforth share a 'strategic relation', he announced (*two Chinese-origin submarines will join the Bangladesh Navy*). What was left unsaid was China's decision to expand its sphere of influence in South Asia at breakneck pace. After Pakistan, Nepal and Sri Lanka, Bangladesh is expected to edge closer to Beijing. This suits the latter's growing political clout in the region, generously funded by the fruits of nearly 40 years of sustained growth. Sometime ago, Prime Minister Narendra Modi had announced a \$2 billion line of credit to build two power projects in Bangladesh. Xi has topped that figure handsomely, pledging trade, loans and investment deals in power and other infrastructure worth nearly \$34 billion. Taken together, this will be the largest overseas investment ever in Bangladesh. It is time for New Delhi to wake up and take stock of our allies nearby.

How does India counter big-money diplomacy by China? India must leverage its shared culture and the goodwill that derives from this. Bengalis in erstwhile East Bengal and erstwhile West Bengal relish pretty similar food and literature.

Writers in Kolkata are eager to discover how their latest book has fared in Bangladesh. But to leverage this form of bonding, there has to be a spirit of camaraderie. For decades, India justifiably took credit for liberating Bangladesh from Pakistan. But coupled with that swagger was condescension about our poorer eastern neighbour. The political turmoil in Dhaka after the assassination of Sheikh Mujibur Rahman, father of current incumbent and head of the Awami League in 1975 did little to foster bonhomie.

In the more recent past, relations have often been frosty over sharing river waters. Indian politicians have often raked up xenophobia, accusing Bangladeshis of smuggling cattle from India and exporting illegal migrants here. It is pertinent to change the way we perceive and deal with neighbours. Generosity of spirit, if not in cash, has to replace current attitudes.

From *The Economic Times*

Credibility of the deterrent

In his position as Defence Minister of India, Manohar Parrikar is one of the senior-most Cabinet members and the one charged with the external security and defence of India. His words are carefully listened to and strongly influence the actions of a swathe of players, including the armed services, foreign governments and terrorist groups.

Therefore, his questioning of India's long-standing nuclear doctrine on a public platform was avoidable. He effectively put a question mark over India's nuclear deterrent, the *sanctum sanctorum* of the country's national security posture. More worryingly, his "personal" comments seem to stem from an inadequate understanding of the strategic logic underpinning nuclear deterrence and a no-first-use policy.

In the dawn of the nuclear age, military strategists recognised that nuclear weapons have changed the purpose of an army. A

conventional arsenal is designed to defeat an enemy. A nuclear war would inflict such enormous damage on both sides that no one could win such a conflict. Therefore, the purpose of a nuclear arsenal was to prevent war. Thus was borne the concept of nuclear deterrent. To put it another way, one wins a nuclear conflict by never having it in the first place.

Once this logic was understood, the next logical step was to signal this in a number of ways including no-first-use, developing the ability to carry out nuclear retaliation even after being attacked and, most important, maintaining the credibility of national intent through testing, technology and a iron-cast doctrine. A country can build all the warheads and delivery mechanisms it wants. But if there is evidence that it lacks the political will to actually use them, it encourages an enemy to carry out a first strike. The messaging of the political determination to retaliate, irrespective of the damage done in the first strike, is absolutely essential in ensuring the enemy attack never takes place at all.

Whether in a personal or official capacity, for a defence minister to question India's nuclear doctrine undermines the credibility of the country's deterrent. Mr Parrikar, in other words, is inviting other countries to presume India is not certain how to use its final line of defence.

From *The Hindustan Times*

Amritsar Opening

'The Heart of Asia Conference', an annual event since 2011 in the diplomatic efforts by "stakeholders" to restore peace in Afghanistan, was the venue last year for India and Pakistan to announce their readiness to resume a "comprehensive bilateral dialogue".

Minister of External Affairs Sushma Swaraj travelled to Islamabad for the Afghanistan donors' meet, where she and Pakistan Foreign Minister Sartaj Aziz cleared a roadmap for bilateral dialogue. It speaks to the collective failure of the two sides that they are now well behind that point in 2015. Indeed, in diplomatic terms, bilateral relations have regressed at least a dozen years, if not more. The only redemption is that nothing is permanent in diplomacy, and as these matters go, here we are again at the doorstep of another opportunity, via the same conference, to be held this year in Amritsar. Pakistan has made the commendable decision to send Aziz for it. Now it is India's turn to seize the opportunity to break out of the steadily worsening ties. Prime Minister Modi will attend the conference, and it is to be hoped that the two sides will fit in a bilateral engagement at the appropriate level on the sidelines. The immediate priority is to silence the guns at the Line of Control. With the 2003 ceasefire ceasing to exist for all practical purposes, the LoC has turned into a daily bleeding ground, escalating the bitterness on both sides by the hour, and making it increasingly difficult to get to peace.

Aziz has said his participation shows that Pakistan has a "better" response than India, which shafted the Islamabad SAARC summit by not attending, and to add injury to insult, got other members of the group to back New Delhi. The point is taken. But Pakistan must come prepared to go beyond the grand high ground, just as India needs to examine how it can cross the red lines it has drawn around itself. The dialogue is stuck in the false binary of discussions on

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terrorism vs discussions on Kashmir, and which should come first. Both sides need to get out of this rut for any meaningful engagement to happen. It has been done before, and is not impossible to do again. A conference on Afghanistan seems a fitting venue to make efforts for a breakthrough, not least because India-Pakistan normalisation is key to peace in Afghanistan.

If all this is too tall a task for the leaderships of India and Pakistan, their diplomats and security establishments, then both sides at least be civil to each other, and avoid the kind of grandstanding and name-calling that has now become *de rigueur* at every India-Pakistan encounter, with each side walking away to its corner proclaiming “victory” in a slanging match. What was said at the United Nations in September is still fresh in the mind. There is no need for a repeat performance.

From The Indian Express

A flight of fancy ?

The aims of the government’s new regional air-connectivity scheme are laudable. It intends to provide affordable air connections to smaller towns that are not yet properly served by airlines. As a necessary step to this, it hopes to create a market for leasing passenger aeroplanes to various entities that will serve these new destinations. Nevertheless, it appears the policy, *Ude Desh ka Aam Nagrik* or UDAN, is a confusing, socialistic network of bureaucratic controls, restrictions, artificial monopolies and cross-subsidies that might create sustained inefficiencies, reduce consumer choice, raise fares, and always be prone to legal challenge. The most crucial element of the scheme is that successful bidders for one of the new regional routes will receive a subsidy of between Rs2,350 and Rs.5,100 per seat from the government. In addition, fares will be capped at Rs2,500 for short flights of under 500 kilometres. Various other subsidies are also planned — waivers on airline fuel excise, on landing fees, and soon. The government might also subsidise start-up capital to make new regional airlines viable. The question is should the government of India be further subsidising air passengers? It already runs Air India, which has for years made enormous losses for the taxpayer. The government’s defence would no doubt be that all these subsidies would not come from the taxpayer. Some would come from a pool of cash that existing airlines would be forced to pay into, through a mandatory levy. Naturally, there are consequences of such a forced cross-subsidy: Either airlines will discover their profit margins have further declined, and they will face the renewed threat of going out of business in an already fragile sector, or they will raise the prices travellers pay on existing routes. Too much in this scheme smacks of Licence Raj-era thinking.

The exact amount of the levy that airlines will have to pay has not yet been announced. However, it is unlikely that airlines will pay up without a legal battle. The government should ask itself whether a scheme that is clearly so unsteady, and so vulnerable to rent-seeking and to legal challenge, is likely to attract genuine entrepreneurs or fly-by-night operators. Who will seek to bid for a sector knowing that the subsidy might at any point be revoked by a court order? In addition, has the government not considered the effect of this scheme on the existing hub airports? Will they be forced to provide cheap landing rights to these flights? If so, would that not

be another source of legal challenge? And, in any case, multiple new flights would increase congestion considerably and reduce the utility of air travel for all passengers. In other words, while the aim of the UDAN scheme is admirable, the entire thinking behind its execution is flawed. There is only one way to grow connectivity: To build more airports at both the hub and the spoke, and ensure free and undistorted competition in the skies.

From Business Standard

The thin red line

Thirteen years after India and Pakistan agreed to a ceasefire that was meant to prepare the ground for peace in Jammu and Kashmir, both countries are locked in savage skirmishes that threaten to unleash a fresh storm over the Himalayas. The tragic killing of bus passengers in Pakistan-occupied Kashmir, preceded by savage attacks on Indian troops and counter-attacks across the Line of Control (LoC), could set the stage for a resumption of the great duels which raged from 1989 to 2003. Hundreds of civilian and military lives were lost for no military end during that period. Prime Minister Narendra Modi will soon be confronted with two difficult choices. He could, first, tamp down the crisis by seeking to raise the costs for Pakistan army to levels which would threaten its standing among Pakistan’s population as the state’s praetorian guard — potentially by seizing small bits of territory along the LoC, as some Indian generals advocated after Kargil, or hitting terror positions deep inside Pakistan-occupied Kashmir. Such actions, however, pose the risk of escalating into war, and undoing the prime minister’s economic objectives. The second option is to give diplomacy another chance to resolve the crisis. But if it fails, the prime minister could find India more vulnerable than before to terrorist attacks, with his own core constituency alienated.

For an understanding of the choices, one must turn to New Delhi’s decision-making - one of reflex, more than reflection - after the Uri attack in September. Following his election, Prime Minister Modi had reached out to his counterpart, Prime Minister Nawaz Sharif, in a bid to normalise India-Pakistan relations. That effort, however, was challenged by Pakistan’s generals, using their time-trusted allies, jihadist terrorists. The generals thought the Indian prime minister would not order a retaliatory strike for fear of sparking off a war. India’s cross-LoC strikes in September were intended to challenge that assumption.

The experience of the years between 1989 to 2003 shows both the armies can indefinitely sustain this low-grade violence. The skirmishes, Pakistan’s generals know, hurt India more than Pakistan: Under fire, it is that much harder for India’s counter-infiltration troops to guard against jihadists crossing the LoC. Jihadist groups will be that much better positioned to capitalise on the growing influence of anti-India political forces in Kashmir’s countryside. The cross-border attacks in September were hailed as a new direction for India’s Pakistan policy — but bar some careful thinking, it could easily lead to a bloody cul-de-sac.

From The Indian Express

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Admiral Arun Prakash on Breaking the N-silence

Raksha Mantri Manohar Parrikar's seemingly wayward remarks about India's nuclear posture may have stirred a hornet's nest in the media, but if they are indicative of a new-found interest in security matters amongst decision-makers, this occurrence needs to be lauded. Given their preoccupation with electoral politics, it is worrying to see how little time and mental space our political leaders devote to national security. Nowhere is this neglect more worrisome than in the area of higher defence management and the existential complexities of our nuclear deterrent. Even if he was expressing personal views, which may or may not be in consonance with state policy or media perceptions, Parrikar has broken a tradition of sphinx-like silence, wherein his two UPA predecessors rarely acknowledged the existence of India's nuclear deterrent or even mentioned the 'N' word. The RM's off-the-cuff remarks will serve a useful purpose if they trigger a debate on nuclear issues that include India's hastily made commitments to no-first-use (NFU), a "minimal" arsenal and the self-imposed moratorium on testing. After all, the BJP's 2014 election manifesto had promised to "study in detail India's nuclear doctrine, and revise and update it, to make it relevant to challenges of current times".

India's hesitant journey to nuclear weaponisation was shaped, on the one hand, by a utopian vision of a nuclear-free world and, on the other, by the persistent urging of scientists like Homi Bhabha. Janus-faced, India embarked on this programme in which the task of charting the nation's path in the fields of nuclear and missile technology was entrusted, in entirety, to the country's scientific enclave. While enabling "plausible deniability" on the part of the politician, this paradigm perpetuated two flaws which persist till today: The omission of any independent oversight for evaluation of, often unrealistic, scientific plans and claims; and the exclusion of the armed forces from all aspects of our strategic programmes.

Come Pokhran II, in which the only military involvement related to site excavation work, a draft nuclear doctrine was released in mid-1999, which promised "punitive" retaliation against a nuclear attack, and made a pledge of "no-first-use", in respect of states which were non-nuclear and had no nuclear umbrella. Four years later, in the finalised nuclear doctrine, the term "punitive retaliation" was replaced by the somewhat implausible "massive retaliation" and the principle of NFU applied to all nations except those posing chemical or biological weapon threats. India's espousal of a credible "minimum" deterrent conveyed the impression that it would be content with a small number of nuclear devices, and politicians, unfamiliar with the subject, spoke of "a few" nuclear weapons as sufficient to deter a nuclear adversary.

However, a simple calculation would have revealed such beliefs to be delusional and even dangerous. The restraint imposed by NFU would require India to suffer the loss of a substantive number of its warheads to an enemy first-strike and then be in a position to retaliate (using the surviving warheads) with a strike that would inflict "unacceptable damage". This clearly shows that a state pledged to NFU must always have more warheads than our enemies can launch in a first strike. Given that China has a large stockpile and Pakistan is racing ahead with production of plutonium warheads, the concept of "minimum" becomes irrelevant.

If the enemy comes to believe that India cannot launch a massive retaliatory strike-for want of enough warheads or other reasons-our deterrent will lose its credibility. But "deterrence breakdown" is a scenario never contemplated by our strategists. Pakistan is now brandishing low-yield short-range missiles - termed tactical nuclear weapons (TNW) - with the intention of lowering the nuclear threshold and, thus, deterring India's putative 'Cold Start' doctrine. So far, India's stance has been that no matter

what label Pakistan puts on its nukes, India will persist with its doctrine of massive retaliation. This posture should provoke thought firstly, because the destruction of a densely populated Pakistani metropolis in response to a TNW attack on a small Indian military unit (possibly on Pakistani soil or even at sea) will flout the principle of proportional response as well international opinion. Secondly, a nuclear first-strike will not only inflict casualties and mayhem, but the accompanying electro-magnetic pulse would also "fry" computer systems and jam communications. Given the entropy in our cities, political authorisation and launching of a retaliatory strike may become problematic.

So, when Parrikar rhetorically asks "Why should I bind myself to NFU. Why say that I am not going to use it?", he is implying that ambiguity may have a role in deterrence. India has a well-deserved reputation for responsible conduct in the nuclear domain. Do we need to provide a cast-iron guarantee to potential adversaries that they are immune from attack, even if seen to be preparing for a first strike? The NFU option is best left open-ended or unstated.

Two other observations of the RM call for brief comments. Firstly, while doctrinal "unpredictability" may be a virtue as far as adversaries are concerned, the total absence of white papers, defence reviews and, above all, a security doctrine, constitutes a huge void in India's strategic domain. Secondly, the one factor that detracts from the credibility of India's deterrent posture is the stark absence of a chief of defence staff. India's adversaries, no doubt, reason that a country that permits a part-time rotational military functionary to preside over its nuclear arsenal could not be serious about nuclear deterrence. There is absolutely no need for the PM or RM to seek a consensus from the service chiefs to install a CDS. If the government considers it necessary in the national interest, they must appoint a CDS by fiat without further delay.



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Hot Response to Cold Start

Pakistan's Tactical Nuclear Warheads



In an endeavour to preserve strategic stability in the sub-continent, India has demonstrated much restraint despite grave incitement from Pakistan. In stark contrast, ever since it became a nuclear-armed state, Pakistan's behaviour has been marked by brinkmanship, with provocation bordering on actions that could lead to large-scale conventional conflict with nuclear overtones. Recent developments in Pakistan's nuclear arsenal have been of the same destabilising pattern.

As part of its quest for 'full spectrum deterrence,' Pakistan has developed the Hatf-9 (Nasr) short-range ballistic missile (SRBM) (*photo above*). Pakistan claims the Hatf-9 is equipped with a tactical nuclear warhead (TNW) and is intended for battlefield use as a weapon of warfighting. The Pakistan Army appears to believe that a few TNWs can stop the advance of Indian forces across the International Boundary

(IB) into Pakistan. By employing TNWs on the battlefield, the Pakistan Army hopes to checkmate India's 'Proactive Offensive Operations' doctrine, which is colloquially called 'Cold Start.'

This article analyses the efficacy of TNWs as weapons of warfighting. It examines the likely impact of its use by Pakistan on the columns of the Indian Army advancing across the IB and, consequently, on India's nuclear doctrine.

Major Shortcomings of TNWs

The term TNW is a misnomer as the employment of nuclear weapons on the battlefield will have a strategic impact and geo-strategic repercussions. A more appropriate term for these low-yield short-range weapons would be 'nuclear weapons designed for battlefield use.' As a class of weapons, TNWs are extremely costly and complex to manufacture and also difficult

to transport, store and maintain under field conditions owing to their intricate electronic components. As missiles capped with TNWs may be required to be fired at short notice, the nuclear warheads have to be kept in a fully assembled state and 'mated' with the missile. Due to the short range of SRBMs – Hatf-9 has a maximum range of 60 km – the authority to fire has to be delegated at an early stage in the battle.

These two factors lead to the dilution of centralised control and create a proclivity to 'use them or lose them.' TNWs are also vulnerable to battlefield accidents and are susceptible to unauthorised use, or what Henry Kissinger had called the "Mad Major Syndrome." SRBMs are normally dual-use missiles and, as these have to be forward deployed because of their short range, they are likely to be targeted during war with conventional missiles, by fighter-ground attack aircraft on search-and-destroy



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missions and, in the case of Hatf-9, by long-range artillery. This could lead in rare cases to sympathetic detonation of a nuclear warhead resulting in unintended consequences, especially if one-point safety capability is not the norm. Together, all of these disadvantages lower the threshold of nuclear use and make TNWs a dangerous class of weapons.

While the Nasr SRBM is technically capable of being capped with a nuclear warhead, whether this has actually been done is not known in the public domain. The warhead is likely to be based on a linear implosion plutonium design and is likely to have been cold tested. Pakistan's plutonium stocks are limited. The four

thousands of casualties. Hence, India has very correctly refrained from adding the TNW class of weapons to its nuclear arsenal. As TNWs lower the nuclear threshold and are, therefore, inherently destabilising, it is necessary that international pressure be brought to bear on Pakistan to eliminate these weapons from its nuclear arsenal.

Strategic Stability

Strategic stability is a product of deterrence stability, crisis stability and arms race stability in the context of a hostile political relationship between two nations. In the South Asian context, the hostile political relationship stems from the unresolved territorial dispute over Jammu

across the LoC once again indicate an increase in the intensity of the proxy war.

Despite grave provocation, including the terrorist strikes at Mumbai in November 2008, India has shown immense strategic restraint and has limited its counter-insurgency operations on its own side of the LoC in J&K. Another 'major' terrorist strike sponsored by the Pakistani 'deep state'—on a sensitive target, causing large-scale casualties and extensive damage to critical military or civilian infrastructure—is likely to result in Indian military retaliation against the Pakistan Army and its organs with a view to raise the cost of waging a proxy war.

Pakistan's 'first use' doctrine, quest for 'full spectrum deterrence', development of TNWs as weapons of warfighting, army's control over nuclear decision making and the risk of nuclear weapons falling into the hands of the jihadis are all potential threats to regional stability. Pakistan views India's 'Cold Start' doctrine as being de-stabilising. Overall, the state of relations between the two countries may be described as 'ugly stability,' a term coined by Ashley Tellis in the mid-1990s. It is at best a tenuous stability that could evaporate very quickly in the face of a prolonged crisis.

Possibility of Limited War

As per conventional Indian wisdom, there is space for limited war below the nuclear threshold. Though Indian military retaliation to a major terrorist strike would be carefully calibrated to avoid threatening Pakistan's nuclear red lines, under certain circumstances the exchanges could escalate into a war in the plains. For example, Pakistan may launch pre-emptive offensive operations across the IB, including strikes on Indian air bases or naval assets. Such a response from Pakistan will force India to launch counter-offensive operations with a view to destroying as much as possible of Pakistan's war waging capabilities and, in the process, simultaneously capturing a limited amount of territory as a bargaining counter. The capture of territory is unlikely to be a primary aim, as territories captured across the IB will have to be returned.

The Pakistan Army seeks to convince India that it has a low nuclear threshold and that its nuclear red lines are fairly close to the IB. The proximity of nuclear red lines to the IB would vary from sector to sector and would be a matter of careful assessment based on intelligence inputs. In keeping



The Abdali (Hatf-II) is a Pakistani Short-Range Ballistic Missile (SRBM)

Khushab reactors can together produce plutonium that is sufficient for only 10-12 nuclear warheads per year. Considering the low level of damage that TNWs cause, the decision on how much of the plutonium stock should be allocated for TNWs vis-à-vis strategic warheads would be a difficult one to make. Hence, it may be deduced that Pakistan is unlikely to have a large stockpile of TNWs in its nuclear arsenal.

As evident from the experience of the NATO-Warsaw Pact of the Cold War, the term 'limited nuclear exchanges' is an oxymoron. Nuclear exchanges cannot be kept limited and are guaranteed to escalate rapidly to full-fledged nuclear war with strategic warheads designed to destroy large cities and cause hundreds of

and Kashmir (J&K) with an active Line of Control (LoC). The state of strategic stability in South Asia has for long been a cause of concern for the international community. Pakistan's proxy war against India is now in its third decade despite several peace overtures made by India. Waged primarily by Pakistan's 'deep state'—the Pakistan Army and the Inter-Services Intelligence (ISI)—through terrorist organisations like the Lashkar-e-Taiba (LeT), the Jaish-e Mohammad (JeM) and the Hizbul Mujahideen (HM), it is showing no signs of tapering off. In fact, the unrest in Kashmir Valley in the summer of 2016, terrorist strikes at Udhampur, Gurdaspur, Pathankot and Pampore and the interception of infiltration attempts

with its behaviour as a responsible nuclear power, India would like to keep the scale and the intensity of the conflict low so as not to threaten Pakistan's nuclear red lines. However, if Pakistan's defensive operations do not proceed as planned and it perceives the 'space' red line as threatened at one or more places, the Pakistan Army may deem it necessary to use TNWs on its own soil to contest India's offensive operations, in keeping with its clearly stated intention to do so.

Pakistani analysts (senior retired armed forces officers as well as diplomats and academics) appear convinced that no Indian Prime Minister will authorise massive retaliation with nuclear weapons if Pakistan uses 'a few' TNWs against Indian forces on its own soil – on the grounds that such use does not constitute 'first use' for India. Presumably, a similar belief is held by Pakistan's senior commanders who are in positions of authority in the nuclear chain of command. Such a belief, though falsely held, lowers the threshold of use of nuclear warheads as weapons of warfighting. Also, though such a belief questions the credibility of India's doctrine of massive retaliation, it does not address the issue of the consequences that Pakistan will suffer in a contingency where the Indian prime minister, heading the Political Council of the Nuclear Command Authority (NCA), actually approves massive retaliation. Deterrence is ultimately a mind game.

Efficacy of TNWs as Weapons of Warfighting

Given the low casualty rates and minimal material damage if TNWs are employed on the battlefield against mechanised

forces, the Pakistan Army's faith in their ability to bring Indian offensive operations to a grinding halt is questionable. Simple calculations on the efficacy of TNWs against a mechanised combat group (roughly comprising an armoured regiment and a company of mechanised infantry) advancing in desert or semi-desert terrain are revealing. The combat group (60 armoured fighting vehicles – AFVs) would normally advance with two combat teams forward over a frontage of 10-12 km and depth of 8-10 km. In a nuclear, biological and chemical (NBC) environment, AFVs generally move forward in buttoned-down condition (cupolas closed, full NBC protection). A reasonable assumption would be that the civilian population of the sector in which TNWs are intended to be employed would have been evacuated.

If a nuclear warhead of 8-10 kt is detonated over a combat group (low air burst explosion, with the ground zero close to the centre), the initial casualties would be in the range of 20-30 personnel killed or wounded and 10-12 AFVs destroyed or damaged. While the leading combat group would need to regroup (undertake casualty evacuation, repair and recovery and decontamination), the reserve combat group of the combat command/ armoured brigade could resume the advance in six to eight hours. In the case of an Indian bridge head across a water obstacle being hit, the casualties would be a hundred times greater, but in a bridge head the adversary's troops would be in contact with Indian troops and, hence, a bridge head is a much less likely target.

By employing TNWs against the Indian forces, even if Pakistan does it on its own soil, the Pakistan Army would have

broken the nuclear taboo without achieving anything substantive by way of influencing the course of an ongoing military operation. In the process, it would risk the destruction of its major cities and strategic reserves as well as nuclear forces should India choose to retaliate massively. The leadership of the Pakistan Army must also have done these calculations. Therefore, their advocacy of the Indian disinclination to retaliate massively in response to their use of TNWs on their own soil indicates either a flawed analysis or a bluff that the Indian armed forces would be inclined to call.

Doctrinal Challenges

During a crisis, if deterrence breaks down, the essence of nuclear strategy would lie in minimising civilian and military casualties and material damage and preventing escalation, while ensuring the survival of the state. If Pakistan detonates TNWs on Indian forces on its own soil, the major options available to India are:

- ★ A massive retaliation to inflict unacceptable damage, in keeping with India's stated doctrine. The adoption of this option would very seriously threaten to cripple Pakistan as a functional nation state.
- ★ A flexible response (quid pro quo or quid pro quo plus response) in order to minimise the probability of further nuclear exchanges and keep the level of casualties and destruction as low as possible. For example, in retaliation for the use of two 8-10 kt warheads against the Indian forces on the Pakistani soil, India may employ four or five or even six nuclear warheads to target Pakistan's strategic reserves and nuclear forces, while ensuring that only those forces are attacked which are well away from civilian population centres.
- ★ Refraining from retaliating with nuclear weapons, but warn Pakistan of dire consequences if any more nuclear strikes are launched and increase the scale and the intensity of conventional offensive operations. (This is the least likely option and is not discussed further.)

Once deterrence breaks down, a publicly declared doctrine becomes irrelevant. In such a scenario, the political council of the NCA will have to decide as to how to retaliate based on the advice given by the executive council, of which the three services



Indian AFVs such as the BMP-2 are equipped with NBC protection systems and can operate in contaminated environments



The Nasr (Hatf-9) battlefield nuclear weapon was first tested in 2011

chiefs are members. The method and the mode of retaliation will be based on the prevailing operational-strategic situation and the likely reactions of the Pakistani armed forces, especially the probability of further nuclear exchanges. The assessment will also include the likely reactions of the international community – the threats held out, the appeals made and the course of the discussions at the United Nations Security Council (UNSC).

India's nuclear doctrine clearly states that "nuclear weapons will only be used in retaliation against a nuclear attack on Indian territory or on Indian forces anywhere." This debunks the Pakistan Army's belief that its use of TNWs against Indian forces on its own soil will not constitute 'first use.' A widely held belief among members of the Indian strategic community is even if the Pakistan Army employs TNWs against Indian forces on the Pakistani soil, the most appropriate option will be massive retaliation to inflict unacceptable damage on Pakistan.

Though such a decision will not be made lightly, from the Indian point of view, massive retaliation is the only suitable option as anything else will run the risk of lowering the nuclear threshold and encouraging the Pakistan Army to continue to bank on the early use of TNWs to counter operational reverses. Also, breaking the nuclear taboo would be considered unacceptable and flexible response would run the risk of continued and repeated nuclear strikes.

A decision to approve massive retaliation would be far easier to reach in case Pakistan uses TNWs against Indian forces, but on Indian soil.

Recommendations for Change

As 12 years have passed since India's nuclear doctrine was approved by the Cabinet Committee on Security (CCS) in January 2003, and many new developments have since taken place, a review of the doctrine is necessary. In fact, a review should be carried out every 10 years. Recommendations for continuity in some provisions and changes in other provisions of India's nuclear doctrine are given below:

India's nuclear doctrine premised on 'credible minimum deterrence' and posture of 'no first use' has stood the test of time and no change is necessary.

India's declaratory strategy is that of 'massive retaliation' to a nuclear first strike and is 'designed to inflict unacceptable damage'. This was enunciated in the statement issued by the Government of India on 4 January 2003, after the CCS had reviewed the progress in the operationalisation of India's nuclear deterrence.

Ideally, the retaliatory strategy should have been that of 'flexible response' that results in 'punitive retaliation... to inflict unacceptable damage,' as envisaged in the Draft Nuclear Doctrine of 17 August 1999, prepared by the first National Security Advisory Board (NSAB) headed by K

Subrahmanyam. However, as the strategy of 'massive retaliation' is a viable deterrence strategy that has served India well, no change is recommended. It would work well even in a contingency where the Pakistani planners may consider using TNWs against the Indian forces on Pakistani soil, as they cannot possibly risk massive Indian retaliation.

The credibility of massive retaliation needs to be enhanced through a carefully formulated signalling plan. Signalling should be based on an elaborate plan designed to showcase the preparedness of India's nuclear forces and the firmness of its political will. For example, information about regular meetings of both the political and the executive council of the NCA should be made public (without disclosing the agenda).

India's nuclear doctrine states that India will retaliate with nuclear weapons in case chemical or biological weapons are used against India. This is neither credible nor desirable as chemical or biological weapons may be used by non-state actors or by a state through proxy non-state actors with easy deniability. In either case, it would not be appropriate to retaliate with nuclear warheads. Hence, this formulation should be dropped from the nuclear doctrine.

Despite its costs and the risk of endangering arms race stability, ballistic missile defence (BMD) provides major advantages to a nation that follows a 'no first use' strategy. The government should consider sanctioning a phased BMD project to protect major cities and strategic forces.

As TNWs are extremely destabilising, Indian diplomacy should ensure that international pressure is brought to bear on Pakistan to eliminate TNWs from its nuclear arsenal. A sustained campaign needs to be mounted by strategic analysts, scholars and academics to apprise the policy community and the public of the risks associated with TNWs.

It is in India's interest to discuss nuclear confidence building measures (CBMs) and nuclear risk reduction measures (NRRMs) with Pakistan in greater depth than has been the case till now. Back channel diplomacy can also play a useful role in promoting confidence and reducing the risk of inadvertent escalation to nuclear exchanges.

Brigadier Gurmeet Kanwal (Retd)

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New Search for single-engine fighters



Artist's depiction of F-16 Block 70 in IAF markings

In an unobtrusive beginning towards the search for 'single-engine fighters' for the IAF, a number of Indian Embassies, including those in Washington DC, Stockholm and Moscow, reportedly issued 'enquiries' on 7 October 2016 to manufacturers inviting responses for meeting the IAF's requirement for "replacements for its 'ageing' fleet of single-engined fighters". Further, this would be for a "minimum 4th generation single-engined aircraft to be indigenously produced under the 'Make in India' scheme."



How the Gripen NG might look in IAF colours

Observers feel that this letter is not in the form of an RFI but more of an enquiry seeking consent that manufacturers were ready to take part in a contest, with the Air Force "seeking a medium weight category fighter to both air-to-air and air-to-ground missions". The letter specifies that the first few aircraft would be procured in "fly away condition, with the balance to be produced in India". Lockheed Martin have been first off the block, reportedly offering

their F-16 Block 70 and Saab their Gripen NG but there is no information on the Russian response.

Defence commentators are somewhat perplexed that this could well be a repeat of the M-MRCA "fiasco" which had begun in 2004 for 126 aircraft and initially specified four aircraft types, including the Lockheed Martin F-16, Saab Gripen, Dassault Mirage 2000 and MiG-29M (MiG-35). Twelve years later, a drastically reduced order for the twin-engined Dassault Rafale was finalised even as meanwhile the Government has cleared the production of 83 Tejas LCA Mk.IA single-engine fighters in addition to the 40 Mk.Is already on order (*see following item*).

There have been subsequent reports that the requirement is for "over 200 such single-engine fighters" to make would be for current short fall but this number could well exceed 300 considering the IAF's fast depleting MiG-21 and MiG-27 inventory.



Tejas LCA : 'Acceptance of Necessity' for 83 more



'Back from the cold ?' Upgraded MiG-29 of the IAF, seen while in Russia








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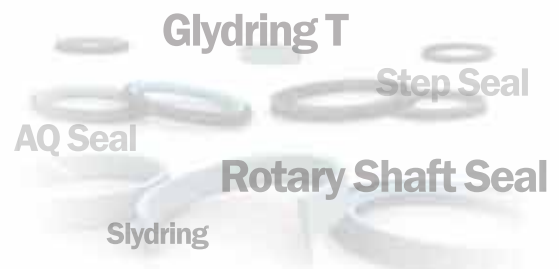


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DAC clears Tejas Mk.1A, mini UAVs, T-90 MBTs, additional Pinakas



On 7 November, the Defence Acquisition Council (DAC) led by Defence Minister Manohar Parrikar cleared a series of defence procurement proposals worth over Rs 82,000 crore (\$12.29 billion). Chief among these was Acceptance of Necessity (AoN) for the IAF to acquire 83 Tejas Light Combat Aircraft (LCA) in the Mk.1A configuration, a proposal worth over Rs 50,000 crore (\$7.5 billion). The Tejas Mk.1A improves upon the current (retroactively named) Mk.1 with structural changes to aid maintainability and reduce weight, adds a unified EW suite with podded jammer, and an Israeli AESA radar. The aircraft will be built by Hindustan Aeronautics Limited after production of the present Mk.1 aircraft is complete, and it is expected that this order will also clear the way for HAL to expand its production rate from eight aircraft per year to 16 per year.

The DAC also approved procurement of 15 Light Combat Helicopters from HAL, at a cost of Rs 2,911 crore (\$436 million). Of these, five will be for the Army and ten for the IAF. Acquisition of 464 T-90 battle tanks for the Army was also cleared, with these to be built by the Ordnance Factory Board and expected to cost around Rs 13,450 crore (\$2 billion). To supplement the four Pinaka regiments already in service or on order, the DAC also sanctioned approval for an additional six regiments, valued at Rs 14,633 crore (\$2.19 billion). 598 tactical mini-UAVs for the Army were also cleared under the 'Buy Indian' category, at a cost of Rs 1,100 crore (\$165 million). These UAVs will assist infantry by conducting aerial surveillance at short ranges.

INS Arihant commissioned

According to a number of reports, the Indian Navy has commissioned its first nuclear-powered ballistic missile submarine (SSBN) INS *Arihant* in August 2016, "thereby completing the country's nuclear triad." The Indian Navy, however, has carefully declined to either confirm or deny this information. Completion of the underwater leg of the nuclear triad significantly boosts the nation's 'second strike' capability, which is of particular importance for India, given the country's 'No First Use' policy as part of its nuclear doctrine.



File photo of a Russian ballistic missile submarine

Arihant weighs 6,000 tonnes and is powered by a 83 MW pressurised light water nuclear reactor. Efforts to construct the indigenous nuclear submarine began as the Advanced Technology Vessel (ATV) project in the 1980s, with the vessel being launched in 2009 by then Prime Minister Manmohan Singh. *Arihant's* on-board reactor went critical in 2013, and it has been put through extensive sea trials since. The submarine will be armed with K-15 Sagarika missiles with a range of 750 km, with a likely upgrade to much longer-ranged K-4 missiles once they are ready for operational use. India plans to build an initial three nuclear-powered ballistic missile submarines and the second vessel in the series, to be known as INS *Aridhaman*, is also nearing completion.

Prithvi II in successful twin-test

On 21 November, the Indian Strategic Forces Command (SFC) successfully test-fired two indigenous nuclear-capable Prithvi II missiles in quick succession as part of a user trial conducted at the Chandipur range in Odisha. The missiles were randomly chosen from production stocks and the launch activities were monitored by Defence Research and Development Organisation (DRDO) personnel.

The missiles were tracked by radars, electro-optical tracking systems and telemetry stations located along the east coast, and downrange teams on board a ship deployed near the designated impact point in the Bay of Bengal monitored the terminal events and splashdown. Inducted into the Indian armed forces in 2003, the nine-metre-tall, single-stage liquid-fuelled dual-motor Prithvi II was the first missile to be developed by the DRDO under the Integrated Guided Missile Development Programme (IGMDP).



File photo of a Prithvi missile launch



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"24 submarines not enough": Parrikar



Addressing a seminar on *Current and Future Challenges in Design and Construction of Underwater Vehicles* at New Delhi on 22 November, Defence Minister Mahohar Parrikar stated that the Indian Navy must rethink its submarine acquisition programme and look beyond the existing plans to induct 24 submarines by 2030. Referring to the existing 30-year submarine building plan approved in 1999 that envisages construction of 24 submarines, including both nuclear and conventional, Parrikar said India needed a longer plan till 2050 with more numbers. The existing plan ends in 2030 and the first submarine under it, INS *Kalvari*, will be commissioned in January 2017. "To maintain and sustain the knowledge in submarine making, India needed a longer plan," Parrikar stated.

India to acquire \$10.5bn in military hardware from Russia

On 15 October 2016, the Governments of India and Russia signed agreements for the acquisition of new generation air



defence missile systems, stealth frigates and to jointly produce light-utility helicopters. Both PM Narendra Modi and Russian President Vladimir Putin, in whose presence the agreements were signed in Goa, were enthusiastic about reinforcement of bilateral strategic partnership "to lay deeper defence ties" in the years ahead. The three projects are collectively worth an estimated \$10.5 billion (over Rs 72,000 crore).



However, the Inter-Governmental Agreements (IGAs) for five new-generation Russian S-400 *Triumf* missile systems and four upgraded *Talwar*-class frigates, apart from the joint venture to produce 200 Kamov-226T light utility helicopters, are yet to be formalised into contracts. As for the Ka-226T helicopters, this programme has moved forward with establishment of a joint venture for the project: defence PSU Hindustan Aeronautics will have a majority 50.5% stake while Russia's Rostec State Corporation will hold the remainder. The plan calls for 200 helicopters to be procured by India, of which 60 will be built in Russia and the remaining 140 by the JV in India.

Second Russian nuclear submarine to replace INS *Chakra*



K-295 Samara seen underway in this undated file photo

Also agreed at the BRICS summit in Goa, but not publicly announced, was lease of a second Russian nuclear attack submarine (SSN) for the Indian Navy. Expected to cost nearly \$2 billion, the agreement will have a modernised Russian *Akula-II* SSN, *Samara* (K-295), enter Indian Navy service for 10 years, beginning around 2021-22. The present lease for INS *Chakra* (known in Russia as K-152 *Nerpa*) expires end-2022, so the two leased SSNs will only overlap in service under the Indian Naval ensign for a short period.

Samara is currently undergoing a deep and extensive refit and modernisation at the Zvyozdochka shipyard in northern Russia, and like her predecessor, will be delivered to India essentially as a 'new' vessel. Meanwhile, the established Indo-Russian cooperation on nuclear submarines continues, with Russian experts supporting the Indian Navy's indigenous SSN programme, which plans to construct up to six indigenous nuclear attack submarines. The Advanced Technology Vessel (ATV) programme, which resulted in the INS *Arihant* nuclear-powered ballistic missile submarine, also similarly benefited from Russian input.

IAF chief visits Russia

Following the finalisation of contracts between India and Russia worth over Rs 72,000 crore including for S-400 *Triumph* missile defence systems and the joint manufacture of Kamov Ka-226T helicopters, Air Chief Marshal Arup Raha, CAS IAF made a six-day visit to Russia from 24 October 2016 (*seen below on the Russian Air Chief's earlier visit to India*).



Raha's visit was considered significant as Pakistan Air Force CAS Air Chief Marshal Sohail Aman (*see picture above*) had visited Russia some months earlier and reports had it that the PAF were considering procurement of Su-35 combat aircraft, already supplied by Russia to China. Although there was no clear indication that Russia would acquiesce to Pakistan's request, which is considered highly political, it is evident that the Russian Government is keen that joint development of the fifth generation fighter aircraft (FGFA) with India "be formalised soon." The FGFA has been subject of detailed discussions with several "protocols" signed over

the past decade. It is also reported that the Government of India is considering further expansion of the Sukhoi Su-30 MKI production programme alongside major upgradation of the aircraft already built, with a total of 272 aircraft contracted for.



Russian sources had earlier opined that "Given that Russian weapon sales to Pakistan was a sensitive issue with its traditional partner, India, a way would have to be found in which it would not appear that Russia was selling aircraft which are more advanced than the Indian Sukhoi Su-30MKIs." A way out could be that a number of Su-35s sold to China could eventually be "transferred" to Pakistan, although the PAF is also reportedly considering procurement of Chinese J-31 fifth generation fighters for its future requirements.

Indian Army Chief visits China

General Dalbir Singh, Chief of the Army Staff, visited China from 21 November and held talks with China's military leadership during his four-day visit, conveying that "lines of communications would remain open despite differences between the two countries." The Indian Army COAS visited the PLA's Eastern Theatre Command in Nanjing and had discussions with senior officers, including Gen Xu Qiliang, of China's powerful Central Military Commission (CMC).



Earlier General Dalbir Singh met the PLA Army Commander, Gen Li Zuocheng, and held talks of "mutual interest". A number of issues, including incursions by PLA personnel along the disputed border and China's close involvement in the China-Pakistan Economic Corridor running through PoK were likely to have figured in these meetings.

IAF C-17 lands at Mechuka ALG

On 3 November, the IAF carried out a successful trial landing of its Boeing C-17 Globemaster III at the Mechuka Advanced Landing Ground (ALG) in Arunachal Pradesh, validating the type's short-field performance at high altitude. The 4,200-foot airstrip at Mechuka lies at an elevation of 6,200 feet above sea level, a mere 30 km from the India-China border, and had been recently upgraded. Air access to remote areas via ALGs is seen as critical in the Himalayas, given limited road and rail infrastructure. The IAF has in recent years been prioritising re-activation of disused ALGs and upgrade of existing airstrips, along with validation of operation of various fighter and transport aircraft from these locations.



CCS approves M777 acquisition

The Cabinet Committee on Security reportedly approved procurement of 145 BAE Systems M777 ultra-light howitzers on 16 November. The proposal, initially valued at around \$647 million in 2010 has been approved at an estimated cost of \$737 million. The howitzers are seen as critical for high altitude mountain warfare, where their air-portability makes them a versatile asset. This procurement also marks the first induction of a new howitzer since Bofors FH-77B guns were acquired from Sweden in the 1980s.

The contract involves a 30% offset clause, and will have 25 guns imported from BAE Systems in the USA, while the remaining 120 will be assembled and delivered by a BAE-Mahindra Defence venture that will establish an Assembly, Integration and Testing (AIT) facility for the howitzers in India.



INS Chennai commissioned

Defence Minister Manohar Parrikar commissioned the third and final *Kolkata*-class destroyer INS *Chennai* into the Indian Navy on 21 November, commissioning of which marks completion of Project 15A for three indigenously designed and built guided missile destroyers. The follow-on Project 15B (*Visakhapatnam*-class) continues, with the second ship of that class launched in September this year (see *Vayu V/2016*). Constructed by Mazagon Dock Limited (MDL), the *Kolkata*-class entered service in 2014, with commissioning of INS *Kolkata* on 16 August that year, followed by INS *Kochi* on 30 September 2015.



INS *Chennai* is among the largest destroyers constructed in India, with a length overall of 164 metres and displacement of over 7,500 tonnes. The gas turbine-powered ship is capable of speeds over 30 knots, and is a multi-role platform armed with supersonic surface-to-surface BrahMos missiles and the Barak-8 Long Range Surface to Air Missile system (LR-SAM). The undersea warfare suite includes indigenously developed weapons and sensors, such as the Hull Mounted Sonar HUMSA-NG, heavyweight torpedo launchers, and ASW rocket launchers. For self-defence, the ship is fitted with a Kavach chaff decoy system and Mareech torpedo decoy system, both developed indigenously. The class incorporates a high level of automation with sophisticated digital networks, such as ATM based integrated Ship Data Network (AISDN), Combat Management System (CMS), Automatic Power Management System (APMS) and Auxilliary Control System (ACS). The *Kolkata*-class is designed to carry and operate up to two multi-role helicopters.

INS Tihayu joins the Indian Navy

The Indian Navy commissioned the fast attack craft INS *Tihayu* into service with the Eastern Naval Command on 19 October 2016, overseen by Vice Admiral HCS Bisht FOC-in-C Eastern Naval Command at Naval Dockyard, Visakhapatnam. INS *Tihayu* is the second ship of the four Follow-On Water Jet Fast Attack Craft (FO-WJFAC), being built by Garden Reach Shipbuilders and Engineers Ltd (GRSE), the ship being an improved version of WJFAC, earlier constructed by GRSE. Armament consists of a CRN-91 30mm cannon manufactured by Ordnance Factory Medak, Igla MANPADS for aerial threats, and a number of heavy and medium machine guns. An electronic day-night fire control manufactured by Bharat Electronics Limited (BEL) controls the main gun.

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Fast Patrol Vessels ICGS Aryaman and Atulya commissioned



Indian Coast Guard Ships *Aryaman* and *Atulya*, eighteenth and nineteenth respectively in a series of twenty Fast Patrol Vessels (FPVs) designed and built by Cochin Shipyard Limited, were commissioned on 21 October 2016 at Kochi by Sunil Kumar Kohli, IDAS, Financial Advisor to Defence Services in the presence of Additional Director General K Natarajan, Coast Guard Commander (Western Seaboard). Equipped with contemporary weaponry, communication and navigational equipment, the ships are meant for multifarious close-coast missions such as surveillance, search and rescue, and interdiction. The special features of the ships include an integrated bridge management system (IBMS) and integrated machinery control system (IMCS).

Exercise Paschim Leher at WNC

Western Naval Command carried out a nine-day operational exercise *Paschim Leher* in November 2016. Conducted in the Arabian Sea, the exercise tested combat readiness of the Command, including mobilisation and operational synchronisation. A large number of ships, submarines and aircraft participated in the exercise,



training in a networked environment alongside with a number of shore based support units.

The exercise also saw participation of Indian Air Force aircraft and Indian Coast Guard units. The scale of the exercise has been enhanced this year, with proactive operations as well as defensive operations practiced, including various contingencies off the coasts of Gujarat, Maharashtra, Goa and Karnataka.

Project-75(I) awaits DPP chapter on 'Strategic Partners'

On 18 October, Vice Admiral GS Pabby, the Indian Navy's Chief Controller of Warship Production and Acquisition (CWPA), stated that Project 75(India) – the planned procurement and domestic construction of six diesel-electric submarines equipped with Air Independent Propulsion (AIP) systems – might be progressed “soon.” He revealed that the project had been held up by delays in finalisation of the ‘Strategic Partners’ chapter in the new Defence Procurement Procedures (DPP) document and said that there had been “complications that needed to be sorted out,” but indicated that these were now almost resolved.



The Admiral confirmed that the six P-75(I) vessels would incorporate an indigenous fuel cell based AIP system, developed by DRDO and to be produced by industrial partner Larsen & Toubro (L&T). At the same time, the CWPA ruled out a long-rumoured option to integrate *any* AIP module onto the final two (of six) *Scorpène*-class submarines presently under construction at Mazagon Dock Limited.

Navy RFI for 7 Next-Gen Corvettes (NGCs)

On 14 October, the Indian Navy issued a Request for Information for “construction of seven Next Generation Corvettes (NGCs),” to be built at an Indian shipyard. The RFI was sent to both private and state-owned shipyards, and aims for the vessels to be capable of offensive surface attack, anti-submarine warfare, local naval defence, maritime interdiction operations and Visit, Board Search and Seizure (VBSS). Deliveries are anticipated to commence from 2023 onward.

While the Navy has not published specific displacement requirements, other performance parameters reveal that the NGC

is required to have a 4,000 nautical mile range and sustained top speed of at least 25 knots. Weapon specifications include an eight-missile surface-to-surface system, a SAM system with 360-degree coverage and capable of countering sea-skimming threats, a medium range (at least 15 km) gun, and a Close-In Weapon System (CIWS) for point defence. The RFI also stipulates “low radar, acoustic, magnetic, visual and infra-red signatures and adequate NCO [network-centric operations] and communications capabilities.”

India and Japan sign nuclear deal



During Prime Minister Modi's visit to Tokyo in November 2016, the Governments of Japan and India signed a civilian nuclear accord, facilitating Japan to supply India with fuel, equipment and technology for nuclear power production, as India looks to atomic energy to sustain its rapid economic growth. It was the first time Japan, the only country to have suffered a nuclear attack, has concluded such a pact with a country that is not signatory to the Nuclear Non-proliferation Treaty (NPT).

The agreement stipulates that nuclear fuel and equipment provided can “only be used for peaceful purposes,” and a separate document signed alongside the nuclear agreement has a clause allowing Japan to terminate the pact if India conducts a nuclear test.

Indian requirement for Shinmaywa US-2i amphibians reviewed

The Government of India revived discussions on acquisition of the Shinmaywa US-2i seaplane for the Indian Navy ahead of PM Narendra Modi's visit to Tokyo on 11-12 November, although no formal commitment or contract has resulted. Japanese Vice Minister for Foreign Affairs, Shinsuke Sugiyama, had earlier held talks with Foreign Secretary S Jaishankar in late October, and the procurement of 12 US-2i aircraft was reviewed during the Defence Acquisition Council (DAC) meeting on 7 November. However,



neither the DAC nor PM Modi's visit led to a clear decision on the programme.

It is learnt that Japan has marginally reduced the price, which was earlier stated at \$1.6 billion or Rs 10,720 crore for the 12 aircraft, in order to secure the deal and expand its strategic partnership with India.

India-Russia Military-Technical Cooperation



The 16th meeting of the India-Russia Intergovernmental Commission on Military-Technical Cooperation (IRIGC-MTC) was held in Delhi on 26 October 2016. Defence Minister Manohar Parrikar stated that during the 17th Annual Summit between Prime Minister of India, Narendra Modi, and the President of the Russian Federation, Vladimir Putin in Goa, discussions were held on wide range of bilateral, regional and international issues. Among others, concluded were many important agreements including an IGA on supply of S-400 Air Defence systems and on Project 1135.6 frigates. Shareholders Agreement for the establishment of a Joint Venture to manufacture Ka-226T helicopters in India was also signed, the first major defence project under the 'Make in India' initiative.

BrahMos developments

India's entry into the MTCR in June 2016 (*see Vayu IV/2016*) appear to have energised export efforts for the BrahMos supersonic attack missile, which is set to be upgraded from an MTCR-compliant maximum range of just under 300 km, to a 600 km range. The Indo-Russian missile is derived from the Russian P-800 *Oniks*, to which it appears physically almost identical, leading to speculation that the 300-km range cap was "an artificial restriction."



Meanwhile, work continues for adaption of the BrahMos for air launch, with Indian and Russian scientists announcing plans for a new attack mode that would allow the missile to more effectively disable large capital warships including aircraft carriers. The first test of the air-launched BrahMos is planned to be conducted in the anti-ship role over the Bay of Bengal in December this year. This test follows the successful integration and drop test of a BrahMos missile from a modified Su-30MKI at HAL Nasik on 25 June 2016. The initial anti-ship tests will see warship targets engaged at shallow angles – more than capable of crippling or destroying ships such as frigates and destroyers. The next phase of testing, scheduled for next year, modifies the terminal phase of the missile's flight, so as to send it plunging vertically onto an aircraft carrier flight deck.

Israeli President visits India

Israeli President Reuven Rivlin visited India in mid-November on a week-long state visit, the first by an Israeli President in nearly 20 years, after Ezer Weizman, who came in January 1997. Amongst a number of other subjects, it was reported that further



deepening of the already close defence ties was a major focus of the Israeli President's trip to India wherein both countries were also to sign a number of MoUs to expand cooperation in areas of energy, agriculture and trade. The visit also laid the groundwork for PM Narendra Modi's visit to Israel in 2017, the first ever by an Indian Prime Minister. The two countries will next year celebrate the 25th anniversary of the establishment of diplomatic ties between them.

Israel's ambassador to India Daniel Carmon said his country had plans for fresh joint ventures and technology transfers in developing weapons systems and ensuring implementation of Modi's 'Make in India' initiative in the defence sector.

IOC for Jaguar DARIN III

The Jaguar DARIN III has been accorded Initial Operation Clearance (IOC), after Air Marshal RKS Bhadauria, Deputy Chief of the Air Staff, flew an upgraded Jaguar DARIN-III twin-seat aircraft on 22 November, thereafter announcing satisfactory completion of the programme. Wg Cdr V Prabhakaran, an ASTE test pilot, was his co-pilot.



Design and development of the DARIN III programme has been carried out indigenously at HAL's Mission & Combat System Research & Design Centre (MCSRDC), while the actual upgrade was carried out at HAL's Overhaul Division. The upgrade incorporates a new avionics architecture including the Open System Architecture Mission Computer (OSAMC), Engine and Flight Instrument System (EFIS), Elta EL/M-2032 radar, a new Inertial Navigation System with GPS and Geodetic height correction, Solid State Digital Video Recording System (SSDVRs), Solid State Flight Data Recorder (SSFDR), Smart Multi-Function Display (SMD), a radio altimeter with 20,000-ft range, autopilot with altitude select and horizontal navigation, and a new Identification Friend or Foe (IFF) system. Three DARIN I Jaguars have been upgraded to DARIN III standard by HAL thus far.

Defence Minister inaugurates HAL-Safran MRO for helicopter engines



On 23 October, Defence Minister Manohar Parrikar inaugurated Helicopter Engines MRO Private Limited (HE-MRO), a joint venture of HAL and Safran Helicopter Engines. The JV will provide Maintenance, Repair And Overhaul (MRO) services for Safran TM333-2B2 and HAL Shakti engines installed on HAL-built helicopters.

There are over 1,000 Safran-designed helicopter engines, including 250 TM333 and 250 Shaktis, in India's armed forces. Shakti is Indian designation for the Safran Ardiden 1H1, co-developed with HAL and produced under licence in India. Shakti is fitted to the HAL Dhruv ALH and has been selected to power the HAL-designed Light Combat Helicopter (*see above*). The Ardiden 1U variant powers the new Light Utility Helicopter (LUH), a three-tonne single-engine helicopter that made its maiden flight in September 2016 (*see Vayu VI/2016*).

Rustom-II in maiden flight



After a two-year delay (*see Vayu II/2014*), the Rustom-II UAV made its first flight on 15 November, from the DRDO's new Rs 2,500-crore Aeronautical Test Range at Challakere, about 200km north of Bangalore. Designed by the Aeronautical Development Establishment (ADE), Rustom-II, now also being referred to as 'Tapas-201' is a two-tonne Medium-Altitude, Long Endurance (MALE) aircraft with a claimed endurance of 24 hours aloft. It will be employed as an Intelligence, Surveillance and Reconnaissance (ISR) asset, and will carry different combinations of payloads such as medium- and long-range electro-optical sensors, synthetic aperture radar, and electronic and communications intelligence-gathering sensors. ADE sources stated that the drone "met all expectations" during its first flight and that it is a contemporary system, "comparable to some of the best in the world."

Saras aircraft project revived?

Over seven years after the Saras, India's first attempt to design and develop a small passenger aircraft, was shelved, it is learnt that this project is being revived. "We are now moving ahead with the project that has remained dormant for the past few years," said Dr Girish Sahni, Director General, Council for Scientific and Industrial Research (CSIR). Development work on the project was carried out by the Bangalore-based National Aerospace Laboratories (NAL), a constituent laboratory of CSIR.



A prototype of the Saras, which first flew in May 2004, crashed near Bangalore in March 2009 during flight trials. A court of inquiry later revealed that an incorrect engine re-light procedure led to a rapid loss of altitude and abnormal behaviour of the aircraft. The crash led to a virtual 'freeze' on the programme, which had been initiated in 1999. CSIR is now seeking funds to resume the project. "We would be requiring investments of Rs 4,000 to 5,000 crore spread over a period of time," said Dr Sahni, who expects the programme's revival will incorporate certain design changes to meet present day requirements as well as address earlier technical issues.

IAF Mirage 2000 upgrade continues

At the IAF Day 2016 ceremony at Air Force Station Hindon, it was noted that a Mirage 2000 from No. 1 Squadron (Tigers) sported a grey radome with the letters 'RDY' stencilled near the



nose. Air Force sources confirmed that although full upgrades from Mirage 2000H/TH standards to the new 2000I/TI configuration (see *Vayu III/2015 for details*) would be carried out subject to pace of work at Hindustan Aeronautics, the new Thales RDY radars are being installed and made operational even as they become available. All RDY-equipped Mirage 2000s can be distinguished by grey radomes, while older Mirage 2000H/TH fighters fitted with the RDM radar retain their earlier black radomes.

Dassault and Reliance Aerospace agreement on Rafale offsets

According to media reports, the Anil Ambani-promoted Reliance ADA Group (ADAG) have reached an agreement with Dassault Aviation, manufacturers of the Rafale fighter, for a joint venture in India which will pursue local sourcing and manufacturing offset obligations of up to Rs 30,000 crore. The Joint Venture (Dassault-Reliance Aerospace) follows the formal contract between India and France on 23 September 2016 for an amount of € 7.87 billion (approx. Rs 59,000 crore) involving procurement of 36 Rafale fighters (see *previous issue*).



The JV will execute Dassault's offset obligations, as well as those of other firms involved in the Rafale deal, such as Thales and Safran, although missile manufacturer MBDA will execute its offsets separately. Although the details are to be worked out, possible areas of cooperation include work related to aerostructures, electronics, engine parts and engineering support. "We are delighted to partner a world leader in aviation like Dassault Aviation, and a visionary leader like (Dassault's CEO) Eric Trappier. This is a transformational moment for the Indian aerospace sector and for Reliance Infrastructure's subsidiary Reliance Aerospace," read a statement from Anil Ambani.

Boeing to offer KC-46 Pegasus to IAF

The Indian Air Force's withdrawal of a tender earlier this year for the \$2 billion purchase of six multi-role tanker transport (MRTT) aircraft has given Boeing an opportunity to offer its new KC-46 Pegasus for any future Indian tanker requirement. The US company did not participate in the earlier IAF tenders in the past as it did not have a suitable aircraft to field. Now, having developed a new multi-role tanker for the US Air Force, "Boeing is now able compete for tanker orders worldwide." The US Air Force has 179 KC-46s on order, with deliveries expected to be complete by 2028.

SR-SAM awaits formal clearance

During a briefing on 17 November, MBDA revealed that it is waiting for the Indian MoD to formally clear development and production of a much-delayed naval short-range air defence missile. "SR-SAM is at very final stage, we have addressed all the topics linked to design, work share, future production, content of technology transfer... all this has been discussed with customer, DRDO and BDL," said Loïc Piedevache, MBDA country head for India.

"Now we need final green light from MoD to finalise our discussion and negotiation with DRDO," he added, going on to say that first deliveries could begin as soon as three years from contract signature. DRDO is the designated organisation for design and development of the SR-SAM, while Bharat Dynamics Ltd (BDL) is the chosen production partner. Piedevache also revealed that the missile configuration as currently decided on actually exceeds the 15-km range requirement for the programme.



IAF fighters carry out highway operations

Three Mirage 2000 and three Su-30MKI fighters of the Indian Air Force carried out 'touch and go' landings on a portion of the newly constructed Agra-Lucknow Expressway on 21 November 2016. The portion of the Expressway used for the purpose has been reinforced and appropriately marked to facilitate aircraft landings. The aim of the exercise was to assess feasibility of highways being used as alternate airstrips during wartime emergencies that render air base runways unavailable.



The IAF has reportedly identified 21 highway stretches across the country to be used for aircraft operations during “operational contingencies” and natural disasters. A number of these are in Rajasthan, Gujarat, Jammu & Kashmir, Assam, West Bengal, and Uttarakhand. The IAF is already working with the National Highways Authority of India (NHAI) to upgrade existing highways or build new ones to incorporate certain characteristics to allow parts of them to function as runways.

MKU Presentation at ‘Future Armoured Vehicles India’

In their presentation at the recent ‘Future Armoured Vehicles India’ summit, MKU focussed on contemporary and future lightweight armour solutions in composite materials. Over several years, MKU has provided protection solutions for more than 2000 platforms globally including a wide range of naval vessels, land vehicles and aircraft. Many naval vessels performing duty on the Indian coastline have armour provided by the company. Engineers at MKU have developed armour solutions using Gen 6 technology, which combines advanced material with modern techniques to reduce the weight and thickness of armour panels by almost 40%. A number of Indian vehicle programmes are in the pipeline and these include the LAM, LSV, LBPV and the FICV.

SASMOS delivers F/A-18 electrical panel assembly to Boeing



SASMOS HET Technologies Limited have delivered the first F/A-18 Super Hornet electrical panel assembly on schedule and within six months from receipt of order to Boeing, from its Bangalore plant. SASMOS is under contract with Boeing to produce mission-critical equipment and cockpit panel assemblies for its F-15 and F/A-18 fighter aircraft. SASMOS HET Technologies is a leading Indian manufacturer of wiring harness, electro-mechanical assemblies and unit integration products in the global aerospace, defence and marine industry.

“This delivery by SASMOS to the F/A-18 fighter programme is testament to our commitment to ‘Make in India’ and demonstrates yet again that Indian suppliers, both big and small are becoming an integral part of Boeing’s global supply chain,” said Pratyush Kumar,

President, Boeing India. “We continue to rapidly increase our efforts to enhance complex aerospace manufacturing in India, at the same time, bringing value to our global customers.”

Seen in the photo are: Anurag Verma of Boeing DSS Supplier Management; Paramjeet Singh, Technical Director, SASMOS; Santhana Kumar, SASMOS Sales & Marketing; HG Chandrasekhar, Managing Director of SASMOS; Pratyush Kumar, President, Boeing India; and Michael Koch, Vice President, Boeing DSS at the delivery ceremony.

PSLV-C35 launches eight satellites in single flight

In its thirty-seventh flight on 26 September 2016 (PSLV-C35), ISRO’s Polar Satellite Launch Vehicle successfully launched the 371 kg SCATSAT-1 satellite along with seven other satellites. PSLV-C35 is the first PSLV mission to have launched satellites into two different orbits, and was the longest PSLV missions conducted to date, lasting 2 hours 15 minutes and 33 seconds after lift-off. The total weight of the satellites launched from the Satish Dhawan Space Centre was 675 kg. After the PSLV-C35 mission, the total number of satellites launched by PSLV stands at 121, of which 42 are Indian and the remaining 79 are foreign.

Of the eight satellites carried by PSLV-C35, SCATSAT-1 is an ISRO payload, PRATHAM is an IIT-Bombay research satellite, and PISAT is a PES University, Bangalore remote sensing satellite. The remaining five satellites were international customer satellites from Algeria (ALSAT-1B, 2B and 1N), Canada (NLS-19) and the United States (Pathfinder-1).



Air Force Commanders’ Conference

Defence Minister Manohar Parrikar presided over an Air Force Commanders’ Conference held at Air Headquarters (Vayu



Bhavan) in New Delhi on 19 October. Participants included the Chief of the Air Staff, Air Chief Marshal Arup Raha, senior Air Force Commanders and officials of from the Ministry of Defence. The Defence Minister also released a 'coffee table book' on the IAF at the Conference.

IAF assesses female fighter pilots

According to reports, the Indian Air Force is continually gathering data on "the performance of its first female fighter pilots, potential difficulties due to physiological attributes and cultural issues in the male-dominated military." Such studies are being made by a leading woman aviation psychologist and accident investigator in the IAF, under consideration of the force's crucial inspection and safety wing. "We propose to carry out a longitudinal study capturing every aspect of fighter flying," said Kuhu Ganguly, a senior scientist in the inspection and safety directorate.



The three women pilots now in the final stage of their training on Hawk advanced jet trainers at IAF Bidar include Bhawana Kanth, Mohana Singh and Avani Chaturvedi who will begin flying supersonic fighters from June 2017. "Fitness norms for flying duties are clearly laid down and both men and women will have to maintain those standards," said Air Marshal Pawan Kapoor, who heads the IAF's medical wing.

Significantly, no woman trainee from the next batch has opted for the fighter stream.

35th Coast Guard Commanders' Conference

Defence Minister Manohar Parrikar inaugurated the 35th Coast Guard Commanders' Conference at Coast Guard Headquarters, New Delhi on 28 September 2016, attended by senior officers of the Ministry of Defence and Indian Coast Guard (ICG). The annual conference encourages Regional Commanders to put forth the roadmap for future and discuss various policy and strategic issues. "The three-day conference was aimed at carving out a futuristic vision for the service and to determine the modalities to overcome future challenges."



Commissioning of ICGS Rani Gaidinliu

The Inshore Patrol Vessel (IPV) ICGS *Rani Gaidinliu* was commissioned into the Indian Coast Guard by Director General Rajendra Singh, DG ICG at Visakhapatnam on 19 October. The ship is named after the freedom fighter Rani Gaidinliu of Manipur.

The 51-metre patrol vessel is the fourth ship of the *Rani Abbakka*-class, designed and built indigenously by Hindustan Shipyard Limited (HSL). The ship is powered by three MTU 4000-series diesel engines driving three Rolls-Royce Kamewa 71S II water jets, and can achieve a maximum speed of 34 knots. ICGS *Rani Gaidinliu* has a complement of 5 officers and 34 sailors, and is commanded by Commandant (JG) Ramesh V Talke. The ship will be based at Krishnapatnam under Commander, Coast Guard Region (East).

"India to be 3rd largest aviation market in 10 years"

"In 10 years, the Indian aviation market could be the third largest in the world, overtaking the UK," according to an International Air Transport Association (IATA) forecast released in October 2016. However, aviation experts are concerned about infrastructure constraints as a major hurdle as far as Indian aviation is concerned. A prime example of this is the congested Mumbai airport which handled 41 million passengers last fiscal. The airport's declared design capacity is 40 million passengers per year. "Though the airport capacity augmentation is underway, neither will the terminal building, nor will its single runway cope with the voracious appetite for air travel that Mumbai has," said an airline official.

IATA represents 265 airlines comprising 83% of the global air traffic. Globally, IATA expects 7.2 billion passengers to fly in 2035, which is almost double of the current 3.8 billion passenger traffic. Its 20-year forecast analysed fundamental drivers of travel demand to identify major air traffic trends for the next 20 years. Passenger demand was predicted by looking at factors like the emerging middle-class, diverging demographics and liberalisation of aviation markets.

'Ude Desh Ka Aam Naagrik': India's new Regional (Air) Connectivity Scheme



On 21 October 2016, two decades after the demise of Vayudoot, India's first and thus far only regional/commuter/third level airline, the Ministry of Civil Aviation took yet another step towards "making flying a reality for the small town common man", when Civil Aviation Minister P Ashok Gajapathi Raju launched the Ministry's much awaited Regional Connectivity Scheme UDAN in New Delhi (*see picture*). This time, however, it was to be an innovative scheme to develop the regional aviation market, a market-based mechanism in which airlines bid for seat subsidies. "This first-of-its-kind scheme will create affordable yet economically viable and profitable flights on regional routes so that flying becomes affordable to the common man even in small towns."

Air India increases flights to North America

The national carrier Air India has begun long range nonstop flights from Delhi to New York, Newark, Chicago and San Francisco. According to an Air India official, "We are looking at some more cities in the USA for adding to our network. This expansion will be done with our existing aircraft and crew. We are in talks with US airports which have traffic demand to and from India. Whichever airports gives us the best deal, we will opt for that. That could be Washington DC or any other city there." Meanwhile, Air India is planning more flights to the UK and Canada including Delhi-Birmingham-Toronto and a Delhi-Washington "capital connect."



Jet Airways and CFM mark 6 million CFM56 flight hours



On 3 November, Jet Airways and CFM International celebrated the achievement of six million total engine flight hours by the airline's fleet of CFM56-7B engines. Jet Airways began operation in May 1993 with four CFM56-3-powered Boeing 737s. Since then, the airline has grown to carry nearly 20 million passengers annually, with a fleet that includes 76 Next-Generation 737-700/-800/-900 aircraft powered by CFM56-7B engines. In November 2015, the airline placed the single largest order in its history when it ordered 150 LEAP-1B engines to power 75 Boeing 737 MAX aircraft.

Air Costa "upgraded" as national airline



On 3 October, Air Costa received their licence from DGCA to operate flights "to any destination in India." The airline had earlier been operating with a regional licence in the three consecutive years since its inception. At present the airline covers eight destinations: Vijayawada, Bengaluru, Chennai, Hyderabad, Jaipur, Ahmedabad, Tirupathi, and Vizag. The pan-India licence gives options to add more destinations including 'trunk routes' such as Delhi-Mumbai, and other sectors with growing air travel populations such as Lucknow, Bhubaneswar, Chandigarh and Indore.

PZL Mielec M28 gets DGCA Certificate

Sikorsky Aircraft and its Polish subsidiary PZL Mielec have been promoting the M28 light transport aircraft to various countries, including India and South Africa to meet varied requirements including maritime surveillance and patrol. According to PZL Mielec M28 Chief Designer Mariusz Kubryn, the STOL aircraft is “a simple, tough airplane that doesn’t need much support to keep flying,”



The M28 has two type-certificates recognised in the Aviation Industry: from the US Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA). The Indian Civil Aviation Authority DGCA has reportedly now also approved the PZL M28 aircraft for commercial operations. The aircraft is built in Poland by PZL Mielec, which is owned by Sikorsky, a Lockheed Martin company.

The M28 joins Viking Air’s Twin Otter Series 400 in the recent promotion of STOL light transport aircraft to Indian operators, particularly for ‘Remote Area Connectivity and Special Mission Operations’. Observers are somewhat bemused at these efforts considering that Hindustan Aeronautics Limited are continuing to manufacture the Dornier 228 light transport aircraft at its Kanpur Division, with over 140 aircraft built to date and HAL also offering a passenger version to meet India’s regional air connectivity requirements.

Ghodawat Aviation and Airbus Helicopters’ H130

Ghodawat Aviation, the aviation division of the Sanjay Ghodawat Group has flown over 3,700 pilgrims in 40 days



to the pilgrimage site of Kedarnath with its newly acquired H130 single-engine, 7-passenger helicopter. Registered as a non-scheduled operator with the DGCA, Ghodawat Aviation currently owns three helicopters – a single-engine H120, a single-engine H130 and a twin-engine H135 – for heli-pilgrimage, charter, sightseeing, aerial survey and other services.

Airlines of India adding capacity

The various airlines of India are to increase capacity to meet the expected increase in traffic during the coming season. According to data collated from Air Travel Intelligence, domestic market leader IndiGo leads the way in capacity addition this winter, having added 285,660 seats in November 2016, compared to the capacity it had in the same month a year ago. This makes it the fastest growing airline, ahead of global low-cost majors like Ryanair, which has increased capacity by 13.7 per cent, or 260,064 seats. Gulf majors Qatar Airways and Emirates have increased capacity by 128,408 seats or 17.2 per cent, and 122,469 seats or 9.2 per cent, respectively. Another low-cost carrier from India, SpiceJet, will fly 73,565 seats or 29.9 per cent more than it did during the same period last year.



According to the Directorate General of Civil Aviation (DGCA), there will be a 20.8 per cent increase in the number of flights in winter 2016 at 16,600 a week, compared to 13,744 a week last year. IndiGo, which plans to induct 24 Airbus A320neo aircraft in 2016-17, has proposed to operate 6,276 weekly flights, some 42 per cent higher than its operations in the winter of 2015. The airline has proposed new flights from Bengaluru, Chennai and Kolkata.

Full-service carrier Vistara, a joint venture between Tata Sons and Singapore Airlines, will have 13 A320s by the end of November 2016 and operate nearly 50 per cent more flights this winter at a proposed 490 a week. The airline has proposed a new service between Delhi and Amritsar and will expand capacity on some of its existing routes. GoAir is increasing its flights by 25 per cent to 1,209 a week. It will launch new services from Bengaluru and Hyderabad. The airline is adding seven aircraft this year and will increase its fleet to 27 by March 2017. Full-service carrier Jet Airways introduced the A330 on 30 October on the Mumbai-Delhi and Delhi-Kolkata routes. The airline said the Airbus A330 would double its capacity on the Delhi-Kolkata sector.

First Bell 407GXP delivered in India



Bell Helicopter has delivered the first Bell 407GXP in India to Premair, an air charter management company, the aircraft ordered earlier this year and outfitted for corporate and VIP transport throughout the region. "Premair, a unit of Afimac Associates Private Limited, has more than 15 years of experience in aviation and provides 24/7 aviation related services to customers. The company arranges aircraft throughout India on short notice."

Derived from the Bell 407GX platform, the Bell 407GXP has an additional 50 lbs (22.5 kg) of payload capability, coupled with the new M250 Rolls-Royce engine that improves performance and fuel efficiency delivering class-leading hot and high performance.

Jet Airways disposes three A330s

Jet Airways are to dispose off three of its A330-200s currently on lease with Turkish Airlines, to a lessor. The airline said that it had made a provision of Rs 129 crore for potential loss from the sale. The airline said it was improving its fleet utilisation and network,



and had lowered net debt by Rs 252 crore in the second quarter of the current financial year. Naresh Goyal, Chairman, Jet Airways stated, "Improvements in operational performance have helped Jet Airways participate in the strong growth being witnessed in the Indian aviation market."

New airport for Goa



Prime Minister Narendra Modi laid the foundation stone of a new international airport at Mopa village in Pernem taluka in North Goa under Mandrem constituency on 13 November 2016. The Greenfield airport project will be designed, built, operated and transferred by GMR Airports which has signed a concessional agreement with the state government. Also present on the occasion was Defence Minister Manohar Parrikar, erstwhile Chief Minister of Goa.

Dynatonic delivers first A330 flap track beams

British Prime Minister Theresa May visited Dynatonic Technologies' facility in Bangalore during November 2016 as Airbus took delivery of the first commercial set of A330 flap track beams, produced jointly in the UK and India. "Airbus has significantly increased its footprint in India over the last 40 years,



and Dynamatic will provide flap track beams for the widebody A330.” The parts will be jointly manufactured in Dynamatic’s facilities in Swindon, Bristol and Bangalore, which contract will create 60 new jobs across Dynamatic’s two UK sites and 100 jobs at their Bangalore site. Flap-track-beams are guide rails fitted to the wings of the aircraft, which are crucial in controlling speed, direction and balance. Dynamatic carries out its technical engineering design in the UK and is the only Indian Tier 1 supplier to Airbus.

Revised ‘blacklisting policy’

In a significant change in policy, the Indian MoD will no longer impose blanket bans on defence companies “suspected of malpractices”. This revised policy was decided reportedly reviewed during the DAC meeting held on 7 November, and had the government reduce the ban period for serious defaulters to five years from the existing 10, and has given the armed forces flexibility in dealing with blacklisted entities in case of critical procurements. The MoD said that articulating a new policy, titled ‘Guidelines of the Ministry of Defence for Penalties in Business Dealings with Entities’ was aimed at ensuring “probity and transparency in defence deals.”

Tata Motors MoU with Indonesia’s PT Pindad



Tata Motors, India’s largest automobile manufacturer have signed a Memorandum of Understanding (MoU) with Indonesia’s PT Pindad on 3 November, “to co-operate in effectively exploring market potential for Tata Armoured Vehicles in Indonesia and other agreed ASEAN markets.” The MoU further includes a study to check the feasibility of locally assembling Tata Armoured Vehicles at PT Pindad’s facility in Bandung in West Java province of Indonesia. Tata Motors has been associated with India’s defence and security forces since 1958, and has supplied over 110,000 vehicles to the Indian military and paramilitary forces to date. Tata Motors also exports a range of specialised defence vehicles to the SAARC, ASEAN and African regions, and with its portfolio of multi-axle vehicles, has started supplying to leading missile OEMs across the world.

Second India-China joint tactical exercise

As part of an on-going initiative “to enhance interaction and cooperation between India and China under the provisions of the 2013 Border Defence Cooperation Agreement,” Indian and Chinese Army units their the second joint exercise ‘Sino-India Cooperation 2016’ on 19 October in Eastern Ladakh, as a sequel to the first exercise, held on the Chinese side of the border on 6 February 2016. This series of border exercises complements the *Hand in Hand* joint exercises and the bolsters efforts of both nations to enhance cooperation and maintain peace along border areas.



During the day-long Humanitarian Aid and Disaster Relief (HADR) exercise, a fictitious situation of earthquake striking an Indian border village was created, with joint teams carrying out rescue operations, evacuation and rendering medical assistance. The Indian team for the exercise was led by Brigadier RS Raman and that of the Chinese by Senior Colonel Fan Jun.

2/8 Gorkha Rifles win 'gold' at Cambrian Patrol



An Indian Army team from 2/8 Gorkha Rifles won the gold medal in Exercise *Cambrian Patrol* organised by the British Army, one of the most gruelling multinational army exercises in the world. The eight-member team from 2/8 Gorkha Rifles covered the 50-kilometre course on foot through the rugged Welsh terrain in less than 48 hours.

The aim of the exercise is "to test leadership, self-discipline, courage, physical endurance, and determination." The exercise is open to the militaries of the world, across branches of service, and is considered one of the most arduous and prestigious military events, testing leadership, fieldcraft, discipline and mental and physical robustness.

India-Russia joint Army Exercise Indra 2016



The eighth edition of the *Indra* series of Indo-Russian joint military exercises commenced in the Ussuriysk District of Vladivostok in eastern Russia in end-September 2016. Main focus of this joint exercise was on 'Counter-terrorism operations in semi mountainous and jungle terrain under United Nations mandate.' To achieve interoperability in joint operations, troops from both sides began by acquainting themselves with the respective approach to such operations.

250 soldiers from the Kumaon Regiment represented the Indian Army, while the Russian Army sent 250 soldiers from its 59th Motorised Infantry Brigade, in addition to a range of infantry

fighting vehicles, armoured personnel carriers, tanks and multiple-launch rocket systems.

The *Indra* series has been one of the major bilateral defence cooperation initiatives between India and Russia since 2003. In a first for an exercise of this type, Russian and Indian motorised infantry personnel taking part in the exercises used Russia's Orlan-10 drone to strike simulated terrorist groups.

Pak Military Exercise Raad-ul-Burq



Prime Minister Nawaz Sharif was taken close to the Indo-Pak border in southern Punjab by Pakistan's chief of army staff, Gen Raheel Sharif during Exercise 'Raad-ul-Burq' (strike of thunder) at Khairpur Tamewali near Bahawalpur in mid-November 2016. Addressing the troops, Sharif said, "The exercises reflect the preparedness of our armed forces to respond to any threat to the country's national security. Pakistan is ready to confront any ambitious and reckless move by its enemies." Constantly referring to India as the "enemy", Sharif said "Indian aggression and brutal tactics to curb spontaneous and indigenous movements in Jammu & Kashmir have been counter-productive." PAF JF-17 Thunder fighters, helicopter gunships and Al-Khalid tanks took part in the military exercise.

Indo-China Joint Military Exercise Hand-in-Hand 2016

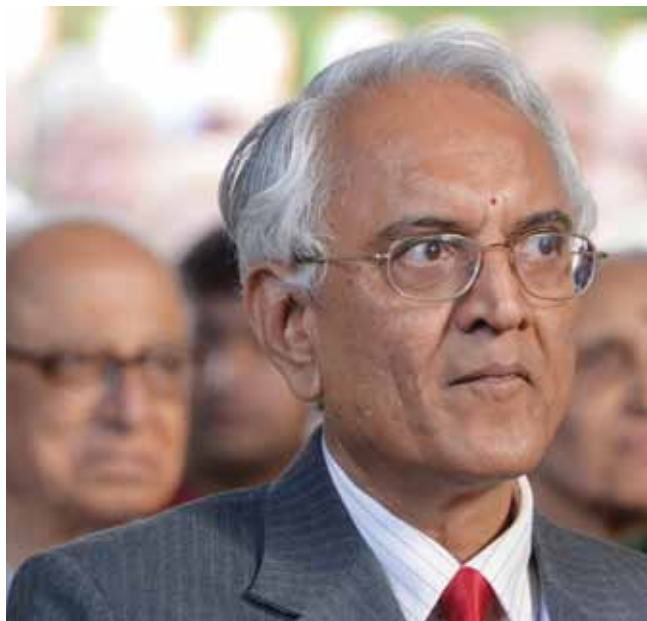
The sixth India China Joint Training Exercise *Hand-in-Hand* 2016 was held at Pune from 16 November. Maj Gen Y K Joshi, ADGMO Indian Army and Maj Gen Wang Haijiang of the PLA plus other senior army officers of both the armies were involved. The aim of the joint exercise is to acquaint both the Armies with each other's operating procedures in the backdrop of counter terrorism environment.

On 15 November, the Chinese contingent from the 13 Group Army, Chengdu Military Region comprising an Infantry Company along with supporting staff, flew from China to the Lohegaon airbase in Pune in two Il-76s. The 13-day exercise focused on special heliborne operations, handling and neutralisation of improvised explosive devices and conduct of cordon and search operations.



APPOINTMENTS

National Security Advisory Board reconstituted



Almost 20 months after the National Security Advisory Board (NSAB) was disbanded, this has been reconstituted and will now be headed by former Indian Ambassador to Russia PS Raghavan as chairperson of the board (*photo above*). The four-member team has domain experts including those on China and the US. The other three members of the board are Lt Gen SL Narsimhan (ret'd), former defence attaché to China; Avdesh Mathur, former special secretary, RAW; and Prof Bimal Patel of Gujarat National Law University. The current agenda of the board reportedly focusses on neighbourhood strategy, western neighbourhood, border management, maritime security, internal security, strategic industries and technology, strategic communications.

Rear Admiral B Dasgupta is FOC Eastern Fleet

Rear Admiral B Dasgupta took over command of the Indian Navy's Eastern Fleet from Rear Admiral SV Bhokare on 14 October 2016 at Visakhapatnam. A specialist in Navigation and Aircraft Direction, Rear Admiral B Dasgupta is a Graduate of National Defence Academy, Khadakvasla and has undergone the Command and Staff Course at Dhaka, Bangladesh. Having commanded INS *Viraat*, INS *Tabar*, INS *Karmukh* and INS *Nishank*, he has also held various prestigious Staff and Operational



appointments including Fleet Operations Officer of the Western Fleet, NA to the Chief of the Naval Staff, and as Directing Staff at the Defence Services Staff College, Wellington.

Vice Admiral SN Ghormade is Director General of Naval Operations

On 21 October 2016, Vice Admiral SN Ghormade assumed charge of Director General Naval Operations at the IHQ MoD (N). The Flag Officer is a graduate of National Defence Academy (NDA), Khadakvasla, Pune, United States Naval Staff College at Naval War College, Newport, Rhode Island and the Naval War College, Mumbai.



During his career spanning over 32 years, he has been through various operational and staff appointments, his appointments including commands of the guided missile frigate INS *Brahmaputra*, submarine rescue vessel INS *Nireekshak* and minesweeper INS *Allepey* and second in command of guided missile frigate INS *Ganga*. His important staff appointments ashore include Principal Director of Personnel, Director Naval Plans and Joint Director Naval Plans at Naval Headquarters (as separate assignments), Director (Military Affairs) at the Ministry of External Affairs, Local Work Up Team (West), Instructor at Navigation Direction School and National Defence Academy. Upon promotion to the Flag Rank in 2012, the Flag officer has held the appointments of Assistant Chief of Personnel (Human Resources Development) and Flag Officer Commanding Karnataka Naval Area. Prior taking over as DGNO he was the Flag Officer Commanding Maharashtra Naval Area.

Vice Admiral SV Bhokare is Commandant, Indian Naval Academy



On 20 October 2016, Vice Admiral SV Bhokare took over as the seventh Commandant of Indian Naval Academy, Ezhimala. The officer belongs to the submarine arm of the Indian Navy and in his career spanning 32 years, has commanded three frontline submarines, INS *Sindhughosh*, *Sindhudhvaj* and *Sindhushastra*, as well as guided missile frigate INS *Beas* and submarine base INS *Vajrabahu*. He has also held various prestigious staff and operational appointments including Command of Submarine Squadron as Commodore Commanding Submarines (West) and Chief Staff Officer (Operations) at Eastern Naval Command. On being promoted to the rank of Rear Admiral, the officer was appointed as Flag Officer Submarines (FOSM) from September 2012 for three years and Flag Officer Commanding Eastern Fleet (FOCEF) from 2015 onwards.

MV Gowtama is new Bharat Electronics CMD

MV Gowtama took over as Chairman and Managing Director of defence PSU Bharat Electronics Limited (BEL) on 8 November 2016. He joined BEL in January 1983 as a Probationary Engineer, rising to GM (Technology Planning) at BEL's Corporate Office in Bangalore on 1 February 2010. He then served as GM (Milcom) at BEL-Bengaluru and was Executive Director (Missile Systems) at BEL-Bengaluru until his elevation as CMD.



RAF Red Arrows in India for displays

The Royal Air Force aerobatic team, Red Arrows, visited India in time for the Indian Air Force Day on 8 October 2016 and thereafter following their appearance at the Zhuhai Air Show, performed formation aerobatics over the IAF Academy at Dundigal. The Government of India has ordered 123 BAE Hawks for the IAF and Navy, of which 99 have been built under licence by Hindustan Aeronautics, using parts supplied by BAE Systems and engines supplied by Rolls Royce. Over 600 IAF pilots have been trained so far on the Hawk Mk.132.



The Red Arrows trail smoke overhead Hindon, with IAF Surya Kiran Hawk 132s and No. 45 Squadron Tejas LCAs parked on the apron (photo: Angad Singh)

'Anchored On Indigenisation'

On eve of Navy Day 2016,

VAYU Interview with Admiral Sunil Lanba, Chief of the Naval Staff

VAYU: *Although a formidable force in the region, the Indian Navy's combat ships have in the recent past attracted criticism for being 'under-equipped'. For example, modern frigates and destroyers are being commissioned without adequate integral helicopters or towed sonar available, and new submarines due to enter service without torpedoes. How are these pressing issues being addressed?*

CNS: The Indian Navy presently has a force level of over 135 ships and submarines, and more than 230 aircraft for ensuring maritime security of the country. Induction of suitable platforms and equipment, as also regular review of deployment patterns, are also being undertaken by the Indian Navy towards ensuring combat capability. However, there are certain capability shortfalls pertaining to multi-role helicopters, submarines, Mine Counter Measure Vessels (MCMVs) and certain weapons, which have been delayed due to unforeseen developments. The Government is seized of the issues and steps are being taken to ensure that capability shortfalls are overcome at the earliest.

Notwithstanding, I can assure you that the Indian Navy remains fully prepared for the defence of the nation. The present force levels, coupled with the quality of training, sound professionalism, resilience, innovativeness and leadership qualities of our personnel, provides us with a definitive edge.

VAYU: *The Indian Navy's submarine force remains an area of some concern. While Project 75 (Scorpene-class) is on the cusp of fructification the Navy still operates a disproportionately small number of submarines, particularly given the challenges of the IOR*



and the maritime activities of nations such as China and Pakistan in the region. Kindly elaborate on status of critical future programmes such as the Project 75(I), and follow-on Scorpene-class orders.

CNS: As you would be aware our induction plans are driven by the need to acquire desired capability as is dictated by the Indian Maritime Strategy. The Indian Navy is progressing its submarine induction plan as envisaged in the 30-year submarine building plan. While there have been delays in certain projects, the Indian Navy maintains

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WHEN RESULTS MATTER



Project 17A, follow on to P17 (Shivalik-class, pictured here) will see extensive use of new construction methods (photo: USN)

the force levels required to meet its mandate. As brought out by you the construction of six P75 submarines at Mazagon Dock Shipbuilders Limited, Mumbai has picked up pace the first submarine, *Kalvari*, is undergoing trials and is due to be inducted in March 2017. This would be followed by indigenous construction of six modern conventional submarines at an Indian shipyard with transfer of technology from a foreign collaborator under the P75(I) programme under the ambit of the 'Strategic Partnership Model,' the guidelines for which are under finalisation at the Ministry of Defence (MoD).

VAYU: *Even as the Indian Navy looks to expand its combat force over the coming years, rate of production and capacity constraints at domestic shipyards, both public and private, could impact these plans. Are you considering introduction of established practices in foreign shipbuilding, such as forming consortiums of shipyards to execute various projects, or investing in modern construction processes such as modular designs and pre-outfitting of ship sections?*

CNS: The blueprint for the future Navy is firmly anchored on indigenisation and self-reliance. Today, the Indian Navy is a balanced force capable of blue water and littoral operations in the Indian Ocean Region and beyond. To keep pace with our growing demands, the warship building programme in the country has also increased considerably.

Our shipyards are continuously embracing modern and contemporary processes to augment their construction capability. Infrastructure upgradation has been already completed at Mazagon Dock Shipbuilders Ltd (MDL), Garden Reach Ship Builders and Engineers Ltd (GRSE) and Cochin Shipyard Ltd (CSL). It is with this modern infrastructure that GRSE will be undertaking

construction of the P17A class of modern stealth frigates. These ships will be built using 'Integrated Construction,' which involves extensive pre-outfitting at the block stage, resulting in reduced build periods and freeing of capacity. Our aim is to gradually enhance the displacement of the ships at launching stage by pre-outfitting at the block stage – up to 70% of final displacement. Literature suggests that the time and cost implications post launching are as much as eight times that at block stage, and this will economise our overall efforts. Further, Goa Shipyard Ltd (GSL) and Hindustan Shipyard Ltd (HSL) will also undergo upgradation for new projects. In addition, these shipyards will adopt a robust outsourcing philosophy to enhance capacity and meet stringent delivery schedules.

As far as forming consortia to execute warship building programmes in the country is concerned, the viability would depend upon the size and complexity of the project and the available capacity and capability at shipyards.

VAYU: *The Indian and French governments have just finalised procurement of 36 Dassault Rafale multirole fighters for the IAF. Furthermore, the MoD is working on selecting another foreign-origin fighter to be built in India for the IAF. Is the Navy involved at all in this process, or even considering operation of a common fighter type with the IAF?*

CNS: The Indian Navy's requirement for a Deck Based Fighter has been projected to MoD and Headquarters Integrated Defence Staff in accordance with the Maritime Capability Perspective Plan (MCPP) and Long Term Integrated Perspective Plan (LTIPP). Indian Navy is also participating in discussions on a 'Make in India' programme for deck based multi-role fighters. The final decision on type and numbers would be arrived at after evaluation process for naval requirements in association with MoD.



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This Navy Day, Boeing salutes all Indian Navy personnel past and present for their bravery and sacrifice. We are proud to support their many missions.



VAYU: *The Indian Navy recently organised the International Fleet Review at Visakhapatnam. What is the feedback received from participating Navies and what have been the significant gains of the IFR as regards the status of the Indian Navy among the leading navies of the world?*

CNS: The overall aim of hosting the International Fleet Review (IFR) was to shape a favourable and positive maritime environment by bringing all like-minded nations together for cooperation to ensure secure and tranquil seas. Such a mega event offers an opportunity for the host nation to enhance mutual trust and confidence with its maritime neighbours. This aspect was underpinned in the theme of IFR 2016: 'United through Oceans.' Participation of ships and delegations from 50 nations in the IFR-16 was a clear indicator of the global trust and confidence in India as a maritime nation and the Indian Navy.

Like the first IFR at Mumbai in 2001, IFR 2016 at Visakhapatnam was a resounding success and has been significant in more ways than one. Apart from showcasing the Navy's maritime capabilities, the IFR included exhibitions that highlighted India's thrust on indigenisation and innovation through 'Make in India,' 'Digital India,' and 'Green India' initiatives. The event also provided an opportunity to showcase to the world India's rich, vast and diverse cultural heritage, which was also on display at the co-located IFR Village. The International Maritime Conference on 'Partnering Together for a Secure Maritime Future' provided a forum for all participants to exchange views on ensuring safe seas for all. As a concluding event of IFR 2016, 51 ships including 17 foreign naval ships participated in exercises aimed to enhance coordination, interoperability and cooperation with the underlying theme of keeping the 'Global Commons' safe and secure.

VAYU: *The Indian Navy has been increasingly 'flying the flag' far from home shores in recent years. What are your views on energised 'military diplomacy' and the Navy's role in this?*

CNS: Today, India is on a transformational curve, and our nation is increasingly being viewed, not just as bright spot of the global economy, but also as an anchor for peace, security and stability.

Naval Diplomacy has been a traditional role of navies, as a potent and effective instrument of national security and foreign policy. Over the decades, the Indian Navy has played an important role in furthering our national and foreign policy objectives through active cooperation and engagement with not just Indian Ocean Region (IOR) littorals, but maritime nations across the globe. India and the Indian Navy have always sought opportunities that seek to enable a safe, tranquil and secure Indian Ocean through cooperative mechanisms. The Indian Navy has taken the lead in promoting mutually beneficial means, methods and mechanism towards constructive engagement in the maritime domain.

In order to energise 'military diplomacy' in India's sphere of influence, the Indian Navy has taken the lead in many significant Foreign Cooperation (FC) initiatives which are based on the four pillars of capacity building, capacity enhancement, constructive engagements and collaborative efforts.

The Indian Navy has remained engaged with friendly island states and littoral nations in the IOR, in a number of ways, primarily through deployments for Exclusive Economic Zone (EEZ)



Multinational exercises such as the Malabar series are key to the Indian Navy's role in military diplomacy (photo: USN)



INS Kolkata at the review, with Rajput-class destroyer INS Ranvir and Godavari-class frigate INS Ganga visible in the background



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surveillance, anti-piracy patrols, coordinated International Maritime Boundary Line (IMBL) patrols, hydrographic surveys, capacity building initiatives, naval training engagements, technical assistance, bilateral exercises and port calls of ships, including transfer of naval hardware in a few cases. Of these, training initiatives have been the cornerstone of our interaction with friendly navies.



Women officers will shortly be trained to fly patrol aircraft such as the Navy's Dornier 228s and Boeing P-8Is (photo: Angad Singh)

VAYU: *The IAF has commissioned its first three women fighter pilots, currently completing training before converting to operational flying. Does the Indian Navy plan to follow suit with women aboard surface ships, submarines and naval aviation fighter units? In any event, what are the organisational and logistical challenges that you foresee before this becomes a reality?*

CNS: With a view to progressively expand avenues open to women in the Navy and maximise their participation, induction of women as pilots in the Maritime Reconnaissance stream is already planned with effect from 2017. This is in addition to the Observer specialisation that has been open to women since 2008. With this, women would have an opportunity to fly modern aircraft such as P-8Is and Dornier 228s, as also to operate complex weapons, sensors and equipment on these aircraft.

As you may be already aware, the Navy, in addition to Pilots and Observers, offers other avenues too, which includes Air Traffic Control, Naval Constructor, Logistics, Law and Education branches.

As we speak, proposals to expand the employment of women in combat roles are being actively considered. The Indian Navy conducted a Human Resource Seminar at Mumbai, where too this aspect received positive feedback. However, the decision to appoint women to warships is subject to a number of factors. To ensure seamlessness and permanence of transition, appropriate policy frameworks are being deliberated to address tangible aspects such as ship design and intangible ones, which include familial

obligations and gender sensitivity, so that all these are addressed comprehensively.

VAYU: *The Navy's 'Ocean of Opportunities' campaign has been very visible across various media - print, television, radio and online. Has the effort resulted in tangible reduction in shortages of officers and sailors, as noted in various parliamentary reports? What are the Navy's future plans to reach and sustain desired levels of recruitment?*

CNS: A particularly strong thrust has been given to the enhancement of awareness amongst the youth, with regard to the Navy as a career option. Extensive publicity campaigns are being undertaken to attract the right kind of youth to join the Navy and this is bearing excellent results. The latest image projection campaign conducted by the Indian Navy titled 'Ocean of Opportunities' was very well received by the youth. The naval recruit today comes from India's aspiring classes and looks to the Navy for a way of life unrivalled in professional and personal growth. Therefore the theme highlights the multitude of opportunities offered by the Navy to the aspirants.

As a result, the Navy is getting adequate response to its recruitment drives from the youth of the country. Every entry is fully subscribed and call letters are issued to only those deserving candidates who are above the cut-off merit. After the selection process, a final merit list is drawn up and only the requisite numbers of candidates as per available vacancies are inducted. Therefore, the Navy is able to select the best amongst the eligible volunteers. I am confident that in a few years we will effectively make good the shortages.



Vayu's Executive Editor in conversation with the CNS at South Block (photo: Indian Navy)

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Marking the Indian Navy's 66th year,

Admiral Arun Prakash (Retd) reflects on



New Maritime Vistas and Challenges

Were the Indian Navy to emulate the Army, it could well have claimed its heredity, as a fighting force, back to 1612 when the East India Company raised the Indian Marine, consisting - apart from a few English galleons - of lightly armed, native *ghurabs* and *galivats*, manned by Konkani seamen. Having decided to renounce this colonial legacy, the Indian Navy today reckons its age as from 26 January 1950 when the prefix 'Royal' was dropped from its designation and His Majesty's Indian Ships (HMIS) became Indian Naval Ships (INS).

Indian Navy Day, however, is celebrated every year on 4 December, to commemorate a famous naval victory: the daring missile-boat attacks on Karachi harbour, 1971. Thus, the navy's 66th birthday is an apt occasion for reflection and a review of some past milestones.

Looking at the Wake

The IN looks back with immense pride on the 1971 Bangladesh War, in which an imaginative leadership, still smarting from India's maritime inaction in 1965, boldly employed the full range of maritime capabilities. Splitting its assets between the Eastern and Western theatres, the navy imposed an effective blockade on both wings of Pakistan. It then unleashed missile-warfare, carrier air strikes, submarine warfare, amphibious landings, special operations and mine-warfare, to quickly bring the enemy to its knees. The invaluable IN contribution to this successful tri-Service campaign demonstrated, to India's ruling elite, the navy's potential as a powerful instrument of state policy.

The brief 1999 Kargil War, despite the absence of any joint contingency planning, saw the IN undertaking mobilisation

and concentration of both Western and Eastern fleets in the Arabian Sea, under an operation code-named 'Talwar'. This overt display of maritime muscle sent the appropriate message to Pakistan and led the Kargil Review Committee to later comment in its report: *"Pakistan was startled by the Indian Navy's deterrent deployment that bottled up its fleet in Karachi. Aware of its vulnerability, Pakistan ordered its navy not to tangle with Indian ships. Any engagement would have resulted in exposing its fuel dumps and sea lanes to the Gulf from where it gets its oil.... Thus a high level of deterrence was maintained at sea by keeping the maritime front alive."*

Still it was to be the 2004 tsunami that established the IN as a credible regional force of substance and resolve. Succour rendered, with alacrity, not just to India's own stricken citizens but also to its Sri Lankan,

Maldivian and Indonesian neighbours in desperate need, left a deep and abiding impression on international observers. This image was strongly reinforced by the non-combatant evacuation operations (NEO) efficiently mounted by IN task-forces to evacuate South Asian refugees, from war torn Lebanon in 2006, Libya in 2011 and Yemen in 2015.



The International Fleet Review 2016 was a spectacular week-long international event (photo: Angad Singh)

But the years 2013-14 must have qualified as *annus horribilis* for the IN on account of a succession of accidents at sea. Most of these were minor collisions, groundings and other minor mishaps that occur in every active seagoing service, but two involving loss of life on board submarines, were indeed of grave import. Sustained and hysterical media focus panicked the MoD into pressurising the navy and culminated in the resignation of a principled Navy Chief. The unseemly haste with which his resignation was accepted clearly spoke of relief on Raisina Hill that a sacrificial lamb had presented itself. However, the service showed tremendous post-traumatic resilience, resolutely bouncing back under its new leadership to register fresh landmarks.

Nothing could have symbolised the resurgence of the IN, better than the International Fleet Review, held in February 2016. This maritime extravaganza saw President Pranab Mukherjee, Supreme Commander of the Indian armed forces, reviewing an international fleet of nearly 100 warships, submarines and merchantmen off Vishakhapatnam. With personnel as well as hardware on display, this glittering event provided an opportunity for navies to size up friends and rivals alike. The IN would have more than achieved its objectives if the Review helped promote mutual friendship and understanding between the 60 participating navies, whose ships and/or

Chiefs had assembled at Vishakhapatnam.

The new Navy Chief, who took over the helm soon after the Fleet Review, also inherited an updated Maritime Strategy, released in October 2015. As the navy's new leadership peers out of the porthole, for a glimpse of 2017 and beyond, they would see a dappled horizon with many dark clouds and a little sunshine.

Peering out of the Porthole

Looming large over the maritime prospect is China whose leadership had made a public pronouncement in 2012, that becoming a 'maritime power' was essential to achieving national goals. This commitment was made after a decade of deliberation over the vital importance of the maritime domain to China's economy and security and its criticality for attainment of China's long-term power aspirations. Above all, it is Xi Jinping's firm embrace of maritime power as an essential element of 'China's Dream' that has converted continentalists in the Party as well as the PLA.

According to a study by the US Centre for Naval Analysis (CNA), in a few years from now, China will have the world's second strongest navy – in numbers as well as capability. It is already a world leader in shipbuilding and has the world's largest fishing industry (over 700,000 mechanised vessels). Its merchant marine ranks first in the world, as does its coast guard. China has also re-activated a dormant civilian auxiliary force, dubbed the 'Maritime Militia', whose huge numbers are expected to help the state in enforcing its maritime and territorial claims.

Given these facts, the report concludes that no other country in the world can match China's maritime capabilities. Whether it is the navy, merchant marine or deep-sea fishing fleet, the Chinese flag is going to be ubiquitous across the world. Recently,

when China mocked the adverse ruling of the Permanent Court of Arbitration tribunal in The Hague, there was a view that weight of international opinion would force it to fall in line. However, abject capitulation by the Philippines – the complainant in this case – has brought the rude realisation that there are limits to how far small nations can defy a rising hegemon like China.

The other cloud on India's horizon is the Sino-Pakistan nexus whose singular aim is to undermine India's progress and prevent its rise in the Indian Ocean Region and beyond. While Pakistan, by itself, may never have amounted to more than a nuisance for India, the unholy alliance of these two revisionist neighbours has served to keep India off-balance and to confine it within a 'sub-continental box'.

China has not only provided nuclear wherewithal to Pakistan, but also sustains the latter's inventory of conventional weapons and helps nurture and protect Pakistani terrorist organisations that torment India. The 2014 appearance of PLA Navy submarines in the IOR had caught India by surprise, but with the seaward end of the China-Pakistan Economic Corridor (CPEC) anchored firmly in the Gwadar deep sea port, visits of PLAN units to India's neighbourhood could become routine.

Sufficient heed has not been paid, in India, to the 2012 inauguration of Pakistan Navy's 'Strategic Forces Command' and the intriguing announcement that the PN is the 'custodian of Pakistan's second strike capability.' Should China provide nuclear warheads for the *Babur* and *Ra'ad* cruise missiles and/or modify the *Yuan* class submarines being supplied to Pakistan, for tactical nuclear weapons it could well change the balance of maritime power in the Arabian Sea!

India's pivot to the USA

Russia's economic woes, renewed antagonism with the West and open flirtation with China and Pakistan has diminished its attraction for India as a dependable friend. For the IN, it will, however, continue to remain a major source of weapon systems and nuclear technology for many years.

In the larger context, given India's growing economic, technological and military asymmetry vis-a-vis China and its rapidly diminishing room for manoeuvre, a 'pivot to the USA' seems to have become inevitable. The Indo-US relationship,



which had hit a speed-breaker soon after the unprecedented 2008 Civil Nuclear Agreement, has seen a vigorous revival under the NDA regime, with the opening of defence imports via the FMS route. Another major breakthrough came with the signing, amidst much controversy, of the Logistics Exchange Memorandum of Agreement, in 2016.

Both PM Modi and President Obama have staked a great deal of personal prestige on the revival of Indo-US relations. In Obama's words "*India and the US are not just natural partners. I believe America can be India's best partner*". The *US-India Joint Strategic Vision*, issued in 2015, affirmed the importance of safeguarding maritime security and ensuring freedom of navigation throughout the region, especially in the South China Sea.

Seen in conjunction with the trilateral Exercise *Malabar* 2016, between the US, India and Japan, this seems to be an affirmation that collective security may be the best way forward in the emerging regional architecture. Noteworthy is the catalytic role played by the IN in helping sustain the Indo-US relationship on an even

keel despite occasional politico-diplomatic perturbations. Starting with the first ever *Malabar* exercise in 1992, the past quarter-century has seen the two navies build a close relationship, exemplified by the little-known fact that our MiG-29K pilots have been taught their deck-landing skills on US Navy carriers!

Recent Past in Review

On Navy Day 2016, the IN can look back on the recent past with considerable satisfaction, having crossed a number of significant markers, signposted by its leadership, through a 15-year 'perspective plan'. This plan, which set out a roadmap for warship-building, hardware acquisition and infrastructure creation was, in turn, underpinned by a Maritime Strategy and its companion; a *Maritime Doctrine*. Here it must be noted that the IN has had to bridge an intellectual void since the India's security establishment has neither spelt out national aims and objectives, nor dwelt on issues related to doctrine and strategy.

Actually, August 2013 saw the IN achieving two long-awaited landmarks that heralded its arrival in the 'big league' of

navies. First, the nuclear reactor of India's indigenous ballistic missile submarine (SSBN), launched in 2009, attained criticality and, then, a few days later, India's first indigenous aircraft carrier (IAC-1) was launched in Kochi. The SSBN has been recently commissioned as *INS Arihant*, and will form the third leg of India's nuclear deterrent, adding immensely to its credibility. India's expensive and ambitious nuclear submarine programme is likely to include 3-4 attack submarines (SSN) in addition to a similar number of SSBNs.

IAC-1 (to be named *INS Vikrant*) displaces 37,500 tons and is the largest warship ever to be built in India. Powered by four gas turbines which would give it a top speed of 28 knots, it will operate the MiG-29K and the indigenous Tejas (Navy) from its ski-jump. Building an aircraft carrier is complex business and Cochin Shipyard could take anything up to 5-6 years before the *Vikrant* goes to sea.

In the meanwhile, plans for IAC-2, a bigger carrier, are on the design-boards in the New Delhi, but naval planners face a difficult chicken-and-egg situation.



INS Kolkata at anchor (photo: Angad Singh)

Depending on the navy's choice of aircraft, the ship's size, configuration and cost could differ enormously. Aircraft like the MiG-29K, Su-33K and Tejas will require a ski-jump for operations and the carrier could be driven by gas turbines or diesel engines. A choice of Rafale (M) or F/A-18 Hornet, on the other hand, would require a catapult, backed by a steam (or nuclear) propulsion plant.

January 2014 saw the much delayed, 44,500 ton, former Soviet aircraft-carrying cruiser *Admiral Gorshkov*, re-named INS *Vikramaditya*, arriving in its home-port of Karwar. Carrying a mix of supersonic, 4th generation MiG-29K fighters, Kamov Ka-28 anti-submarine warfare (ASW) and Kamov Ka-31 airborne early-warning (AEW) helicopters, the *Vikramaditya* packs



The first of six Scorpene-class submarines, Kalvari, is set to be commissioned shortly, but the Navy's submarine shortage remains a concern (photo: Indian Navy)



The Navy still operates large numbers of obsolescent HAL Chetak utility helicopters (photo: Angad Singh)

a punch that promises to transform the maritime balance of power in the Indian Ocean region.

The year 2014 saw another event of considerable significance, when the first of a series of stealth destroyers, INS *Kolkata* was commissioned in Mumbai. So far, the largest Indian-built warship to join the navy, the size, firepower and advanced technologies incorporated in this 7500-ton ship make it a formidable weapon platform. What places the *Kolkata* many notches above most of its contemporaries, worldwide, is the advanced multi-function radar embedded in its mast, and a long-range surface-to-air missile both being the fruits of a joint Indo-Israeli venture. Its formidable, Indo-Russian, BrahMos supersonic surface-surface missile has no counter-measure, so far.

Another bright light on the horizon was the launch, in October 2015, of first of six *Scorpene*-class submarines being built under licence from France, by Mazagon Docks. With its submarine force severely depleted and rapidly approaching obsolescence, the IN is, no doubt, keenly looking forward to the delivery of the remaining five boats of this class by 2020. A question that still hangs fire, relates to the option of installing an air-independent propulsion (AIP) system on the last two boats. Typically, the navy will need to decide whether to risk placing faith in DRDO's promises or go for the imported AIP system.

Even the delivery of all six *Scorpene*s will leave the IN well short of its long-standing objective of attaining a force-level of 30 submarines. Meeting this goal requires the

act as a 'force-multiplier' for the IN. Naval aviation, however, continues to suffer an acute capability-deficit due to a long-standing shortage of shipborne ASW helicopters, whose acquisition is caught in the Stygian coils of our complex acquisition processes.

While Indian strategists are working out ways to counter China's maritime resurgence, including its 'string of pearls' and 'maritime silk road' concepts, the IN has been doggedly pursuing its decade old 'Foreign Cooperation' strategy. By undertaking bilateral exercises with the world's major navies, and by extending a hand of friendship to smaller navies in our neighbourhood, through security, material and training assistance, it has not only established its own credibility, but also reinforced our diplomatic outreach.

Navy Day is an opportune moment to remind ourselves - and our decision-makers - that a nation's maritime power encompasses much more than merely a 'fighting navy'. Even as India is creating a world-class navy, we lack most of the other constituents that make up 'national maritime power'. Inexplicably, the national leadership as well as most maritime states have neglected its remaining : efficient ports and infrastructure, a large merchant fleet, a competent shipbuilding industry, exploitation of deep-sea fishery and seabed resources. Without them, India cannot aspire to become a great maritime nation; a status already attained by China. Successive governments have flourished grandiose 'maritime visions', but with little impact on ground.



The Navy's maritime patrol/ASW capability received a significant boost with induction of the Boeing P-8I (photo: Angad Singh)

selection of another submarine type and nomination of a second agency for serial production. Both decisions seem to have eluded the MoD for over a decade now.

With PLA Navy submarines - both diesel and nuclear - undertaking long endurance patrols in the Indian Ocean, the IN was in urgent need of upgrading its anti-submarine warfare (ASW) capabilities. The induction of the Boeing P-8 (I) maritime patrol and ASW aircraft, carrying an advanced sensor suite as well as formidable weapon-load will

On Navy Day 2016

Finally, there is food for thought, both for the Government of India and for the IN, in the fact that China, for all its impressive maritime infrastructure and assets, has refrained from declaring itself a 'maritime power'. This deliberate decision of its leadership is attributed to the fact that it perceives certain deficiencies in its maritime capabilities. India, on the other hand, has anointed itself as 'net security provider' in the Indian Ocean region.

India will, in a few years, be amongst the foremost centres of power in the world, whose economic strength and technological prowess would need to be underpinned by concomitant military power, of which maritime strength will be a critical component. In its 66th year, the IN shows full promise of becoming a maritime force of substance. Whether it remains a regional actor or strides the international stage will depend entirely on India's economic progress—and political vision.

Ajai Shukla urges that



The Navy (Should) Get the Gravy

INS Vikramaditya and INS Viraat (in the background) at the International Fleet Review off Visakhapatnam in February 2016

The Indian Navy, the smallest but most strategic of the three services, is suffering from chronic malnutrition with its share of defence allocations cut from 18 per cent four years ago to just 14.5 per cent today. In dealing with any Chinese military offensive, the Army and Air Force will be on the defensive. The Navy alone can take the offensive, with its control over the Indian Ocean trade routes providing an instrument to throttle China's economy. Yet, short-term preoccupations grab the country's resources. When a high-power, empowered committee visited Russia in October 2016 after the Uri attack, the focus was entirely on making up the Army's shortfalls. Similar committees went to Israel. Meanwhile, many warship and naval acquisitions remain starved of funding while indigenous projects, like the building of a nuclear-powered aircraft carrier, have languished for years awaiting clearance.

It should not take an operational emergency to remind planners that the Navy needs urgent attention. Given the years it

takes to build warships or to integrate naval systems into the existing fleet, one cannot rely on makeshift solutions at times of crisis. So here are five vital naval concerns that are seriously worrying the admirals.

First, the Navy needs more warships to discharge the multiple responsibilities of a regional security provider—dominating two seas and an ocean, counter piracy duties, humanitarian aid and disaster relief (HADR) missions, showing the flag in port visits across the world and growing bilateral and multilateral exercises like Malabar. Planning documents - including the Navy's 'Maritime Capability Perspective Plan' and the tri-service 'Long Term Integrated Perspective Plan' - recognise the need for a 198-warship fleet by 2027. The Navy would like 60 per cent of these (some 120 vessels) to be capital warships, a category that includes large, offensive combat platforms like aircraft carriers, destroyers, frigates, corvettes and submarines. The other 40 per cent can be smaller vessels like missile boats, fast attack craft, patrol boats, amphibious landing ships and logistic support vessels.

Against this requirement, the Navy has just 140 vessels today, of which barely half are capital warships. The admirals say they need 24 frigates, the workhorses of any navy, but are ten short of that requirement. Worse, they see no way of making up the deficiencies by 2027.

India's only two yards that build capital warships - Mazagon Dock Ltd, Mumbai (MDL) and Garden Reach Shipbuilders & Engineers, Kolkata (GRSE) - are stretched to capacity. MDL is building four destroyers and four frigates, while the smaller GRSE constructs three frigates and two corvettes. Meanwhile, the largest defence shipyard, Hindustan Shipyard Ltd (HSL), and the smallest one, Goa Shipyard Ltd, have never built capital warships - a lacuna the Defence Ministry should purposefully address, but does not. The same is true of two private shipyards, Larsen & Toubro's Kathupalli Shipyard, and Reliance Defence and Engineering's Pipavav Shipyard, which both have world-class facilities but are still to demonstrate that they can build high-tech warships.



INS Satpura stealth frigate of the Indian Navy built by Mazagon Docks



Indian Navy's first Scorpene-class submarine INS Kalvari on launch



Pair of IN Sea King helicopters : the Navy's rotorcraft requirements are vital (photo: Angad Singh)

With so many facilities idling, small wonder the Defence Ministry has clutched at Moscow's offer of four half-built frigates, variants of six *Talwar*-class vessels already in the Navy's fleet. This 'Band-Aid', while perhaps inescapable, provides little assurance about who will build seven Next Generation Corvettes in the pipeline (*see news item in this issue*), or the next-generation destroyers and frigates on the drawing board.

A simultaneous focus must ensure full operational capability of warships in service. For varied reasons, including the blacklisting of prospective vendors, crucial vessels have worrying operational gaps. Torpedoes have not been procured for the *Scorpène* submarines; several capital warships are dangerously vulnerable to enemy submarines for lack of advanced towed array sonars and a five-year delay in inducting the Indo-Israeli Long Range Surface-to-Air Missile has left several frigates and destroyers without adequate defences against anti-ship missiles, their primary threat. The 127 millimetre anti-aircraft gun for warships remains stalled since the company that builds it is blacklisted. As one Admiral grimly observes: "Without all these systems, our new platforms will serve only to provide target practice to the enemy."

Thirdly, focused attention is needed on procuring naval multi-role helicopters, to be deployed on capital warships for airborne early warning (AEW), anti-submarine



IAC-1 (to be commissioned as INS Vikrant) seen under construction at Cochin

warfare (ASW) and search and rescue (SAR). These rotorcraft significantly extend a warship's bubble of influence, especially its ability to detect and destroy enemy vessels. For decades, Indian warships deployed the Westland Sea King Mk.42B helicopter but the fleet atrophied rapidly after the USA imposed sanctions on spare parts after India's nuclear tests. Now, ironically, Sikorsky is riding renewed US-India defence relations by offering S-70B multi-role helicopters.

The fourth focus area must be fleet support ships, essential for a 'blue water navy' to operate far from the mainland. Fleet support ships carry the logistics support-like fuel, stores and repair facilities - that sustain a naval flotilla on long deployments. The Navy currently makes do with four such vessels: two 27,500-tonne fleet tankers, *Deepak* and *Shakti*, built by Fincantieri and commissioned in 2011; INS *Jyoti*, a 35,900 tonne Russian oiler commissioned in 1996 and INS *Aditya*, a 24,600 tonne replenishment and repair ship delivered by GRSE in 2000. To add to this capability, HSL is required to build five 40,000 tonne Fleet Support Ships with technology transferred by Hyundai Heavy Industries. An Inter-Governmental Agreement with South Korea is moving at a leisurely pace

and must be expedited. Similarly impetus must be given to the construction of four Multi-Purpose Vessels (MPVs), for which private and public shipyards were invited to bid last year. These 4,000-5,000 tonne vessels are jack-of-all-trades, used for varied tasks like logistic support, HADR missions and towing targets - all essential for effective naval functioning.

Finally, we must focus on quickly beginning construction of six submarines under the long-delayed Project-75(I). This will boost the submarine arm, which dwindled to just 13 boats when INS

Sindhurakshak sank after an explosion in 2013. Some relief is on hand with six *Scorpène* submarines entering the fleet by 2021. Yet, expensively acquired submarine building skills are atrophying on MDL's idle production line while the government dawdles over sanctioning Project-75(I). This mirrors events in MDL in the 1990s and early 2000s, when submarine building skills, developed while building two HDW submarines, attenuated because of delays in concluding the *Scorpène* contract. We cannot afford to repeat this multi-billion dollar blunder.



The Indian Navy operates a single leased Akula-class nuclear attack submarine, INS Chakra, with a second boat expected to enter service in 2020-21 (photo: Indian Navy)

Further, on the vitality of



An artist's impression of what INS Vishal might have looked like before the Navy decided on the EMALS

India's next Aircraft Carrier

The Navy has made its choices. When INS *Vishal*, the Indian Navy's second indigenous aircraft carrier enters service, it will be a technologically cutting edge warship, on par with the world's most advanced carriers. The Navy's finalised specifications include nuclear propulsion, a catapult launch system based on the new American Electro-Magnetic Aircraft Launch System (EMALS) and the capacity to embark 55 combat aircraft.

But advanced technologies also mean delay. Naval planners, talking

anonymously, say INS *Vishal* will not enter service before 2030, and might take as long as 2035 to join the fleet as India's third operational carrier.

Already, the Navy faces six years of delay in the first indigenous carrier, the 44,000-tonne INS *Vikrant*, which Cochin Shipyard Ltd was supposed to deliver in 2015. Until the *Vikrant* is commissioned in 2021, the Navy will operate just a single carrier - the 45,000-tonne INS *Vikramaditya*, built in Russia and commissioned in 2013.

Yet the Navy's decision is clear : delay is acceptable, but INS *Vishal* must pack the power needed to effectively dominate India's extended area of operations. Over the years, the Navy has defined this as extending across the Indian Ocean, from the Strait of Hormuz in the west, to the Malacca Strait in Southeast Asia.

To dominate this swathe of sea, the Navy believes *Vishal* would need at least 55 aircraft on board. These will include two fighter squadrons, electronic warfare (EW) aircraft, airborne early warning (AEW)



USS Gerald R Ford will be the first operational aircraft carrier to employ EMALS (photo: US Navy/MC3 Cathrine Mae O. Campbell)

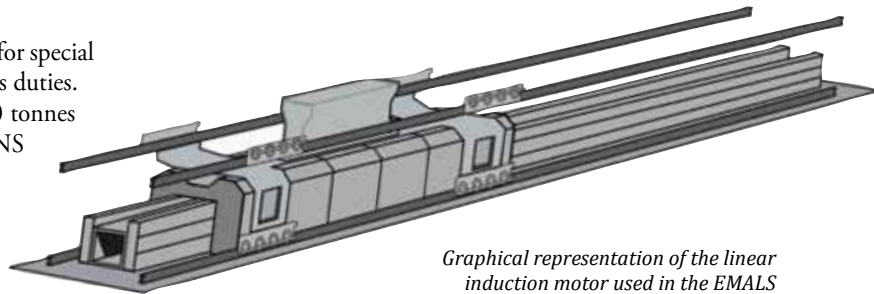
aircraft to monitor and control airspace, and helicopters for special operations, anti-submarine warfare and communications duties.

Given the capability-to-weight thumb rule of 1,000 tonnes of displacement needed for each aircraft embarked, INS *Vishal* would have to be about 60-65,000 tonnes. To propel such a carrier at a sustained 30 knots (over 55 kilometres per hour), a nuclear propulsion system has been considered inescapable.

India does not yet have a nuclear propulsion system suitable for an aircraft carrier. The 83 Megawatt (MW) nuclear reactors designed for the *Arihant*-class nuclear ballistic missile submarines (SSBNs) are inadequate, since an aircraft carrier requires several times more power than an SSBN.

Developing a new, purpose-built reactor remains an option, but planners could also attempt to modify the 540 MW nuclear reactors that India has developed for commercial power generation.

The Navy has extensively debated the question of nuclear propulsion. Opponents of nuclear propulsion point to the Royal Navy's 65,000 tonne *Queen Elizabeth II*, slated to be commissioned in 2017, which will be powered by Rolls-Royce MT30 gas turbines. Proponents of nuclear propulsion argue that India's carriers would require more electrical power, since these would launch aircraft with the power-intensive EMALS system.



Graphical representation of the linear induction motor used in the EMALS

Even so, India's carriers would be significantly smaller than the US Navy's 95,000-tonne *Enterprise*-class; and the new 100,000-tonne *Gerald R Ford*-class super carriers that embark 90-100 aircraft.

"We have conveyed our choice. Now the government will decide. An aircraft carrier has huge financial implications, with large annual outlays during construction and even while it is in service. So the government will understandably consider the choices carefully. And that means delay," says a senior naval planner.

The government's decision will be complicated by recent reductions in the naval budget. This year, allocations to the Navy are down to just 14.55 per cent of the defence budget, from 18 per cent in 2012-13. Defence experts opine that, given the Navy's growing role and the cost of capital warships, an 18 per cent allocation is unavoidable.

Yet, in the wake of the Uri attack, a high-level empowered committee that visited Russia for emergency purchases of military equipment bought mainly army weaponry. The admirals worry that the current focus on tactical skirmishes with Pakistan on the Line of Control might shift focus from the strategic, long-term need to bolster the Navy.

Last year the Navy specified INS *Vishal*'s approximate weight while seeking consultancy assistance from global shipbuilders in designing the carrier. But that request was silent on several key questions-including nuclear propulsion and EMALS. Nor was there a completion date.

Another crucial question to be decided is what aircraft INS *Vishal* will embark. The MiG-29K/ KUBs, bought from Russia for *Vikramaditya* and *Vikrant*, have limitations that are still being ironed out. Nor is the Naval Tejas light fighter making significant headway.

That opens the door for two bigger fighters that already fly off aircraft carriers: the French Rafale, already procured from Dassault for the Indian Air Force; and Boeing's F/A-18E/F Super Hornet, the world's premier carrier-borne aircraft. With EMALS technology chosen for INS *Vishal*, the US fighter has a slight edge in this race.

(See also article 'Building the Indian Navy's Super Aircraft Carrier' by Vice Admiral Arun Kumar Singh in *Vayu* II(2011).

Adapted from articles first published in Business Standard



The MiG-29K operates from INS Vikramaditya and is slated to do likewise from INS Vikrant (photo: Angad Singh)



US Navy F/A-18F Super Hornet about to launch from the carrier USS Theodore Roosevelt (CVN-71) during Exercise Malabar 2015 (photo: Angad Singh)

“One of our best ships ever” !



Vice Admiral Surinder Pal Singh Cheema, who retired from the Navy on 31 January 2016 after four decades of distinguished service which included as FOC-in-C of Western and Southern Naval Commands, C-in-C of Strategic Forces Command and finally Chief of Integrated Defence Staff (CIDS) to the Chairman, Chiefs of Staff Committee, recalls his command of INS Viraat, the Indian Navy's second aircraft carrier

I commanded the INS *Viraat* for a full one year and I have to start by saying that, in my 40-year naval career, that stint was the best, ever. Mariners say all ships have a soul but let me tell you, the INS *Viraat* was something special-she had a distinct soul. The feeling you got when you were on board was unmatched, spectacular even.

Lady Winston Churchill had launched her in the year 1953 and she became an integral part of the Indian Navy in 1986. That's a long time for a ship but INS *Viraat* just refused to show age. Each refit, each upgrade made her deadlier, more formidable. She had the latest in guidance systems, weaponry, radar... everything. Like fine wine, she only got better. And this was only possible because of our excellent maintenance and engineering crews. They spared no effort whenever she docked for a service. Never was I forced to spend a day extra at a port due to maintenance issues.

"Full steam ahead!" Splendid image of the INS Viraat at the International Fleet Review in February 2016



[Top: At the Captain's bridge; crest of the Viraat; pennant number ('R22')]

The job done by our Navy crews was so impeccable that the carrier held her own even when we participated in exercises with some of the world's biggest naval vessels. We sailed with the Americans who had sent the USS *Nimitz* and the USS *Ronald Reagan*. We later sailed with France's massive *Charles de Gaulle*-the largest warship in Western Europe. But the INS *Viraat* matched wits with all of them. At no point during these vast training exercises did we feel a lacking in capabilities-such was her strength, such was the quality of upgrades she had received by our Navy.

There may be a debate now that asks, "do we really need aircraft carriers?" My answer is a resounding yes ! Having a carrier forces the enemy to completely rethink its strategy. Also, a carrier allows a country to operate a true blue-water navy. We must understand that an aircraft carrier is not just a ship. It's actually a floating airfield that can deploy fighter jets at a moment's notice to counter strategies aimed at creating air superiority. Having fighters in the air is a strategic deterrent and an aircraft carrier allows you to do just that-deter. Which is why almost every important Navy is now busy developing the next generation of aircraft carriers.



Harrier T Mk.4(I) two seat trainer on INS Viraat

The other pertinent point is trade. The Prime Minister has hit the accelerator on the economy. Much of the trade that's coming into India-its most essential needs-arrives via sea. In fact, 95 per cent of India's trading by volume and 70 per cent by value is carried out via maritime routes. Having an excellent Navy then is imperative in keeping these trade routes, and the economy safe, and active.

The *Viraat* looked after us all with flair. But it was all about its dedicated crew-including the Harrier pilots, the Sea King pilots and the Kamov pilots who had the skills and the honour of landing their

aircraft on this beautiful ship. There never was an incident involving any of the aircraft while approaching the ship. And landing on a stretch in the middle of the sea was quite the task.

The INS *Viraat* still had plenty of life left in her. She was only retired because crucial components belonging to the Sea Harrier jets-which had the short take-off and landing ability — ran short on supply. This is the chief reason why we had to reconsider her service with the Indian Navy.

Overall then, the INS *Viraat* remains one of the finest ships we have ever sailed and this, is a fond farewell !



From HMS *Hermes* (R12) ...



HMS Hermes returning from the Falklands to Portsmouth on 5 April 1982, after 108 consecutive days at sea

HMS *Hermes* had been in service with the Royal Navy for some three decades and was due for de-commissioning in 1982 just as the Falklands War broke out. *Hermes* was made flagship of the British South Atlantic Task Force, setting sail just three days after the Argentine invasion of the Falkland Islands. *Hermes* embarked an air group of 12 Sea Harrier Fighter-Reconnaissance-

Strike aircraft of the Royal Navy's Fleet Air Arm, plus 18 Sea King helicopters. A few weeks after sailing, more aircraft were flown in or transported via other ships to replace some losses and augment the task force. *Hermes's* air group finally grew to 16 Sea Harriers, 10 Harrier GR3s of the Royal Air Force and 10 Sea Kings (after some of the helicopters were dispersed to other ships) as well as a troop

of Special Air Service (SAS) and Royal Marines.

As *Hermes* was the RN's largest warship, she was considered too valuable to risk being close to the Falklands, considering the possibility of Argentine air force attacks. Her Harriers therefore operated at the limit of their endurance radius, but were very successful in keeping the enemy aircraft at bay, shooting down

... to INS *Viraat* (R22)



INS Viraat conducting a PASSEX with multinational warships after the International Fleet Review 2016 (photo: Indian Navy)

several attacking enemy fighters including Mirages and Skyhawks.

After her return to home waters from the Falklands conflict, HMS *Hermes* continued in service till 12 April 1984, and then entered into a much needed 4-month refit to her propulsion and electrical systems, as well as a thorough cleaning and repainting. *Hermes* was then put into the reserve and finally 'paid off' in 1985.

Meanwhile, the Governments of India and Britain had begun negotiations for sale of the HMS *Hermes*. On 19 April 1986, the sale was formalised and the carrier began a year long Dry Docking and Essential Defect Rectification (DED) programme at Devonport Dockyard, Plymouth prior to her new commission under the Indian flag. Selected Indian Navy crew of specialists reached England soon after and extremely hard work was put in to meet the tight schedule, earning laurels from both Royal Navy and Plymouth Dockyard.

At 1145 hrs on 12 May 1987, the HMS *Hermes* was handed over and the INS *Viraat* was commissioned at HM Naval Base at Plymouth in England, under the command of Captain Vinod Pasha Pasricha, a naval aviator who earlier commanded INAS 300, *White Tigers*. '*Viraat*' means massive and majestic with the ship's crest depicting a sea eagle, signifying airpower, with a clutch of five arrows depicting an all-round weapons capability. During its extensive refit programme, some of the ship's systems were replaced, including the electronic suite, parts of the installed weaponry and the propulsion system were brought upto new standard. Existing problems with boiler tubes were sorted out and a state-of-the-art Computer Aided Action Information System (CAAIS) installed.

INS *Viraat* carried out month-long sea trials along the English Channel and with an initial complement of over 800 personnel abroad, sailed out from Plymouth on 23 July 1987, visiting Naples and Athens before transiting through the Suez Canal. The *Viraat*, which also carried three Westland Commando helicopters on delivery to India, then embarked its new Sea Harriers, Sea Kings and Chetaks off Goa on 17 August 1987, carrying out some exercises in the Arabian Sea before being formally received on the 21st August 1987 by the Prime Minister of India, Rajiv Gandhi.

The Chief of the Naval Staff Admiral RH Tahiliani had then famously stated

that acquisition of the second aircraft carrier was "a great moment for us in white uniform" and marked "the beginning of a true blue water capability", with an ability to control specified areas of the sea to forestall intrusions, a task "best performed by aircraft carriers".

Meanwhile, the Indian Navy's first aircraft carrier INS *Vikrant* had proceeded for the second installment of its

modernisation programme involving the fitting of ski-ramp to enhance operational capability of Sea Harriers. The arrival of INS *Viraat* was thus timely, this second aircraft carrier ensuring that one was always operational with the Service.

The *Vikrant* was decommissioned in 1997 and the *Viraat* is following her nearly two decades later, after over six decades of distinguished service under two flags.



INS *Viraat* at sea with aircraft on deck (photo: Indian Navy)

From Rolls-Royce:



“A Trusted Partnership with

The Indian Navy can be counted as one of the most technologically advanced and potent guardians of the nation's borders. As India grows to expand its sphere of influence regionally and globally, the Indian Navy is dynamically evolving to play a greater role in regional maritime security to ensure peace on the high seas and in the air.

Rolls-Royce takes pride in the fact that it has had a deep and strong partnership with the Indian Navy that stretches back to 1953 when the first aircraft of the navy was inducted into service. A great experience was with INAS 300, where Rolls-Royce

personel continually worked alongside the squadron for over 54 years. RR's current priority is to support the mission-readiness of the Indian Navy's Sea King fleet which has many years of operation left in its role. The Sea King helicopter has proven to be an important force multiplier for the Indian Navy, being employed in multiple roles ranging from anti-submarine warfare, commando operations, ambulance, to anti-shipping strikes in multifarious weather conditions both by day and night. The Sea King has been a potent weapon platform for the Indian Navy and will continue to be so for many years. While RR engines

provide operators with unparalleled fuel efficiency that enable to stay on station and on mission for longer times, the services and support are aimed at further maximising the number of engines available to fly and reduce the cost of support to operators. RR is helping the Indian Navy maximise its use of the Rolls-Royce powered Hawk Advanced Jet Trainer, which is an expanding fleet, crucial to the Navy's combat aircraft capability. Also, MTU engines form backbone of the Indian Coast Guard and Indian Navy Fleet. Bergen Engines are also fitted on vessels of the Indian Coast Guard.



The US-2 shares a largely common engine type, the AE2100, with the IAF's C-130J Super Hercules

the Indian Navy”

The Indian Navy is currently considering acquisition of the US-2I amphibious aircraft. The US-2I shares a largely common engine type, the AE2100, with the Indian Air Force's existing C-130J Super Hercules fleet as well as the CTS-800 engine which assists with take-off. Drawing on experience in supporting a common engine fleet, Rolls-Royce is the perfect choice for providing support to the US-2I fleet to ensure operational capability – anytime, anywhere!

The Indian Coast Guard and Indian Navy are transitioning to a faster fleet for increased littoral security: replacement of propellers by water jets for smaller craft. Even the Indian

Navy's major modernisation drive presents an opportunity to develop indigenous capability for design and manufacturing of ships, submarines and subsystems. Rolls-Royce is well placed to aid this upgrade of the Indian Navy by offering engines, ship design, gas turbines, propulsors, electrical power systems, underway replenishment, propellers and water jets, cranes and handling systems, etc. Recent orders include supply of stern gear for seven Indian naval frigates and five OPVs.

Globally, a number of the world's leading coast Guard services already use Rolls-Royce-designed vessels and more

than 70 navies around the world use RR power systems and equipment. “In India, we continue to build on our distinguished legacy and long-standing partnership with Indian Navy. We are proud of the fact that over 40 Indian Navy and 41 Indian Coast Guard vessels are powered by Rolls-Royce equipment.”

Our extensive product base and experience in both ship design and propulsion and power systems integration, enables Rolls-Royce to contribute to system selection, the interfacing of the propulsion system to the ship structure, ship services, auxiliary systems and ancillaries.

Our marine business offers an extensive product base and proven experience in both ship design and system integration which enables us to bring the right products together when developing power, propulsion and motion control solutions that are fully matched to a vessel's operating profile. Our approach enables us to deliver a complete service, from initial concept studies, through equipment selection, systems integration and through life support. With MTU now a part of the Rolls-Royce marine equipment portfolio it helps us in building up a synergy by the offering of complete drive-line integrated system solutions to naval customers across the world.

Dr. Glenn Kelly, VP - Customer Business Defence India, Rolls-Royce



Flexible Surveillance

Swordfish MPA



Be it jet or turboprop, Saab's Maritime Patrol Aircraft provide extensive domain awareness

Monitoring the seas is a key part of the defence and security strategies of nations across the world. Parallel to increased global trade and shipping, the nature of marine threats ranging from accidents to piracy is rapidly evolving. At the same time, the number of countries that employ submarines is increasing.

The Swedish aerospace group are conscious of the need to combat such threats and to help meet these, Saab have developed the Swordfish Maritime Patrol Aircraft (MPA). Using Bombardier's Global 6000 business jet as also the Q400 turboprop, Swordfish delivers strategic, multi-role capabilities that allow operators to achieve multiple domain awareness.

"Swordfish aircraft are adept at tasks as diverse as search-and-rescue operations,

anti-surface-unit warfare and even overland roles," states Gary Shand, Saab's Director of Marketing and Sales, Airborne Intelligence, Surveillance and Reconnaissance (ISR).

A particularly useful role is the use of these aircraft in anti-submarine operations. "An increasing number of countries are investing in diesel-electric submarines, and this creates a need for solutions to locate, track and identify them," Shand stresses. "Submarines are the ultimate stealth technology, and Swordfish is one way of combating them."

To perform their duties, Swordfish Maritime Patrol Aircraft rely on a combination of Saab's advanced technological systems and operationally proven sensors. In maritime ISR mode, the aircraft's 360-degree active electronically scanned array (AESA) radar provides a

clear picture of the area, working with identification aids such as an Automatic Identification System (AIS).

In search-and-rescue operations, radar and electro-optics can be used in tandem with human observers for optimal results. In anti-submarine operations, Swordfish's acoustics technology and sonobuoy and torpedo payload come into action. What knits all these together is Saab's next-generation airborne command-and-control system. Serving as the nerve centre of the aircraft, it fuses incoming data and provides intelligent support to the crew, helping them to make more efficient tactical decisions.

Swordfish aircraft have four or five workstations and they can carry 150 sonobuoys of various sizes. With operations stretching over several hours, the well-

from Saab



Swordfish MPA on the Bombardier Q400

Maximum range: More than 3,000 nautical miles

Maximum cruise: 329 knots

Time on station: More than 7.5 hours at 200 nm

Swordfish MPA on the Bombardier Global 6000

Maximum range: 4,400 nautical miles

Maximum cruise: 450 knots

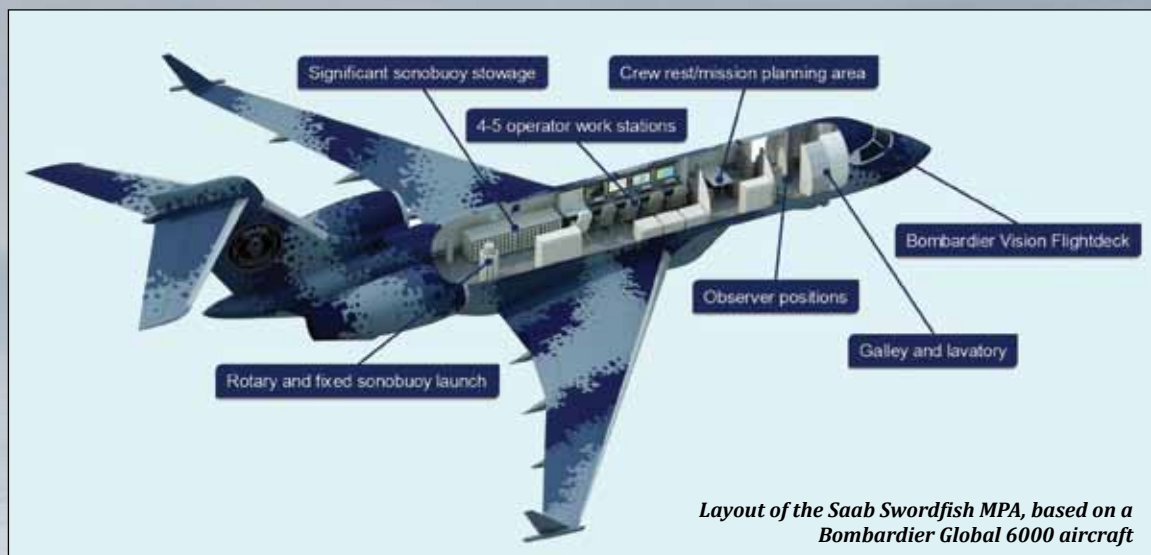
Time on station: More than 8.5 hours at 1000 nm

designed internal cabin enhances comfort to help crew avoid fatigue, stay alert, and focus on the job.

Shand says the mission flexibility of Swordfish aircraft is one of their greatest strengths. “The standard configuration of the platform makes it simple to alternate between submarine-hunting mode and search-and-rescue mode, without having to land.”

“Saab is able to offer such a complex system owing to decades of experience in airborne surveillance and an expanding maritime portfolio. In fact, Saab is unique in that this company offers both MPA, and the latest-generation air-independent propulsion submarines to customers.”

Courtesy: Saab



Layout of the Saab Swordfish MPA, based on a Bombardier Global 6000 aircraft

The doctrine of 'Sea Denial'

Pakistan Navy's Submarine Arm



PNS Hamza, a Khalid-class (Agosta 90B) submarine, seen docked at Karachi

The Pakistan Navy's doctrine of operations against India has always been centred on employment of its forces for 'Sea Denial.' During the 1971 War, the PN focus was on targeting Indian ships with its submarines until India was able to blockade Karachi harbour, the country's leading commercial port and economic hub. However, the PN was successful in its efforts when INS *Khukri*, an Indian Navy frigate, was sunk off the coast of Diu, by the Pakistan Navy *Daphné*-class submarine PNS *Hangor* on 9 December 1971. This was the first warship sunk in action by a submarine since World War II. In the last few decades, while India has embarked on the path of naval modernisation and development and expanded its force with inclusion of aircraft carriers, destroyers, submarines and aviation assets to achieve the status of a blue water navy, Pakistan continues to lay emphasis on the instruments of sea denial to take on the stronger adversary.

One of the Pakistan Navy's clearest and most achievable areas of modernisation



INS Sindhuvi Jay, a Kilo-class boat of the Indian Navy

and growth is regarding its submarine fleet. Presently, the Pakistan Navy operates five French submarines, which include three Agosta 90B (*Khalid*-class) boats and two older Agosta 70 (*Hashmat*-class) boats of 1970s vintage. The three Agosta 90Bs form the core of Pakistan's current submarine fleet. Of these, PNS *Hamza* was commissioned and assembled at the Karachi Shipyard and Engineering Works (KSEW) in 2008. The other two submarines, PNS *Khalid* and PNS *Saad* were indigenously overhauled and retrofitted with air-independent propulsion (AIP) systems in 2011.

To augment the *Khalid*-class boats, the PN has been seeking to replace its now-

(which the Chinese Navy Type 039A does have), the boat's modular design allows integration of an AIP module based on customer requirement. Pakistan's then-Minister for Defence Production, Rana Tanveer Hussain, confirmed last year that four submarines under this project will be built in China and the balance will be simultaneously constructed in Pakistan at KSEW, Karachi under a transfer-of-technology agreement.

The *Yuan*-class incorporates some of the best features of the *Song*- and *Kilo*-class SSKs. This 2,300-ton submarine has a range of 8000 nm at 16 knots cruising speeds and is capable of operating at depths up to 300 m. The double hull design is integrated

missile (SLCM) capability acquired with this induction. The Type 039A has an anti-submarine/anti-ship weapon capability of six 533 mm torpedo tubes and short range YJ-82 ASCMs. It is speculated that the submarine will eventually be equipped with the supersonic YJ-18 missile, currently under development. These missiles have a reported range of 220 km and, represent a credible anti-access/area denial (A2/AD) force multiplier. It is not yet clear whether these boats will be equipped with the capability to launch cruise missiles with light plutonium-based nuclear warheads, but if so, they will give Pakistan an assured nuclear second-strike capability in the form of Babur land attack cruise missiles.



An Agosta-class submarine under construction in Pakistan

retired *Daphné*-class and ageing *Agosta* 70 submarines. In fact, it was very close to procuring three Type 214 submarines from Germany in 2009, but could not proceed owing to financial constraints. However, on 23 July 2015, Pakistan approved purchase of eight S-20 submarines from China for \$5 billion. This acquisition will significantly augment the Pakistan Navy submarine fleet. S-20 is the export version of the PLA Navy's Type 039A/041 (*Yuan*-class) diesel-electric submarine. Although the S-20 is not normally equipped with an Air Independent Propulsion (AIP) system

with advanced noise reduction techniques including anechoic tiles, passive/active noise reduction and asymmetrical seven-blade skewed propeller, making it difficult to track. It is expected that Pakistan will opt for a Stirling engine-based AIP for these submarines, which would give them greater operational flexibility through increased endurance. In any case, the PN has gained adequate experience and technical expertise in operating AIP systems on board their existing Agosta 90B submarines. The Pakistan Navy's biggest gain will be in the form of the submarine-launched cruise

Most analysts believe that the *Yuan*-class submarine was designed primarily as an attack submarine with a secondary role as an anti-ship cruise missile (ASCM) platform capable of operating in shallow littorals. Additionally, its large size, particularly for a non-nuclear boat, grants it the capability to operate beyond coastal waters. Moreover, its sonar and other combat equipment are well suited for deep waters, hence the PN will have the flexibility of deploying these boats around choke points off Indian coasts, on defensive tasks off the Makran coast

or on mid-ocean targeting tasks against Indian merchantmen/warships. In a conventional role, because of its modern sonar and the tactical flexibility provided by the AIP system it will undoubtedly be an effective ASCM platform against enemy ships. However, limitations in the form of missile load may restrict its effectiveness as an ideal ASCM platform. In the absence of any vertical launch system (VLS), it is obvious that the existing six torpedo tubes will be used to load a mix of missiles and torpedoes. With the present fitment of short-range YJ-82 missiles, a *Yuan*-class submarine may be better off engaging the target with its primary weapon of torpedoes at close ranges. Even after the induction of the long range YJ-18 ASCM, the restrictive factors of the torpedo room's capacity and the limited number of launchers will make it very hard for the submarine to saturate an enemy ship's air defences with only four, or at most five, missile salvos.

As for the strategic aspect of this induction, Pakistan Navy could be preparing itself to take on the new challenge of having a potent platform at sea with strategic weapons. With the Indian Navy at the threshold of operationalising its first nuclear powered ballistic missile submarine (SSBN) – *INS Arihant* – which will form the nucleus of India's sea-based deterrent, Pakistan's former Minister for Defence Production, Rana Tanveer Hussain, has indicated that three or four

Yuan-class AIP submarines armed with nuclear or conventional land attack cruise missiles might offer a suitable answer from Pakistan. Although all eight *Yuan*-class boats might not be put on strategic deterrence tasks, this new induction may be called the sea-based arm of Pakistan's nuclear triad.

Keeping in mind the PN concept of operations, it is expected that many of these boats, along with the older *Agosta* 90Bs, will be on conventional patrol duties, fulfilling the traditional sea denial role against an expanding modern Indian naval armada. It is also heard that a Turkish state-owned defence contractor has won a contract for the mid-life upgrade and modernisation of the three *Agosta* 90B boats. With these developments, the PN submarine force will be a significant threat to the Indian Navy's ambitions to establish sea control in the north Arabian Sea.

Inadequacy of credible anti-submarine capabilities has always been a cause of concern for Indian maritime forces. Although considerable progress has been made in this regard with the fitment of indigenous high performance sonars on board ships and induction of P-8I long-range ASW aircraft, a lot more needs to be done to tide over this capability gap. While the distant ASW support to the fleets can be provided with the P-8Is, the provision of close support in the form of integral ASW aircraft element needs attention.

With the existing – insufficient – inventory of integral ASW helicopters in both the fleets, the surface ships, including aircraft carriers, are under considerable submarine threat. China, in its recent drive to achieve maritime supremacy, has started deploying its submarines in the Indian Ocean region. During one of its deployments in 2015, to support its ongoing anti-piracy campaign in the Gulf of Aden, a *Yuan*-class submarine called on Karachi port. That visit was probably the first indication of such impending acquisition by the Pakistan Navy. The sale of Chinese submarines along with transfer of technology to Pakistan is certainly not based on commercial benefits only, and could well be a step in China's ambitions to establish a toehold in the Indian Ocean.

The PN decision to acquire eight new AIP and ASCM-equipped submarines from China and conduct a mid-life update of their *Agosta* 90Bs has once again brought into focus the importance of the underwater threat to Indian naval forces. No doubt the new induction is India-centric, for which AIP-equipped submarines provide a cost-effective solution in terms of maintaining a possible nuclear deterrent at sea. The Indian Navy will have to lay emphasis on acquisition of additional and credible anti-submarine assets to bridge over this critical capability gap.

Capt HPS Sodhi
Senior Fellow, CAPS



The Westland Sea King: The Indian Navy is facing a shortage of ASW helicopters, critical to countering the PN submarine threat (photo: Angad Singh)

India-Russia Defence Co-operation

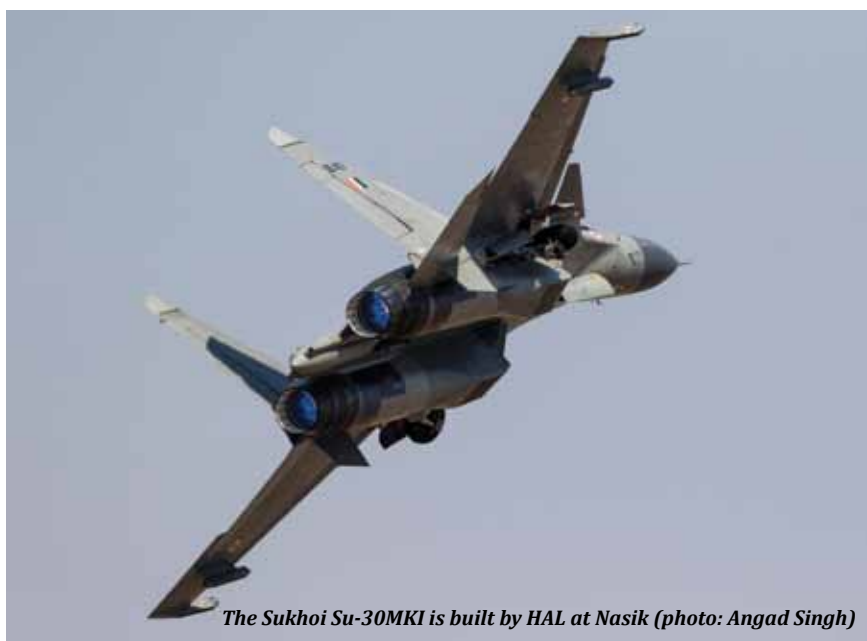


The Navy's flagship INS Vikramaditya is symbolic of Indo-Russian defence cooperation

Time to Look Forward

The Soviet Union, and later Russia, have been the most reliable suppliers of state-of-art armament for India's defence forces. India and Russia have an institutionalised structure to oversee the complete range of issues of military technical cooperation. The *India-Russia Inter-Governmental Commission on Military Technical Cooperation* (IRIGC-MTC), set up in 2000, is at the apex of this structure.

The backbone of India's military deterrence, in the form of frontline offensive hardware like the Sukhoi Su-30MKI fighter aircraft of the IAF, the Navy's aircraft carrier INS *Vikramaditya*, *Rajput*-class guided missile destroyers and nuclear submarine *Arihant*, as also T-90 main battle tanks and BMP II infantry combat vehicles (ICVs) of the Indian Army, are all of Russian origin. In fact, bulk of the MBTs and ICVs are manufactured



The Sukhoi Su-30MKI is built by HAL at Nasik (photo: Angad Singh)

under licence at the Medak and Avadi Ordnance factories. In addition, other critical military equipment in the Indian inventory including long range artillery, air defence missiles, attack submarines, medium helicopters, surveillance aircraft and transport aircraft have also been majorly sourced from Russia.

However, more recently, the 'buyer-seller relationship' has transformed to a new approach involving joint research and design development for production of 'state of the art' military platforms. Joint development and production of the BrahMos cruise missile and joint development of the fifth generation fighter aircraft (FGFA) signify landmark advancements in the field of defence technological cooperation between the two countries. The supply and joint manufacture of two hundred Kamov 226T helicopters for the Indian military, as part of the Indian Government's 'Make in India' initiative, puts Russia at the forefront of the new model of India's equipment procurement procedure.

Since 2003, naval ships and army units from Russia and India have been participating in combined annual military exercises 'Indra', alternately in either country. This has enabled both countries to build relationships, share tactics, techniques and procedures as well as gain knowledge about each other's military and ethos.

The Soviet Union, and subsequently Russia, have also provided support to India

in the field of military training. Although most of this support was in the form of technical training related to military equipment procured from Russia, Indian officers have attended tactical and military leadership courses at prominent academies such as Voroshilov, Frunze, Malinovsky, Vasilevsky, and Kursi Vystrel. Indian officers also trained at the Timoshenko Academy on Chemical and Nuclear Defence. Russian officers in turn have attended the Indian Staff College. Unfortunately, language and cost proved serious barriers in later years and this element of the mutual relationship was allowed to die down after the previous bilateral agreement on the subject expired in 2004.

Challenges in Indo-Russian Defence Co-operation

As Soviet-India defence cooperation had mostly remained a buyer-seller relationship in the field of military equipment, problems started surfacing in the post-Cold War era when the cost of Russian items shot up suddenly, spares availability kept deteriorating (after Russia lost access to its factories in erstwhile Soviet republics), and India started making efforts to diversify its sources of defence procurement. Russia sought privileged 'single vendor' status and expressed uneasiness at being put through 'multi-vendor' procurement procedures along with vendors from other countries. The cost escalation of the aircraft carrier

Admiral Gorshkov was a major bone of contention that defied resolution for an extended period of time. There are significant problems even today, such as Russian aircraft being delivered without critical Western-origin parts (owing to sanctions), which India has had to import directly.

It is also a fact that, over recent years, quadrilateral dynamics of the India-USA-Russia-China equation have been throwing their shadow on the India-Russia relationship. At a time when relations of the United States with both China and Russia have been deteriorating, US relations with India have been on an upswing. China and Russia have been strengthening their mutual security relations through the Shanghai Cooperation Organisation, which is developing as an anti-US/Western grouping. Further, India's relationship with China continues to face challenges owing to its border disputes as well as China supporting Pakistan on a host of issues of concern to India. Nonetheless, it is to the credit of both India and Russia that they have not let such challenges come in the way of their time tested mutual relationship.

Towards that end, the Indian government has painstakingly ensured that positive developments in India's relations with the United States have not been at the cost of its special relationship with Russia. The Indian Government has always been at pains to explain to their Russian counterparts that India has its own strategic and security compulsions independent of Russia, where the United States plays a special role. India has shared a special relationship with the United States thanks to common democratic values—and the English language. Indian Americans draw the highest income and are among the best-educated immigrant groups in the United States, and at 3.18 million, are also the fastest growing racial group. Nonetheless, the bottom line is that India will never allow the dynamics of the India-US relationship to impact negatively on Russian interests. Thus far, it appears Russia is appreciative of these facts.

In recent years, the non-renewal of Russia-India Agreement for military training in each other's institutions of higher learning has led to loss of opportunity at strengthening the



The Kamov Ka-226T is to be produced in India by an Indo-Russian JV



The BrahMos supersonic cruise missile programme is a flagship example of defence cooperation between India and Russia

mutual defence relationship. The previous agreement on the subject was allowed to lapse in 2004 (possibly because of the high cost of military courses in Russia) and thereafter this remained unsigned for ten years, until President Putin's visit in 2014. Consequently, the relationship was restricted to just equipment issues, which suffered from the ups and downs related to equipment shortcomings, non-availability of spares, and so on. Costs of military courses, in dollar or euro terms, are perceived as extremely high and there are also issues with regard to 'medium of instruction' (language) and course content. Reciprocal arrangements for attendance at courses by officers from both sides may be a good way out to resolve the current impasse and resume this important instrument of defence cooperation available to both sides.

However, recent developments in Russia-Pakistan defence cooperation have been causing concern in India. Since the last three years, in a marked shift in Russian defence policy, Russia has started enhancing defence cooperation and supplying defence equipment to India's arch-rival Pakistan, in contravention of earlier informal agreements between India and Russia. Russia has reportedly signed an agreement last year to sell four Mi-35 advanced attack helicopters to Pakistan. It has also signed an agreement to directly supply Klimov RD-93 engines for the JF-17 fighter aircraft being manufactured by Pakistan under licence from China. Russia

has also started conducting joint military exercises with Pakistan.

In discussions with their Indian counterparts, Russian officials make efforts to play down these developments and explain them as being linked to Russian interests in Afghanistan and Central Asia. However, Russia needs to be conscious of the fact that all defence equipment that is sought by Pakistan is meant for use against India. Consequently, enhanced defence cooperation, resulting in supply of modern military equipment to Pakistan by Russia, will have negative impact on India-Russia relations, which definitely needs to be avoided at this sensitive stage.

The Road Ahead

Energising the India-Russia strategic partnership remains a vital need for both countries amid a changing regional and global security environment. This assumes special challenges at a stage when both countries appear to be strengthening strategic relationships on opposite sides of the global power divide. In these challenging circumstances, both countries would need to tread a careful path to make sure that they do not undermine each other's strategic and security interests.

In addition to the strong traditional bilateral partnership, the BRICS platform must be used by both countries to enhance their mutual partnership and develop relationships in many fields, including that of defence cooperation. Russia must show

understanding about India's efforts to assume a more substantive role in regional and global affairs and provide support accordingly. Russia must understand that any progress by India will not run contrary to Russia's interests. In fact, India's growth will always be cognizant of and sensitive to Russia's strategic interests.

There are agreements underway for Russia to supply and/or jointly manufacture a number of items of critical need to the Indian military, including Kamov Ka-226T light helicopters, stealth frigates, S-400 long-range air defence systems and air launched BrahMos missile systems. Russia can play an important part in the ongoing Future Ready Combat Vehicle (FRCV) and Future Infantry Combat Vehicle (FICV) projects of

the Indian Army by collaborating with the Indian public or private sector. Negotiations are also reportedly underway for upgrades of frontline equipment such as Su-30MKI aircraft, T-72 tanks and ICVs. Thus, India-Russia defence cooperation is likely to continue with renewed vigour, albeit in a more cooperative mode, involving collaborative manufacture in Indian facilities.

With regard to the overarching need to enhance defence cooperation, Russia-India defence relations must expand beyond the field of military equipment and tactical level training. Training of military leadership, especially strategic and operational level training of middle level military officers, provides maximum opportunity to build bridges between militaries. Both countries must get over the language barrier and engage each other more vigorously in the field of military training, especially attendance at each other's military courses and other events.

In the meantime, special efforts must be put in mutually to address the problems in spares availability that has cropped up in recent years. Russia must be cognizant of India's aims and objectives to achieve self-reliance in the field of arms manufacture. A cooperative approach would enable Russia to play an important role in empowering the Indian defence industry, thus contributing to further strengthening the mutual relationship.

Lt Gen Philip Campose (Retd.)

'Black Holes in the Ocean'

110 Years of Russian Submarine Prowess

The previous articles in this series (see Vayu II and III/2016) covered the early history of Soviet submarine development. This final feature now examines Russian underwater warfare capabilities as they evolved through the Cold War and through to the present day.

Development and testing of Russian conventionally powered submarines passed another milestone on 17 November 2016, when Russian submarine *Sankt Peterburg*, the lead ship of the *Lada*-class (Project 677) fired a cruise missile at a sea-going target in one of the Northern Fleet's test ranges. Although the weapon type was not reported, it was confirmed that the launch was performed while the submarine was submerged, and that the missile hit the assigned target.

News of this first successful missile test must be encouraging for Russian sales managers at Rosoboronexport, which is promoting the *Amur 1650* export variant of the *Lada*-class in India and other Asian countries. Unfortunately in the case of India, the Project 75(I) competition for six conventional submarines seems to have been stuck somewhere between the RFI and RFP.

Project 677 is the most recent conventionally powered submarine developed by the Rubin design house, responsible for a majority of Russian

submarines developed over the past 115 years. The lead ship – designated *Sankt Peterburg* (Saint Petersburg) with pennant number B-585 – was laid down at the Admiralty Shipyards in 1997, launched in 2004 and demonstrated publically for the first time at the IMDS 2005 marine show. After trials in Baltic waters with numerous repairs and modifications in the process, she was commissioned in 2010. Today, this ship represents the most advanced diesel-electric submarines ever made in Russia.

Having completed all possible testing in the shallow waters of the Baltic Sea, *Sankt Peterburg* headed to the Arctic. After an uneventful 1,900-mile ferry, the boat arrived at a naval base on the Kola Peninsula in October 2013. She received positive comments on her handling qualities and her ability to withstand rough seas. Up north, *Sankt Peterburg* was subjected to testing in deep waters. Operational trials continued through 2014 and 2015. Last year, she successfully dived to the maximum advertised depth, to verify hull strength and check for proper functioning of on board systems. Rubin has also reported about torpedo launches and release of mines during trials.

Following sonar tuning at sea, *Sankt Peterburg* “demonstrated high efficiency in detection of various low-noise targets,” thanks to the superb performance of the new ‘Lira’ sonar suite, with an L-01 quasi-conformal antenna in the nose section, a towed array, and a host of other sensors. This sonar system is described as “the most powerful and advanced ever installed into a combat-capable diesel-electric submarine.”



Sankt Peterburg at sea (photo: Rubin)



At the same time, however, some of the new equipment was malfunctioning or not performing as promised. The SED-1 permanent magnet motor (PMM) worked fine at low and medium power, but failed to propel *Sankt Peterburg* to her maximum advertised underwater speed of 21 knots. The issue is to be resolved on series boats by replacing the motor with a more advanced model from the Russian firm Electrosila. There are other areas of concern that are to be addressed, but Rubin says the remaining issues are minor and that *Sankt Peterburg* is on track to complete operational trials later this year.

In a number of interactions with the media in the first half of 2016, Russian Naval officials stated that the Navy is committed to the *Lada*-class. They confirmed that orders for completion of two more boats remain in place. The nose and rear sections of B-586 *Kronshtadt* have been mated, while sections of B-587 *Velikiye Luki* are being pre-outfitted. The first boat will be completed in 2018, followed by the other in 2019. An even more interesting piece of information came from Alexander Buzakov, CEO of Admiralty Shipyards : he stated recently that the Russian Navy is expected to place an order for a fourth *Lada*-class boat shortly.



A preserved Project 613 boat in Saint Petersburg

Discussing History

To better understand the way Russia develops conventional submarines, *Vayu* spoke to Yuri Kormilitsin, a General Designer and the genius behind the *Kilo*- and *Lada*-class designs, who headed Rubin's diesel-electric design team for a long time, a job now taken over by Rubin's Chief Designer Igor Molchanov. Kormilitsin shared his views on the history of conventional submarine development after WW II.

He began with Russia's first generation of submarines, which Rubin developed shortly after the Second World War ended.

"After the Second World War, we came to face the Cold War. First off, we developed the Project 613 (*Whiskey*-class) diesel-electric submarine, using combat experience – that of the Germans as well as our own – amassed during the WW II. Documentation for this design was done by the Central Design Bureau No. 18

(which later became Rubin) reporting to the People's Commissariat of the Shipbuilding Industry. Our industry built 215 Project 613 submarines. With licence production in other countries taken into account, the grand total rises to almost two hundred and fifty examples."

It is worth adding that the work on a medium boat commenced back in 1942, and after a pause, resumed in 1946, when the Soviet Navy issued a renewed specification. Peregudov, Evgrafov, Deribin served as chief designers for Project 613 at different times, and the first boat was commissioned in 1951. With a displacement of 1055/1347 tonnes (surfaced/submerged), she developed a maximum speed of 18.5 knots on the surface, using two diesel engines of 2000 hp each. For submerged operations, Project 613 relied on two electric motors each developing 1350 hp, allowing for speeds up to 13 knots. Like all preceding designs, this boat moved faster on the surface than when submerged.

The submarines built under Project 613 proved reliable, durable, and easy to maintain. These qualities facilitated quick and comprehensive mastery of the new boats by Soviet crews. In 1955, one of the submarines operating in the Barents Sea performed a test mission during which she steamed for 30 days non-stop while snorkeling. The Project 613 submarines were produced by several shipyards across the country, and at the peak rate production saw 73 units delivered in a year! The production run came to 215, terminating in 1957. Had Stalin lived longer, the figures might have been even more impressive.

A note on exports

The Soviet Union began exporting submarines in 1954, when it handed over several *M*- and *S*-class boats to Bulgaria, China and Poland. Three years later these submarines of WW II vintage were followed by deliveries of the much more modern Project 613. Egypt



Project 611

“Boats of the Project 613 design were relatively small, intended for use in coastal waters. Design solutions and equipment first tried on this design found further application in Project 611, a larger boat developed for operations out in the open ocean. Project 611 was a design success, and in recognition of this achievement, the Soviet government presented high awards to a number of the design house’s employees.”

Sergei Egorov was the chief designer for Project 611 (*Zulu*-class). He developed the class with a surfaced top speed of 17 knots, employing three 37D-type diesels developing 3000 hp each. Submerged, the submarine relied on three electric motors to propel her up to 15 knots. Compared to earlier boats, conditions for the crews were improved with help of on board

refrigeration, air conditioning and water purification systems.

The lead vessel of the class was laid down in January 1951 and commissioned next year. Factory No. 402 in Severodvinsk (which later became Sevmash) built eighteen Project 611 boats, and the shipyards in Saint Petersburg (then Leningrad) built eight more. These ships are remembered for their long voyages round the world that Soviet crews commenced in the late 1950s. For instance, boats B-88 and B-90 performed a 150-day half-circumnavigating ferry (over 23,000 miles) from the North of Russia to Vladivostok on its Pacific shores via Africa and in between Australia and New Zealand.

Project 641

“The next move in Russian diesel-electric submarine development came with Project

received ten such submarines, Albania, Poland and North Korea four each, Syria three, Bulgaria two and Cuba one. The largest number of these submarines went to Indonesia, along with a *Sverdlov*-class (Project 68bis) cruiser and ten *Skoryy*-class (Project 30bis) destroyers, Moscow donated twelve Project 613 submarines to Jakarta between 1959 and 1963.

The delivery of twelve submarines of a single class remains to this day the largest such shipment in the history of Russian arms trade. Some of these assets were in active service until the late 1980s. KRI *Pasopati* is preserved as a museum in Surabaya, and serves as a monument to Soviet-Indonesian friendship in the early 1960s. China matched this number, taking delivery of twelve *Kilo*-class boats (two Project 877EKM and ten more advanced Project 636). Further down the list are Egypt with ten Project 613 submarines and India with ten Project 877EKM.



INS Vagli, a Vela-class (Project 1641K) boat, seen underway shortly before decommissioning in December 2010 (photo: Indian Navy)

641. Whereas only 26 ships were made under the preceding Project 611, the production run of Project 641 came to 76, of which 17 were exported. India became the first foreign country to take delivery of Soviet-made warships customised to meet specific requirements. Eight Project I641 and I641K submarines joined the Indian Navy in the late 1960s and early 1970s.”

Project 641 (*Foxtrot*-class) submarines displaced 1952/2475 tonnes and could steam at 16-17 knots when surfaced and 15-16 knots when submerged. The lead boat was commissioned in 1958, with the Soviet Navy taking delivery of 58 examples, the final one arriving in 1971. The class incorporated the newly developed AK-25 steel alloy, allowing the maximum diving depth to be increased by 40-50 per cent.

It is important to note that the Indian Navy acquired its first submarines from the Soviet Union. New Delhi first inquired about a possibility of purchasing Russian boats in August 1964, during Defence Minister YB Chavan’s visit to Moscow. It then took the Indian side only twelve months to prepare all the necessary documents and permissions, and proceed to contract signature in September 1965. The first submarine built under that contract, INS *Kalvari*, was commissioned in December 1967. Fifty years pass and...

the acquisition process under Project 75(I) seems to take ages!

Four Project I641 (*Kalvari*-class) boats were delivered in 1967-1969, and became the first-ever Soviet submarines built to an exportable design made for the requirements of a foreign customer. After the *Kalvari*-class, India placed a second order for four boats of the improved I641K (*Vela*-class) design. These were delivered in 1972-1974. The last of these, INS *Vagli*, was decommissioned in December 2010, after 36 years in service.

Atomic via conventional

Scientific progress brought about the advent of the nuclear-powered submarine. Naval thinkers – and some experts in industry and academia – were quick to jump to conclusions. They argued that submarine development and production should now be limited only to nuclear-powered boats. The United States was quick to embrace this approach. A closer look, however, revealed that six countries allied to the United States proceeded with development and manufacture of diesel-electric submarines for the navies of NATO member-states, while Japan resumed conventional submarine construction a few years after its defeat in WW II.

To illustrate this point: in 1978 the member states in the NATO bloc operated 78 nuclear-powered and 140 diesel-electric submarines.

At the same time, the Soviet Union had to rely completely on its own capability in building a great navy. There was a big struggle between supporters of non-nuclear submarines and their opponents. Among those who spoke in support of conventional submarines were Pavel Pustynstev, who headed the design house [Rubin] from 1951 to 1974, and the Bureau’s chief engineer Igor Spasski. “Later, when Spasski was Rubin’s chief executive, we managed to win the argument.” Subsequently, the Soviet Navy made their decision to stay with diesel-electric submarines, and to procure them in meaningful quantities. To meet the Navy’s renewed requirements, Rubin developed Project 641B, which, for political reasons, was structured as a further development of the previous Project 641.

The Red Sormovo shipyard in Nizhny Novgorod assembled eighteen submarines to the Project 641B (*Tango*-class) design in the period 1972-1983. All of these were delivered to the Soviet Navy, with no exports. Compared with previous designs, these boats leveraged new technology and demonstrated better performance, and are therefore attributed to the second generation



Project 877 submarine Lipetsk seen steaming near a 1911-vintage paddle steamer near the city of Arkhangelsk (photo: Oleg Kuleshov)



Velikiy Novgorod during sea trials (photo: Admiralty Shipyards)

of Russian diesel-electric submarines developed after WW II.

Project 641B featured a brand-new, very advanced sonar system, and differed significantly from previous ocean-going boats in a number of areas. She had a differently shaped hull, with enlarged nose and rear sections. While retaining three shafts, she was equipped with

modern radio-electronics, more accurate navigation equipment and a number of other high-technology systems. For the first time on a conventional Soviet submarine, Project 641B featured a combat and information management system, designated *Uzel* [English: Knot]. This combat system has proved its merits and is still in service.

The Kilo-class

To date, the production run of the *Kilo*-class has seen completion of 43 Project 877 (original *Kilo*-class) and 24 Project 636 (Improved *Kilo*) boats. Algeria is the most recent export customer for the new sub-class, and has ordered two such boats that will join two 877EKM and two 636M already in Algerian Navy service.



Kolpino seen under construction at Saint Petersburg, shortly before launching (photo: Admiralty Shipyards)

The Algerian deliveries are expected to commence in 2018.

The most recent domestic order from the Russian Defence Ministry awarded the Saint Petersburg-based Admiralty Shipyards a contract to build six Project 636.3 diesel-electric submarines for the Pacific Fleet. These are due for delivery in 2019-2021, with a build rate of two hulls per year. Keel layings are planned from 2017 onwards. This order follows on from a previous Russian MoD order for six Project 636.3 boats, which is nearing fulfilment. The Black Sea Fleet received two boats in

2014 and two more in 2015. The fifth boat, *Velikiy Novgorod*, was launched in March this year, went for sea trials in June and was commissioned in October. The sixth, *Kolpino*, was launched in May and delivered in November.

Yuri Kormilitsin shared his views on the *Kilo*-class, the history of the programme, and its strengths and weaknesses: “The time came to answer accusations by US naval experts, who were referring to Soviet submarines as ‘roaring cows.’ According to them, our boats – chiefly the nuclear-powered submarines, but also to some extent diesel-electric boats

as well – generated so much noise when moving at speed that their paths could easily be tracked by powerful sonars aboard NATO warships. The primary customer (the Soviet Navy) challenged Rubin to develop a third generation non-nuclear submarine that would be able to defeat any NATO opponent in a duel.”

“So, our job was to engineer a boat that would prevail over any enemy warship. This required our boat to have a very low noise signature, so as to remain un-detected underwater. It also implied that the sonars of our own boats should

Russian Diesel-Electric Submarines – WW II to the Present

<i>Class, Production run, NATO codename</i>	<i>Year of construction/ EIS</i>	<i>Displacement, Surfaced/ submerged. tons</i>	<i>Length *width, m</i>	<i>Max speed, submerged, kt</i>	<i>Max speed, surfaced, kt</i>	<i>Crews</i>	<i>Electric motors, number *power, hp</i>	<i>Diesels, number *power, hp</i>
L (Leninets, Series XIII, 5)	1942-1943	1100/1400	81.5*7.2	9	18	52	2*650 2*112	2*2000
S (Stalinets) Series IX, 3	1936-1938	840/1070	78*6.4	9	19.5	45-46	2*550	2*2000
Project 613, 215 (USSR only) Whiskey	1951-1958	1050-1080/1350	76*6.3 (6.6)	13-14	18.3	52	2*1350, 2*50	2*2000
Project 611, 26, Zulu	1953-1958	1830/2350	91*7.5	15-16	17	65-72	2*1350, 1*2700, 1*140	3*2000
Project 633, 20, Romeo	1959	1328/1712	77*6.7	13.2	15.3	54	2*1350, 2*50	2*2000
Project 651, 16, Juliett	1963-1968	3174/4137	86*9.7	18.1-14.5	16	78	2*6000 2*200	2*4000 1*1360
Project 641, 58, Foxtrot	1958-1971	1952/2498	91*7.5	16	16.8	70	2*1350 1*2700 1*140	3*2000
I641/I641K, 17, Foxtrot	1967-1969 1972-1983	1952/2498	91*7.5	16	16.8	70	2*1350 1*2700 1*140	3*2000
Project 641B, 18, Tango	1972-1982	2770/4600	90*8.6	13	15	64	2*1350 1*2700 1*140	3*1900
Project 877, Kilo (43, of which 10 were for India)	1986-2000 (for India only)	2300/3040	74*9.9	19	10	57	1*4050, 1*190, 2*102	2*2000
Project 677, 1, Lada	2010 (EIS), production continues	1765/2650	67*7.1	21	10	34	1*4100, 2*102	2*2000
Project 636.3, 6, Improved Kilo	2014 (EIS), production continues	2350/3950	74*9.9	19-20	11	52	1*5500, 1*190, 2*102	2*2210

Note: Ranges for old submarines (L- and S-class) are given for ferries on surface, while these for later models are for snorkel mode. Figures in brackets for Projects 613, 611

be very powerful. Third, our weapons systems must be rapid-fire.” Such was the assignment the Soviet Navy gave Rubin, who assigned a team of specialists headed by Chief Designer Yuri Kormilitsin to tackle the project.

“We succeeded in development of such a boat! The lead head ship built to the Project 877 design became operational in 1980. Today, this design is recognised and highly acclaimed around the world. Series produced Project 877 and Project 636 submarines are in service with the Russian Navy and a number of foreign navies around the globe. India acquired ten Project 877EKM boats in the period from 1985 to 2000. The last boat in this batch,

INS *Sindhushastra*, represents an improved design featuring the Club-S tube-launch missile system.”

On 8 December 2015 *Rostov-na-Donu*, a Russian Navy Project 636.3 submarine deployed to the Mediterranean, became the world’s first diesel-electric submarine to launch a salvo of cruise missiles at live targets. The Russian Navy reported that all four 3M14K land-attack missiles hit assigned Islamic State targets in Syria. At the Army 2016 trade show in September, the Navy said that during the second quarter of 2016 it took delivery of 47 Kalibr-family missiles to compensate for those fired into Syria during the Russian campaign there. (see *Vayu III/2016*).

Project 677

“Even though the *Kilo*-class has proved its merits, this design no longer represents our current vision of what a truly modern non-nuclear submarine should look like. Scientific and technical progress has come a long way since Project 877’s entry into service, stimulating further development of warships and other means of naval warfare.” Some time ago, Rubin’s team was challenged again, this time to develop a conventional boat of the fourth generation. It should differ from the previous generation in having a smaller displacement and yet higher combat efficiency. Such a ship has been developed, and is referred to as the Project 677 *Lada*.

Duration, days	Range surfaced/ submerged, miles	Depth, operating maximum. metres	Torpedo tubes (weapons)	Other weaponry and systems	Comments
30	5500-10000/150	100	6 and two mine tubes	1*100mm, 1*45mm, 20 mines	Minelayer, a further development of D class originated in 1926
30	9800/148	100	6	1*100mm, 1*45mm	Designed by IvS/Deshimag in Netherlands by German engineers, built in USSR
30 (up to 45)	5000/3538580 (8500-13000)	170/200	10 (22)	57mm and 25mm AA till 1956	World’s largest series of diesel-electric submarine built after WW II. Comes with snorkel, radars, and sonars.
75	-/443 (18400-22000)	170/200	10 (22)	57mm and 25mm AA till 1956	Large “oceanic” boat of three-shaft design. Tamir-5L and Fenix sonars.
60	4400-9150/300 (2400-14590)	270/300	8 (14)	Torpedo fire controls	Further evolution of Project 613 with MG10 and MG200 sonars. Egypt, Syria, Algeria, Bulgaria. Licenced to PRC.
90	18000/810-350	270/300	10 (18)	4 P-5/6 cruise missiles	The 5.5-tonne missiles had range up to 500km, launch from surfaced sub
90	20000/400	250/280	10 (22)	MG10 and MG200 sonars	Further development of Project 611. Poland leased two.
90	20000/400	250/280	10 (22)	MG10 and MG200 sonars	Developed in USSR for India (8), also built for Libya (6) and Cuba (3).
80	14000/450	240/300	6 (24)	MGK400 sonar	Combat management system. Rapid reloading system for torpedoes
45	6500/400	240/300	6 (18)	Club-S missile system	Indian navy version comes with LAMA-ER fire control system and USHUS sonar Production run totaled 43 for all 877 variants
45	6500/650	240/300	6 (18)	Kalibr-PL missile system	Russian navy operates one; two more being built. Lira sonar. Export version is designated Amur 1650
45	7500/400	240/300	6 (18)	Kalibr-PL missile system	Modern type in service with Russian navy, six more on order (12 altogether) Production run 24 as of 2016, for all variants

and 633 are for on-surface ferries, depending on speed and whether additional fuel is carried in water tanks.



Sankt Peterburg underway in Arctic waters (photo: Rubin)

The lead ship of the class, designated *Sankt Peterburg*, was commissioned in 2010. It passed testing and is now completing operational trials with the Russian navy. Kormilitsin spoke about the current state of these trials:

“After testing and initial operations in the Baltic, she made a successful ferry to the Arctic, and now operates with the Northern Fleet. A series of tests performed in Arctic waters last year proved our claim that the newer submarine’s noise level is several times less than that of previous generation boats. No one can detect her presence close by, while she can sense previous generation boats with ease. The *Lada* has a much more powerful sonar system than the *Kilo*-class. This sonar has no equal; so far no other country managed to produce anything that would compete with our sonar. This new sonar can sense diesel-electric boats of previous generation at a distance of several kilometres, and nuclear-powered boats, including those of foreign make, at a distance of several dozen kilometres.”

“The lead ship of the Project 677 *Lada* is about to complete operational trials with the Russian Navy. Sadly – and this happens quite often during development of advanced machinery – new technology does not receive proper and timely recognition. In the meantime, our new ship has been performing well and proving her merits every time she goes to sea. This design deserves mass production, so as to equip the Russian Navy, and the navies of our allies and friendly countries. My opinion is this: if a navy needs a potent hunter-killer, the *Lada* is the best candidate to fill such a role.”

Amur 1650 : the AIP contender

The export version of the *Lada*-class is referred to as the Amur 1650. At *Army 2016*, Rubin exhibited a freshly made scaled model of Amur 1650 with an AIP section (diesel fuel reformer and fuel cells). This one was different to an earlier model of such a version on display at IMDS 2013

and 2015. Rubin then commented that it “continues working to mature the respective technologies, and that the process finds reflections in the models it puts on display.”

Earlier this year, in its report on achievements made in 2015, Rubin was keen to highlight “successful completion of work on creation of the fuel processor unit and land prototype of AIP with electrochemical generator that consumes diesel fuel and oxygen, coupled with a disposal system for oxidation by-products.”

According to the design house, the AIP module is currently at the trials stage on a full-scale specimen in a ship environment using a special stand (test rig) emulating a submarine. This AIP is intended to work in conjunction with lithium-ion (Li-ion) batteries. Rubin claims it has created such a battery for marine applications which is now available for series production and installation into newly built submarines – “in accordance with the Russian Navy plans.”

Vladimir ‘Vovick’ Karnozov



Euronaval 2016

DCNS' new submarine concept: SMX3.0

This premier maritime trade show of Europe took place between 17 and 21 October 2016, with defence companies and customers flocking to Paris to explore 'Naval Technologies of the Future.' Vayu's Sayan Majumdar was on hand to report.

The 25th Euronaval exhibition ended on 21 October in Paris-Le Bourget with very positive results for all involved: industrialists, delegations, international organisation, visitors and journalists. Created in 1968 and organised by GICAN (the French Marine Industry Group), this biennial event continues to confirm its position as world leader of naval defence exhibitions, with this year again a particularly promising affair.

For the 2016 edition, 129 delegations were welcomed at the exhibition, including 89 foreign military delegations representing 64 countries. Among the French and European delegations, there were ministerial and parliamentary delegations, as well as representatives from the Court of Auditors, the MEDEF, CNI, the Military School, IHEDN (Institute of Advanced Studies in National Defence).

On 18 October, at the French Ministry of Defence stand, the Minister of Defence Jean-Yves Le Drian chose the occasion of Euronaval to reveal a model of the future French intermediate-size frigates *Frégate*



The BrahMos stand at Euronaval 2016

de Taille Intermédiaire (FTI). The launch of the FTI programme was decided upon in mid-2015 on occasion of the legislation update for military programming. The objective is ambitious, as delivery of the first frigate is set for 2023. With a tonnage of 4,200-tonnes, the FTI will be crewed by a complement of 125. By 2030, these five new frigates will add to the French Navy order of battle comprising eight multimission frigates (FREMM) and two *Horizon*-class air defence frigates.

Also on 18 October, a high-level colloquium brought together industrialists, politicians and sailors to discuss a topical issue: *Together for safe and secure oceans*. Opened by the President of Euronaval, Patrick Boissier, this colloquium was concluded by Admiral Christophe Prazuck, Chief of Staff of the French Navy.

Against backdrop of the future order of Australian submarines, this three-day seminar, held in the presence of Martin Hamilton-Smith, Minister of Defence for South Australia, was an opportunity to encourage exchange and

DCNS unveils SMX3.0, the submarine concept-ship

DCNS unveiled its new submarine concept-ship SMX3.0 at Euronaval 2016. Featuring on board 3.0 technologies, better power management, operational performance and system upgradeability facilitating vessel maintenance, and with a displacement of 3,000 tonnes, the SMX3.0 integrates the 'latest digital technologies for strengthened operational efficiency' and significant versatility of use. DCNS and Dassault Systèmes are partnering on this project to design a ship tailored to improve the level of comfort for those onboard with interconnected, robust, secure, fast and duplicate upgradeable data systems.



Model of the French aircraft carrier Charles de Gaulle

build relations between industrial, state and academic players from France and Australia. Concurrent to the seminar, some 70 meetings between French and Australian industrialists were organised.

DCNS unveiled the Belh@rra, a new front-line 4,000-tonne digital frigate geared toward the export market. With the Belh@rra

Elettronica: custom-made innovation

Elettronica, with numerous systems delivered to navies all over the world, boasts of products that are equipped with high sensitivity, high accuracy, full automatic surveillance function and data processing for intelligence analysis (ELINT function). Elettronica is currently engaged in the most important European co-operation programmes such as Horizon and FREMM frigates, teaming with Thales Systemes Aeroportes in the SIGEN consortium as the supplier of the EWS systems. The active subsystem supplied by Elettronica is the Nettuno-4100, a state-of-the-art radar ECM equipment featuring a scalable architecture that can be adapted to meet different customer needs. In fact, subsystem installation can be configured according to the on-board space limitations with two possible configurations, Split and Monomast. The 'Split' configuration is composed of two separately installable Jamming Antenna & Source Subsystems (JASS) while the 'Monomast' solution is best suited to single mast installations. The Nettuno-4100 ECM System can provide naval platforms with an Active Electronic Defence using dedicated ECM tactics. These tactics can be equally effective against both terminal missile attacks and long-range designation radar systems, and can exploit a wide range of ECM techniques against surface search and tracking radars in support of anti-surface engagements.

frigate, DCNS intends to continue the success enjoyed by *La Fayette*-class frigates, an export leader with over twenty units sold to four navies around the world. DCNS thus completes its product line by positioning a latest-generation vessel between the 6,000-tonne FREMM multi-mission frigate segment and that of the 2,500- to 3,000-tonne *Gowind*-class corvettes. With the Belh@rra frigate, DCNS responds to the expectations of navies looking for a compact frigate, capable of ensuring long-range missions, operating alone or embedded in a naval force, on the high seas or as part of coastal surveillance missions in a dense and hostile environment. The new Belh@rra frigate offers operational intelligence “that is unequalled on the market,” in addition to a modular design, robustness and simplified use. Ten years after the first design studies for the FREMM multi-mission frigate, DCNS’ latest frigate also capitalises on the experience of the French Navy with this vessel across a large number of operational theatres. DCNS’ Setis combat-management system, proven on the FREMM frigates and *Gowind* corvettes, will position the Belh@rra frigate to respond to specific needs of client navies in all areas of warfare, whilst at the same time offering significant platform modularity to increase vessel payload or autonomy.

DCNS also unveiled its new submarine concept ship, the SMX 3.0. Available from 2025, the submarine will feature better power management and completely interconnected, robust, secure, fast and upgradeable data systems (*see box item in this article*).

At Euronaval 2016, DCNS and Airbus Helicopters announced a collaboration to design the future tactical component of France’s Naval Aerial Drone (*Système de Drones Aériens de la Marine, SDAM*) programme. By pooling naval and aerospace skills and expertise, the DCNS and Airbus teams will be equipped to address all technical challenges arising from the naval integration of drones through the creation of a robust system architecture that can evolve and adapt to meet every need. DCNS’ role in the partnership will be to design and supply the entire warship-integrated VTOL drone system. DCNS will design and develop the solutions for the ship-based operation and integration of the drone, including the specification and validation of the payloads and mission data links. DCNS will also produce the drone’s mission system, which will enable real-time management of its operations and allow its payloads to be controlled through the combat management system.

Thomas Ljungqvist from Saab’s Underwater Systems business unit, revealed during Euronaval that the Saab Light Weight Torpedo (SLWT) projected to arm Royal Swedish Navy (RSwN) combat vessels would begin testing at the company’s training facility next year. Also on display at the show was Saab’s Multi-Shot Mine Neutralisation System (MuMNS), an adaptable vehicle which can be used in a variety of different roles, including live operational mine clearance, peacetime operations against standard ordnance, mine investigation and underwater demolitions.



NHI NH90 NFH maritime helicopter

The system is effective against a complete range of underwater targets: mines (ground, moored, floating and drifting), depth charges, torpedoes and Improvised Explosive Devices (IEDs).

Saab also showed their new A26 submarine, a silent, long-endurance, modular design that uses the latest stealth technology and advanced tactical communication to allow submarines to integrate their communications with those of other defence forces and civilian agencies. “Operational flexibility, together with a

SIMMAD contracts Saab for Giraffe AMB

Saab has contracted with SIMMAD (integrated structure for the operational maintenance of the aeronautics equipment of the French Ministry of Defence) for spare parts and support contract for Giraffe AMB, over an ordering period of 17 months and a performance period of 34 months, which commenced on 8 August 2016, including obsolescence management. A Saab team has been participating in the Giraffe Air detachment committed in the CASEX 16 exercise in the military camp of Valdahon. The Saab team was invited to support and monitor how the French Air Force uses the Giraffe AMB radar and C2 shelter. “The recently awarded spares and support contract, as well as participating in CASEX 16, is important for Saab in providing continued support and presence in France” stated Henrik Vassallo, head of Saab country unit France & Benelux.



Giraffe AMB

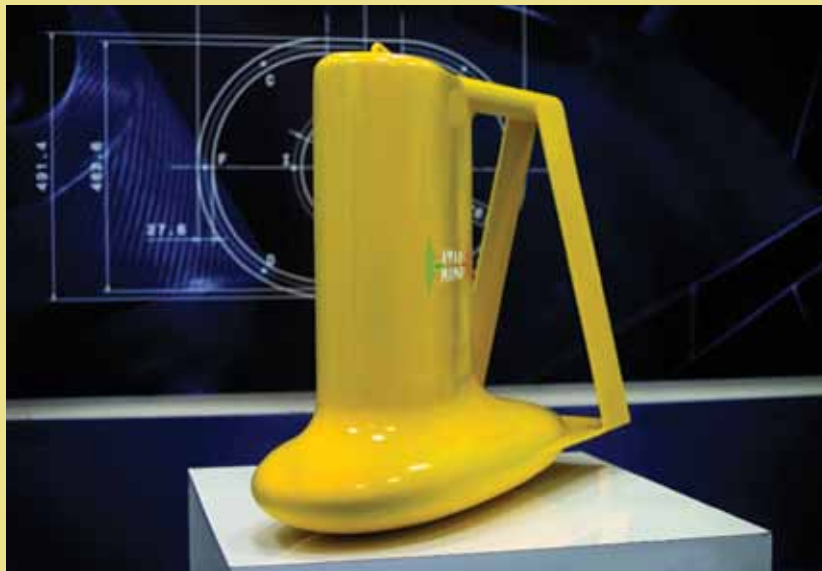
comprehensive weapons suite, enables it to carry out a wide variety of missions, including maritime security operations, intelligence operations, covert mine countermeasure operations, Special Operations by carrying, deploying and retrieving special forces along with equipment and underwater vehicles, underwater work, anti-submarine and anti-surface warfare, and mine-laying in covert mode.”

On the Israeli front Rafael Advanced Defence Systems displayed an array of advanced naval systems and a comprehensive, integrated suite of ship defence systems for detection, tracking, interception and neutralisation of a variety of threats. The Rafael Typhoon MLS-ER Missile System is a light-weight missile launch platform that can be installed on a variety of vessels, ranging from Rigid Hull Inflated Boats (RHIBs) to larger boats and ships. The system employs the Spike-ER, an electro-optically guided multipurpose missile that is accurate up to ranges 8 km. Typhoon MLS-ER features day and night operation and includes fire-and-forget, as well as fire-and-observe and update modes of operation. Rafael’s also showed the C-Dome, a maritime version of the land-based Iron Dome anti-rocket system, which is designed to effectively protect combat vessels against a large set of modern threats. C-Dome handles saturation attacks by engaging multiple targets simultaneously. Reaction time is very short and enables automatic and semi-automatic engagements. C-Dome components include a multi-round launcher assembly loaded with vertically-launched canisterised interceptors. The launcher is installed under the ship deck.

Ofer Ben Dov of Elbit Systems provided a detailed presentation to this *Vayu* correspondent on Seagull multi-role Unmanned Surface Vessel (USV) manufactured by Elbit Systems to meet the maritime warfare mission requirements of the naval forces worldwide. Unveiled at the Singapore Air Show held in February 2016, the vessel is capable of conducting Mine Counter-Measures (MCM) involving the detection, categorisation, localisation, recognition and neutralisation of seabed, tied up and floating naval mines. Although primarily a MCM vessel, it can also be deployed in potent Anti-Submarine Warfare (ASW) with torpedoes, Intelligence, Surveillance & Reconnaissance (ISR), electronic warfare, maritime security and

Leonardo-Finmeccanica introduces latest generation active sonar

Leonardo presented its new ATAS sensor (Active Towed Array Sonar). Developed by Leonardo as part of the Italian fleet modernisation programme, where the company is also responsible for supplying and integrating all the new naval units onboard systems, including the underwater combat systems, ATAS can detect the presence, location and characteristics of targets at great distances. ATAS was designed to equip the Italian Navy’s new multi-purpose off-shore patrol vessels (PPAs) and can be used in combat operations at a variety



of depths to over 300m. The sensor is “dramatically smaller and lighter than other active sonars” with a similar range, measuring just one metre long and weighing only eight tonnes. ATAS offers high performance detection that amid the ocean overcomes the first acoustic convergence zone that is at up to 40km in the Atlantic Ocean in certain seasons.

hydrography missions by swapping modular payloads.

Leonardo-Finmeccanica revealed details of its Osprey AESA radar that has been picked for the US Navy’s newly-upgraded unmanned helicopter, the Northrop Grumman MQ-8C Fire Scout. The helicopter will be launched from the decks of US naval combat vessels to keep watch for distant threats. The contract will see Leonardo delivering an initial batch of 5 radars to Naval Air Systems Command (NAVAIR) for testing and evaluation. NAVAIR then has an option to buy a larger quantity of the radars for use in real operations. Leonardo has already built a number of Osprey radars so the primary task under this contract is integration with the MQ-8C Fire Scout in time for first production deliveries. Leonardo also

presented its new ATAS (Active Towed Array Sonar) system, the ‘smallest and most powerful’ active and passive underwater sonar on the market at Euronaval 2016 (*see box item*).

Thales announced a number of new offerings for the naval market. Among these were the compact CAPTAS-4 towed array sonar, which provides frigates with an ASW capability to support collaborative combat at sea. The new product is a compact, modular version of the CAPTAS-4 four-ring variable depth sonar. It requires less room on board the vessel, in particular because it incorporates an optimised deployment and recovery system for the towed array. Importantly, the compact version delivers the same detection performance as CAPTAS-4 with 20% weight reduction and a 50% smaller footprint. In addition,

Safran's Sigma 40 inertial navigation system

Safran Electronics & Defence has conducted integration tests of the Sigma 40 shipborne navigation system with the alignment system on the AGM-84 Harpoon anti-ship missile intended for *Krabi* corvettes and KDX class frigates deployed by the Royal Thai Navy.

This test was carried out within the scope of a contract signed with Korean naval shipyard DSME, which builds warships. Safran also worked with Boeing, prime contractor for the Harpoon missile system. With the success of this test, Safran's inertial navigation systems can now be used on all of Thailand's warships.

This system is also used for conventional navigation and stabilisation functions on shipborne sensors and weapons. Sigma 40 navigation systems are built around a ring laser gyro (RLG) inertial core, which "guarantees" sustained very-high-precision, coupled with a high degree of operational flexibility. They are compact and easy to use, with scalable hardware and software while boosting the performance of the ship's sensors and its self-defence systems.

250th order for Safran's Vigy System

Safran Electronics & Defence has registered a record 250th order for its Vigy Observer naval optronic system from a navy that wants to use this technology on several dozen fast attack craft for commando forces. Ten navies worldwide have now ordered the Vigy Observer system. Developed and produced by Safran Electronics & Defence, Vigy Observer is a light, panoramic, multi-sensor shipboard optronic system operated from a touch terminal and includes a cooled infrared imager, video channels and a laser rangefinder. Employing advanced stabilisation techniques, it provides clear images day or night, including in rough seas and at speeds exceeding 50 knots, with a Vigy Engage version, which adds a fire control function for light weapons. Capable of detecting targets out to a range of 16 kilometres and more, Vigy Observer offers a 'decisive advantage in the asymmetrical environments' where fast attack craft are deployed: protection of ports and infrastructures, maritime police, anti-terrorist and anti-piracy combat. The system is "well suited" to government actions at sea, including coast guard, fast attack craft and ocean-going patrol boats as it provides invaluable assistance in missions designed to protect fishing and economic zones, navigation aid, and assistance to ships and crews at sea.

DCNS *Mistral*-class helicopter carrier for Egyptian Navy

DCNS delivered the second of two helicopter carriers acquired by the Arab Republic of Egypt in October 2015, the LHD (Landing Helicopter Dock) *Anwar El Sadat*. On 10 October 2016, DCNS had contracted with the Ministry of Defence of the Arab Republic of Egypt for the supply of two *Mistral*-class Landing Helicopter Dock vessels (LHDs) and delivery of the first of these the LHD Gamal Abdel Nasser took place on 2 June 2016. The flag transfer for the two helicopter carriers forms an integral part of the continuity of the strategic partnership with the Egyptian Ministry of Defence formalised already in July 2014 through the signature of a contract for the sale of four *Gowind*-class corvettes, then in August 2015 through the delivery to the Egyptian Navy of the FREMM multi-mission frigate *Tahya Misr*. DCNS is also committed to the Egyptian Navy over the long term to the multi-annual maintenance contracts for Egyptian vessels, as well as through the deployment of a technology-transfer agreement allowing the Alexandria shipyards to build three of the four *Gowind* corvettes acquired in 2014.



File photo of the LHD

the compact version can be containerised, making it the “only product of its kind” that can be moved from ship to ship to maximise operational effectiveness. Thales says that any frigate equipped with the new compact CAPTAS-4 will have the same collaborative anti-submarine warfare capabilities as a destroyer. Thales is proposing to supply the sonar to the French Navy under the FTI (*Frégate de Taille Intermédiaire*) programme.

Thales introduces NS200 multi-mission radar

Thales launched its NS200, the latest dual-axis multi-beam radar at Euronaval, which brings advanced multi-mission capabilities to naval platforms up to destroyers with a 400 km range performance for this type of radar. Owing to its unique dual-axis multi-beam design, the AESA1-based sensor system provides high quality weapon support while maintaining fully automated detection and tracking of all naval threats. Various navies have already expressed their interest in the NS200 radar. NS200 is the larger version of the NS100, which is in full series production. In addition to more transmit and receive modules, NS200 uses newer and more powerful Gallium Nitride (GaN) technology and caters to a wide range of naval ships and missions, yielding logistics advantages across the fleet.



Thales's Pathmaster unmanned mine countermeasures system

Thales also introduced its Pathmaster, the ‘first fully configurable unmanned mine countermeasures system’ for naval forces seeking to minimise the risk exposure of their crews. This can be deployed from the shore, from a mine countermeasures vessel or from any other type of naval platform, very relevant to volatile international threats whereby countries are stepping up measures to protect their maritime approaches, commercial ports and naval bases. At the same time, it is crucial to limit the exposure of operational personnel to undersea mines. For this, Pathmaster is equipped with SAMDIS, Thales’s latest-generation high-resolution synthetic aperture sonar. With its multi-aspect functionality, the SAMDIS sonar views targets from three different angles. Thales is already using multi-aspect technology on the French-UK maritime mine countermeasures programme (MMCM), this contract awarded in 2015 to meet specific requirements set out by France and the United Kingdom.

Thales Nederland, a subsidiary of Thales, added a new member to its NS family of radars with the brand new NS200 long range AESA air and surface surveillance radar (*see box item*). Thales also launched Pathmaster, the first fully configurable unmanned Mine Counter-Measures (MCM) system, at the show (*again, see box item*).

Safran had a large presence at Euronaval 2016, displaying a complete range of optronic systems for surface vessels, including the new Paseo NS (Naval System) and XLR turrets (eXtra Long Range). Paseo is a modular family of optronic sighting and surveillance systems, featuring high-resolution sensors for target detection and identification at very long range, by day or night, to provide timely threat warnings. Integrated in a Combat Management System (CMS) or operated in a stand-alone mode, Paseo XLR allows manual or automatic sector surveillance, automatic target tracking, visual identification and transmission or reception of 3D target designation information. It is also able to simultaneously control several guns of different calibres. It offers precision identification, tracking and fire control functions, operating at long range against air and naval targets, even under adverse weather conditions.

The Indian defence company MKU, a leading manufacturer and supplier of comprehensive ballistic protection solutions (for personnel and platforms) and electro-optic devices showcased its range of products and technologies at Euronaval

2016. With over 30 years of experience MKU has supplied products to 230 forces in over 100 countries, including the UN and NATO. It has also designed and delivered lightweight armouring solutions for over two thousand platforms: land vehicles, aircraft and naval vessels. On the maritime front, MKU has extensive experience gained from providing armour solutions for more than 600 naval systems. MKU offers a wide range of ballistic protection solutions for naval systems, including complete project management for design, development, manufacturing and integration of armour protection solutions for different platforms such as patrol boats, fast interceptor craft, RIBs, hovercrafts, crew boats, OPVs etc.

Rosoboronexport (part of the Rostec State Corporation) presented a range of Russian naval products at Euronaval 2016. A Russian delegation was also in attendance at the show, headed by Anatoly Punchuk, Deputy Director of the Federal Service for Military and Technical Cooperation. Scale models of a number of advanced surface combatants were displayed, such as the Project 20382 *Tiger*-class corvette with the Club-N integrated missile system, Project 22356 and 11356 frigates being currently supplied to India, Project 22460 *Rubin*-class offshore patrol vessel, Project 21632 *Tornado*-class corvettes and their derivatives armed with guided missile systems. Rosoboronexport also expected that the *Amur*-1650 and Project 636 diesel-electric submarines equipped with guided missiles would draw interest from export customers at Euronaval.

Other ships showcased were the Project 14310 *Mirazh*, Project 12200 *Sobol*, and Project 12150 *Mangust* patrol boats and the Project 12701 *Alexandrit*-class coastal mine countermeasures vessel. Maritime weapon systems that drew interest at the Russian stand included the Bastion coastal defence missile system and Club-N/S integrated missile systems intended for deployment on surface ships and submarines.

At a separate stand the Indo-Russian BrahMos JV was prominent, with various models displaying the missile's many modes of deployment.

Spain's Navantia showcased for the first time a scale model of the planned F-110 frigate that will be replacing the Spanish Navy's *Santa Maria*-class frigates from around 2025 onwards. The F-110 design is not only focused on substituting the functionality of the *Santa Maria*-class but also in providing solutions to the latest threats and performing new missions that are likely to come about in the future.

Nexter, a major supplier of marine weapons systems, showcased its Narwhal remotely operated weapon system. The stabilised 20 mm gun turret was designed using Nexter's experience in light naval mounts and technologies for gun turrets used on helicopters (see box item).

Nexter's Narwhal 20mm gun turret introduced



Nexter launched Narwhal, a remotely operated and stabilised 20mm gun turret which was designed using Nexter's experience in light naval mounts and technologies for gun turrets used on helicopters (THL20 and THL30). Combining the firepower of Nexter's 20M621 20mm gun used by more than 25 countries with a set of high-performance day/night electro-optic cameras and a moving target monitoring function, Narwhal is the 'ideal system' for a broad range of critical missions. It is suited for surveillance and maritime police operations, but also interception and self-defence operations in the face of constantly evolving asymmetric threats. Narwhal provides short-range self-defence for French and Egyptian FREMM frigates, for French *Mistral*-class vessels and for Lebanese navy patrol boats.



Overall, Euronaval 2016 proved to be an exceptionally well-managed event within a compact space, with visitors of different expertise appearing from different corners of the world. The event was best summed up by event director Hugues d'Argentré, as he stated: "Despite the particularly demanding security requirements implemented this year, participation levels are comparable to those of the last edition, and according to the exhibitors themselves, there is progression in terms of the quality of professional visitors. On the whole the results are highly positive for this 25th edition, with the presence of close to 130 official delegations from 65 countries and more than 20 chiefs of staff from foreign Navies. One of its kind in the naval defence sector, this exhibition displaying vessels, submarines and naval equipment has established its position as leader with decision makers and contractors in this dynamic sector. In 2016, all the majors were present!"

Text and photos: Sayan Majumdar

(left): Strikingly, an actual MBDA SIMBAD RC short-range air defence system was showcased at the MBDA stand and was provided elaborate press briefing on the system comprising 6-km ranged Mistral Infra-Red (IR) homing missiles with a speed of Mach 2.7

Combating new Challenges



Protector USV from Rafael

The contemporary naval battlespace, which encompasses littoral warfare, has created new challenges that require innovative responses. When operating in such an arena, one has to look for different solutions that conventional approaches do not address. One of these is employment of the Protector USV (Unmanned Surface Vehicle), that deals with modern threats. The USV is an autonomous system suitable for various scenarios such as maritime security, force protection, naval dominance, mine countermeasures, intelligence and more. The Protector is in operation with the Israeli Navy and a number of other countries.

USVs have recently gained recognition for their potential to effectively carry out a wide range of missions, within the maritime domain. This trend mimics past development and proliferation in the use of Unmanned Aerial Vehicles (UAVs), which

have become ubiquitous. Rafael's Protector is a mature product, with capabilities proven during operational use by several operators. On-going spiral development yields a highly advanced naval solution for a variety of operational needs. "With its fourth generation Protector, Rafael continues to maintain a leading position in the USV market."

With an ability to operate under hazardous conditions, the Protector can be integral in various naval missions, as it eliminates risk to personnel and capital assets, enables long and continuous operation, and minimises operational and maintenance costs.

Strategic assets such as oil and gas pipeline and rigs, power stations, ports, and harbours, are vulnerable to terrorist and criminal threats. Such infrastructure have high economic and political value, and considering the low probability of detection of threats, owing to their relative anonymity

and sensitive geographical location of such the infrastructural assets, makes them vulnerable and 'attractive' targets.

The ensuing immediate and long-term economic, environmental and political consequences that could emerge from attacks on such infrastructure, and the potentially high cost in human lives, requires governments to adopt a holistic approach, which addresses complexities of such challenges. The main advantages of using an unmanned system for harbour security are that one can perform prolonged missions without exposing the crew to dull routine and, in crucial events, "without exposing them to high risk." Dull routine, in harsh environmental conditions, naturally affects crew alertness and their objective capabilities. With an unmanned system, the crew is located at a command room on shore are mostly at rest, and when called upon, can perform duty without any risk.



Elbit's Seagull: The Protective 'Bird'

At Euronaval held in October 2016 at Paris, Ofer Ben Dov of Elbit Systems provided an outstanding presentation to this *Vayu* correspondent on the Seagull multi-role Unmanned Surface Vessel (USV) manufactured by Elbit Systems to meet the maritime warfare mission requirements of naval forces worldwide. Unveiled at the Singapore Air Show held in February 2016, the vessel is capable of conducting Mine Counter-Measures (MCM) involving the detection, categorisation, localisation, recognition and neutralisation of seabed, tied up and floating naval mines. Although primarily a MCM vessel, it can also be deployed as a potent Anti-Submarine Warfare (ASW) asset with torpedoes, Intelligence, Surveillance & Reconnaissance (ISR), electronic warfare, maritime security and hydrography missions by swapping modular payloads. Subsequently Elbit successfully demonstrated the MCM capabilities of a Seagull USV integrated with Klein 5900 multi-beam mine hunting side scan sonar, during MCM exercises conducted in the Mediterranean Sea in March 2016. For swift response to asymmetric threats, two diesel engines, driving two propellers and a pair of thrusters, can propel the USV to a maximum speed of 60km/h which craft

can continuously operate at sea for more than four days.

To reduce magnetic signatures Seagull (12 metres long) is made of aluminium and composite materials. The boat incorporates removable floats and bridge dynamic positioning system, and can be configured according to the customer's requirements.

The vessel offers a highly autonomous and safe seagoing capability, can operate in sea states up to four and survive sea state seven. The USV is operated in manned and unmanned modes from port

or a mother-ship and can be controlled by a single Mission Control System (MCS) using Line of Sight (LoS) and Satellite Communications (SATCOM) data-links. The built-in Command, Control, Communications, Computers, and Intelligence (C4I) capability of the MCS enables the control of two USVs simultaneously along with situation awareness of the area of operation.

Standard sensors include a navigation, sailing and safety suite, Electro-Optical/ Infra-Red (EO/IR) sensors, side scan sonar or Synthetic Aperture Sonar (SAS), forward looking sonar or multi-beam echo sounder, diver detection sonar and dipping sonar.

The vessel can also carry a diver neutralisation system, remotely-operated vehicle (ROV), as well as Electronic Support Measures (ESM) and Electronic Counter Measures (ECM) systems. With a maximum payload capacity of 2,500kg, the Seagull USV can launch expendable mine disposal vehicles to clear mines. The autonomous navigation system (ANS) aboard the vessel integrates obstacle avoidance system, which meets international regulations for precluding collisions at sea. Kraken Sonar was awarded a contract by Elbit Systems to deliver the KATFISH (Kraken Active Tow FISH) towed sonar system for the Seagull USV, in February 2016. KATFISH provides real-time ultra-high resolution seabed imagery and maps for a range of maritime applications.

For patrol tasks the Seagull USV is armed with a remote control weapon system mounted with a 12.7-mm machine gun, plus a non-lethal weapon system.

Sayan Majumdar



MR-SAM / LR-SAM, alias Barak 8



Replying to a query in the Rajya Sabha on 26 July 2016 regarding upgrade of the Barak missile system, Defence Minister Manohar Parrikar gave a status report on two similar systems: the Long Range Surface to Air Missile (LR-SAM) and the Medium Range Surface to Air Missile (MR-SAM), being jointly developed and produced by the Indian Defence Research and Development Organisation (DRDO) and Israel Aerospace Industries (IAI). While the Rs 2,606.02 crore contract for the Naval version, designated LR-SAM, was signed on 27 January 2006, the contract for the land based MR-SAM, worth Rs 10,075.68 crore, was inked on 27 February 2009. Both systems are capable of detecting an incoming aerial threat at a distance of over 100 km and have a destruction range of 70 km.

Testing and Trials

While successful operational flight trials for the LR-SAM aboard the destroyer INS *Kolkata* were conducted on 29 December 2015, three consecutive flight trials for the MR-SAM

have been conducted on 30 June and 1 July 2016, against a target drone at the Integrated Test Range (ITR), Chandipur. These trials were clearly seen as significant, with the President of India, Pranab Mukherjee, conveying a congratulatory message to Dr S Christopher, Secretary and Director General, DRDO, stating, "I extend hearty congratulations to all those associated with the successful test-firing of the Medium Range Surface to Air Missile (MR-SAM), developed jointly with Israel. The nation is proud of the achievement made by DRDO and looks upon DRDO to make even greater efforts to boost India's indigenous defence capabilities in technologically challenging areas."

These trials validated the system components and capabilities in extremes of reference scenarios. The targets were simulated utilising Meggitt BTT-3 'Banshee' pilotless target aircraft. The Banshee, which has an operational range of 100 km, was originally developed by Target Technology Limited in the 1980s, and was likely chosen over the indigenous Lakshya target drone because of its cost effectiveness and ability to carry varied payloads, including flare and chaff dispensing pods, IFF transponders, frequency specific active radar augmentors, radar altimeter and acoustic and doppler radar systems to enable better collection and analysis of telemetry data.

The success of these tests paves the way for induction of the MR-SAM system. The Indian Air Force is planning to initially induct nine such systems with 432 missiles, which will enhance the ground based Air Defence (AD) capabilities of both the Army and the IAF significantly. It would also complement the existing airborne platforms in securing the airspace against most aerial threats, responsibility for which task rests primarily with the IAF.

DRDO & Israel

In addition to collaboration by DRDO and IAI, other significant contributors have been Israeli companies Elta and Rafael, which developed various components in association with Indian private and public sector companies such



The missile by many names: MR-SAM is also known as Barak-8, and in Indian Navy service as the LR-SAM

as Tata, Bharat Electronics Limited (BEL), Larson & Toubro (L&T), and Bharat Dynamics Limited (BDL), among others.

The complete MR-SAM system, in addition to the missiles themselves, is composed of an advanced phased array radar called the Multi Functional Surveillance and Threat Alert Radar (MF-STAR) with a range of 250 km, a command and control system, mobile launchers, and missiles with advanced Radio Frequency (RF) seekers. The system would provide a quantum jump from the sub-30 km range ground based AD systems currently in service, such as the SA-3B (*Pechora*) and SA-8B (*Osa-AKM*) systems of Russian origin and the indigenous Akash systems, which are providing only point defence. A series of these systems would be able to provide area defence and, more importantly, the system architecture also indicates an ability to counter short-, medium- and intermediate-range ballistic missile threats.

The Future

It has been a very long wait for the IAF to modernise its ground-based SAM systems and to move from a point defence approach to the implementation of an area defence concept. It has been worth the wait, as developing an indigenous capability remains a preferred choice vis-à-vis acquiring 'off the shelf' systems. It is likely that the Army and Navy will employ similar systems as well, in which case the task of devising fool-proof communication systems with multiple redundancies to avoid fratricide as well for efficient utilisation of available systems will become even more critical.

The IAF on its part, must take the lead and establish an integrated (tri-service) command and control centre for their deployment and evolve procedures, tactics and doctrines to effectively govern their employment in both peace and war time situations. Since major responsibility for air defence of the country rests with the IAF, the onus of revising procedures for smooth integration of the new air defence system being inducted into the arsenal of all the three services and including it in the Union War Book (currently being revised), also rests with IAF.

Wg Cdr BS Nijjar
Research Fellow, CAPS

More Rafale Ms for French Navy



Flottille 17F of *Aéronautique Navale* (the French Naval Arm) has operationalised its first Dassault Rafale Ms whose onshore location is at *Base d'Aéronautique Navale Landivisiau*. 17F was the last unit to operate the Super Étendard Modernisé (SEM), its final five airworthy aircraft retiring during a ceremony at Landivisiau on 12 July (see *Vayu* VI/2016).

Charles de Gaulle rejoins war against Daesh



The French aircraft carrier *Charles de Gaulle* (R 91) has rejoined operations against Daesh. Missions were resumed from the vessel on 30 September when Rafale Ms took part in an operation against the militants in their Iraqi stronghold, Mosul. Earlier, on 16 March, the ship had returned to its home port Toulon for maintenance after previous anti-Daesh missions, before returning to the eastern Mediterranean.

J-20 debuts at Zhuhai

At China's International Aviation and Aerospace Exhibition in Zhuhai, Guangdong Province in early November, the 5th Generation Chengdu J-20 stealth fighter made its public appearance, with a pair carrying out a brief display. This was the second successive display of China's stealth fighters, following the 2014 debut of the J-31 or FC-31. The larger J-20 had made its maiden test flight in



2011 and has been the object of much analysis, with limited series production begun after six prototypes have test flown. The FC-31 is reportedly intended for export much in the same manner as the JF-17 Thunder, which is in operational service with the PAF. The FC-31 first flew in 2012 and China is the only country apart from the US to have two concurrent stealth aircraft development programmes. Experts believe that both Chinese 5th Gen fighters could well enter service as early as 2018 which would "significantly improve China's existing fleet of fourth-generation aircraft...to support regional air superiority and strike operations".

The Pakistan Air Force could well be the first operator of J-31s.

Chinese Y-20, CH-5 UAV at Zhuhai

Aircraft on display at Zhuhai, alongside the latest Chinese weapon systems, radar and drones included the Xian Y-20 strategic airlifter (*picture below*), with a maximum takeoff weight of around 200 tonnes.



Also featured was the AG600 flying boat which is officially promoted "as a fire-fighting or search and rescue aircraft," but analysts note the AG600 is well suited to resupplying military outposts in disputed island areas. Also on display was the CH-5 unmanned aerial vehicle, China's largest combat UAV, which made its first flight in 2015 and appears to be based on the US MQ-9 Reaper.

PAC JF-17s at Zhuhai



Air Chief Marshal Sohail Aman, Chief of the Air Staff, Pakistan Air Force (picture above) led a large delegation to the Zhuhai Air Show-2016, where JF-17s of the Pakistan Air Force were on both static as well as aerial displays. The PAF Chief also met with General Ma Xiotian, Commander Peoples Liberation Army Air Force and “discussed matters of professional interest”. Both the Chiefs agreed “to enhance the cooperation in training and capability enhancement between the two friendly air forces.”

RAF Typhoons in the Far East



Eurofighter Typhoons of the RAF’s No. 1 Squadron from RAF Lossiemouth were deployed to Malaysia, flying in to the RMAF Air Base, Butterworth for Exercise *Bersama Lima* in October 2016. They were later deployed for exercises in Japan and then the Republic of Korea. RAF Voyager tanker aircraft provided air-to-air refueling for the Typhoons, multiple re-fuelling operations conducted over the 7,600 miles (12,230km). Exercise *Bersama Lima 16* is the annual FDPA Exercise, which involves the UK, Malaysia, Singapore, Australia and New Zealand, the exercise “providing an opportunity for the five countries to improve integration and interoperability, whilst showing their collective commitment to the FPDA”.

Another Lossiemouth-based Typhoon unit, No II (AC) Squadron, deployed to Misawa Air Base in northern Japan in October for Exercise *Guardian North 16*. Joint training was carried out with the Japan Air Self-Defence Force (JASDF). The four Typhoons from II (AC) Squadron then participated in the first ever joint UK-Republic of Korea fighter exercise, which took place from 4-11 November at Osan Air Base. Republic of Korea Air Force F-15K Slam Eagles and KF-16C/Ds, along with US Air Force aircraft, also joined in the training, dubbed *Exercise Invincible Shield*. The overall *Exercise Eastern Venture* also included an Asia-Pacific and Middle East tour by the RAF’s Red Arrows aerobatic team, its largest in a decade. 12 Hawk T1s visited 12 countries, including India and later gave their first ever performance in China at the Zhuhai Air Show on 1-6 November.

Iran seeks major weaponry from Russia

According to reports from Moscow, the governments of Russia and Iran are discussing major weapon deals including aircraft, helicopters, main battle tanks, artillery and other systems. “Russia is ready to develop military and technical cooperation with Iran,” according to Zamir Kabulov of the Russian foreign ministry. While the types and numbers were not detailed, the director said “naturally, some of these products, namely tanks and fighters are covered by the UNSC sanctions... and we have to apply for the UNSC permission.” Iranian Ambassador to Russia Mehdi Sanaei said that Tehran was looking for ways to broaden the scope of defence cooperation with Moscow, even in areas that require coordination with the UN Security Council (UNSC) and need a resolution. He added that “Russia was ready to work with Iran in the area of military and technical cooperation.”

RAAF receives first P-8A Poseidon



The first of 12 Royal Australian Air Force (RAAF) P-8A Poseidons was rolled out at in Seattle on 27 September and received by Chief of the Air Force, Air Marshal Leo Davies. The aircraft later arrived at Australia on 15 November with the remaining 11 to follow by March 2020, the Poseidons progressively replacing the RAAF’s AP-3C Orion fleet at RAAF Base Edinburgh over the next three years, enabling the latter to be phased out in 2018-19.

Finland's HX fighter search

On 22 April, the Finnish Defence Forces Logistics Command sent out requests for information (RFI) on the Boeing (F/A-18E/F Super Hornet), Dassault (Rafale), Eurofighter (Typhoon), Lockheed Martin (F-35 Lightning II) and Saab (Gripen E), but pointedly not on the F-15 Eagle or the F-16 Fighting Falcon. The HX project covers the procurement of 60-64 aircraft, projected cost of which would be between \$7-10 billion. "The fighter acquisition will become a fundamental component of a strengthened national air defence system that comprises a robust anti-aircraft defence system," stated Jussi Niinistö, Finland's defence minister. The deadline for response to the RFI is 31 December 2016. The invitation to tender bids will be dispatched in 2018 before a tender issue in February 2019. Contracts are then being lined up for signature in 2021, with initial operational capability expected in 2025.

Final production Su-30s for Vietnam



Recently delivered were two Sukhoi Su-30MK2Vs, the final pair of 38 ordered for the Vietnamese People's Air Force, built at the KnAAPO factory at Komsomolsk-on-Amur in Russia's Far East. These were the last two production Su-30s, ending 16 years of manufacture of the type (although production of Su-30MKIs at HAL Nasik continues). KnAAPO will now instead only produce the new generation, single-seat Su-35 and the next generation PAK-FA (also known as the FGFA), once this is fully certified for series production.

Zambian Hongdu L-15s

Two Zambian Air Force (ZAF) Hongdu L-15AFT (Attack Fighter/Trainer) Falcons made their public debut at the African Aerospace and Defence (AAD) exhibition, 4-18 September at Air Force Base Waterkloof, near Pretoria, South Africa. China National Aero-Technology Import and Export Corporation (CATIC) had promoted the aircraft at AAD along with two Zimbabwe Air



Force K-8s. Weapons put on show by CATIC alongside the L-15s included 250kg and 500kg bombs, the PL-5E II short range air-to-air missile, TL-10(YJ-5E) air-to-surface missile, LS-6 GPS/INS-guided bomb and HFD-18D 57mm rocket pod, plus a centreline 23mm PC-2AI gun pod.

The first batch of three L-15AFTs had earlier been airfreighted to Zambia for service with No. 15 Squadron, Air Defence Command, based at Lusaka-Kenneth Kaunda International Airport. The ZAF has ordered six L-15AFTs and the remaining aircraft are scheduled to arrive in Zambia in early 2017. A second batch of six is also understood to be on order.

Ex-USAF F-15Ds for Israel



Eight ex-US Air Force F-15D Eagles have been transferred to the Israeli Air Force to supplement its existing fleet of the type at Tel Nof Air Base. All eight were previously in service with the Oregon Air National Guard/173rd Fighter Wing's 114th Fighter Squadron at Kingsley Field Air National Guard Base. Two of Israel's units at Tel Nof already operate the F-15D, being the 106 'Spearhead' and 133 'Knights of the Twin Tail' Squadrons.

\$38bn from USA for Israeli military assistance

A major military assistance agreement has been signed between the US and Israel to provide the country with a massive \$38 billion over 2019-2028, the single largest pledge of military assistance given to any country in the entire history of the United States. The memorandum of understanding was signed at Washington DC on 14 September when US National Security Advisor Susan E Rice stated, "This additional funding will, among other things, allow Israel to update the lion's share of its fighter aircraft fleet, including the acquisition of additional F-35s and F-15s." A White House fact sheet on the MoU stated that more than \$26 billion in assistance has already been provided to Israel which has included ten additional F-15 Eagles, 'several' C-130J Super Hercules, Hellfire missiles, Joint Direct Attack Munitions (JDAMs) and other precision-guided munitions. Of that list, the US Air Force has confirmed the Eagles are F-15Ds supplied as 'Excess Defence Articles' rather than new Foreign Military Sales, with eight delivered to date.

Taurus KEPD 350K for South Korea



Taurus Systems GmbH, a joint venture of MBDA Deutschland GmbH (67 %) and Saab Dynamics AB (33 %), has delivered the first lot of Taurus KEPD 350K stand-off missiles to the Republic of Korea Air Force (RoKAF). The ceremony was performed at the headquarters of Taurus Systems GmbH in Schrobenhausen, Bavaria, and marked the start of series deliveries. Taurus KEPD 350K is an enhanced and upgraded version of the Taurus KEPD 350 missile, which has been in service with the German Air Force since 2005 and with the Spanish Air Force since 2009. The Taurus KEPD 350K is a modular stand-off missile system for precision strikes.

More F-16C/Ds for Indonesia

Another five F-16C/Ds have been delivered to the *Tentara Nasional Indonesia-Angkatan Udara* (TNI-AU) under the *Peace Bima-Sena II* programme, arriving at Iswahyudi Air Base,



East Java. The aircraft comprised two seat F-16Ds plus three single-seat F-16Cs. The fighters had flown from Hill Air Force Base Utah routing via Joint Base Pearl Harbour-Hickam, Hawaii and Andersen AFB, Guam, before arriving at Iswahyudi. The TNI-AU is acquiring 24 USAF surplus F-16C/D Block 25s (19 F-16Cs and five F-16Ds) as 'Excess Defence Articles' to supplement its older F-16A/Bs. Including the latest deliveries, a total of 14 aircraft have now arrived in Indonesia, comprising ten F-16Cs and four F-16Ds. The remaining aircraft will be delivered in two further batches, one in February and the final one in December 2017.

Romanian F-16A/Bs

Portugal has handed over the first six of 12 second-hand F-16A/Bs that have been acquired by the Romanian Air Force (*Forțele Aeriene Române* – FAR) under the 'Peace Carpathian programme'. The six F-16s departed Monte Real airbase enroute to Borcea Fetești in Romania. The 12 former Portuguese Air Force aircraft have been refurbished by OGMA, supported by Lockheed Martin and given a mid-life upgrade to MLU M5.2 standard. They will be operated from Baza 86 Aeriana (86th Air Base) at Borcea Fetești, where they will start replacing the MiG-21 LanceRs of 861 Escadrila, and later Escadrila 53 Vânătoare 'War Hawks'. The 12 aircraft comprise nine single-seat F-16As and three twin-seat F-16Bs. The FAR hopes eventually to acquire an additional 12 second-hand F-16s to replace their MiG-21s at Baza 71 Aeriana, Campia Turzil.



Myanmar Y-8F-200Ws and G120TPs



Two Shaanxi Y-8F-200Ws have been delivered to the Myanmar Air Force at Meiktila Air Base formally inducting them into service along with ten Grob G120TP trainer aircraft. In addition to transport missions, the Y-8Fs will be used for maritime reconnaissance and overwater search and rescue, joining four Y-8Ds already in Myanmar. As for the trainers, Myanmar had placed an order for 20 G120TPs on 24 October 2014 and the first two were delivered in February 2015. A further eight had arrived by the end of that year and the ten newly inducted additional aircraft are believed to have been the final aircraft of the order.

Pakistan Army receives AW139s

According to sources, the first of some four Leonardo AW139 utility helicopters ordered by Pakistan has made its first flight. The Pakistan Army is to receive these new helicopters, which can transport up to 15 personnel. Eleven AW139s are already in service with various operators in Pakistan for various tasks such as search and rescue operations, while certain private sector entities, such as Golden Eagle Aviation, also operate AW139s.



Although the acquisition pattern is incremental, there is a chance that Pakistan may have opted to select the AW139 to serve as its mainstay utility helicopter platform. The Leonardo AW139 is close in function and performance to the Bell 412, which is already in use with the Pakistan Army. The dedicated military version AW139M is equipped with a night-vision goggle (NVG)-compatible glass cockpit, tactical data-link connectivity, and stations for external sensor and electronic warfare and countermeasures systems.

A400M deliveries to RAF and Ejército del Aire

An additional A400M Atlas C1 was delivered to the Royal Air Force in September 2016 bringing the total delivered to the service to ten of 22 on order for the RAF. Meanwhile, Airbus D&S has flown the first Airbus A400M for the *Ejército del Aire* (Spanish



Air Force) from Seville-San Pablo Airport, Spain, which is the first of 27 aircraft ordered by Spain, the sixth nation to put the A400M into service. Under an agreement signed in September 2014, these aircraft will be delivered to the Spanish Air Force at a steady pace between now and 2022, with the remaining 13 scheduled for delivery from 2025 onwards.

New standard A330 MRTT in maiden flight

Airbus Defence and Space has successfully completed the maiden flight of the first new standard A330 MRTT Multi Role Tanker Transport, which model incorporates a number of enhancements introduced on the basic A330 as well as upgraded military systems as part of Airbus and Airbus Defence and Space's continuous product improvement programme. The new standard A330 MRTT features structural modifications, aerodynamic improvements giving a fuel-burn reduction of up to 1%, upgraded avionics computers and enhanced military systems. First delivery is due in 2018. A total of 51 A330 MRTTs have been ordered by 10 nations of which 28 have been delivered.



Bangladesh orders C295W



Bangladesh has ordered the Airbus C295W medium airlifter for Bangladesh Army Aviation. This aircraft, in transport configuration, will be delivered in the second half of 2017 under a contract that also includes customer support and training. It is the first multi-engine fixed-wing aircraft to be operated by Bangladesh Army Aviation.

Meanwhile, the Airbus C295W medium transport has been demonstrated as an airborne tanker. The C295W, equipped with a palletised air-to-air refuelling unit and associated computer control system, conducted multiple contacts with a standard Spanish Air Force C295 in a test flight on 29 September. The system is intended for refuelling turboprop aircraft, helicopters, and eventually unmanned aerial vehicles.

Luftwaffe to procure C-130Js

German Defence Minister Ursula von der Leyen has stated that the Luftwaffe (German Air Force) will procure four-to-six Lockheed Martin C-130J Super Hercules transports. It is planned to initially base the German Air Force aircraft in France to operate alongside the AdlA examples at *Base Aérienne* 123 Orleans-Bricy, supplementing the German AF A400Ms.

L-159 production renewed

The Czech Aerospace company Aero Vodochody has resumed production of the L-159, some 13 years after the last one was built. The two seater L159T1 is amongst 11 aircraft for the Iraqi Air Force, while another four are coming from the Czech Air Force.



The Company has also revealed that it is in discussions with two countries over procurement of this advanced light combat aircraft/trainer and is hopeful more L-159s could be sold to Iraq. Two Aero Vodochody L-159s were delivered to the Iraqi Air Force on 25 August, increasing to five the number of aircraft in service with Iraq's 115th Attack Squadron, the first batch of two ALCAs being delivered in November 2015. The Iraqi government had ordered 12 L-159s from Aero Vodochody in April 2014.

Singapore orders H225M helicopters



Airbus Helicopters has signed a contract with the Singapore Ministry of Defence for the acquisition of H225M Medium Lift Helicopters, which will be used for a wide spectrum of operations including Search and Rescue (SAR), Aeromedical Evacuation (AME), and Humanitarian Assistance and Disaster Relief (HADR) operations. "A proven platform with exceptional payload, a world-class automatic flight control system and long endurance, the H225M has demonstrated its versatility and performance even in the harshest operational environments."

Black Hawks for Chile



The Chilean Air Force has selected the Sikorsky S-70i Black Hawk for its medium-lift requirement. A contract for six helicopters to be produced by Sikorsky's Polish subsidiary PZL Mielec is to be signed by year end. Other types in competition were the AW149, Mi-17 and Surion.

MD 530s for Afghanistan



Deliveries of MD Helicopters MD530 Cayuse Warriors to the Afghan Air Force have been completed, the final four Cayuse Warriors arriving at Hamid Karzai International Airport, Kabul on 25 August. The aircraft were part of an October 2015 contract awarded by the US Department of the Army non-standard rotary-wing programme office for 12 additional aircraft for Afghanistan. The final delivery brings the number of MD530s in AAF service to 27.

1000th H-60M Black Hawk delivered to US Army



Sikorsky has delivered an epochal 1,000th H-60M Black Hawk helicopter to the US Army in a ceremony held in Stratford, Connecticut. Sikorsky had delivered the first UH-60M Black Hawk helicopter in 2007 and the first HH-60M MEDEVAC helicopter in 2008. The 'Mike' model helicopters represent the Army's third standard baseline H-60 Black Hawk aircraft version in the 38-year production history of the programme. The newest models feature more powerful engines than older variants, a new airframe, avionics and propulsion system, improved rotor blades, a digital cockpit, and an autopilot among other modern enhancements. Currently, there are 2,135 H-60 Black Hawk helicopters in service, making the Army's Black Hawk helicopter fleet the largest flying fleet of all the services.

Final MH-60R Seahawk for RAN

Lockheed Martin has delivered the 24th, and final MH-60R Seahawk helicopter to the US Navy in support of the Navy's Foreign Military Sales (FMS) programme with the Royal Australian Navy (RAN). The milestone delivery took place during a ceremony at Lockheed Martin's Owego, New York facility. The Commonwealth of Australia chose the MH-60R 'Romeo' helicopter in June 2011



to fulfill the Australian Defence Force's requirement for a fleet of 24 new-generation, multi-role naval combat aircraft. In addition to the MH-60R helicopter's primary mission areas of anti-submarine and anti-surface warfare, it also has the capability for secondary missions including search and rescue, vertical replenishment, naval surface fire support, logistics support, personnel transport, medical evacuation, and VHF/UHF/link communication relay. The new MH-60R helicopters are currently replacing the RAN's existing fleet of S-70B-2 helicopters.

More orders for Leonardo-Finmeccanica AW169

Helikorea have ordered two AgustaWestland AW169 helicopters for Emergency Medical Service (EMS) missions in the Republic of Korea, where Leonardo has experienced significant success in recent years. Approximately 50 helicopters of various types are now in service or on order for military, para-public and commercial roles ranging from naval applications, search and rescue, law enforcement, firefighting and VIP/corporate transportation. The contract, which also includes an option for one additional aircraft, foresees deliveries by the end of 2016.



Milestone for S-92 helicopter fleet

The Sikorsky S-92 helicopter fleet's marked its one million flight hour milestone with events in the North Sea Region, the largest S-92 operating area in the world. Of the S-92 fleet's first one million flight hours, 87 percent were flown in support of offshore oil missions with a greater than 95 percent availability rate. Since 2004, Sikorsky has delivered more than 275 S-92 helicopters. Eleven nations fly the dual-engine S-92 helicopter for their head of state missions. In May 2014, the US Navy selected Sikorsky for the US Presidential Helicopter Replacement Programme, using the S-92 platform.



Indonesian Air Force will be operating the SAGE system in the maritime environment, where identification of an adversary's use of the electromagnetic spectrum is essential.

Rockwell Collins to service UH-60 Black Hawk displays units



The US Army has selected Rockwell Collins to service the MFD-268C4 multi-function display (MFD) units for its UH-60M Black Hawk fleet under a five-year firm-fixed-price, "indefinite delivery, indefinite quantity contract." This continues the US Army's relationship with Rockwell Collins for long-term support of the programme. Installed on the Army's UH-60M Black Hawk helicopters, the MFD-268C4 displays provide advanced graphic engines, safety critical processing, and Active Matrix LCD technologies, as well as multiple video interfaces.

Leonardo's SAGE ESM on Indonesian CN-235 MPA

Leonardo-Finmeccanica's SAGE Electronic Support Measures (ESM) system is incorporated on the Indonesian Air Force's first modified CN-235 Maritime Patrol Aircraft (MPA). The modification programme was led by PT Dirgantara Indonesia (PTDI) and Integrated Surveillance and Defence (ISD). The first CN-235 was modified during 2016, with SAGE being installed and integrated with the aircraft's tactical mission system. The

Dominica's P2006T for special missions

An Italian-built Tecnam P2006T Special Mission Platform (SMP) has recently been delivered to the *Fuerza Aérea de República Dominicana* (FARD – Dominican Republic Air Force.) Based at San Isidro, this is operated by the *Escuadrón de Transporte Aéreo 'Pegasus'*, which flies all the other FARD fixed-wing transport types. Primary roles for the aircraft will be countering transnational organised crime (CTOC), along with providing support for the *Armada de República Dominicana* (ARD – Dominican Republic Navy) and the Dominican Republic's National Drug Control Direction (DNCD).

China agreement on An-225 manufacture

The Ukrainian company Antonov has signed an agreement with Ukroboronprom State Corporation and the Aerospace Industry Corporation of China (AICC) for license manufacture of the An-225 Mriya. The long-term co-operation agreement includes completion of the second An-225 airframe, which has remained at Antonov's facility in Kiev since the late 1980s for joint series production under licence to Antonov. The company Antonov, however, denied foreign media reports that the intellectual property (IP) will pass to the Chinese Government. It said the company's IP and design experience, together with the "broad experience" of China's aviation industry, will be "key to the success of the project."



Italian P-72As



Official delivery of the P-72A to the Italian Air Force's 41° Stormo, at Sigonella Air Base, Sicily will happen following crew training, which began in May 2016. The P-72A will replace the Breguet Br.1150 (P-1150A) with Italy's *Aeronautica Militare*, which is launch customer of the P-72A, based on the ATR 72-600 airframe and the design of ATR 72ASW developed for the Turkish Navy. The anti-submarine warfare systems have been replaced by a full C4I (command, control, communications, computers and intelligence) suite to perform maritime patrol, vessel identification and search, electronic intelligence, warfare command and control, and search and rescue.

US Army selects Grob G120TPs

The US Army has selected the German Grob G120TP for its Fixed-Wing Flight Training programme; the initial three aircraft are to be used to train CAE instructor pilots at the contractor's newly constructed Dothan Training Centre. This complex will train more than 450 US Army fixed-wing aviators annually, and will provide training for US Air Force C-12 aircrew. The programme will provide all training required to instruct experienced Army rotary-wing aviators to operate the service's fleet of more than 350 fixed-wing aircraft. Additionally, the US Army Fixed-Wing Flight Training Programme will serve as the formal training unit for Army C-12/RC-12 recurrent raining and annual training for USAF C-12 pilots, using six Grob G120TPs, as well as two CAE-designed G120TP integrated procedures trainers and a suite of desktop trainers and courseware that will support the training programme.



Dornier 328s are USAF 'Wolfhounds'



The USAF has named its Dornier 328s as the C-146A Wolfhound. This aircraft's primary mission is to provide US Special Operations Command with "flexible, responsive and operational movement of small teams needed in support of Theater Special Operations Commands (TSOC)", from semi-prepared airfields around the world. Deployed since October 2011, the C-146A is the military version of the Dornier 328 turboprop commuter airliner modified to permit cargo and CASEVAC missions and currently supports overseas contingency operations across four geographic combatant commands.

Northrop Grumman B-21 is *The Raider*



Secretary of the US Air Force, Deborah Lee James has confirmed that the service's new B-21 bomber has been given the name *Raider*, the name intended to honour the 'Doolittle Raiders' that carried out a surprise attack against Japan during WW2. Secretary James also noted her efforts to increase USAF strength and keep its largest modernisation programmes, the B-21, F-35 and KC-46 tanker, "are on track." The new bomber, which is expected to enter service around 2025, is now under full-sale development by Northrop Grumman. Air Force Global Strike Command chief Gen Robin Rand said that the official number of aircraft to be procured will not be made official for some time, but he expects the 80-100 number to increase, noting the operational tempo of the existing fleet of 160 strategic bombers.

Northrop Grumman's T-X contender

Before Boeing-Saab's 'clean sheet' T-X contender was formally unveiled in mid-September 2016 (*see Vayu VI/2016*), Northrop Grumman's T-X Model 400 aircraft was seen on 19 August at Mojave Airport, California, during what appeared to be high-speed taxi tests. The aircraft, registered N400NT, was manufactured by NGC's Scaled Composites subsidiary at Mojave, and according to the FAA registry is powered by a single GE F404-102D turbofan. However, Northrop Grumman has not yet officially displayed its T-X offering in public.

KC-46A tanker production



Following receipt of Defence Acquisition Board Milestone C approval to enter low-rate initial production of the KC-46A, Boeing has received a \$2.8 billion contract from the US Air Force comprising production lots of seven and 12 tankers. Boeing had received an initial contract to develop its 767-2C into a multi-role tanker cargo aircraft in 2011, following which, four prototype aircraft have completed more than 1,000 flight hours. In addition to its aerial refueling mission, the KC-46A will be capable of carrying passengers, cargo and operating in the aeromedical airlift role. Boeing is assembling KC-46s at its Everett, Washington facility and will begin delivering the tankers to the USAF in 2017.

Russian aircraft carrier deployed in Mediterranean

Plans to deploy the Russian Navy aircraft carrier *Admiral Kuznetsov* to support Russia's military campaign in Syria, have



now fructified. The carrier, deploying Su-33s, MiG -29K/KUBs and Kamov Ka-52K attack helicopters, had earlier undergone pre-deployment maintenance and repair during late September prior to this Eastern Mediterranean deployment.

Russia reinforces military in Kaliningrad

Russia has reinforced its Baltic Fleet in Kaliningrad with two warships armed with long-range cruise missiles to counter what it sees as "a worrying NATO build-up in the region." These are *Buyan*-class corvettes armed with nuclear-capable Kalibr cruise missiles, known by the NATO codename 'Sizzler', which have a range of some 1,500 kilometres. This will certainly raise tensions in the Baltic already heightened since Russia's 2014 annexation of Crimea and is likely to cause particular consternation in Poland and Lithuania which share land borders with Kaliningrad. The deployment comes at a time when NATO is planning its biggest military build-up on Russia's borders since the Cold War to counter Moscow and Russian military analysts said the move looked like a direct response to NATO.



Meanwhile, Sweden's Defence Minister has stated that they are worried by the presence of such warships in the Baltic Sea, complaining the move was likely to keep tension in the region high. "This is ... worrying and is not something that helps to reduce tensions in our region," Defence Minister Peter Hultqvist said. "This affects all the countries round the Baltic." Earlier, Russia had moved nuclear-capable Iskander-M missiles into Kaliningrad, leading to protests from Lithuania and Poland (*see Vayu VI/2016*).

Sino-Russian Exercises in South China Sea

The recent Sino-Russian exercise in the South China Sea involving ships, aircraft, submarines and marines from the People's Liberation Army Navy (PLAN) and the Russian Federation Navy (RFN), included a simulated assault on an island off the Chinese coast. In addition to the 11 fixed-wing aircraft taking part, eight helicopters including Z-8, Z-9, and Ka-31 AEW types flew support missions. As part of the exercise, JH-7A fighter-bombers flew simulated maritime strikes against 'enemy' destroyers and frigates operating in the area (*see picture*).



Earlier in June, US, Indian and Japanese forces conducted operations in the Philippine Sea under *Exercise Malabar*, which prompted Chinese Foreign Ministry spokesman Lu Kang to remark at the time: “Everyone should keep an eye on their true intentions.”

Croatian Navy test fires RBS15



The Croatian Navy fired an RBS15 missile from the RTOP-42 *Dubrovnik* fast attack craft during the military exercise HARPUN 16, held in the waters of Dugi Otok and Žirje in October 2016. “Croatia have for a long time been an important customer for us and this firing is a strong proof of their expertise and knowledge and clearly demonstrates the reliability of the missile system”, stated Michael Höglund, head of marketing and sales at business unit Missile systems within Saab business area Dynamics.

Airbus DS contract for Maritime Network Evolution

Airbus Defence and Space has been awarded the *Maritime Network Evolution* contract by the UK Ministry of Defence. The contract will cover the communications networks of 20 Royal Navy warships, including Type 45 destroyers and *Queen Elizabeth*-class aircraft carriers, upgraded over the next four years. This solution creates the Internet Protocol backbone of the future Maritime Architecture and extends the life of the military satcom

well into the middle of the next decade. “This programme has been achieved without having to compromise any of the key military requirements needed by our Royal Navy warships to defend against any major threat scenario, whilst keeping them at the forefront of modern technology.”

Atlas Elektronik Finland mid-life upgrades



The fully refitted minelayer *Pansio* has now been handed over to the Finnish Navy, the mid-life upgrade carried out by Atlas Elektronik Finland Oy together with Uki Workboat Oy (*Uudenkaupungin Työvene Oy*) as a subcontractor. All three *Pansio*-class minelayers *Pansio*, *Porkkala* and *Pyhäranta* will be refitted and will extend the use of the ships well into the 2030s. AEFI has previously delivered systems technology to *Hamina* class missile boats of the Finnish Navy. They have also delivered an integrated navigation and mission management system to the offshore patrol vessel *Turva* of the Finnish Border Guard. This system has raised wide interest in the field, also internationally.

Bangladesh inducts two submarines from China

The Bangladesh Navy has inducted its first submarines, acquired from China, as it seeks to “boost its naval power in the Bay of Bengal” (*representative picture below*). Bangladesh paid a reported \$203 million for the two submarines a deal that reflects the country’s growing economic and defence ties with China.



Bangladesh has been expanding its defence capabilities in recent years, building a new airbase close to neighbouring Myanmar, opening several new military cantonments across the country and adding new frigates to its naval fleet. In 2013, the government of Prime Minister Sheikh Hasina signed a billion-dollar deal with Russia to buy Yak-130s, helicopters and anti-tank missiles.

Irkut's Yak-152 trainer in maiden flight



The maiden flight of the Yak-152 initial training aircraft took place at the airfield of Irkutsk Aviation Plant, the affiliate of Irkut Corporation on 29 September 2016. Yak-152 aircraft has been developed by Yakovlev Design Bureau, the affiliate of Irkut Corporation, providing initial pilot training by day and night. Yak-152 is designated for training pilots in flying techniques, basics of navigation, simple, complex, and aerobatic pilotage, as well as group piloting.

Airbus celebrates delivery of its 10,000th aircraft

Airbus has celebrated the delivery of its 10,000th aircraft, an A350-900 for Singapore Airlines. The milestone event was marked by a special ceremony in Toulouse hosted by Airbus Group CEO Tom Enders and attended by Goh Choon Phong, CEO of Singapore Airlines. The aircraft delivered is the sixth A350-900 for Singapore Airlines, out of a total order for 67. Featuring a special '10,000th Airbus' logo, the aircraft will be used to launch the airline's new non-stop services between Singapore and San Francisco.



Leonardo-Finmeccanica's Osprey for US Navy

Leonardo-Finmeccanica's Osprey AESA radar has been picked to serve as look-out on-board the US Navy's newly-upgraded unmanned helicopter, the MQ-8C Fire Scout, the helicopter to be operated from the decks of US naval combat vessels. Leonardo will deliver an initial batch of five radars to the US Navy's procurement organisation, the Naval Air Systems Command (NAVAIR), for testing and evaluation work, with further options.

Boeing's China Plant

Boeing have announced that a planned facility to finish and deliver 737 jetliners to Chinese customers would be sited at a new industrial development on Zhoushan island near Shanghai. Plans were announced in 2015 for such a plant to complete the airliners before delivery, including specific painting, installation of seats and other cabin fittings. Boeing will continue assembling 737s at its Seattle plant "but send some to China for completion through a joint venture with the state-controlled Commercial Aircraft Corp. of China Ltd." A separate Boeing-owned delivery centre in Zhoushan will oversee the handover of the completed aircraft. The new plant would mark a milestone for Boeing's presence in China, where rival Airbus Industrie already assembles some A320s at a factory in Tianjin.

A350s ordered by Chinese airlines



Airbus Group expects to deliver its first A350 to Chinese airlines in the second half of 2017 and "is bullish about the country's demand for wide-body aircraft, fueled by fast-growing long-haul international routes markets." An A350 test aircraft commenced its China tour in early November 2016, visiting Haikou, Hainan province, after which it was demonstrated at the Zhuhai Air Show, before visiting Beijing, Shanghai, Guangzhou and Chengdu.

China Eastern Airlines had ordered 20 A350-900 aircraft in April following Air China, which contracted for ten earlier. In September, Sichuan Airlines signed a letter of intent to lease four more. China's long-haul market has been surging as the number of direct international flights to and from China have gone up by

150 percent in the last five years, mainly fueled by the growth of the middle class and relaxed visa policies. "China's booming growth of international flights, especially those long-haul routes, requires wide-body aircraft. The A350 is suitable for those airlines with complete international flight networks," stated Eric Chen, Airbus China President and CEO.

Philippine Airlines to acquire Q400 turboprops



It is reported that Philippine Airlines will acquire up to 12 Q400 aircraft. Bombardier's Dash 8/Q Series turboprops and CRJ Series regional jets have made significant advances in the Asia-Pacific region where approximately 190 aircraft including more than 165 Dash8/Q Series turboprops are in service with, or ordered by, over 25 customers and operators.

A320neo for Air Astana

Air Astana, Kazakhstan's flag carrier, has taken delivery of its first A320neo at Airbus headquarters in Toulouse, the aircraft leased from Air Lease Corporation is part of a deal announced at Farnborough Airshow 2015 for 11 A320neo Family aircraft. The A320neo will join Air Astana's Airbus fleet of 13 A320 Family



aircraft, and will be operated on domestic and international network. Air Astana's A320neo is powered by Pratt & Whitney engines and features a two class cabin layout, seating 16 passengers in business and 132 in economy.

Air China selects V2500 engines for A320ceo



Air China has selected the V2500 engine to power 18 firm-ordered Airbus A320ceo family aircraft. The V2500 engine is offered through IAE International Aero Engines AG, a multinational aero engine consortium whose shareholders comprise Pratt & Whitney, a division of United Technologies Corp.; Pratt & Whitney Aero Engines International GmbH; Japanese Aero Engines Corporation; and MTU Aero Engines GmbH.

Elbit Systems' Skylens ATR-72/42



Elbit Systems' Skylens wearable display has begun flights in final configuration mode onboard the new ATR-72/42 series aircraft. ATR is the launch customer for Skylens, which replaces the traditional Head Up Display (HUD) with this configuration. The system can also be offered as a retrofit to ATR-600 aircraft already in service, as well as to additional potential business aviation aftermarket customers. Skylens is a part of the Clearvision Enhanced Flight Vision System (EFVS) family. It displays high-resolution information, images and video on a high transparency visor, providing pilots with cutting-edge head-out capabilities.

Airbus Helicopters and Helibras' H225M



Helibras and Airbus Helicopters have launched the H225M multirole utility helicopter in naval combat configuration. Developed and assembled locally by Helibras, Airbus Helicopters' subsidiary in Brazil, this new H225M version is designed to meet the demanding requirements of the Brazilian Navy, with mission capabilities including anti-surface warfare and maritime surveillance. This version of the H225M has a Helibras-developed tactical mission system including an APS-143 surveillance radar, advanced self-protection systems as well as signals intelligence capabilities. The helicopter will carry two AM39 Exocet anti-ship missiles, while the cargo bay accommodates a dedicated sensor operator console providing the mission commander with an overview of the tactical situation. An automatic identification system (AIS) will also allow crew members to gather information on surface vessels.

UPS orders 747-8 Freighters

UPS have ordered 14 Boeing 747-8 Freighters, including an option to purchase an additional 14 of the cargo aircraft. "These aircraft are a strategic investment for increased capacity for UPS customers around the globe," stated Brendan Canavan, president, UPS Airlines. "The 747-8 will allow UPS to upsize our network in both new and existing markets." With 109 747-8 passenger and freighter aircraft delivered to customers around the globe, the fleet is performing with the highest dispatch reliability and utilisation of any four-engine airplane in service.



MA700 programme delayed



The Chinese MA700 turboprop airliner development programme has been delayed and the prototype is now planned to make first flight in 2018, a slippage of twelve months. According to AVIC, first deliveries will now take place in 2020, by when the 78-seater would have received a Chinese airworthiness certificate. The MA700 will be powered by Pratt & Whitney Canada PW150C engines, which new powerplant would "give it an advantage in the market", apart from lower production costs relative to competitors.

SARA by Denel



The *Small African Regional Aircraft* (SARA) concept has just been revealed with Denel completing a full-size mock-up and seeking international partners to complete development. Denel Group Acting Chief Executive Officer Zwelakhe Ntshepe said that SARA is "a national flagship project." SARA was launched in 2014 to exploit South African aerospace design and development capability. Beginning with a market study, Denel in conjunction with South Africa's with Department of Public Enterprise, the Department of Trade and Industry and the Joint Aerospace Steering Committee, supported by feasibility studies from Lufthansa Consulting. It has been assumed that there is a definite world market for a twin-turboprop, 24-seat aircraft, the nearest competitor being the Dornier 328, which went out of production a decade back. SARA would be certified to FAA FAR 25 regulations and available in passenger (24 seats), combi (12 passengers and one container) or cargo (three LD-2 plus containers) variants.

Airlander 10 in test flights



The Hybrid Air Vehicles (HAV) Airlander 10 airship has had a heavy landing on its second flight from Cardington, Bedfordshire. Post investigations, test flights are to resume, leading to certification. The Airlander 10 is one of the world's longest aircraft at 302ft (92m) in length, while by comparison, the Antonov An-225 Mriya is 84m (275ft) long, the Airbus A380 72.72m (238ft 7 in) and the Boeing 747-8 is 250ft 2 in (76.3m).

Rolls-Royce Trent 700 engines for China Southern



Rolls-Royce have received a \$700m order from China Southern for Trent 700 engines to power ten Airbus A330 aircraft, the order including TotalCare long-term engine service support. The airline currently operates 14 A330s that are powered by the Trent 700, five A380s powered by the Trent 900 and nine Boeing 757s powered by the RB211.

CDB Leasing orders CFM LEAP-1A engines

CDB Leasing has selected CFM LEAP-1A engines to power all its first batch of next generation single-aisle aircraft orders; valued at \$1.26 billion with deliveries scheduled between 2018 and 2021. The LEAP-1A engine entered commercial service on 2 August 2016. A total of 10 aircraft have been delivered to date and the in-service fleet has logged nearly 3,000 flights to date. The engine is delivering the promised 15 percent improvement in fuel



efficiency, along with an equivalent reduction in CO2 emissions; a 50 percent margin to new emissions regulations; a dramatically lower noise signature; and CFM's industry-leading reliability and low overall operating costs.

Airbus A400M demonstrates 'buddy-buddy' air refuelling



The Airbus A400M new generation airlifter has demonstrated its capabilities as a tanker by carrying out air-to-air refuelling contacts with another A400M. In two flights conducted from Seville, Spain the development aircraft performed more than 50 contacts in level flight and turns using the centreline hose and drum unit (HDU). The standard A400M aircraft has full provisions for air-to-air refuelling (AAR) operations already installed and only requires the rapid installation of the optional air-to-air refuelling kit to become a tanker.

30,000th CFM56 engine

CFM International has recently delivered the 30,000th CFM56 engine, with one each for Airbus and Boeing; a CFM56-5B going to Delta Air Lines powering an Airbus A320neo and a CFM56-7B engine to China Eastern Airlines for a Next-Generation

Boeing 737-800. Delta Air Lines actually launched the CFM56 engine into commercial service in 1982 and currently has more than 400 CFM56-powered aircraft in service or on order. China Eastern Airlines became a customer in 1994 and, today, is the largest CFM customer in China, operating more than 800 CFM56 engines.

Modernised TACMS in flight test



Lockheed Martin's first modernised Tactical Missile System (TACMS) missile completed a flight test at White Sands Missile Range, New Mexico. The missile was launched from a High Mobility Artillery Rocket System (HIMARS) launcher at a target area more than 130 kilometers away, precisely hitting the target with a proximity sensor-enabled detonation. "All test objectives were achieved". As part of the US Army's TACMS Service Life Extension Programme inventory refurbishment effort, the modernised missile includes updated guidance electronics, and added capability to defeat area targets without leaving behind unexploded ordnance. The missile was produced at the Lockheed Martin Precision Fires Production Centre of Excellence in Camden, Arkansas.

Saab's new helmet mounted display system

Saab has received an order from the Swedish Defence Material Administration (FMV) for an advanced helmet mounted display (HMD) system, the *Targo* to be used by pilots flying the

Swedish Air Force's Gripen E fighter aircraft. Deliveries will take place between 2022 and 2026. The *Targo* system will be manufactured and supplied by the Brazilian company AEL Sistemas (AEL), and has also been ordered by Brazil for the Brazilian Air Force Gripen fighters.



MBDA Deutschland tests new laser effector

MBDA Deutschland has conducted tests of a new high-energy laser effector at a military training facility on Germany's North Sea coast, marking the next step in the progression from technology to product. In this series of trials, the system was tested under real environmental conditions for the first time. The primary



purpose of this series of trials was to test the beam guidance and tracking system, with a simulated engagement of airborne targets. In this exercise, the targets were preset, scanned with the laser target illuminator, and an aim point was held on the target for an extended period. The quadcopter, serving as the airborne target, performed a variety of often highly dynamic manoeuvres at a variety of ranges.

MBDA's Sea Ceptor for UK's Royal Navy

MBDA has been awarded a *Demonstration and Manufacture* contract by the UK Ministry of Defence for the Sea Ceptor air defence system for the Royal Navy's new class of frigate, the Type 26 (T26) Global Combat Ship (GCS). This advanced missile



Safran contracts for Sigma 30

Safran Electronics & Defence will supply several dozen Sigma 30 systems for mobile counter-battery radars deployed by “an unidentified armed force”. The Sigma 30 navigation and pointing system addresses the diverse requirements of artillery units, especially in terms of accuracy and speed. Integrated in mobile radar systems, Sigma 30 helps determine the precise location of enemy batteries, as soon as it detects any firing. Designed to optimise the operational deployment of artillery units and their intelligence systems, Sigma 30 gives combat platforms an autonomous engagement capability, even when there are no GPS signals.

Sigma 30 has also largely proven its ability to resist the harsh environments typical of military environments. Forces in the field favor this system because of its ability to be integrated in latest-generation digital networks for artillery units.

Rafael's Trophy systems for Israeli defence forces

Israeli Ministry of Defence have placed orders for “hundreds of additional Trophy active protection systems (APS),” manufactured by Rafael. The systems are for equipping new Merkava 4 tank and Namer APCs, providing significant additional



protection for every tank and APC. In recent months, the Tank Management Programme at the Ministry of Defence, together with the IDF (Israeli Defence Force) Ground Forces, conducted a series of successful tests on the Namer.

Saab contracted for RBS 70 NG

Saab has signed a contract on delivery of the new RBS 70NG VSHORAD (very short range air defence system), which involves

system will provide the principal air defence against advanced airborne threats including sea-skimming anti-ship missiles, fast jets, helicopters, and UAVs.

Rockwell Collins selected by US Army



Rockwell Collins has been selected by the United States Army to conduct collaborative studies on advanced system designs and integration processes for the Architecture Implementation Process Demonstration (AIPD). As a part of the Joint Multirole (JMR) Mission Systems Architecture Demonstration (MSAD) Science and Technology (S&T) effort, this AIPD is informing standards, processes, tools and architectures for the Future Vertical Lift (FVL) family of systems. Under the agreement, Rockwell Collins will assist the US Army in investigating advanced open-system architecture technologies and architectural centric model-based engineering capabilities necessary to achieve cost-effective system design and certification for future mission equipment packages (MEPs).



supply and long-term maintenance and support of the RBS 70NG, the latest version of this advanced Air Defence Missile System. Deliveries will take place between 2018 and 2020, followed by long-term maintenance and support of the systems. The core of RBS 70 NG is the new generation sight module with integrated high-resolution thermal imager that allows for an all-target capability both day and night.

Saab and Embraer inaugurate Gripen D&D Network

Saab and Embraer Defense & Security have inaugurated on 22 November 2016 the Gripen Design and Development Network (GDDN) in Gavião Peixoto, in the state of São Paulo. The GDDN will be the hub for the Gripen NG technology development in Brazil

for Saab and Embraer together with the Brazilian partner industries and institutions, AEL Sistemas, Atech, Akaer and the Brazilian Air Force, through its research department DCTA.

Airbus A350-1000 in maiden flight



The first A350-1000 has made its maiden flight at Blagnac in Toulouse and this is Airbus' largest and most powerful twin-engined airliner equipped with specially developed Rolls-Royce Trent XWB-97 turbofans. Benefitting from the experience of the original A350-900 test campaign (accomplished in 2014), the A350-1000's development programme will be shorter – under one year for the three aircraft. The overall campaign will culminate in the type's certification followed by its entry into airline service scheduled for the second half of 2017.



Cautious Commitments

Russia's MC-21 airliner

The combined output of Airbus A320 and Boeing 737 narrowbody airliners is presently around eighty aircraft its month and is projected to rise to 120 by 2020. With a planned *annual* output of 70 aircraft, the Irkut MC-21 is unable to pose an existential threat to the existing duopoly and so realistically, UAC can only hope for a small share in the global market for new narrow body jets, which Boeing estimates at 26,730 units in 2015-2034.

In today's market, demand far exceeds supply. The European manufacturer sold 1,253 A320s in 2013, 1,321 in 2014 and 966 in 2015, while deliveries in those years numbered 493, 490 and 491 respectively. As of January 2016, the backlog was 5,535 aircraft, 401 airliners more than the backlog a year earlier. This backlog is so massive that it ensures Airbus ten years of production at today's rates. But orders continue to come and the European manufacturer does not expect to be able to match its manufacturing capacity against the new order intake earlier than 2020. Boeing delivered 495 Boeing 737s in 2015 and has a broadly similar situation.

Thus, would any airline wanting a brand new narrowbody airliner be content to wait for ten years? Surely some would prefer to have their aircraft earlier. This gives an opportunity to new entrants such as the Bombardier CSeries, AVIC C919 and the Irkut MC-21. They can, and indeed hope to, claim a portion of the huge market, measured in the hundreds of billions of dollars, and so justify the investments into R&D and production.



Russian Prime Minister Dmitry Medvedev speaking at the MC-21 rollout ceremony on 8 June 2016



The second MC-21 airframe under production

Airline customers

Four Russian airlines – Aeroflot, NordWind, IrAero and Red Wings – have contracted for the MC-21. Two of them hold direct purchase agreements with the manufacturer. In 2010, NordWind Airlines signed for three firm and two options. Three years later, IrAero ordered ten aircraft.

Aeroflot hopes to benefit from the MC-21's performance which reportedly "surpasses" that of the Boeing 737-800 and Airbus A320/A321, already in the fleet of the Russian flag carrier. That is why the airline agreed to lease these aircraft from Rostec-controlled lessor Aviation Capital Service (ACS), which awarded Irkut a 50-aircraft firm order with 35 options in 2011.

Other lessors that have signed for the MC-21 are Ilyushin Finance Company (IFC) with 22 firm and 28 options (signed in 2010), VEB-Leasing with sixty (2011 and 2013) and Sberbank Leasing with 20 (2013). These and other contracts gave the manufacturer a base to claim a backlog of 175 firm orders and commitments.

Red Wings CEO Eugeny Klyucharev is "pleased with the Tupolev airliners the airline flies inside the country and into popular tourist destinations abroad. The Tu-204 has proved effective on our route network, demonstrating best performance on services lasting two-three hours." He stated "We are considering taking more such aircraft on operating lease terms and,

later, the more advanced MC-21." In 2013, Red Wings and IFC signed an agreement for ten MC-21-300s.

As IFC CEO Alexander Roubtsov says, "In my view, the MC-21 represents the best offering in the global market for narrow body jetliners when it comes to quality-price ratio. Compared to other types available today, it is eight to ten tonnes lighter. Consequently, it burns less fuel. Besides, the MC-21 comes with an all-composite wing of high aspect ratio. Such a wing generates less drag, which further improves the airplane's fuel performance. The next advantage is the passenger cabin, which is ten to twenty centimetres wider than the competition. This ensures higher passenger comfort and shorter turnaround times at airports."

On 8 June 2016, IFC signed a Letter of Intent with Azerbaijan Airlines (AZAL), whose CEO Jahangir Askerov says that the LoI calls for ten aircraft to be acquired through to 2028. "By March next year we shall sign a memorandum of understanding. That document shall determine exact number of aircraft, their exact delivery dates and prices, depending on interior options and a few other details." Askerov added that AZAL's decisions would be dependent on the MC-21 making its first flight by that time. "Before proceeding further, we want to see the aircraft in the air and understand if it flies well," he explained.

Roubtsov added: "We are in agreement with AZAL to proceed with MoU and

then the firm contract shortly after the first prototype takes to the air. I expect this to happen in December 2016 or January 2017." Irkut president Oleg Demchenko in turn promised to put the MC-21 into service "in the first quarter of the next year at the latest."

Even though AZAL has signed only a letter of intent, it is nonetheless an important event for the MC-21 sales campaign, which previously saw only one deal with a non-Russian airline. In November 2015 Cairo Aviation agreed to take ten MC-21-300s. These shall first supplement and later replace Rolls-Royce RB211-powered Tupolev Tu-204-120 narrowbodies that the Egyptian carrier has been using since the turn of the century. The Cairo Aviation order was the only one for the MC-21 in the 2014-2015 timeframe.

A number of airlines have expressed interest in the MC-21, but remain cautious when it comes to commitments. Most say they will make decisions after the advertised performance is demonstrated in flight tests. Should the MC-21 prove technically superior to competitive aircraft, it can expect many sales in the domestic market and in countries traditionally oriented toward Russian equipment. "Russian lessors Sberbank, VEB-Leasing, AviaCapital Service and Ilyushin Finance Company are ready to place their aircraft with Asian airline customers on finance or operating lease terms."

*Text and photos:
Vladimir 'Vovick' Karnozov*

New Mounts for the Russian Knights



A New Diamond

In mid-October 2016, the Russian Aerospace Force's (RASf) premier aerobatic display team, the *Russian Knights*, acquired their first batch of four "super-maneuvrable" Su-30SM fighters from Irkut Corporation.

Select Russian pilots flew the four fighters out from Irkutsk Aviation Plant, which is an

Irkut subsidiary. The welcome ceremony for the new Russian Knights aircraft was held at the Kubinka air base, where the team is based. The pilots and aircraft were received by Colonel-General Viktor Bondarev, Chief of the Russian Air Force, Irkut President Oleg Demchenko, and Oleg Pankov, the Su-30SM's Chief Designer.

The Russian Knights' new Su-30SMs are painted in the team's traditional design, incorporating the three colours of the Russian national flag on the fuselage, with the RASf service flag on the tail.

Taking delivery of four new aircraft, the assigned pilots have begun training on the 'rhomb' (diamond) formation, with first



Su-30SM is landing



Colonel-General Viktor Bondarev greeted at Kubinka

displays on the Su-30SMs expected to start once the team achieves the necessary level of flying together with the new fighters.

One new regiment a year

In March 2012, the Russian MoD and Irkut Corporation signed their first contract for supply of Su-30SM multirole fighters for the Russian Air Force. The contract was followed by several more, including one in December 2012 (for 30 Su-30SMs) and April 2016 (for 28 Su-30SMs), as well as one contract for supply of 28 fighters to the Russian Navy's air arm. These fighters are now operational with the RASF and the Russian Navy; Irkut has delivered around 60 Su-30SMs to the RASF and nine fighters to the Navy.

The export potential of the Su-30SM is considered "very strong." Since 2015, it has already found an export customer in Kazakhstan, a Russian ally in the Collective Security Treaty Organisation (ODKB Treaty). At international air shows the aircraft is being promoted as the Su-30SME, an export variant of the base Su-30SM. Irkut officials feel it has good chances to repeat the success of the Su-30MKI, the progenitor of the Su-30 family of fighters from Irkutsk.

Su-30SM has already built an enviable track record in operational service. As stated during the welcome ceremony at Kubinka by Colonel-General Bondarev, "Today you've got state-of-the-art fighters of 4++ generation, which confirmed their characteristics in combat units while performing combat missions in Syria — both in the air and on the ground. We will continue with acquisitions of this fighter

every year, up to one regiment per year, or 20-24 of these fighters annually."

By the end of 2016 Irkut will deliver the second batch of four Su-30SM fighters to the Russian Knights.

A gift for the Silver Jubilee

Pilots of the Russian Knights aerobatic team made their first flights on Su-30SM in 2013, and were most impressed by the fighter's unique manoeuvring characteristics during aerobatics. The RASF commanding staff then decided to grant the pilots new aircraft, and in 2014 the RASF Chief announced plans to re-equip the Russian Knights team with Su-30SMs. Shortly after that, the pilots started their theoretical training, assisted extensively by Irkut specialists.

As Oleg Demchenko, President of Irkut Corporation, stated, "The RASF commanding staff's decision to re-equip their aerobatic team with Su-30SMs is in fact a great honour and a big challenge for us."

Colonel Andrey Alekseev, lead pilot of the Russian Knights outlined "The Su-30SM is much easier to control. It is equipped with state-of-the-art systems that make piloting very comfortable."

The Su-30SM is "far better than the legacy Su-27," with a new navigation system, which enables long-range flights without a navigating aircraft. An increase in on-board fuel load and in-flight refueling capability enables virtually unlimited flight range, constrained only by a pilot's physical abilities.

Finally, as stated by AN Tupolev, the legendary Russian aviation designer: "Only beautiful aircraft fly well!" In this context, the Su-30SM is considered one of the most beautiful fighters extant, and plays a significant role in its selection to perform aerobatics in front of thousands of spectators at air shows.

Re-equipment of the leading Russian aerobatic team with these new fighters demonstrates that both the RASF and Russian aviation industries have successfully overcome difficult periods. "Russian Knights, equipped with new fighters, will inspire aviation fans worldwide with the beauty of the art of flight, and keep the prestige of Russian aviation abroad high."

Courtesy: Irkut Corporation



The Russian Knights aerobatic team with their new mounts

Atlas 2016



Tiger Diplomacy

Just one week after the NATO Tiger Meet at Zaragoza airbase had concluded, another exercise kicked off in Spain. On 30 May 2016, four Moroccan Air Force F-5 Tiger II's from the Escadre de Chasse (Fighter Wing) from Meknes-Bassatine and three Spanish Air Force F-5M Freedom Fighters from Talavera la Real deployed to Mátacán air base to take part in the biennial 'Atlas' Exercise.

Over thirty years of history

Exercise Atlas was developed between the *Ejército del Aire Español* (Spanish Air Force) and the *Alkawat al Malakiya al Jawiyya* (FRA, Royal Moroccan Air Force) following an agreement between the two countries in Rabat more than thirty years ago. *Atlas* started off in 1984 as an annual exercise without any aircraft deployment. The participating jets would take off from their home soil, perform mock combat and at the end of the day all aircraft would land at a single airbase for debriefing. Since 2000, shrinking defence budgets forced *Atlas* to become a biennial exercise with both countries taking turns to play host. For both countries, it is one of the longest standing bilateral exercises with another country.



A pair of CASA C.101 Aviojets take off for an Atlas 2016 mission

Planning of Atlas 2016

The planning of *Atlas 2016* started with the Initial Planning Conference (IPC) when officers of the *Mando Aéreo de Combate* (MACOM) or Air Combat Command visited Rabat during the second week of November 2015. Colonel Ivorra, Exercise Director (DIREX), explained how an exercise like this is planned “During the IPC in November the guidelines for the exercise are drawn and form the basis for the MPC (held

commenced with locally-based Casa C.101 Aviojets of *Grupo de Escuelas de Matacán* (GRUEMA) and three detached Spanish F-5Ms of Ala 23 out of Talavera,” stated Lt Col Moya, commander of the GRUEMA. “The first aerial battles were flown the next day with 1v1 or 2v2 missions executed by all participants. Then was the big day when a small COMAO (Combined Air Operations) was flown, with external participation. Friday was the last day of the

Defending the bridge !

The big COMAO consisted of four Spanish C.101 Aviojets, two Spanish F-5Ms and four Moroccan F-5s against two EF-18+ Hornets of Ala 12 out of Torrejon air base near Madrid. Lt Col Moya elaborated on what the mission was like: “We scheduled the flight in D-125, which is a training area Southwest of Toledo. The two Spanish EF-18Ms out of Torrejon had to defend an important landmark, in this case a bridge



A Spanish Air Force SF-5B(M) from Ala 23

at Meknes air base, Morocco in February) and the Final Planning Conference (FPC) which was held in Madrid during April. During the MPC other issues including media relations during the exercise are discussed and IPC matters like the number and type of aircraft involved in the exercise are confirmed as well as goals set for both countries. At the FPC we discuss everything concerning the exercise, including all side affairs.”

The exercise started on 30 May with the arrival of four Moroccan F-5s and their C-130 Hercules support aircraft at Matacán air base, after a one-hour flight from Meknes. The C-130 continued to Torrejon air base in order to bring a small group of staff officers to MACON headquarters in Madrid from where an exercise command post was set up for the exercise along with their Spanish counterparts. “The exercise began when mixed familiarisation flights

exercise. In the morning a final mission was flown and around midday the C-130 arrived to pick up personnel and equipment after which the Moroccan detachment departed for Morocco.

in that area. First we sent in the C.101s to attack the EF-18s. The Moroccan F-5s followed shortly after, two in the sweeper role to attack the bridge, while the other two performed Suppression of Enemy Air



A Moroccan Air Force pilot in the cockpit of his Tiger II



A Moroccan F-5 takes to the air for an Atlas 2016 mission



Moroccan F-5 trailing brake parachute during landing

Defences (SEAD) in order to eliminate any ground based air defence. The two Spanish F-5s flew as escorts for the Moroccan F-5s in case anything would come after them.”

Needless to add, the mission was won by the combined Moroccan-Spanish force! Although the EF-18s were outnumbered, this did not mean that they did not have a chance at all, as explained by Major Vazques, an instructor pilot with Ala 23 and detachment commander for the Spanish F-5Ms: “The Spanish Hornets were two

against ten but still could have made a difference. With their weapons arsenal and much better radar they could have gotten the upper hand at some point. But that was not the objective in this exercise with the Moroccans. It was all about executing a mission with all its aspects together and we succeeded in that.”

More diplomacy than tactics

Whatever the tactical value of a 10 on 2 training mission might be, it is the relationship between the two neighbouring countries and their military forces that really counts. “Exercises like these are less about tactics and more about diplomacy,” emphasised Lt Col Moya. Given the long history of *Atlas*, one can only conclude that this primary goal is being reached during every edition.

Text and photos: Remco Stalenhoef

Ukrainian Exercises



'Sea Breeze and South Wind 2016'

In July and August 2016, two military exercises, *Sea Breeze* and *South Wind* were simultaneously held in Ukraine. Both are annual exercises, the former involving the Air Force and Navy, and the latter the Air Force and Army.

The 15th edition of *Sea Breeze* was held in the area of Odessa and Mykolaiv and the north-western part of the Black Sea. The United States of America and Ukraine co-hosted the air, land and maritime exercise, "designed to improve maritime safety, security and stability in the Black Sea." The main theme of this year's edition was conducting a multinational operation on security in a crisis region. Realistic training was carried out on air defence, anti-submarine warfare, damage control, search and rescue, and landing operations with air support. Some 4,000 troops from 16 countries participated.

The Air Division of the Ukrainian Navy had to relocate to Mykolaiv-Kulbakino after their base in Crimea was taken over by Russia. Now they share aprons and runways with the Air Force, the prime operator of this airbase. Fortunately, all aircraft and



Ukrainian An-30 staying low after take-off

helicopters were able to make the move, and after an initially difficult adjustment period, the Navy's Air Division is up and running again.

The Beriev Be-12 flying boats were waiting for new tyres and could not participate in this edition of *Sea Breeze*, but all locally-based Antonovs (including a venerable An-2) and multiple helicopters did. Their main task was SAR, for which

helicopters also operated from frigates. Ships from NATO's Standing Maritime Group 2 joined the second part of *Sea Breeze*, while Ukrainian frigate *Hetman Sahaidachny* hosted a Kamov Ka-27 helicopter for the duration of the exercise. Apart from SAR, transport of marines and special forces was carried out, along with anti-submarine training. For this last task, Mil Mi-14s flew daily from Mykolaiv. Colonel Igor Bedzai,

A Mi-24 takes off to relocate to a forward operating base



Shipboard helicopters such as this Ka-27 were active participants in the exercise



public after the outbreak of hostilities in the eastern part of Ukraine. Both aircraft, which are appropriately named 'Phoenix' and 'Lucky Man,' and sport modern 'digital' camouflage, flew daily missions during the exercises. This was done not only from Boryspil, but also from forward operating bases where they were deployed for a few days at a time.

Alongside *Sea Breeze*, a command and staff exercise, *South Wind*, was conducted throughout the territory of Ukraine. Its main goal was improving the activities of military control bodies and the interaction between operational and tactical groups during strategic actions. Included were live firing, airborne troop operations, joint long-distance air transport, air



One of the Mi-14 helicopters shows its dipping sonar, used to detect and track submarines

commander of the flying division, was "very satisfied" with the performance of his aircraft and helicopter crews. He is also looking forward to receiving new Mi-8MSB-V helicopters and An-148 cargo aircraft in the near future, which will improve Ukrainian naval aviation capabilities.

The 15th Transport Aviation brigade, based at Kiev-Boryspil, was heavily involved in both exercises. The unit's commander, Lt Col Alexander Gogol, gave details on the transportation of soldiers, paratroopers and cargo all over the country, as they have been doing on anti-terrorist missions since 2014. One of their An-30 aircraft was lost in action recently, but two An-26 cargo aircraft have been added to the fleet. Overhaul for these two aircraft, which had been in open storage for a decade, was funded by donations from the

defence, and others. All three flying regiments of the Ukrainian Army participated with Mi-8 and Mi-24 helicopters, operating from Kherson-Chornobaikva air base as well as multiple forward bases. The helicopters bore white stripes on their tailbooms, much like the invasion markings applied by allied forces for D-day in WWII, to distinguish them from their Russian counterparts while operating in the eastern part of the country.

***Text and photos:
Patrick Dirksen & Frank Mink***



An-26 in 'digital camouflage' and fitted with bomb racks along the fuselage

Romanian Naval Aviation



Return of the Black Sea Knights

Romania's Navy (*Fortele Navale Române*, FNR) is quite small compared to other naval forces in the Black Sea region, and within NATO. Although the FNR operates a number of frigates, corvettes and minesweepers, the naval aviation component is limited to just three locally-built IAR.330 Puma helicopters serving in a variety of roles.

The history of Romanian Naval Aviation dates back to June 1920. By the end of WW II, twenty-four Heinkel He-114s were in service. These seaplanes were withdrawn from service over the years with no replacement, and Naval Aviation operations were finally disbanded in May 1960, when the last eight He-114s were scrapped. Naval aviation was revitalised in the 21st century with the introduction of new naval rotorcraft, and modern-day Romanian Naval Aviation celebrated its tenth anniversary in 2017.

The Black Sea Knights

The 'Black Sea Knights' helicopter squadron is housed at Tuzla Airport, southwest of Constanta, and operates all three FNR

IAR.330 'Puma Naval' helicopters. In the late 1980s, when the first *Tetal II*-class frigate and destroyer *Mărășești* entered service with the FNR, a number of IAR.316B Alouette helicopters from the Air Force (*Fortele Armeei Române*, FAR) inventory were outfitted with flotation gear and a winch on the port side, as well as foldable main rotor blades. While the *Tetal II* ships are capable of handling one IAR.316B while *Mărășești* has a deck and hangar capable of accommodating two of them.

With disbandment of the 59th Helicopter Group from Tuzla in 2001 and the retirement of most IAR.316s, the Romanian Navy found itself with no helicopter support from the FAR. The few operational IAR.330s from the disbanded squadron at Tuzla transferred to the 863rd Helicopter Squadron at Mihail Kogălniceanu.

"With the acquisition of two Type 22 frigates; F-221 *Regele Ferdinand* (ex HMS *Coventry*) and F-222 *Regina Maria* (ex HMS *London*) in 2004 it became clear there was a need for a dedicated naval helicopter force and procedures had to be adopted,

resulting in a steep learning curve for our crews. Without helicopters we are not able to perform all our tasks," stated Captain Ioan of the Romanian Navy. "They are a vital part in our ASW/ASuW tasks."

"In March 2016 a modernisation programme has been started to upgrade the Type 22 frigates to be able to carry out ASW and ASuW missions and to improve the command and control systems on board. The upgrade will have a timespan of three years planned to be finalised in 2019," revealed Captain Ioan.

A request for three new helicopters was issued, and Elbit Systems and IAR Brasov were contracted in July 2005 to provide these, in cooperation with FHL Claverham, Aerazur, Rockwell Collins, Breeze Eastern and Rafael. The first IAR.330 Puma Naval (#140) made its first flight at Ghimbav, Brasov on 30 January 2007. The IAR.330 Puma Naval underwent testing from February until June 2007, including sea trials and ship compatibility tests.

The main modifications to the Puma Naval compared to the standard IAR.330L variant are: cockpit layout, Rafael Toplite

electro-optical sensor in the nose, laser- and radar-warning receivers, blade antennas under the tail boom and on top of the fuselage, and countermeasure dispensers under the main gear. These modifications were also implemented in the IAR.330 SOCAT fleet of the Romanian Air Force (FAR). For naval operations a number of changes were made to the basic IAR.330L airframe, including foldable main rotor blades, inflatable flotation gear, a door-mounted winch on the starboard side, anti-crash seats, harpoon for deck landing in rough weather conditions, crash position indicator on the port side of the tail boom, two searchlights under the fuselage and a bubble-type observation window on the sliding doors. “We basically added what devices we require for naval operations to the standard IAR.330L airframe,” stated Commander Marius Mitric, the unit CO.

In December 2005, ten naval officers were selected for initial flight training at the Air Force Academy at Boboc on the IAR.316B helicopter type, qualifying as Navy pilots in July 2006 after completing a 100-hour training syllabus. “Initially, the trainers at Boboc were a bit hesitant to train naval



Romanian Special Forces on exercise with a Puma Naval

aviators with no prior experience, but luckily this changed as we showed our capabilities and managed successfully with the fast pace of training,” stated a Romanian naval aviator.

“The new naval aviators continued with an accelerated training on the IAR.330 SOCAT at Bucharest-Otopeni airport for an additional 75 hours, focusing

on day operations, basic manoeuvring and emergency procedures,” explained Commander Ciobotaru, one of the current naval pilots. Simultaneously with pilot training, eighteen ground crew technicians were trained at Boboc Air Force Academy. Two of the eight pilots were also trained as instructors on the Naval IAR.330.



IAR.330 operating from a warship at sea



A Puma Naval flying low over water, ready to deploy divers

On 13 July 2007 the 'Black Sea Knights' squadron was formally re-established after forty-seven years of "absence" with the introduction into service of the first IAR.330 Puma Naval (#140), assigned to the frigate *Regele Ferdinand*. By the end of 2007, the small cadre of eight Naval Aviation pilots had logged a total of 25 flight hours each. The second IAR.330 Puma Naval (#141) was delivered in January 2008, with the third and final helicopter following the next year. After delivery of the third IAR.330 Puma Naval (#142) the squadron relocated to Tuzla at the end of 2009.

"Initial tasks were mainly day operations to get to learn how to operate the Puma Naval and get used to seaborne operations," said Lt Cdr Bogdan Curca. "In the next phase we started to train and explore the capabilities of the tactical consoles on board, and lastly, in the 2009-2010 period night operations were the focus of the training syllabus, to be able to operate 24/7 when required." However, not all pilots of the Black Sea Knights are presently qualified for night operations. To support the future expansion of roles and sustain the Black Sea Knights, a new group of young pilots is planned to be trained at Boboc training school in the near future.

To enhance the IAR.330's ASW capabilities, IAR Brasov awarded a contract in June 2013 to Thales to develop and deliver TMS 2000 sonobuoy processors. The sonobuoys send acoustic data to the processor through a VHF link, and the data is processed on board the aircraft in real-

time. The TMS 2000 provides capabilities for detection, tracking, localisation and classification of surface and subsurface targets in all environments by processing active and/or passive acoustic data gathered from sonobuoys, and provides mono and multi-static processing modes for all active sonobuoys.

"As we did not have any relevant experience anymore in naval operations we had to start building our expertise again. In a way we are a 'self-learning' squadron," said Lt Cdr Bogdan Curca, a naval aviator. "To build up our expertise in Anti-Submarine Warfare (ASW) operations, we have been working closely together with ASW operators on our frigates since 2014. After extensive training we gained operational ASW capabilities in 2015. Currently we are conducting real life exercises with Turkish Navy submarines in order to test our procedures deploying the new TMS 2000 system with the support of technicians from Thales."

The last stage of the modernisation was finalised by late 2015, and fitted the helicopters with torpedo launchers, extending their ASW utility. "We have not selected and procured the actual torpedoes yet, but the Puma Naval is able to carry various torpedoes. We just select what equipment we want to have and put it on the helicopter. That is our way of working and thinking," clarified Commander Mitric. A final decision on the torpedo will be made before the end of 2016, with the BAE Systems Stingray seen as the most likely candidate.

Operations with the Black Sea Knights

At the time of the Authors' visit, the Black Sea Knights were conducting exercises with the US Navy *Arleigh Burke*-class destroyer USS *Porter*, to gain experience and understand procedures for operating in a multi-national environment. This included deck landings of an IAR.330 on board USS *Porter*. Till date the FNR have been involved in *Operation Unified Protector* (2011) and *Operation Atalanta* (2012) as part of European Union Naval Force (EU NAVFOR). The latter deployment included an IAR.330, 4 pilots and 12 technicians/engineers. "Before we deployed we had a Maritime Interdiction training to prepare ourselves for the anti-piracy mission," said Commander Ciobotaru. "We mainly conducted ISR missions off the Somali coast, working with multi-national MPAs with usage of digital cameras. On average two missions were flown each day during the three-month deployment."

Operations with the Puma typically involve a pilot, copilot and a mechanic, who also operates the winch during SAR missions. "For ASuW missions two operators are added to the crew who are responsible for operating the sonobuoys and Link 11, which is used to exchange large amounts of data between the helicopter and the ASuW operators on board our frigates. The tactical consoles can be added rapidly and deliver a valuable Recognised Maritime Picture (RMP) to our fleet," explains Commander Mitric.

To further sustain the future of Romanian Naval Aviation there are plans to acquire a fourth IAR.330 Puma Naval specifically to support the *Batalionul 307 Infanterie Marina* (307th Marine Infantry Battalion), an elite unit of the Romanian Marines. The Marines are trained in a similar fashion as the US Army Special Forces ('Green Berets'), and are primarily used for on/off-shore and beachhead establishing missions, as well as fighting in river delta regions such as the Danube Delta. Less known is the cooperation with the Naval Special Operations Group, which also saw action during *Operation Atalanta*.

Text and photos: Carlo Kuit & Paul Kievit/ Bronco Aviation

Major General Rajendra Prakash recollects those



Troops of 4 Kumaon on arrival at Srinagar Airport, November 1947, being bussed in civilian transport to the 'front'

Badgam, the Kashmir Valley,

In October 1947, when the raiders from Pakistan invaded Kashmir, my parents, two younger brothers and I lived in Badgam, a small village south-west of Srinagar fairly close to the only airfield in the Kashmir Valley. My father Sardar Om Prakash was the officer in-charge of what is now Badgam district. We lived in a solitary cottage, poised on the very edge of *Karewa*, a vast upraised geological formation, typical of the Valley, stretching away towards Gulmarg-Baramulla in the north-east. My father's office and the Government treasury

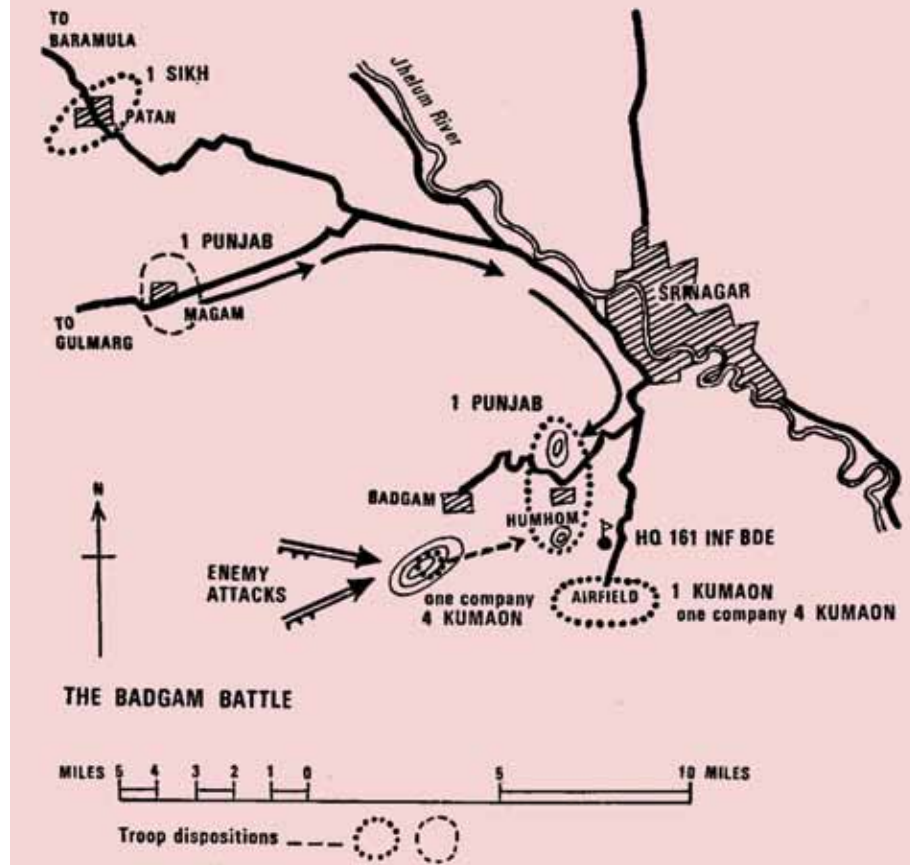
were housed in a 'U' shaped building, on the lower ground in vicinity, while the small village of Badgam lay a few hundred yards further down.

I used to cycle down to Sri Amar Singh Degree College on outskirts of Srinagar, where I had obtained a provisional pass because examination results for my FSc (Intermediate) examination could not be declared by Punjab University, owing to the disruption caused by partition of the country on 15 August 1947. (Subsequently I was awarded a FSc diploma in 1948,

having rendered three months 'service' in a refugee camp in Pathankot, as per then prevailing rules).

It was on 25 or 26 October, while returning from my college, that I saw a couple of tall hefty men in *salwars* lurking in a village half-way to Badgam. These men did not look like Kashmiris and on getting home, mentioned this to my father. We were still blissfully unaware of what was happening in Kashmir, except for rumours since there was no TV or other information means those days. Even to listen to All India

fateful days in



26 October, we saw a wide circle of fires blazing on the *Karewa* towards Tangmarg-Baramulla : these were learnt to be the Sikh villages attacked and being burnt by the tribal invaders.

Around midnight the next day, we were woken up by a mounted cavalry patrol of J&K Bodyguards, who were out on reconnaissance, but they were as much

in dark as we were on what was happening. Unaware of the situation in the larger context, we blissfully carried on, hoping for the best, although very apprehensive. All this while, the Pakistani-led tribal Lashkars were making their way from Uri-Baramulla towards Srinagar, and then to Badgam.

Next night (28/29 October) some rifle shots were fired at our cottage, hitting

October 1947

Radio one needed bulky and expensive wet or dry batteries to run the radio, while newspapers (*Tribune* and *Civil & Military Gazette* in English and *Milap* and *Pratap* in Urdu) had to come all the way from Lahore, which was now in Pakistan.

However, there was a general sense of unease, heightened by rumours on this invasion by tribals from the north west who had massacred Hindus and Sikhs in Muzaffrabad and our home-town of Mirpur, though nothing specific was known at that time. On the night of





Douglas DC-3 of Indian National Airways at Willingdon Airport, New Delhi

the corrugated tin roof and making a lot of noise. We also saw some Sikh villagers passing through our vicinity, during the night. My father then decided that under the circumstances, my mother and us siblings (17, 11 and 3 years old) should leave Badgam and get to Srinagar airfield, where Indian troops were rumoured to have landed on 27 October.

At dawn, when my father asked for our *Peshawari tonga* to be made ready, the horse was found to be missing from the stables. My father with his loyal *Jamedar Chaprassi* then raged around the village and eventually found our horse hidden away in a dilapidated hut at the outskirts. Having then hitched the horse to the *tonga*, our family

made off for the airfield, only carrying some essentials.

We reached Srinagar airfield in the early morning, passing Bakshi Ghulam Mohammad (later Chief Minister, but then a vigorous National Conference leader) *en route*, where he seemed to be energetically trying to restore some order amongst the milling and panicky crowds. My father exchanged courtesies with Bakshi Sahib and we drove on to the airfield (just a few ramshackle sheds, then), where there were about four or five DC-3 Dakotas on the ground, with some taking off and landing. There were soldiers with maroon berets and green turbans (possibly from 4 Kumaon and 1 Sikh) but mostly distressed looking

civilians, mostly women and children milling around.

An Army Major was herding civilians into the Dakotas and as my mother and young siblings were put on a Dakota, asked me why I was not staying back to fight the invaders. I told him that I had to escort my family to India while my father was staying on. My mother and two brothers soon flew off in the Dakota (Dalmia Jain Airways, I remember) and later landed at Ambala. Soon, I was put into another Dakota (my first air experience) and after some hours, landed at Safdarjung airfield in New Delhi, but not knowing what to do next. Fortunately, after an anxious wait, my mother and two brothers were flown-in from Ambala and our family was re-united.

This was on 28 October 1947. We soon managed to locate an uncle in nearby Lodi Colony, moved there but later went to live with relatives in Lucknow and finally to Gurdaspur with my maternal grand-parents. I joined the Army in 1948, after the 6th post-War Regular IMA Course in 1949, was commissioned into the Regiment of Artillery, raising 220 Medium Regiment, became Senior Instructor (Army) at the Defence Services Staff College, Wellington and finally was GOC of an Infantry Division. My younger brothers also joined the armed forces, the elder being Brigadier Brijendra Prakash with the Signals and Intelligence Corps while the youngest distinguished himself as a Naval aviator and eventually became Chief of the Naval Staff: Admiral Arun Prakash.

I remain mystified as to why the tribal *Lashkars* had waited till 3 November to reach Badgam, when they could easily have taken over Srinagar airfield a week earlier before first troops of the Indian Army were flown in. Possibly, the attractions of Baramulla (including St Joseph's, my old college, and the poor nuns there) were bigger!

Meanwhile, after we had been flown off to safety, my father went back from the airfield to Badgam and resumed his duties, though the administration was in complete disarray. On 3 November, a fighting patrol of 4 Kumaon, whose company commander was Major Som Nath Sharma met my father in his office. Very soon, disturbance and firing was heard and Major Sharma immediately rejoined his company and fought what became known as the fateful Battle of Badgam.



Indian troops in combing operations in the Kashmir Valley



Tribals from the North Western Frontier being mustered for the invasion of Kashmir

The gallant Major and his Kumaonis held-up 700 tribal marauders, who intended to capture the airfield, the only access for Indian forces into Kashmir then, and thereby secure the Valley for Pakistan. In the ensuing battle, 4 Kumaon killed over 200 attackers but Major Sharma himself was killed in action. He was later posthumously awarded India's first Param Vir Chakra for his gallantry.

After watching the battle from his office, my father collected contents of the Government Treasury and along with his faithful *chaprassi* (the village had been deserted by then) made his way to Srinagar, cross-country over marshes en route, with great difficulty, for depositing the contents of Badgam Treasury in Srinagar's Head Treasury.

In subsequent years, my father served as the Deputy Commissioner of Ladakh when the first encounter with the Chinese took place at Kongka-La on 20 October 1959, resulting in capture of Deputy Commandant Karam Singh and his CRPF patrol. My father finally retired as Principal of J&K Revenue Training School in 1961 and passed away in 1978. A deep personal regret remains that while in the Army from 1949 to 1983, I never found the time to be with my father and amongst other things, record in detail his 'live' recollections of the Battle of Badgam.

The Tin Trunk

An interesting footnote : there was a tin trunk left behind by a family-friend from Gurdaspur, Major Syed Irshad Ahmed, a paratrooper from 3 Para (Rajput), who had served with his battalion in Egypt, Palestine and Italy in World War II. Our friend was spending his holidays with us in Kashmir, when he was recalled from leave on 15 August 1947 but left his luggage behind in a hurry, to be picked-up later.

In the event, Major Ahmed opted for the Pakistan Army and his 'left behind' luggage traveled to Badgam, on my father's transfer there. After the tribal invaders

had been cleared from Badgam, my father returned to his duties there and found that our cottage had been burnt down by the tribals and all our belongings and household effects were looted or destroyed. But amongst the few remnants was the Major's tin trunk, which my father managed to retrieve intact, and eventually this landed in Gurdaspur, by end-1947.

This retrieved luggage was then restored by me to the owner, in January 1948 at Kasur, just south of Lahore, which was now in Pakistan. Although there was a war going on in J&K by then, things seemed to be fairly 'cool' as far as the recently partitioned components of the Indian Army elsewhere were concerned. Even after 67 years, I remember the beautifully appointed Officers' Mess of 2/8 Gurkha Rifles in Ferozepur, where I (then a college student) was given breakfast and then a Jeep ride, courtesy the Gurkha unit, to Hussaniwala border-post. There I was picked-up by a jeep of the Frontier Force Regiment and driven to Kasur to meet friend Irshad Ahmed (no passports or visas needed, then) and hand over his trunk. After the much-traveled tin trunk and its owner were happily reunited, I was back to home country and the life ahead.

Incidentally, 2/8 Gurkha Rifles under command of their redoubtable CO, Lt Col HS Parab, soon after left Ferozepur and were flown to Leh which was threatened by Pakistani invaders in mid-1948. While a company was air-lifted, the rest of the battalion 'marched' to Leh, via Manali-Rohtang-Baralacha La, along what now is Manali-Leh Road : but that is yet another story !



Indian Air Force C-47 at the improvised airstrip at Leh, observed by curious local Ladakhis

Lt Gen HS Panag recalls that

'Lost' Operation in Chorbit La

When the Line of Control was demarcated after the Shimla Agreement, it was done with a “thick pen” on a small-scale map – a quarter-inch to a mile or one centimetre to 2.5 km. Once interpreted on a large-scale map – one inch to a mile or one centimetre to 500 metres, the differences become glaring, with claims and counter-claims by both sides on the ground. This problem came to the fore after the 1999 Kargil War, as most of the area that was being secured now, was earlier not physically held by either side.

In the Batalik-Yaldor-Chorbit La Sector, which was under the command of my brigade, we had four such tactical features that needed to be secured. All of them were on the formidable Ladakh range and heights varied from 5,200-5,300 metres, or 17,000 to 17,500 feet.

After the ‘cease fire’, these features were not secured by either side owing to initial errors of judgment and the onset of winter. Out of the four, three features that were in the Batalik and Yaldor Sub Sectors were not a cause for concern as the approach from our side was easy, while being extremely difficult from the Pakistani side.

The Chorbit La sub Sector had one feature, Point 5310, which posed a peculiar problem. Pt.5310 was covered by the ‘thick pen’ used while demarcating the LOC, but the approach to it (particularly in winter) was arduous.

The LOC beyond Pt.5310 took a ‘U-turn’ of two kilometres towards India. After that, the LOC ran along the base of the ‘U’ for six kilometres before turning north towards the Pakistani side for two kilometres.

The area of the ‘U’ was known as Karubar Bowl (a ‘nullah’ is known as a ‘bar’ in this area and a ‘bowl’ is the military term for a small valley) and a road from its northern end connected it to Siari on the Shyok River, opening an avenue to cut off Pakistani defences opposite the Turtok Sector.

The feasible approach for us was over a glacier at the southern end of Karubar Bowl, but it involved a movement of two kilometres through Pakistani territory. Whoever controlled Pt.5310 also controlled the 12 square kilometres of Karubar Bowl – which meant that if we secured Pt.5310, we would also ‘tactically’ control 12 square kilometres of Pakistani territory. Domination of this area also threatened the Pakistani posts opposite Turtok Sector from the rear.

In this sector, posts can only be held and sustained in winter if adequate infrastructure is created and stocking is done in summer as the routes get cut off due to heavy snow in the winter months. It was therefore decided that these features must be secured at end of the winter season, as soon as the weather allowed. In all likelihood, the Pakistanis were planning the same. The race was going to be won by the bold and swift !

Pt.5310 had an interesting background. During the Kargil War, 14 Sikh was moved post haste from Delhi by air to Leh and thereafter to the Chorbit La Sub Sector.

The unit under its dynamic Commanding Officer, Colonel KK Sinha (recently retired as a Major General), secured the LOC, which earlier had a solitary post manned by a platoon of the Border Security Force (BSF) at Chorbit La. Colonel KK Sinha also had a company, less a platoon, of Ladakh Scouts commanded by Major Sonam Wangchuk, under his command.

Pakistani troops made an unsuccessful attempt to get a foothold on the Ladakh Range on 30 May 1999, but were foiled in the nick of time by 10 soldiers of the Ladakh Scouts, under Major Wangchuk. Five soldiers of Pakistan’s Northern Light Infantry (NLI) were killed – the first success and first identification of NLI in the Kargil War. This operation was coordinated by Colonel Sinha.

On noting the tactical significance of Pt.5310, Colonel Sinha sent a platoon-strong patrol under Captain Praveen Kumar, who, exploiting complete surprise, secured the feature in July 1999.

On one hand there was the ‘thick pen’ ambiguity regarding Pt.5310 and on the other hand, the route of maintenance traversed two kilometres over a glacier through Pakistan territory. At that time in

Chorbat La sub Sector there were no roads or tracks and 14 Sikh was maintained by helicopters and porters/ponies from a road head 30 km away. Pt.5310 could not be stocked for the winter and the post had to be vacated in November 1999, with the hope that it would be reoccupied in summer of 2000.

However, the Pakistanis, showing exceptional enterprise had moved fresh troops into the Karubar Bowl in December 1999 and set up a number of posts in vicinity of Pt.5310. This was feasible as a motor-able track existed up to a distance of three kilometres from Pt. 5310. However, there was no clarity with respect to the occupation of Pt. 5310 by Pakistani forces.

Our planning to secure Pt. 5310 began in dramatic manner. Within two days of my taking over in January 2000, the Army Commander paid a visit to my brigade headquarters. Without much ado he came straight to the point: "In view of the Pakistani build up in Karubar, can we still capture Pt.5310 next summer?"

I had done my homework and told him that we would never be able to capture it in summer, as the Pakistanis would pre-empt us, but that it could be done in the winter. The Army Commander knew me from before and sarcastically remarked, "HS, you have spent too much time with mechanised forces and you need to understand high altitude warfare."

I reminded him of my infantry background, my Command of the pioneer Combat Group in Eastern Ladakh at similar heights and as a clincher I said, "the Pakistanis did it in Kargil, why should not we do it here?" I rubbed in the point by emphasising that if we do not do it in the winter, then the Pakistanis will be there in strength in summer, waiting for us. The Army Commander gave the go ahead in principle, subject to final decision, keeping in view the ambiguity with respect to Pt.5310.

The acclimatisation period at high altitude is six days for heights up to 12,000 feet, another 4 days for heights up to 15,000 feet and another four days for heights beyond 15,000 feet. I had been in the sector for only two days when I managed a helicopter and landed at the base of our Takpochand Post. The base was at 15,000 feet and Takpochand was at 17,500 feet. The 2,500 feet climb over 1.5kms took nearly four hours.

Takpochand gave a bird's eye view of Karubar Bowl and of Pt.5310, exactly

two kilometres away on its western flank. Between Takpochand and Pt.5310 was a glacier with deep crevasses at an average height of 5,000 metres. The northern and eastern face of Pt. 5310 had sheer cliffs. To the west, the terrain was higher and equally difficult, leading on to our Chorbat La post. The only suitable approach was along the glacier, hugging the Ladakh Range. There was no movement on Pt.5310, but in battle, one can never be sure.

Colonel Sinha and I made a rough outline plan for the operation. The plan was based on surprise and on the assumption that the feature was not held or lightly-held. The operation would be carried out by a 30-soldier strong *Ghatak* (Commando) platoon, led by Captain Praveen Kumar and backed by another 30 soldiers to carry loads and act as reserve.

Training began in right earnest a week later. Three issues were critical.

First: the traversing of the glacier. Advice and help was sought from the Siachen Brigade, which was readily given, and a similar glacier was chosen on our side for training. Snow Shoes 'Trugger'—an oversized shoe 1.5 feet long and one foot wide, meant for walking on snow—were made available. Techniques for moving while 'roped-up' and negotiating crevasses were practiced until perfected. Avalanche avoidance and rescue were also drilled. By the end of February 2000, we were confident that we could do it.

Second: the timing had to be perfect. Until around 20 March, it was extremely cold, with temperatures as low as -35 to -40 °C. At this temperature, troops could not survive without shelters and heating. As the weather warmed up towards end-March and early-April, and temperatures "rose" to -15 to -20 °C, the danger of avalanches increased and the openings of crevasses also widened. Moreover, the probability of the enemy pre-empting us increased. After a lot deliberation, we decided that the operation could not be launched before 25 March, but also not later than 10 April.

Third: was Pt.5310 being held by the enemy or not? We decided to keep Pt.5310 under 24-hour surveillance. Thermal night sights were moved to Takpochand. Daily helicopter surveillance was carried out, flying at 20,000 feet on our side of the LOC. As part of deception,

this was done over the entire sector. Satellite imagery of one metre resolution was obtained periodically, depending on the satellite orbit.

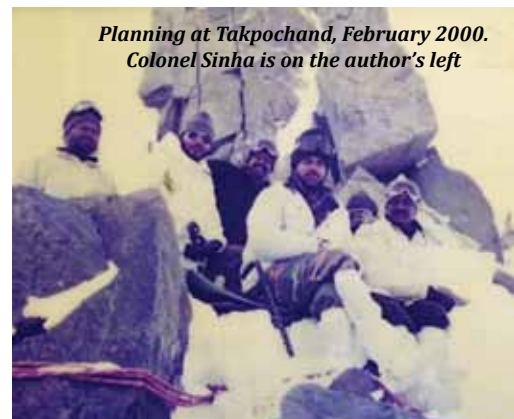
I personally went to meet the troops many times and was very impressed with the high morale. The confidence of Capt Pravin Kumar, his second-in-command Naib Subedar Satnam Singh, Havaladar Devinder Singh and Havaladar Raghbir Singh was infectious. On my misgivings about traversing the glacier, all four of them volunteered to personally lead the Ghatak Platoon, based on their knowledge of the route used in the earlier operation.

There was one more problem: from Takpochand to the glacier there was a sheer convex-shaped cliff of 100 metres. A boom, like those on cranes, had to be constructed to lower the Ghataks onto the glacier. The forward slopes were under the observation of the enemy, so we decided to do this just before the operation in hours of darkness.

Takpochand post itself was just 25–30 feet wide, and the construction of the boom posed a major problem. The Officer Commanding of our Electrical and Mechanical Engineers Workshop, Major Haridas, had a solution: dismantling the boom of a recovery vehicle and fabricating anchors that would be put in place using a mechanical drill.

Silent registration was done by the artillery, and fire support of 100 guns was coordinated. The fire plan was to be used in event of a loss of surprise.

We estimated that it would take us the entire night to traverse the glacier and the time for the final assault was fixed at 0400 hours. Logistic loads were ferried up and broken down to 20 kilograms for carriage by the reserve soldiers. D-Day was fixed for 4 April 2000, with operations to commence after last light.



**Planning at Takpochand, February 2000.
Colonel Sinha is on the author's left**

Now began the dithering at higher headquarters. There were genuine apprehensions about terrain difficulties, the enemy surprising us, and even international implications. Every day I got direct queries about every aspect of the operation. Three times the operation was called off by headquarters just an hour before the time of launch.

I protested that time was running out: after 10 April, the probability of the Pakistanis pre-empting us would be much higher. Finally on 7 April, we got the “go ahead.”

It had started snowing. Col Sinha requested that the operation be launched at 1500 hours instead of 1800 hours, to gain time. I readily agreed, as apart from gaining time it would pre-empt any last minute cancellation!

Up went the boom and the Ghataks began their descent, 100 metres down to the glacier. Colonel Sinha personally supervised the launch at Takpochand. Despite adrenaline pumping, after meeting the troops at mid-day, I had returned to the unit base to avoid the difficult to resist ‘higher commander interference.’

By 1600 hours, all the bravehearts were on the glacier. A blizzard had started, but there was no turning back now. Praveen, Satnam, Devinder and Raghbir alternately led the column. Movement was painfully slow. Eight crevasses had to be bridged and two crevasse rescues had to be organised. Every 100 metres, the troops had to rest. Temperature gauges were reading -20°C.

Since radio silence had been imposed, we had no idea of the ongoing battle of human endurance, on the glacier. At 0300 hours on 8 April, disaster struck when the attacking troops were still 600 metres from Pt.5310. Satnam was leading the way when he suddenly fell into a narrow crevasse. The fall dragged the second Ghatak too, but the rest anchored themselves to prevent the entire ‘rope’ going down. During the rescue, Satnam yelled his last words before losing consciousness: “*Mission poora karo* (Complete the mission).” It took an hour to rescue them. Both were suffering from extreme hypothermia. Stoves were lit under raincoats and resuscitation began. Unfortunately, Satnam was martyred but the second Ghatak survived.

Dawn was breaking and the setback notwithstanding, Praveen galvanised his

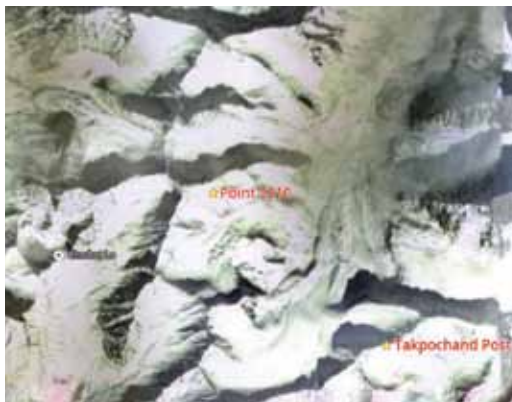
men into action. Bad weather continued and the Ghataks were in the shadow of Pt.5310, safe from the observation of the Pakistani posts and the possible enemy on top of Pt.5310.

At 0500 hours, Praveen and the 30 Ghataks started clawing their way towards the top. Praveen along with Devinder Singh and Raghbir Singh led from the front, reserve troops stayed at the base and artillery gun crews were ready to open up in the event of a loss of surprise. Messages were being relayed by pressing the talk buttons of the radio sets. We all were very tense.

It took nearly two hours to tactically move towards the top. The enemy still had not opened fire. Were they waiting?

Suddenly, the weather opened up and Praveen found himself staring down at a Pakistani post one kilometre away, across a deep valley with cliffs. We had beaten the enemy in the race to Pt.5310!

The success signal was passed on the radio. Celebrations began at the base and right up to the Army Headquarters.



But the work of the bravehearts had just begun. Immediately, defences were organised. The reserve troops were called up, tents were pitched on reverse slopes, and weapons were sited. At 1500 hours the troops had a cup of tea and *khoya pinnies* (balls of reduced milk, wheat flour and sugar), the staple survival ration of the Sikh Regiment. It was their first meal after they had taken ‘prasad’ before launch, 24 hours ago.

After last light Colonel Sinha started lowering more soldiers carrying logistic loads. The route, though still dangerous, was now well marked. In the next 48 hours, the defences were in reasonable shape and the strength had been built up to one company. The enemy still did not have a clue that Pt.5310 had been secured.

Elsewhere in the Brigade, simultaneously, all other ‘thick pen’ features had been secured by 3 Punjab and 1 Bihar in Batalik and Yaldor Sub Sectors. The demons of surprise at Kargil had been buried for good.

On 10 May 2000, accompanied by Col Sinha, I traversed the glacier to reach Pt.5310. The defences were in very good shape and the morale was high. By the third week of May as the snow melted, the enemy discovered us, but could do very little about it!

On 20 May 2000, Pakistani troops tried to get observation over us by climbing the slopes of Dolmi Barak, a peak 20,000 feet high on the eastern flank of Karubar Bowl, to set up a post.

I arranged a ‘Konkurs’ missile launcher (NATO: AT-5 ‘Spandrel’) with a range of four kilometres from the Mechanised Infantry unit and personally supervised the firing to bring this post down. That same day, we mounted the *tiranga* and I ordered all weapons of the brigade to fire a volley to salute the bravehearts.

By October, before the onset of winter, we had built a motorable track up to Takpochand and a single-span two-kilometre ropeway had been laid to maintain the logistic link in winter.

Because of ambiguity with respect to the status of Pt.5310, this operation is ‘lost’ in the files of Army Headquarters. Both the 1999 and 2000 operations to secure Pt.5310 received no official recognition and no gallantry awards. The remarkable achievement of a ‘reverse Kargil’ remains an unsung saga of bravery and dynamic leadership, displayed by the Commanding Officer and junior leadership of the 14th Battalion, Sikh Regiment.

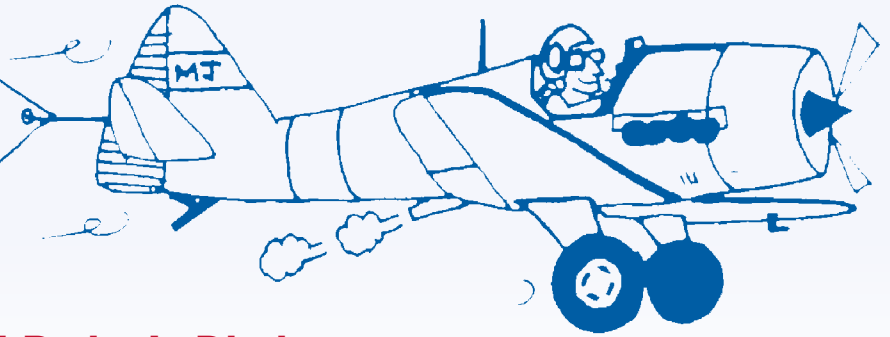
Now that the Nation has rediscovered our lost territories – POK and Gilgit Baltistan – it is time to make amends and recognise this operation done against all odds.

[It is a sad reflection on our selection system that Colonel Sinha, one of the most dynamic Commanding Officers of the Indian Army, suffered professionally in terms of promotions in later years due to egotist senior officers. He had to represent to become a Brigadier. I was still in service and supported his case.]

Again as a Major General, he was superseded for promotion to the rank of Lieutenant General despite a favourable and unambiguous order by the Armed Forces Tribunal upheld by the Supreme Court. Soldier that he always was, he decided to fade away.]

Lt. Gen. Harcharanjit Singh Panag
[Formerly GoC-in-C Northern Command]

Ancient Aviator Anecdotes



From Air Vice Marshal Cecil Parker's Diaries



Hunters Over Staff College

The Defence Services Staff College (DSSC) Wellington in the Nilgiris is the oldest of our four major joint training establishments. Through their institutional specialisations, they aim to create and develop 'jointmanship', i.e. the integration of land, naval and air forces to achieve a common outcome. I had the good fortune of serving three tenures at DSSC spread over 20 years.

In 1960, as a young flight lieutenant, I was selected to attend the 14th Staff Course where I found myself the juniormost of 120 students. There were 82 in the Army wing, 14 in the Naval wing, 24 in the Air wing and included 20 foreign students plus two civilian officers from the IAS. It was my very first exposure to the other two Services and, for a year, was a great professional education. In addition, we made a large number of personal friends from all three arms of the Services; some of those friendships last well into retirement.

As a Wing Commander in 1973-75, I was posted to DSSC as a Directing Staff (DS) Air. As all instructors know, one learns most when one is teaching. In 1973, the JTC of the COSC had tasked Staff College to compile a new draft Joint Services Staff Duties Manual: Vol. 1 on Service Writing. From each of the wings, one member was nominated to form a three-member team under the chairmanship of the (then) CI Navy. I was appointed from the air force and, along with my two colleagues from the Army and the Navy, laboured hard for months, reconciling all our differences to create a draft publication that was well received by all vetting authorities and reached the JTC without a single amendment. What became of it I still do not know but years later (after we had both retired) I enquired about its fate from the erstwhile CI Navy (now a retired CNS) who, with an enigmatic smile observed that perhaps there was inadequate jointmanship at the required level! Within the Air Wing, I was also tasked to draft the

QRs for DS (Air) and these were accepted by Air HQ.

I was a beneficiary of these QRs when, as an Air Commodore, I returned to DSSC as the CI (Air) 1981-83. I had a well-qualified team at DS (Air), which relieved me of all routine duties and left me free to innovate, make future plans and improvements. One of the highlights of this tenure came about unexpectedly. In 1981, my old squadron (No.20) was chosen to form the IAF's first formation aerobatics team. The Hunter aircraft of the "Thunderbolts" mesmerised the country with their scintillating displays. In 1982, they happened to be based briefly at Coimbatore for display commitments down south. I knew the CO / Team Leader very well as he had also been a student at DSSC during my previous tenure. Since he was familiar with the layout / altitude of the institution, I asked him if he could carry out his rehearsal over Staff College between 1015-1030h the next day but above 7000 feet AMSL? He readily agreed and I got permission from the Commandant for this 'surprise' air display during the coffee break. I also took my two colleagues (the CIs Army and Navy) into confidence and we ensured that all students and staff were outside when six liveried Hunters, in a tight arrow-head formation, swept low and fast and went into their display mode in perfect weather conditions. Apart from the college, I think all residents of Wellington, Coonoor and surrounding areas gazed skywards quite fascinated at the magnificent air display on this, the first (and last) sight of the Hunters over Staff College. Those 15 minutes did a great deal for the Air Force too. The Commandant was delighted and immediately invited the team up to DSSC. In his vote of thanks during their felicitation, he made special mention of their fine visual example of teamwork and 'jointmanship' in the broadest meaning of the word.

My last appointment in the IAF was as AOC J&K 1985-86, in which assignment



I had to work closely with the Army's Northern Command almost daily and occasionally with it's Western Command whenever joint exercises / operations involved J&K. I like to think that my successful tenure there was due largely to the fact that both army commanders happened to have been my coursemates at DSSC 25 years earlier!

A Moveable Feast

An aviator's logbook is a record of data pertaining to details of his or her time in the air. However, for long retired octogenarian pilots (like this writer), it also serves as a memory box of events, people and places. The December 1969 entries in my logbook refer to an exercise code named *Ice Kool II* organised by HQ WAC. I had recently taken over command of my old squadron, equipped with Hunter Mk.56A aircraft, based at Hindan (near Ghaziabad) and was instructed to operate a detachment of six aircraft from a disused World War II airfield called Sirsa located on the western edges of present day Haryana.

Other than a runway with a couple of 'soft' blast pens at either end and a small tarmac, Sirsa had no facilities and was looked after by a Care & Maintenance (C&M) Unit commanded by a young navigator and a small team of airmen. We had therefore to be self-sufficient operationally, administratively and maintenance wise. Our advance party stressed the requirement to clean all operating areas, as there was danger of FOD (Foreign Object Damage) to our engines. I led six

aircraft with 45 personnel and we spent the first 48 hours sweeping the tarmac, runway, blast pens and pitching tents! Our task for the exercise was counter air strikes on airfields and air defence of our own air base.

Our technicians kept all six aircraft serviceable and we did great deal of productive flying. Our squadron catering arrangements were of necessity vegetarian but determined personnel soon discovered a *dhaba* in 'downtown' Sirsa owned and operated by an ex-Army veteran with the unforgettable name of Sheermal Singh. Most evenings (after some 'spiritual' sustenance) a large number of us wound up at his establishment and he was delighted with the business he generated with his delectable non-veg fare. Army-Air co-op could get no better!

On the third day, widespread bad weather over the entire exercise area interrupted flying totally. We had brought along indoor games and a cricket set and soon a spirited limited overs match was in progress on the tarmac long before the BCCI/IPL laid down the rules! Suddenly we all heard the drone of propeller driven engines and looking up, caught glimpses of a transport ac through the clouds. The CO C&M Unit borrowed my jeep and raced off to our ATC (Air Traffic Control) and soon we saw a C-119 Packet land, taxi and switch-off adjacent to our cricket game. From the approaching jeep stepped a familiar figure – none other than our AOC-in-C WAC! I knew him very well as

he flew with us on occasion. On receiving him, his first query was what the score was! His aircraft, returning from a forward area supply drop mission had not been cleared to his destination, which was temporarily closed owing to weather. Being close to Sirsa, which they could see through the cloud cover, they decided to put down.

He insisted on sitting through the rest of our game and accepted my invitation to have lunch at Sheermal Singh's *dhaba*. While I debriefed him on the progress of the exercise of the squadron detachment, an advance party was quietly sent off to alert the eatery! On arrival, he was pleasantly surprised to receive a military salute, a warm welcome and the unusual sight of a *dhaba* table covered with a tablecloth adorned with crockery, cutlery and glassware. He certainly enjoyed the food, which (perhaps in honour of his visit) was somewhat richer than usual. In the afternoon he was able to take off and was kind enough to give two of my airmen a lift to Delhi, as they were required back at base.

Late that evening I received a call from his Staff Officer to say that (post-lunch) the AOC-in-C was 'temporarily indisposed' but wished to convey his thanks for our hospitality. At the formal debrief of Ex *Ice Kool II* he commended the squadron's performance but understandably made no mention of his enforced stop-over in Sirsa. *Postscript: Only five other pilots will recall our farewell flypast over Sirsa town on 19 December 1969!*

25 Years Back

MiG-21 replacements and the LCA

Air Chief Marshal NC Suri, CAS still believes that the Light Combat Aircraft (LCA) will replace the IAF's ageing inventory of MiG-21s, but has admitted that the LCA was unlikely to be inducted before 2005 ! The CAS stated that the LCA had been conceived as a replacement for the Soviet-built MiG-21s originally scheduled to be phased out of the IAF from 1995. "The LCA is a complicated programme, involving the highest level of technology including stealth."

The ambitious LCA programme has been plagued with delays which had upset the planning of the IAF. Maintaining that the Air Force's combat capability had by no means been compromised, the CAS affirmed that an intermediate fighter would need to be purchased to tide over this period. He said the IAF was evaluating various options and would decide accordingly. The IAF presently has 17 squadrons of MiG-21s in service.

Joint MiG-29M production proposed

President of Russia Boris Yeltsin has announced that the Republic will continue supplies of defence material to India. Significance is being attached to the report in the daily *Izvestia* about joint Indo-Russian ventures in defence production, and the MiG-29 has been specifically mentioned. According to Russian experts, the feasibility of transferring MiG-29 production to India is being seriously considered as "more than 90 percent of the MiG-29 components are produced in Russia and the balance could be manufactured in India."

INS Dega commissioned

INS *Dega*, the Indian Navy's newest Air Station was commissioned at Visakhapatnam on 21 October 1991 by the Chief of Naval Staff Admiral Laxminarayan Ramdas. A brief ceremony involving naming of the Station, reading of the Commissioning Order of INS *Dega* by the Commanding Officer Capt S Swaminathan, hoisting of the ensign and unveiling of a plaque marked formal commissioning of the Air Station.

SA-2 phased out

After 27 years of active service, the *Dvina* or SA-2, surface-to-air missile is being phased out of the IAF service. The *Dvinas* were inducted into the IAF in September 1964 and were deployed around vital areas/points in Northern and Eastern India.

Radical restructuring of the USAF

In an effort to reduce manpower, two new commands, the Air Combat Command (ACC) and Air Mobility Command (AMC) are scheduled to replace the three current major USAF commands;

From Vayu Aerospace Review Issue VI/1991

Strategic Air Command (SAC), Military Airlift Command (MAC) and Tactical Air Command (TAC). Overall the number of major commands will be reduced from thirteen to ten. ACC will encompass all present SAC and TAC attack, fighter and bomber aircraft elements together with some tactical transport and tanker aircraft as well as ballistic missiles, command, control, communications and intelligence platforms. The AMC will take over MAC's responsibility for global airlift but will also include the tanker support required for such a capability.

JAS 39 flight test programme

The fifth and last JAS-39 Gripen prototype (39.5), made its first flight from Saab's Linköping airfield on 24 October 1991, joining three other prototypes in the flight test programme. Prototype 39.5 is the closest to the production aircraft, 140 of which have been contracted for to date for the Swedish Air Force who have an eventual requirement for some 340-350 of the type to re-equip up to 23 squadrons.

China's Trunkliner

China's much-publicised Trunkliner requirement for 150 aircraft has been shortlisted to either the Boeing 737 or MDC MD-90-30T to replace older aircraft on routes throughout China. Although the China National Aero-Technology Import & Export Corporation has not made a final decision on which aircraft will be chosen, indications point to the MD-90 being chosen as MDC is the only company which is now proceeding with detailed contract negotiations.

Premiere of the Dornier 328

Premiere of Germany's new regional airliner, the Dornier 328, was held on 13 October 1991 at the company's Oberpfaffenhofen airfield, south-west of Munich. In the presence of over 6000 invites, the first prototype of this new generation regional airliner (D-CHIC) was rolled out to the strains of *Pomp and Circumstance* played by a Bavarian brass band.

Debut of the Dornier 328 is regarded as a major milestone in regional airliner technology. Dornier's concept of developing the Dornier 328 as a modern 30-33 seater with the best possible comfort features at the lowest possible direct operating cost has been vindicated even before aircraft's first flight with a total of 146 orders and options received.

Mirage 2000D increased operational efficiency

The Mirage 2000D has recently flown from Istres to test a new independent and discreet localisation system providing continuous attitude correlation. This function of the navigation and attack system combines data from the inertia generators and from the radio altimeter. Improved localisation information will mean improved operational efficiency during all weather low altitude speed penetration missions. "The excellent results obtained are owed to the model cooperation existing between Dassault, industrial architects of the Mirage 2000D navigation and attack system and SAGEM, experts in inertia generators and hybridisation techniques".

Tale Spin

Join the Indian Air Force (1942)



Join the Indian Air Force (2016)



Clearly there has been a generational change in the appeal to young Indian men (and now Indian women) to join the Indian Air Force. The advertisement on the left had appeared in India's leading news magazine (*Illustrated Weekly of India*) during the Second World War years while that on the right has just appeared in the 'New Woman', a publication edited by a former Bollywood star. The first three Indian women to fly fighters are presently under advanced flight training and the IAF is monitoring their performance including "physiological attributes and cultural issues in the male-dominated armed forces".

Come on Girls!

6E and the City

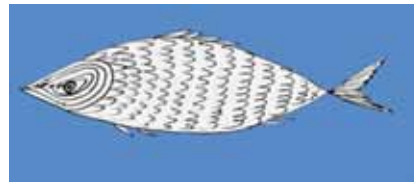
Say that quickly and it certainly does sound like that American romantic comedy television series, based in New York City, which had worldwide following for several years! A clever IndiGo twist, or an innocent



happencance? Perhaps so but known for its punctuality, IndiGo airlines have also been a trendsetter in advertising and branding innovations. Even in terms advertising, it is quite 'to the point' while being witty with lines like 'Sleep with your wife' for same day return flights says the brand consultancy firm.

Nut case!

Hilsa in the 'House of Ming'



One of the most popular Chinese restaurants in India's capital is the 'House of Ming' at Taj Mahal hotel in New Delhi. Included in its fare are delicious fish-dishes but whether

the Bengali specialty Hilsa is included remains unlikely considering its rarity and high cost.

In a smart editorial, a Financial daily warned Indians: 'Wake Up and Smell the Hilsa, says China' with reference to the recently announced strategic relationship between Beijing and Dhaka, exemplified by the induction of Chinese-built submarines by the Bangladesh Navy. These *Ming*-class submarines will surely share waters of the Bay of Bengal with the Hilsa fish so revered by peoples of that region.

From Ashoka to KamaScootra

What's in a name? A lot, if it's an aircraft belonging to a commercial airliner. A considerable amount of time and money is spent by airlines on naming planes, which are specially painted or stickered, and may be based on a theme, rivers, kings or a destination the airline is flying to. So there's KamaScootra, the brand new Dreamliner 787 from Scoot, the Singapore-based low-cost airline, no doubt inspired from Vatsyayana's text Kama Sutra (*wipe that smile!*).



Scoot, however, is not alone. Air India has for long been naming its airliners after kings, rivers, mountains, monuments and cities, while budget carrier SpiceJet takes its inspiration from spices. So while you have Indian state names such as Kerala and Goa for Air India's long-haul B-777s, the B-747s, mostly used for VIP flights, are called Tanjore, Khajuraho and Ajanta. Then there are Turmeric, Saffron, Red Chilli, Oregano and Mango Powder airliners in SpiceJet's colours.

"Red, Hot and Spicy"

Afterburner

Publications by The Society for Aerospace Studies on

Naval Aviation



On The Wings of Gold

Golden Jubilee of INS Hansa
by Pushpindar Singh

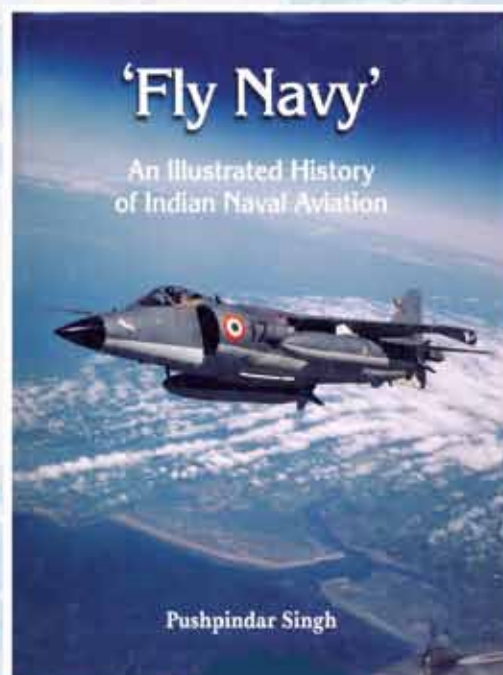
This book explores in comprehensive detail the history of the Indian Navy's largest and most active Naval Air Station, INS Hansa, at Dabolim in Goa. From the Station's beginnings as the Naval Contingent, Coimbatore in September 1961, to the move to its present day home in Goa in 1964, and right up to contemporary times, this richly illustrated book details the growth and evolution of the Station as well as all Naval Air Squadrons associated with it.

'Fly Navy'

An Illustrated History of Indian Naval Aviation
by Pushpindar Singh

The first dedicated history of Indian Naval Aviation, this book contains hundreds of rare photographs a treasure trove of painstakingly collected information on India's Naval Air Arm, making it a tremendous resource for enthusiasts and analysts alike.

In his Foreword, Admiral Arun Prakash, then Chief of the Naval Staff observed that "over half a century after the first Short Sealand amphibian flew into Cochin, marking the foundation of our Fleet Air Arm, India's naval aviation has grown to the size of a respectable air force. Even as the navy's growth as a maritime force is seen to be inextricably linked to India's renaissance as a major Indian Ocean power, aviation has progressively assumed centrality in our operational planning"



'Fly Navy'

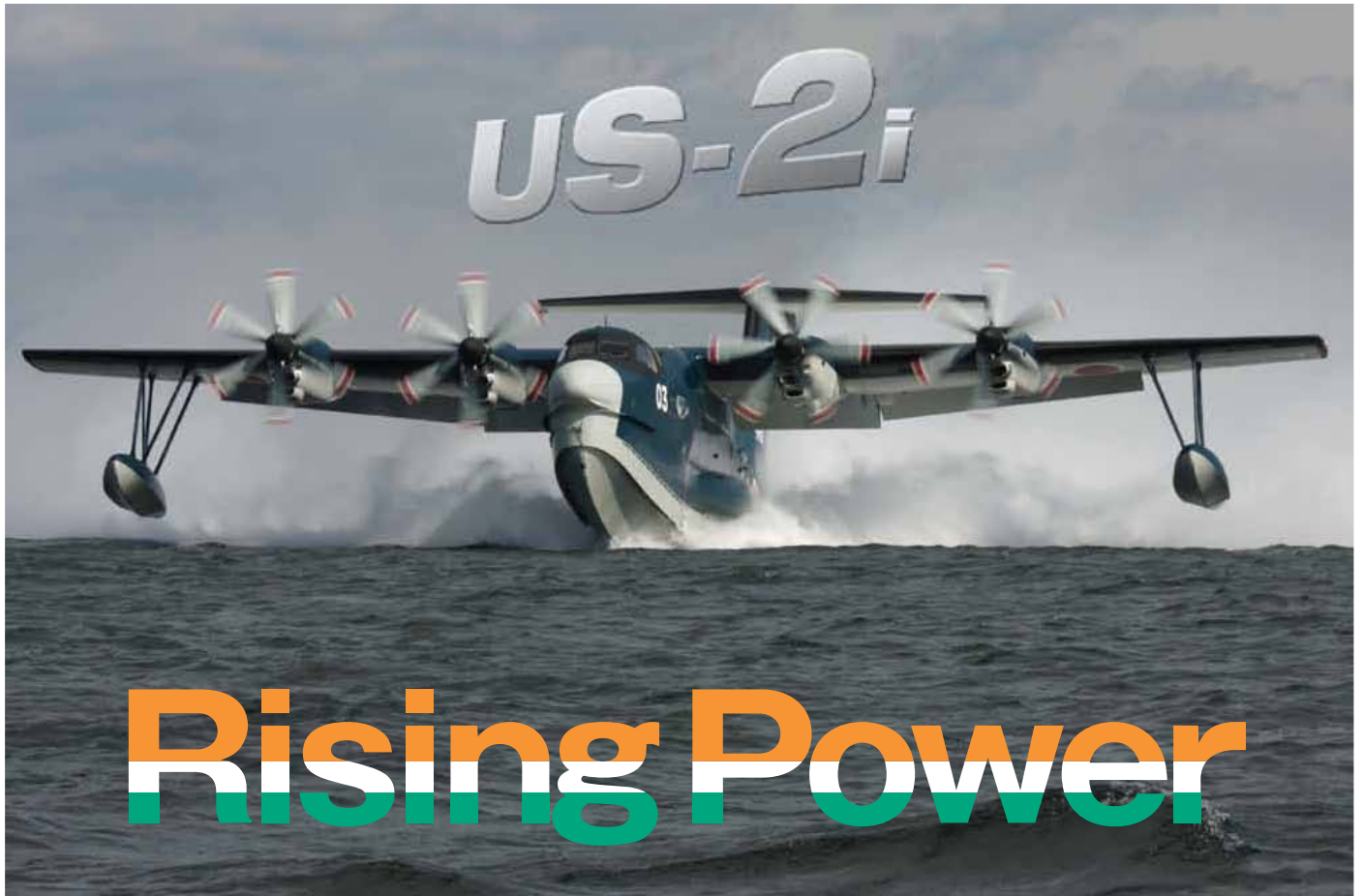
An Illustrated History
of Indian Naval Aviation

Pushpindar Singh



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