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Indian Navy SPECIAL ISSUE

Interview with the CNS

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INS Arihant : Third leg of deterrence

With INS *Arihant* completing its maiden deterrence patrol, India has taken its first steps towards establishing the third leg of a nuclear triad: the ability to launch nuclear weapons from under the sea. It now joins a small group of countries United States, Russia, China, France and United Kingdom that have this capability. This is a big moment in India's quest for strategic independence; it is, however, no giant leap.

Successive Indian governments have committed to the doctrine of *Credible Minimum Deterrence* and "No First Use." A submarine capable of launching a nuclear missile from somewhere in the expanse of the ocean gives India assured second-strike capability. It is meant to deter adversaries from nuclear misadventure. However, India's nuclear sub is equipped to carry short-range missiles, which limits its deterrence potential. Clearly, subsequent additions to the navy's arsenal will focus on longer-range missiles and larger submarines capable of carrying them. Augmenting capability, however, will require higher allocation of funds.

Even if defence gets more funds, rejigging the defence budget is inevitable. Too much of the defence budget goes to manpower costs: salaries and pensions. Defence allocation in Budget 2018-19 was to the tune of Rs 4,04,365 crore; of this, defence pensions accounted for Rs 1,08,853 crore; It is imperative that the government revisit manpower costs, particularly pensions and benefits, if it is to increase funding for defence research and development. Indigenising defence production is another way to get "more bang" for every defence rupee.

Augmenting naval strategic capabilities is an imperative for India, especially considering the strategic importance of the Indian Ocean Region. The region is central from a strategic and security point of view, given China's growing ambitions and activities, as well as from India's own rise as a key player in the region, in Africa and as a strategic partner to other key countries. INS *Arihant* is a major achievement, but India now needs to focus ahead and move fast, if it is to fully secure and advance its cherished strategic autonomy.

From *The Economic Times*

Strengthening ties with Japan

Prime Minister Narendra Modi made a successful visit to Japan as part of the Annual Summit schedule. The talks between Mr Modi and his Japanese counterpart, Shinzo Abe, were described as "fruitful and extensive" and covered a wide range of issues that concern both the countries. Mr Modi reiterated that Japan was the cornerstone of India's *Look East* policy, while Mr Abe expressed his determination towards advancing the "new era in India-Japan relations". Both leaders also stressed the need to work together for a rules-based and inclusive world order. The two leaders reviewed the progress of several initiatives in the recent past such as enhancing connectivity and ecological management in India's north-eastern region through the India-Japan Act East Forum and the progress made on the Mumbai-Ahmedabad high-speed rail-way project. While the two countries signed several agreements, the two issues most worthy of highlighting pertain to economic and security matters.

The first big development was the signing of a $75 billion currency-swap agreement, one of the largest swap arrangements in the world. A currency-swap agreement allows India to avail itself of $75 billion from Japan in exchange for rupees in case the need arises. This arrangement makes eminent sense since the rupee has lost around 13 per cent of its value against the dollar this year; indeed, the Indian rupee has been the worst-performing Asian currency. Rising interest rates in the United States, higher crude oil prices, and a widening current account deficit, which is nearing the crucial level of 3 per cent of gross domestic product, have put the rupee under tremendous pressure. The Reserve Bank of India has been intervening in the markets to ensure that the rupee's fall is not any more precipitous. But that has meant that India has used its foreign exchange reserves. The on-tap avail-ability of $75 billion thus not only calms the frayed nerves in the markets but also makes it decidedly cheaper for Indian businesses to borrow funds. To be sure, this is not the first time India has had such an agreement with Japan; in 2008 and 2013, Indian signed up for similar swaps valued at $3 billion and $50 billion, respectively. This swap arrangement also means that bilateral trade between the two countries, which has been far below expectations despite the two countries having a comprehensive economic partnership agreement, will likely get a boost, especially as it dials down its dependence on the dollar.

Enhancing the strategic dimension of the relationship between India and Japan, both countries reaffirmed their desire to further deepen bilateral security and defence cooperation and institute Foreign and Defence Ministerial Dialogue (2+2); at present, India has this arrangement only with the US. Building on the existing maritime security cooperation, the Indian Army is now conducting its first joint exercise with Japan's Self-Defence Forces. Cooperative research in the area of the unmanned ground vehicle (UGV) and robotics was also announced. And there was encouragement for technological collaboration between the respective agencies of the two countries in the Joint Lunar Polar Exploration Mission. While China was not mentioned explicitly anywhere in the joint statement, there is no guessing what the prime motivator for both India and Japan was. The call for a "free and open Indo-Pacific" makes it clear that this partnership is aimed at countering the biggest regional power.

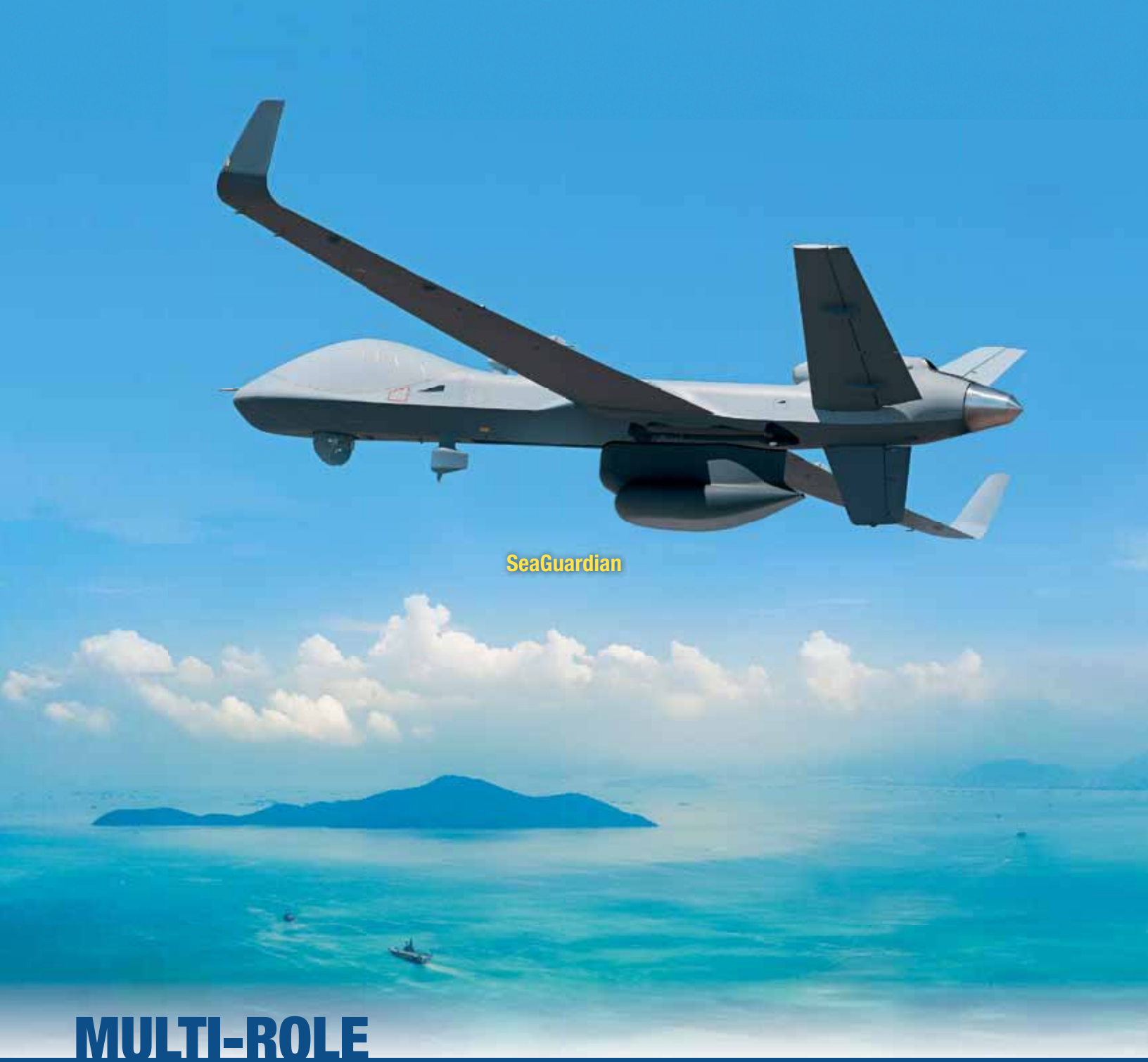
From *Business Standard*

Before the Supreme Court

The Rafale controversy has ended up before the Supreme Court, and it is therefore moot to argue whether the country's top-most court should be weighing in such matters. It has heard the matter, decided not to get into the pricing issue, and reserved its judgement. And there things stand.

There are two other dimensions to the problem, though, which are about, one, the very nature of such deals (and where there is a need for clarity and informed debate) and, two, the need for both the selection and the post-selection process being transparent and above board.

This holds true for all arms purchases, not just the Rafale deal. India needs to get this right. As much as the country would like to (and should) manufacture most of the arms it needs, the fact is that it is



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currently an importer of arms, one of the biggest in the world, and will remain so for the foreseeable future. The need for transparency in the post-selection process is particularly important, especially in deals where corruption is being alleged. That's because the arms business is an infamously competitive one, and it isn't unknown for losing bidders for a deal to indulge in some good old-fashioned mud-slinging. Indeed, in the absence of either a money trail or a beneficiary, it should be ensured that the motivations behind the allegations are above board. All deals can and should be questioned in the interests of the country and fair-play, but they need to be questioned for the right reasons. Otherwise, the country's already-lengthy process for inducting much needed equipment into the defence forces could be even more delayed. It makes little sense to politicise defence purchases, even less sense to allow commercial rivalry to vitiate such deals.

Arms deals are also notoriously complex, but, fortunately, well documented. Thus, the process followed in deals of various sizes and hues (and with countries and companies) is easily available. This is important because the lack of knowledge itself could result in misunderstandings about a deal. For instance, in the case of Rafale, much has been made of the lack of a sovereign guarantee from France for what is essentially a government to government deal, although several deals, including the recent G2G one between India and Russia for the S-400 missile system have been done without such guarantees. Here, it is the responsibility of all stakeholders to ensure that all pertinent information that can be placed in the public domain, is.

From *Hindustan Times*

S-400 pact and world realities

India signing the contract for the purchase of the S-400 Triumf missile system from Russia during President Vladimir Putin's two-day working visit to New Delhi stands out as a positive sign. It indicates a meaningful step on India's part to negotiate a multi-polar world without looking over its shoulder. The present government had given every impression so far of being too solicitous of US concerns in the foreign policy and security arenas, permitting serious observers to wonder if it was going to turn its back on Moscow, a time-tested strategic ally which of late had begun to align its foreign policy away from New Delhi's in the regional context, in part due to the perception that India appeared to have made up its mind to play second fiddle to Washington.

The signing of the five billion dollar contract for arguably the world's most advanced system – which can not only effectively counteract enemy aircraft but also intermediate range ballistic missiles (IRBMs) – has come in the wake of threats of the agreement possibly attracting US sanctions under America's recent law *Countering America's Adversaries Through Sanctions Act* (CAATSA). While this law is the latest instrument in the US armoury to be used against Russia, it also menaces other countries with sanctions for entering into defence and other strategic agreements with Russia, although waivers are factored in.

What Washington will do about India concluding the missile deal with Russia is not yet known but the US embassy in New Delhi has spoken with remarkable restraint in its media response on the issue. It has just said that "CAATSA is not intended to impose damage to the military capabilities of our allies or partners." This suggests Washington is giving itself more time to devise a suitable view in light of its meaningful all-round relationship with India. America will be showing maturity if it can sustain this stance. It will be short-sighted of it to expect that any country trying to be in step with it on a broad range of issues must also sign up on adopting all of its political and strategic preferences. The West Europeans, for instance, who are America's natural allies, do not see eye to eye with it on not doing any business with Iran, which under the Trump administration is seen as the number one adversary of the US after Russia.

Apart from signing up to purchase the Russian missile system, India has also signalled activating synergies on strategic aspects of international life such as space exploration and energy sector cooperation, although it is evident that Moscow and New Delhi have different positions on Pakistan, possibly Afghanistan, and the Asia-Pacific (of late being called the Indo-Pacific by the Americans) where constraining China is emerging as a key US concern. However, this is to be expected in a multilateral global arena in which the leading powers do business with one another to the farthest degree they can but not hesitate to declare their divergences.

From *The Asian Age*

Centenary of the Armistice

More than a million Indian soldiers fought overseas in the World War I. They fought in the European, Mediterranean, Mesopotamian, North African and East African theatres of war. And some 62,000 of them died in these battles, countless more were injured. While the British built a monument, India Gate, in 1931 to commemorate the fallen soldiers, over time, the Indian soldiers were, for the most part, forgotten, most of all by their own country. India Gate became a memorial to the fallen soldier, not just the soldiers of the Great War. The centenary celebration of the Armistice should recall those soldiers India lost to the Great War.

India's inclusion in the celebrations in Paris stands apart from the 50-year celebration of the Armistice, when the country's contribution had been edited out. This historical recompense reflects recognition of India's growing role in the world today. But it is not just the world that has made the correction. India too has recognised the heroic sacrifice made by its soldiers, fighting in strange lands far away from home, in inhospitable weather, for a country that had colonised it.

The memorial built by the government of India, at Villers-Guislain in France, to commemorate the Indian soldiers who fought in the Battle of Cambrai marks India's acceptance of its history. Restoring India to its rightful place in the history of the Great War is a reminder of the fact that dealing with big global challenges will require countries to work together.

The centenary of the Armistice marks a vital moment, especially for the West, as it struggles against the political forces of isolation and narrow nationalism. It is a moment to remind all about the need to strengthen international cooperation without sacrificing national identities and interests.

From *The Economic Times*

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Brigadier Gurmeet Kanwal asks,

"Where is India's Chief of Defence Staff ?"

When he was India's Defence Minister, Manohar Parrikar had said two years ago that he would 'soon' recommend the creation of the post of Chief of Defence Staff (CDS), which he considered "a must", to the Cabinet Committee on Security (CCS). He had also said that the Ministry of Defence (MoD) was engaged in working out a mechanism for the post. So far there has been no progress on appointing a CDS and constituting integrated theatre commands.

Consequent to the submission of the Kargil Review Committee report, a group of ministers (GoM) headed by then Deputy Prime Minister LK Advani had analysed the functioning of the higher defence organisation in India. Among the major recommendations of this GoM was the establishment of the post of CDS with a tri-Service joint planning staff HQ. The CCS accepted this recommendation but held its implementation in abeyance. The two reasons cited for the deferment were the lack of political consensus on the need for a CDS and opposition within certain sections of the armed forces and the bureaucracy. More recently, the Naresh Chandra committee is reported to have recommended the appointment of a 'permanent' chairman of the Chiefs of Staff Committee (CoSC) as the first among equals.

While the army and the navy are known to support the idea of a CDS and theatre commands, many senior officers of the Indian Air Force (IAF) oppose the move. General Bikram Singh, former army chief, wrote recently that an "empowered CDS" is needed to draw up a "pragmatic architecture for integrated tri-Service theatre commands" (*A Fresh Security Strategy is Needed,* Hindustan Times, 28 August 2018.) Admiral Arun Prakash, former naval chief, has often written about the need for reform in higher defence organisations at the apex level. Air Chief Marshal S Krishnaswamy, former air chief, opposing the concept of CDS has written that theatre commands are unnecessary (*Why Theatre Commands is an Unnecessary Idea*, Indian Express, 16 August 2018). About a year ago, Air Marshal Vinod Patney had written in a similar vein (*Unity of the Services,* Indian Express, 10 May 2017).

It is well known that the operational plans of the armed forces lack synergy. In 1962, the IAF was not given any role to play during the war with China when it could have wreaked havoc on the Chinese hordes that had concentrated on the Tibetan Plateau without air cover. In 1965, the Indian Navy (IN) was not even informed about the plans to launch a three-pronged attack across the international boundary (IB) into Pakistan.

It is repeated *ad nauseum* that the 1971 war was a well-coordinated tri-Service effort that led to a grand victory. The rather limited coordination that was actually achieved during the wars with Pakistan in 1965 and 1971 was mainly due to the personalities of the Chiefs in position of authority and not due to any institutionalised arrangements. During the 1971 war, Field Marshal Sam Maneckshaw was able to carry his naval and air force colleagues with him due to the personal rapport that he had established with them. Yet, there were several glitches in the planning and conduct of the land and air campaigns and it cannot be stated that India fought a coordinated 'air-land' war.

The Indian intervention in Sri Lanka was undoubtedly a disaster from the joint planning point of view. The Kargil conflict of 1999 is the only real example of some coordinated effort. Even here there were initial hiccups and it took the IAF several weeks to begin bombing the Pakistani intruders' *sangars* (ad hoc bunkers) on the Indian side of the LoC after the army had made such a request.

India's prevailing security environment is marked by regional instability with a nuclear overhang, unresolved territorial disputes with China and Pakistan, an active Line of Control (LoC) with Pakistan, tensions along the Line of Actual Control (LAC) with China, Pakistan's proxy war in Jammu and Kashmir, repeated air space violations, burgeoning maritime security challenges and increasing demands for Indian contribution to multinational coalition forces. More than ever before, it is now necessary for the national security decision makers to be given "single-point military advice" that takes into account the operational strengths and weaknesses and the inter-dependence of each of the armed forces on the other to meet complex emerging challenges. Such advice can come only from an empowered CDS.

Ideally, the CDS should be an overall commander-in-chief and not merely the first among equals with no forces under his command. From the CDS command should flow to individual theatre commanders who are in command of troops and equipment from all three Services. Given India's long land borders with a varied terrain configuration and two major seaboards, a "theatre" system of tri-Service command is best suited for the optimum management of both external and internal security challenges. At present, HQ Eastern Command of the army is located at Kolkata while the corresponding HQ of the navy and the air force are at Visakhapatnam and Shillong, respectively.

Some misperception has been created that only the United States needs a theatre system because of its wider geo-political

interests and involvement in security issues all over the globe. With its sprawling land borders, long coastlines and complex national security threats and challenges, India too needs a theatre system for integrated functioning to achieve synergy in operations by optimally exploiting limited resources. The Chinese, with similar needs, have a well-established theatre command system. While a single Chinese commander is responsible for operations against India, three Indian army commanders will be involved in the planning and conduct of operations against China.

Each theatre commander should have under his command forces from all the three Services based on the operational requirement. The initial allocation of forces will seldom remain constant. At the inception stage it would be more appropriate to appoint a CDS without simultaneously constituting theatre commands. The second step can follow a few years later. Once the new system matures and theatre commanders are appointed, the Chiefs of Staff of the three Services should have responsibility primarily for force structure and drawing up perspective plans. They should oversee the development and acquisition of weapons and equipment, plan recruitment, guide and coordinate training at specialised training establishments and control administrative matters such as the annual budget, pay and allowances, maintenance support and medical services etc.

Several other areas of functioning necessitate overarching military command and control at the national level. While India's nuclear doctrine and policy are guided by the National Security Council and the Cabinet Committee on Security, their execution is entrusted to the Services and here a joint approach is mandatory. The Strategic Forces Command (SFC), constituted for the planning, coordination and control of India›s nuclear weapons, must function directly under the CDS even while functional control over the nuclear warheads and the delivery systems comprising the «triad» remains with the civilian political leadership.

Aerospace, information warfare, cyber-security and issues like the management of the electro-magnetic spectrum, including frequency management, electro-magnetic compatibility (EMC), electro-magnetic interference (EMI), electronic emission

policy (EEP) and the offensive employment of non-communications devices such as radars for electronic warfare, should all be the legitimate domain of the CDS and HQ IDS. It is time to set up a tri-Service Aerospace and Cyber Command as well as a Special Forces Command to meet emerging challenges in these fields and to better manage all available resources. A tri-Service Logistics and Maintenance command has also been long overdue.

Similarly, on the non-operational side, training institutions such as the National Defence College, the College of Defence Management and the National Defence Academy and organisations like the Armed Forces Medical Services, Canteen Stores Department and a host of others must be placed under the direct command of the CDS for better synergy in their functioning and optimum exploitation of their potential. International experience shows that such reform has to be imposed from the top down and can never work if the government keeps waiting for it to come about from the bottom up.

The Chiefs of Staff Committee (COSC) is an experiment that can only be described as partially successful. It is driven by single-Service requirements and perceptions. The Chairman, COSC, normally the senior most serving chief, has no executive authority over the other two Services. The COSC works primarily by consensus and cannot make hard decisions that would be binding on all the services. During peace time, turf battles and inter-Service rivalries rule the roost and minor, inconsequential issues take up most of the time available for discussion.

War-time decisions require professional understanding, a bi-partisan approach and, often, hard compromises. As Winston Churchill famously said, "Committees cannot fight wars." It is time to implement the GoM recommendation to appoint a CDS. Theatre commands are but one step further in the quest for synergy in operations. It should be a short step, but the way the Indian system works, it is likely to be a very long one indeed.

Often during war, the fate of an entire campaign can hinge on a single decision. Such a decision can only be made by a specially selected defence chief and not by a committee like the COSC that operates on the principle of the least common denominator. Military history is replete with examples of how such decisions changed the course of a war. Eisenhower's decision to launch the Normandy landings in the face of continuing rough weather and MacArthur's decision to land at Inchon against stiff opposition from virtually his entire staff, could not have been made by committees. All other major democracies have opted for the CDS system. India cannot ignore it any further except at great peril. It is an idea whose time has come.

OPINION

Air Marshal Brijesh Jayal cautions that the

Rafale and surgical strike political-gaming must not hurt our ability to wage war

Carl von Clausewitz was a military theorist who stressed the moral and political aspects of war. His treatise 'On War' is considered standard text to military doctrine and is study material in military leadership establishments across democracies. The text has many aphorisms, of which the most famous is: "War is the continuation of politics by other means." Politics here refers to the larger principle of governance, of guiding or influencing government policy with the welfare of the state in mind.

It is unlikely that a majority of practitioners of politics in our democracy today would have heard of this text, let alone have enlightened themselves on its finer points. Considering the current level of political discourse, it is doubtful whether they even comprehend the difference between this higher aim of politics and electoral politics, which today appears far removed from the interest of welfare of the state.

The reason why this text needs to be mentioned is because, of late, Indian electoral politics, through which the process of national governance is born, appears to be wounding the state's instrument of war, namely the military. In this convoluted manner, our ability to wage war is becoming a victim of politics by other means.

This brings us down from the exalted heights of a classical text to the mundane level of national dailies, where two competing narratives are currently vying for public attention.

The first was a directive issued to universities and higher educational institutions across the country by the University Grants Commission to observe 29 September as the 'Surgical Strike Day' and to "celebrate this in a befitting manner by conducting various activities."

It will be recalled that on this day two years ago, in response to a militant attack army personnel in J&K in which 19 army personnel lost their lives, the Indian Army had undertaken surprise attacks by special forces on seven terror launch pads along the Line of Control and inflicted significant damage. Such operations by their very nature carry an element of surprise, are conducted by special forces and carry a very high level of risk to those involved. They are also meant to convey a subtle message to the adversary – but are not advertising tools.

This action in later public discourse came to be termed 'surgical strike', and, rather than be considered as another tactical action by the army in the face of a decades-long proxy war in J&K, it seems to have been adopted by the government as a landmark event justifying commemoration. By glorifying one specific tactical action over others, we undermine the dangers, challenges, successes and sacrifices that our soldiers are facing and making on a daily basis including the conduct of such high risk actions where necessary. This may appear good political optics, but it is bad for the morale of those in the daily line of fire.

Regrettably, a tactical commando action has now become the subject of political one-upmanship. This bodes ill not just for the morale of the force but also their respect for the moral values of the civil leadership under whose authority they derive their legitimacy to serve and fight, and to kill if necessary.

The second narrative being played out is the very vocal and concerted attempt by the opposition to label the recent government-to-government agreement for the purchase of much needed combat aircraft to shore up IAF's seriously depleting force level, as involving corruption and cronyism.

So ugly has the Rafale debate become that the IAF top brass have indirectly jumped into an unfortunate political fray.

It may be recalled that towards meeting the IAF's requirement for a medium multi-role combat aircraft, the MoD had floated a global tender for 126 aircraft in 2007 after having floated the first 'Request for Information' as early as 2004. After comprehensive technical and flight evaluations, the GOI shortlisted two aircraft and after due commercial process, identified the French Rafale as the "winner" in 2012.

There are differing narratives on why contract negotiations for the Rafale did not make headway while the previous government was in saddle and with the change of government the original proposal to buy 18 aircraft outright and licence produce 108 at HAL was dropped and the government-to-government route chosen to make an urgent outright purchase of 36 aircraft. It is worth noting that virtually all major aircraft purchases in the recent past have been through the government-to-government route, examples being the C-17 Heavy Lift transport, the C-130J Hercules, P-8I Maritime Reccee aircraft, Chinook heavy helicopter and others. The principal reason is that a Bofors syndrome still haunts our defence procurement system and few are willing to stick their necks out and take decisions where the open tender route is concerned.

This action of the government has now been faulted by the opposition on many counts, not least of which are "crony capitalism, higher prices, corruption", with a leader of the principal opposition party dubbing the PM a thief. So ugly has this debate become that, for the first time, top brass of the IAF have come out publicly in favour of the process, thus indirectly jumping into an unfortunate political fray.

Ironically, amidst all the finger pointing, the one issue that seems to be of least concern to all is why it should have taken national governance eight long years (fourteen years if RFI is considered the starting point) to have taken a decision when the IAF is seriously deficient of its combat squadron strength. This clearly shows how our politics is about other peripheral issues and not about keeping national security and welfare of the state foremost in mind.

It is not the purpose of this piece to delve into which side is right or wrong in either of the narratives mentioned above. It is only to remind ourselves that the armed forces are not only watching these developments with dismay but no doubt debating it and following it on social media and perhaps being driven by one side of the argument or the other. Since both these narratives relate to the respective armed service, its operation and leadership, any perception driven by other than professional agenda is harmful to the unity of the military, the morale of the forces, and their confidence in the civil leadership, whatever be its political colour. We then run the risk of introducing a dangerous cancer of politicisation in the military that is injurious to the health of civil-military relations and of our cherished democracy.

Dassault Rafales

It is imperative that political parties draw a mutually agreed, self-imposed line beyond which electoral politics will not stray into military affairs. Let any such issues instead be deliberated within constitutionally mandated institutions to ensure confidentiality, probity and accountability. In our bitterly fractured polity, whilst the temptation to take advantage when a political adversary appears on weak ground or to exploit a political opportunity may appear legitimate, let politics by other means not hurt our ability to wage war.

Contract signed for S-400 Triumf

On 5 October 2018 in New Delhi, Rosoboronexport (part of the Rostec State Corporation) signed a contract to supply India with the S-400 Triumf long-range air defence missile system (ADMS)."The S-400 supply agreement with India is a new landmark in the history of military-technical cooperation between our countries. The deal demonstrates the highest level of trust and understanding between India and Russia. I am sure that this agreement will also be a new impulse for strengthening and deepening our cooperation in civil industry," stated Head of Rostec State Corporation Sergey Chemezov.

"The main advantage of the S-400 lies in its versatility. The system is able to engage both all types of aerodynamic targets and ballistic missiles, up to intermediate-range ballistic missiles. The Triumf is far superior to its foreign counterparts in maximum engagement range and minimum engagement altitude, emplacement/displacement time, as well as in a number of other key characteristics.The contract for the supply of S-400 Triumf air defence missile systems to India is the biggest for the entire period of military-technical cooperation between Russia and India and the largest in history of Rosoboronexport" continued Head of Rosoboronexport Alexander Mikheev.

Nirmala Sitharaman visits France, Rafale production line

Indian Defence Minister Nirmala Sitharaman visited France in mid-October and held "wide ranging talks with her French counterpart Florence Parly on ways to deepen strategic and defence cooperation between the two countries". This was under the framework of the annual Indo-French defence ministerial dialogue and according to official sources, "both sides deliberated on co-production of military platforms and weapons by the two countries besides expanding cooperation between their armed forces, particularly in the maritime domain". Ms Sitharaman also visited the Dassault production facilities at Bordeaux where the IAF's Rafales are under production (*seen in photo with M. Eric Trappier, Head of Dassault Aviation*).

'Super Sukhoi' offered to the IAF

It is understood that the IAF has conveyed that acquisition of more Su-30MKIs currently in service with a dozen squadrons, is "not an option" to meet the new MMRCA requirement, the latter type to have next generation avionics, engines, radar and other state-of-the art systems. The IAF presently has 247 Su-30s in its inventory with another 25 expected to be inducted over the next two years, taking the total to 272.

However, it is learnt that the Russian OEM has offered upgradation of the Su-30MKI to 'Super Sukhoi' standard, making it an aircraft with "nearly fifth generation capabilities". This will become "an effective multi-role weapon system equipped with AESA radar, a more powerful electronic warfare suite, jamming systems, along with high performance engines" much of these incorporated in the Sukhoi Su-35.

Barak 8 LR-SAMs for Indian Navy

Israel Aerospace Industries have been awarded an additional US$ 777 million contract by the Government of India for the supply of Barak 8 LR-SAMs for installation on seven warships of the Indian Navy. The contract is with Bharat Electronics Limited (BEL) which serves as main contractor for the project. IAI CEO Nimrod Sheffer stated in Tel Aviv, "This deal reflects the direction in which IAI is heading: business focus, profitability and growth. IAI's partnership with India dates many years back and has culminated in joint system development and production."

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CNS on IAC-2 and the MRCBF

In an interview on eve of Navy Day 2018, Chief of the Naval Staff Admiral Sunil Lanba has said that the Indian Navy's quest for a second indigenous aircraft carrier (IAC-2) is still on track and the overall size and propulsion systems have been decided upon. This will be a 65,000 tonne CATOBAR (catapult assisted take off but arrested landing) carrier and conventionally powered. 'This is central to the Navy's philosophy to have three aircraft carrier battle groups".

As for the 57 multirole carrier borne fighters for which an RFI was issued some years back, the CNS said that "we should be able to issue the RFP towards the end of 2019".

India and Britain to enhance naval interaction

In enhancing their strategic relationship, India and the UK are planning to increase joint training between their navies through carrier battle group operations. During his visit to India UK's Permanent Secretary of Ministry of Defence, Stephen Lovegrove reportedly discussed training with Indian forces and particularly Carrier Battle Groups. Mr Lovegrove also said that the Indian and Royal Navies are in discussion on such cooperation as a prelude to the intended deployment of the Royal Navy's latest aircraft carrier, HMS *Queen Elizabeth* in the Straits of Malacca. Continuing, Lovegrove said, "I think the most relevant item is comparing practices and techniques of carrier battle groups, which will be happening when our new carrier (*Queen Elizabeth*) is fully operational... The two navies are discussing those types of cooperation on carrier battle groups."

On the UK playing a greater role in the Indian Ocean Region, he said, "We have enduring interests in the region. We want to continue to play our part in maintaining security here...the *Queen Elizabeth* will also represent some of our commitment to our trading relations. It's important for us that the Indian Ocean and South China Sea remain open to trade, navigation." Mr Lovegrove also referred to interaction of Special Forces, essentially the Royal Marines training with their Indian Naval counterparts (*Marcos*) in contested environments, on sea boarding techniques and interdiction. The UK Minister also referred to the IAF's interest in the Advanced Hawk, combat version of the Hawk AJT, presently operated by the IAF and Navy.

INS Viraat to become maritime museum

On 1 November 2018, the Maharashtra state cabinet approved a Rs 852 crore plan for the INS *Viraat*, now decommissioned, to be converted into India's first maritime museum-cum-marine adventure centre. The Indian Navy's former aircraft carrier will be grouted (grounded, sealed to the seabed with concrete and moored) seven nautical miles off the Malvan coast at Nivati rocks in Sindhudurg. This Konkan site was shortlisted for its tourism potential, apart from meeting the sentiments of the Indian Navy.

Indian President in Vietnam

Indian President Ram Nath Kovind on his visit to Vietnam on 20 November has stated that the country would expand maritime security cooperation with Vietnam. In his discussions with Vietnamese President Nguyen Phu Trong, Mr Kovind referred to further strengthening of bilateral cooperation in defence, atomic energy, oil & gas, and outer space research. It is understood that the two sides also discussed the situation in the South China Sea and implementation of India's defence related $500 million line of credit.

RFP for 12 minesweepers

The Indian Government is expected to issue an RFP for 12 mine-counter measure vessels (MCMVs or minesweepers), in collaboration with a foreign shipyard under a Rs 32,640 crore programme. South Korean shipyard Kangnam Corporation and Italian shipbuilder Intermarine are expected to compete for the project, both shipyards having responded to the expression of interest (EoI) for the project in May.

This is the third attempt in a decade to strengthen the Indian Navy's mine warfare capabilities. India would be without a single minesweeper till 2021, as per the March 2017 parliamentary report on the alarming decline in naval force levels. Facilities have been created at GSL for building glass-reinforced plastic hulls, a design that reduces the ship's magnetic signature, allows safer navigation through mine-infested waters.

According to Rear Admiral Shekhar Mital head of Goa Shipyard Limited (GSL) they hope to build the MSMVs in India. "The navy is finalising its qualitative requirements for the minesweepers before holding discussions with the defence ministry to take the project ahead". The Indian Navy's present mine counter-measure force consists of just two vessels, of the six acquired from the erstwhile Soviet Union in the late 1970s but requires at least 24 minesweepers to secure major harbours in the country.

HAL HTT-40 'spin tested'

The HAL HTT-40 was `spin tested', putting it through two turn spins and subsequently recovering with the appropriate controls, on 9 November 2018. The aircraft was piloted by Gp Capt KK Venugopal, DGM-Test Pilot (FW) from front cockpit and Gp Capt S Chaki, Sr Test Pilot (FW) in the rear. The stall testing was earlier completed with the project proceeding to spin tests. The final certification process of the HTT-40 has also progressed with completion of the fuselage Structural Test Specimen (STS) tests to 6g, as per the Preliminary Air Staff Qualitative Requirements (PSQR) some six months ahead of schedule.

R Madhavan, CMD, HAL said that the successful start of spin testing "gave a boost to HAL and also restored credibility of HAL in effectively designing a spin worthy aircraft". HAL's Aircraft Research and Design Centre (ARDC) had carried out extensive wind tunnel testing and mathematical model analyses to arrive at spin characteristics of the aircraft.

According to Arup Chatterjee, HAL's Director (Engg and R&D) "the PSQR test points have been met and the spin completion was the last metric which needed to be accomplished before the aircraft enters service. As a matter of fact, the HTT-40 exceeds the Preliminary Services Qualitative Requirements (PSQR) on most fronts and offers a technologically advanced product than its competitor" [*read Pilatus PC-7 Mk.II. It may be recalled that in October 2013, the then CAS had suggested that HAL should licence-built the remaining 106 PC-7 BTAs as follow-on to the 75 directly imported from Pilatus. HAL's then Chairman however gave full support to HAL designers to complete development of the HTT-40]*.

Detail design of the HTT-40 began in August 2013, with internal funding and the Defence Acquisition Council (DAC) has approved procurement of 70 such Basic Trainer Aircraft, from HAL. Production clearance for the HTT-40 is expected to be accorded by end of this year.

Foreign delegations visit HAL

Mohammed Ahmed Al Bowardi Al Falacy, Minister of State for Defence Affairs, United Arab Emirates visited HAL facilities in Bengaluru on 17 October 2018 when the UAE delegation was briefed on ongoing projects and taken around the Helicopter Complex, LCA Division and Hawk Final Assembly hangar. The Minister reportedly "evinced keen interest in the LCA".

Other recent visitors to HAL were Air Chief Marshal Masihuzzaman Serniabat, CAS Bangladesh Air Force and a senior delegation from the Kingdom of Morocco, who were given presentations on the Tejas LCA and Dhruv ALH.

DAC clears upgrade of 17 HAL-Dornier 228s

The Defence Acquisition Council (DAC) has approved midlife upgrade of 17 Dornier 228s of the Indian Coast Guard (ICG), at an approximate cost of Rs. 950 crore. The upgrades will be carried out by Hindustan Aeronautics Limited at their Transport Aircraft Division in Kanpur.

ICG is responsible for protecting national interests in the maritime zones of India which entails surveillance of approximately 2.01 million square kilometres of India's Exclusive Economic Zone (EEZ). ICG is also the nodal agency in India for maritime pollution response. The Coast Guard has a fleet of 39 Dornier 228s which play a pivotal role in various maritime tasks including surveillance, search & rescue, pollution monitoring and control. The DAC approval involves upgradation of these aircraft with state-of-the-art technology, spares, Special Maintenance Tools (SMT) and Special Test Equipment (STE). The DAC also approved equipping of three Dornier 228s with Pollution Surveillance Systems.

Naval Commanders' Conference

During the second edition of this years' bi-annual Naval Commanders' Conference on 2 November 2018, the Navy's modernisation plan was reviewed including induction of the new aircraft carrier, warships, nuclear-powered submarines, conventional submarines, re-vitalisation of aviation and sub-surface assets and induction of certain state-of-the-art weapons, sensors and equipment. Further, development of technical and support infrastructure for maintenance of these assets were also discussed in consonance with the 'Indian Naval Indigenisation Plan 2015-30', which has formulated requirements of the Indian Navy towards indigenous development of equipment and systems over the next 15 years.

10th Anniversary of IONS

IONS marked its 10th Anniversary at Kochi on 13-14 November 2018 in presence of Chief of the Naval Staff Admiral Sunil Lanba, who was accompanied by Vice Admiral AK Chawla, FOC-in-C, Southern Naval Command. The IONS Seminar was held at Lulu Bolgatty International Convention Centre, which was attended by Chiefs and senior representatives from navies of the most member nations. As a part of the anniversary celebration CNS also inaugurated the 'Tall Ships Sail Together' event on 14 November 2018.

In line with vision of the Prime Minister, SAGAR *(Security and Growth for All in the Region)*, the theme for the 10th anniversary seminar was *IONS as a Catalyst for SAGAR*, which is in consonance with India's 'Act East' policy and the nation's diplomatic, economic and military outreach in the region. 26 of the 32 countries which constitute membership of IONS participated in the seminar that focused on maritime issues pertaining to cooperative capacity-building to deal with common security concerns in the region. "The IONS initiative endeavoured to generate a flow of information among naval professionals so as to enable a common understanding of regional maritime issues and in turn facilitate generation of mutually beneficial maritime security outcomes."

Indian Coast Guard expansion plans

In their long term perspective plans (2017-2032) the Indian Coast Guard have projected a requirement to become a 190-ship and 100-aircraft force by 2023, with a total outlay of Rs 2.09 lakh crore

spread over the next 15 years. The Coast Guard presently have a total of 136 surface platforms, including 18 hovercraft, 39 HAL-Dornier 228s, 19 Chetak and 4 Dhruv helicopters. Phase II of the Coastal Surveillance Network (CSN), will have 38 more stations with static radars, forr mobile surveillance stations and integration of 13 radar stations of the VTMS (vessel traffic management systems) sites in the Gulfs of Kutch and Khambat

"IAF very much alive to emerging threats": CAS

In a recent interview, Air Chief Marshal BS Dhanoa, CAS has reiterated that the Indian Air Force is fully equipped to take on threats which occur from across the border be it in the realm of sub conventional or other domains, including the Indo-Pacific region. In this context, the US has been pushing for a greater role for India in the Indo-Pacific region even as a year ago India, Australia, Japan and the US gave shape to the long pending 'Quad' Coalition to develop news strategies. The Indian Air Force have the second largest fleet of C-17 Globemaster III heavy transport aircraft in the world which would play a strategic part in the region. The Chief also made indirect reference to China's rapid modernisation of its Air Force and also about the infrastructure development being carried out in the Tibet Autonomous Region (TAR), bordering India.

Air Force Commander's Conference

The second Bi-annual IAF Commanders' Conference of 2018 was inaugurated by the RRM Dr Subhash Bhamre at Air HQ (Vayu Bhawan) who stressed the PM's SAGAR *(Security And Growth for All in the Region)* Doctrine. "I commend the IAF leadership in promoting indigenisation in multiple ways. The IAF's resolve

to wholeheartedly support the indigenous LCA programme by committing to procure 18 squadrons of the LCA and its variants, endorsing its capability, is notable and praiseworthy. The RRM wished success to the innovative *Mehar Baba Swarm Drone Competition* as also complemented the IAF in beginning an Artificial Intelligence Project with participation of the private industry.

The CAS emphasised the need for robust training of IAF personnel to maintain The IAF's operational competence and reiterated the need for joint training with the Indian Army and Indian Navy "to enhance the synergy between the services for ensuring national security". Preparations for future inductions including the Rafale and Tejas fighters, Chinook and Apache helicopters, SPYDER and MRSAMs was also discussed. The Commanders later interacted with senior officials from HAL on issues pertaining to production, upgradation, indigenisation, design & development of various equipment and aircraft.

WAC Station Commanders Conference 2018

Air Chief Marshal BS Dhanoa, Chief of the Air Staff presented trophies to various Commanders of WAC at HQ Western Air Command at Subroto Park, New Delhi during WAC Commanders' Conference on 1 November 2018.

35 'decommissioned' Jaguars procured for 'spares'

The Government of India has reportedly identified sources to procure decommissioned Jaguar fighters to be used for spare parts in support of the current Jaguar fleet with the Indian Air Force. The IAF has six squadrons of Jaguars in its present order of battle, with the initial 40 received as 'fly aways' from the manufacturers in the UK the balance of some 110 produced under licence by HAL at its Bangalore Complex. The Jaguars are being upgraded in tranches to DARIN III standard which involves integration of EL/M-2052 AESA radar from Elta plus other advanced systems. Some 31 Jaguar airframes have been provided "without cost" by France and two by Oman while Britain has sold two trainer variants plus 381 types of spares at nominal cost.

IBSAMAR-VI Multi-National Maritime Exercise

Sixth edition of IBSAMAR, the joint Multi–National Maritime Exercise between the Indian, Brazilian and South African Navies, was held at Simons Town, South Africa in mid-October 2018. Aim of the exercise was to undertake collective training for participating navies, building interoperability and mutual understanding as well as sharing of best practices. The Indian Navy was represented by

the guided missile frigate INS *Tarkash*, guided missile destroyer *Kolkata*, long range maritime patrol aircraft P-8(I), Seaking and *Chetak* helicopters as well as a MARCOS detachment.

The exercise included both harbour and sea phases with various navigation and seamanship evolutions, surface weapons firing, force protection exercises, anti-piracy exercise, anti-air and anti-submarine exercise as well as flying operations.

JIMEX 18 maritime exercises

In mid-October 2018, Japanese Maritime Self Defence Force (JMSDF) Ships *Kaga*, an *Izumo*-class helicopter destroyer and *Inazuma,* a guided missile destroyer sailed to Visakhapatnam. The JMSDF ships under the command of Rear Admiral Tatsuya Fukada, Commander, Escort Flotilla-4 (CCF-4) participated in the third edition of Japan-India Maritime Exercise (JIMEX) with the ships of Eastern Fleet of the Indian Navy. JIMEX-18 is aimed to enhance interoperability, improve understanding and "imbibe the best practices of each other."

Participating IN ships included the INS *Satpura* multipurpose stealth frigate, INS *Kadmatt* anti-submarine warfare corvette, and INS *Shakti* fleet tanker. In addition, one submarine, a P-8(I) aircraft and a number of integral helicopters also participated in the exercise, under command of Rear Admiral Dinesh K Tripathi, FOC, Eastern Fleet.

General Atomics establishes India Office

General Atomics has established a new office at New Delhi and Pratesh Gandhi will serve as Director of India Strategic Development with responsibilities for directing business and strategic outreach efforts for General Atomics in India. As director of Strategic Development, Mr. Gandhi brings his experience in defence acquisition to support General Atomics strategic initiatives in India. He is a veteran Naval Aviator with over 3,000 flying hours on a variety of aircraft and has held flying, staff, and project office positions in the Indian Navy.

General Atomics is working with both governments in an effort to provide India with a variety of systems and technologies supporting national defence, including General Atomics' MQ-9B SeaGuardian Unmanned Aerial System, and electromagnetic aircraft launch and recovery systems (EMALS) for Indian aircraft carriers.

Honeywell launches commercial UAV IDAS in India

Honeywell is launching its commercial Unmanned Aerial Vehicle (UAV) Inspection and Data Analytics Service (IDAS) in India. Targeted at utilities and oil and gas companies, the new service is designed to help customers across the country improve and modernise critical structural inspections. Using UAVs to carry out this work and collate necessary data reduces the need for employees to conduct inspections manually, which in turn increases safety by eliminating many of the risks associated with dangerous structural examinations.

INS *Rana* at Korea for IFR

INS *Rana* which was on operational deployment to the North West Pacific region in wake of India's *Act East Policy*, visited Jeju in the Republic of Korea to participate in the International Fleet Review (IFR) held during 8-15 October 2018. During the seven day visit, INS *Rana*, commanded by Capt Atul Deswal was involved in a series of confidence-building engagements with Republic of Korea Navy and other foreign Navies participating in the IFR.

INS Rana visits Manila

The Indian Navy's guided missile destroyer INS *Rana* (D52), commanded by Capt Atul Deswal then visited Manila in the Philippines, docking at Pier 15, South Harbor on 24 October 2018 for a four-day goodwill visit. The ship was accorded a welcome ceremony upon arrival, with a PN band in attendance. The four-day visit included a series of confidence-building engagements between Philippine and Indian Navy personnel, such as shipboard tours, goodwill games and reciprocal receptions.

Indian Navy ship and aircraft in Indonesia for CORPAT

INS *Kulish*, a *Kora*-class missile corvette commanded by Commander Deepak Bali and an Indian Navy Dornier 228 of INAS 318 from Andaman and Nicobar command were at Belawan

in Indonesia for the 32nd edition of India – Indonesia coordinated patrol (IND-INDO CORPAT), held during 11–27 October 2018.

The Indian side was led by Commodore Ashutosh Ridhorkar, Naval Component Commander, A&N Command. Ships and aircraft from both countries carried out patrolling on respective sides of 236 nautical mile long International Maritime Boundary Line, followed by the closing ceremony at Port Blair in the Andamans.

GRSE to build 4 large survey vessels

Garden Reach Shipbuilders & Engineers (GRSE) has been given contracts worth Rs 2,435.15 crore for building four large survey vessels for the Indian Navy, covering their design, construction and supply. The first ship will be delivered within 36 months from date of signing contract and subsequent ships within an interval of six months for each vessel, the project completion being 54 months. The four survey vessels (large) shall be 110 m

long with a deep displacement of 3300 ton and complement of 231, capable of full scale coastal and deep-water hydrographic survey of ports and harbours, approaches and determination of navigational channels/routes.

Meanwhile, L-55 which is a Mark IV LCU vessel, built by GRSE, was formally handed over to the Indian Navy on 28 September 2018 at Kolkata. Currently 12 ships are under construction with nine ships (1 ASW Corvette, 3 LCUs, 5 FPVs) in advanced stages of construction, expected to be delivered to the Indian Navy by end 2019. Three ships of Project P17A advanced stealth frigates with an order value of Rs 192,934.60 million are being constructed using modular construction technology and various softwares such as Aveva Marine, NAPA etc. GRSE is in competitive bidding for 12 ships (4 Survey Vessels (Large) and 8 ASW SWCs) for the Indian Navy.

HSL to construct Diving Support Vessels

Hindustan Shipyard Limited at Vishakhapatnam will build two Diving Support Vessels (DSV) to augment the Indian Navy's submarine support operations on both coasts, to be based at Vishakhapatnam and Mumbai respectively. The DSVs would be 118 m in length and of approximately 7,650 tonne displacement. The DSV will facilitate various activities such as submarine rescue, under water inspection, testing or salvage, and recovery of objects/ ship aircraft lost at sea. The DSV is also equipped with a Deep Submergence Rescue Vessel (DSRV), which significantly enhances its Submarine Rescue Capabilities (*Representative image above).*

4th Offshore Patrol Vessel for Coast Guard

Shipbuilders L&T launched their fourth Offshore Patrol Vessel (OPV) ahead of schedule for the Indian Coast Guard on 2 November 2018 at Kattupalli Shipyard, near Chennai. This is fourth in the series of seven Offshore Patrol Vessels (OPV) designed

and constructed by L&T for the Ministry of Defence awarded in March 2015. In April 2018, L&T set a new benchmark by delivering the 'First of Class' OPV named ICGS *Vikram* ahead of schedule, followed by the second OPV, ICGS *Vijaya* in August 2018. Third OPV, which was also launched in August 2018, is presently being readied for sea trials.

L&T has so far delivered 45 defence vessels to the Indian Navy and Indian Coast Guard, all these vessels comprehensively designed in-house at L&T's Warship Design Centre using sophisticated design and digital analysis tools. The Floating Dock FDN-2 for the Indian Navy, designed and built for the first time in India, was delivered in March 2018 and is now fully operational. Further, 42 Interceptor Boats have been delivered from the series of 54 such boats being built for the Coast Guard and the remaining 12 are also ready for delivery, this programme being ahead of schedule by about two years.

Operational preparedness of the Indian Coast Guard

The MoD's Consultative Committee met on 17 November 2018 to review the Indian Coast Guard's (ICG) operational preparedness, infrastructure development and coastal security mechanism. During the meeting, Defence Minister Nirmala Sitharaman was briefed about the coastal security mechanism and

preparedness of the Coast Guard to tackle maritime emergencies, and in particular Coast Guard's initiative of making fishermen its "eyes and ears".

Ms Sitharaman reiterated that the ICG discharges 'a silent but invaluable service to the nation' and lauded the efforts of all personnel of Coast Guard for multiple successful search and rescue missions, humanitarian aid, assistance to fishermen and increased surveillance capability. She also laid emphasis on modernisation of the ICG with the definitive action programme 2017–22 which envisages acquisition of 43 ships, 20 aircraft and increased infrastructure.

New engines for T-72 tanks

The MoD has approved procurement of 1,000 engines for the Indian Army's Russian-origin T-72 tanks, estimated at over Rs 2,300 crore, while also making a few amendments to the Defence Procurement Procedure to reduce timelines in acquisition of these. "The tank engines of 1000 BHP (brake horsepower) will be procured under the 'buy & make' category. After technology transfer, most of these engines will be made by the Ordnance Factories Board. The engines will enhance mobility, agility and acceleration of the tanks, making them more effective in battlefield," said an official.

Military Exercises with the US, Russia and Japan

Indian armed forces will conduct three major military exercises with the United States, Russia and Japan in keeping with its balanced and inclusive strategic construct. Taking their military cooperation forward, India and Japan held their first joint army exercise '*Dharma Guardian-2018*', at the Counter-Insurgency Warfare School in Vairengte, Mizoram, November 1 to 14, the Indian contingent consisting of troops from 6/1Gorkha Rifles, while the Japanese fielded troops from their 32nd Infantry Regiment.

"Emphasis was on increasing interoperability between forces from both countries. Both sides were to jointly train, plan and execute a series of well-developed tactical drills for neutralisation of likely threats that may be encountered in urban warfare scenario. Experts from both sides also held detailed discussions to share their expertise on operational aspects," said the Indian Army's spokesman.

The Indian Army will hold another exercise 'Indra' with their Russian counterparts at Babina, the Army's 5th Mechanised Infantry participating in this even as special forces from India and the US will be exercising on counter-terrorism skills in the '*Vajra Prahar*' exercise at Mahajan in Rajasthan.

Lockheed Martin and Tatas host F-16 Supplier Conference

On 9 October 2018, Lockheed Martin Corp. and Tata Advanced Systems Limited (TASL) hosted an F-16 industry supplier conference in Bangalore, involving current F-16 suppliers and prospective Indian industry partners for discussing opportunities on the F-16 programme. "The F-16 provides unmatched opportunities for Indian companies of all sizes, including micro, small & medium enterprises and suppliers throughout India, to establish new business relationships with Lockheed Martin, Tata and other US and global industry leaders," stated Vivek Lall, Vice President of Strategy and Business Development for Lockheed Martin Aeronautics. "Exclusive F-16 production integrates Indian industry into a US$165 billion fighter aircraft sustainment market."

Lockheed Martin has recently emphasised its commitment to India by announcing a significant initiative that positions TASL "to become the provider of F-16 wings for all future customers".

SASMOS delivered 1000th F/A-18 electrical panel assembly to Boeing

SASMOS HET Technologies Limited has delivered the 1000th F/A-18 Super Hornet electrical panel assembly to Boeing, "on schedule." SASMOS manufactures electrical panels for the F/A-18 Super Hornet and this delivery marks a significant milestone in the 'Make in India' initiative, "which underscored the importance of Indian manufacturers in building the future of aerospace and defence globally." SASMOS also produces mission-critical equipment and cockpit panel assemblies for Boeing's F-15 and F/A-18 fighter aircraft, and has delivered more than 3,000 F-15 panels to date.

Pratt & Whitney launch 'Industry Capability Enhancement' programme

Pratt & Whitney, a division of United Technologies Corp., has recently launched its *Industry Capability Enhancement* programme to support medium and small scale enterprises serving global aerospace majors through precision manufacturing and highly specialised engineering services from India. As part of this Pratt & Whitney organised a special training session with its suppliers Belcan and QuEST Global Engineering Services Pvt. Ltd., at its Hyderabad training centre 26-28 October, 2018.

90-seater Q400 for SpiceJet

Bombardier has delivered its first 90-seat Q400 aircraft to launch airline SpiceJet. "We are excited to induct the 90-seat Q400 aircraft into our fleet," stated Ajay Singh, Chairman and Managing Director, SpiceJet. "The additional seats and performance improvements will result in substantial reduction in unit costs and we will also be able to address our market needs in the regional space."

In related news, SpiceJet, operated its first daily direct flight on the Kolkata-Pakyong (Gangtok)-Kolkata route on 4 October, being the first (and only) airline to offer daily direct air connectivity between Kolkata and Pakyong. SpiceJet launched a second flight connecting Guwahati with Pakyong on 16 October.

CDB Aviation and SpiceJet agreement for 3 B-737 MAX 8

China's CDB Aviation has signed an agreement with SpiceJet for long-term lease of three Boeing 737 MAX 8, the first such aircraft expected to arrive in Delhi in December 2018, with

the remaining two aircraft slated for delivery in September and November 2019. Meanwhile, KSU has initiated TaxiBot operations in Delhi International Airport the first commercial flight using the TaxiBot being of SpiceJet on 29 October 2018.

Funds infusion for Vistara

Tata Sons and Singapore Airlines have committed Rs 2,000 crore ($285 million) for Vistara even as the airline is expanding with order for 56 more aircraft, to be delivered between 2019 and 2023, with firm orders already for 13 Airbus A320neos and six Boeing 787-9s, while some 37 A320neos will be taken on lease. The fund infusion will help in pre-delivery payments to Airbus and Boeing, and help plans for international expansion.

With this infusion, Tatas and Singapore Airlines will have invested over Rs 3800 crore ($ 543 million) in equity into the JV till now. "Vistara invests in short-term and long-term initiatives to be more cost-competitive. We have digitised some of our internal processes and leveraged technology. Our new aircraft order, with deliveries starting from next year, comprises fuel-efficient aircraft. We will continue to keep a close watch on our expenses as we expand our wings," the spokesman said.

According to CEO Leslie Thng "the aircraft order would provide a fillip for profitable operations, as it would enable the airline to make its network denser and operate on more profitable international routes and we will use the A320 and A321 to boost our domestic network as well as to launch international destinations from Delhi. The Boeing 787 Dreamliners will be used on the medium- and long-haul international routes."

SpiceJet flights from Amritsar to Bangkok, Goa

SpiceJet have launched two daily flights from Amritsar to Bangkok and Amritsar to Goa, with services beginning on 6 November. Lauding the initiative, Punjab's Chief Minister Captain Amarinder Singh said there was a huge potential for tourism in Punjab, which State expects increased traffic to Amritsar which is visited by a large number of Indian and foreign tourists.

GECAS contract with Vistara for 7 A320neo

GECAS has signed a lease contract for seven A320neos to enter service with Vistara, the joint venture airline between Tata Sons and Singapore Airlines, following deliveries from Airbus in the latter part of 2019 and continuing into 2020.

Air Deccan, Air Odisha operations

The government may well withdraw the routes allotted to Air Deccan and Air Odisha under the regional connectivity scheme UDAN, "if they fail to operate on routes given to them." The two airlines, citing lack of funds and pilots, have only operated flights to just 10 of the 84 routes originally awarded. Under the first round of UDAN, some 70 airports including 31 unserved and 12 under-served ones, were to be air connected. Five airlines won bids to operate UDAN flights on 128 routes with these two airlines getting 84 routes.

A Civil Aviation Ministry official stated that the routes will be bid out again and "we expect that serious airline operators will fly these routes". However, experts have opined that "lack of planning in terms of choice of routes and manpower was the main reason behind bad shape of the airlines". Without much capital, these two airlines had leased four 19-seater Beechcraft 1900-Ds which are "a maintenance nightmare for any airline. Spare parts are hard to find, and there is no adequate support system. Engine manufacturers have no incentive to create an ecosystem, with just a handful of aircraft flying. Even engineers and pilots do not see a bright career prospect in training for an aircraft that is not much in use". *Meanwhile, HAL has built two new Dornier 228s for the civil market which are available for commercial operation.*

Wow Air to connect Delhi with Vancouver

Icelandic long-haul budget carrier Wow Air, which is set to commence flight services to India from December, plan to fly direct to Vancouver from Delhi, starting June 2019, the proposed flights to be operated thrice a week. Wow Air has announced inaugural fares starting Rs 21,999 for economy class and Rs 63,610 for business class tickets on the New Delhi-Vancouver flight. The transatlantic airline had earlier announced services from New Delhi to multiple destinations in North America and Europe through its Reykjavik hub in Iceland from December.

GSAT-29 communication satellite launched

India's GSAT-29 communication satellite was successfully launched by the second developmental flight of Geosynchronous Satellite Launch Vehicle MarkIII (GSLV MkIII-D2) on 15 November 2018 from the Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota. GSLV MkIII-D2, carrying the 3423-kg GSAT-29 satellite lifted off and 17 minutes later, the vehicle injected the satellite into Geosynchronous Transfer Orbit (GTO) as planned.

ISRO's Master Control Facility at Hassan then assumed control of the satellite and three orbit raising manoeuvers were executed to position the satellite in Geostationary Orbit at its designated location. GSLV Mk III is a three-stage heavy lift launch vehicle developed by the Indian Space Research Organisation (ISRO). Two massive boosters with solid propellant constitute the first stage, the core with liquid propellant form the second stage and the cryogenic engine completes the final stage.

Appointments

Ajit Doval takes over as head of 'Strategic Policy Group'

National Security Advisor Ajit Doval has replaced the Cabinet Secretary as Head of the Strategic Policy Group (SPG), a mechanism first notified in April 1999 to assist the National Security Council (NSC) in strategising on matters dealing with external, internal and economic security of the country. While the SPG as notified in 1999 was a 16-member body, the new notification makes this an 18-member body with the cabinet secretary and vice-chairman of NITI Aayog as the new members.

Others who remain part of SPG are Chief of the Army Staff, Chief of the Naval Staff, Chief of the Air Staff, RBI governor, secretaries of external affairs, home, defence, finance, defence production, revenue, atomic energy, space, besides the Scientific Adviser to Defence Minister, Secretary (R) in Cabinet Secretariat and the Intelligence Bureau chief.

Air Marshal Pradeep Padmakar Bapat takes over as AOA

Air Marshal Pradeep Padmakar Bapat has taken over as Air Officer-in Charge Administration (AOA) on 1 November 2018. Commissioned in the Administrative Branch on 28 May 1983, the Air Marshal is a post Graduate in Zoology, has served as a Fighter Controller, Senior Administrative Officer and Chief Administrative Officer of a fighter base. He was

member of the IAF team which participated in the joint exercise *Golden Eagle* with the South African Air Force at Hoiedspruits in South Africa. Prior to being appointed as AOA, he was Director General (Works & Ceremonials).

Air Marshal MSG Menon appointed DG Works and Ceremonial

Air Marshal MSG Menon has been appointed Director General Works and Ceremonials at Air Headquarters. The Air Marshal was commissioned in the Administrative branch in December 1982, is a Category 'AYE' Air Traffic Controller and has commanded an operational radar unit at a major flying station. He was member of the first UN Mission to Sudan, has served as Chief Administration Officer at Air Force Station Jalahalli, was Director National Defence University, also Commandant, Air Force Administrative College, Principal Director Ops (Air Traffic Services) and ACAS (Org & Ceremonial).

Pratyush Kumar to lead Boeing Defence Programme

Pratyush Kumar, President of Boeing India, has been selected to lead the iconic F-15 fighter aircraft programme in the United States, "focussing on further expanding the business of F-15 in the US and across the globe". As Boeing's senior in-country leader, Kumar has for over five years advanced Boeing's activities in India across its three business units: Boeing Commercial Airplanes, Boeing Defense, Space & Security and Boeing Global Services "while building strong relationships with the government and industry". During his tenure, Boeing launched a rapidly growing engineering and technology centre in Bangalore to drive innovation, scaled up its aerospace supply chain, established a joint venture in Hyderabad with Tata to manufacture fuselages for the Apache attack helicopter, established Boeing Defence India to serve customers locally, finalised the sale of both Apache and Chinook helicopters to the Indian military and converted options for the P-8I maritime surveillance aircraft to firm orders.

Lt Gen P S Rajeshwar is Chief of Integrated Defence Staff to Chairman, COSC

Lt Gen PS Rajeshwar took over as the Chief of Integrated Defence Staff to Chairman, COSC on 1 November 2018. He was commissioned in the Regiment of Artillery in December 1980, holds a Masters in National Security Administration from the NDC, Philippines, has considerable operational and staff experience, serving on operational assignments at high altitude area counter insurgency in the north east and counter terrorist operations in J&K, apart from United Nations Peacekeeping Operations.

The General has commanded an Artillery Regiment during Operation *Parakram*, an Infantry Brigade on the Line of Control, a Counter Insurgency Force in Jammu and Kashmir and a Corps in the desert sector. Prior to assuming this appointment Lt Gen PS Rajeswar was Director General (Perspective Planning) at the Integrated HQ, Ministry of Defence.

Enhancing Indian Army firepower with The K9 Vajra, M777 and artillery tractors

Defence Minister Nirmala Sitharaman with Army Chief Bipin Rawat and K9 Vajra during the induction ceremony

Indian Army inducted the first batch of its 'state-of-the-art' artillery systems at Devlali Field Firing Ranges in Nasik on 9 November. The artillery gun systems included the M777 Ultra-Light Howitzers, K9 Vajra tracked self-propelled howitzer and a 'Composite Gun Tractor' for towing some existing guns in service: each tractor is fitted with a crane that can handle ammunition weighing up to two tons.

The induction ceremony was attended by Defence Minister Nirmala Sitharaman and Army Chief General Bipin Rawat. As Sitharaman stated, "state-of-the-art gun systems have been inducted at Devlali Field Firing Ranges in Nasik. The recently inducted M777s can be heli-lifted in mountainous areas. While negotiations to buy the M777 Ultra-Light Howitzers started in 2006 with the US Government, the contract was signed with the USA for the supply of 145 ultralight howitzer M-777, of which 25 will be brought to India in combat-ready condition. The remaining 125 guns will be made in India with Mahindra Defence. The third piece of equipment, inducted along with the guns, is the Common Gun Tower, a 6x6 vehicle with cross country capability. These Common Gun Towers are made by Ashok Leyland."

The Army's artillery modernisation plan has been moving very slowly since a couple of decades but picked up pace when the Indian Army issued a Request for Proposal (RFP) for 100 155mm / 52-calibre SP guns in 2011. In fact, more than three decades have passed since a modern artillery system was inducted by the army, the last being the Bofors FH77B02 in 1987.

The first regiment of K9 Vajra tracked artillery guns manufactured by the Indian private sector (but procured from South Korea), is expected to be formed by July 2019. "The gun has a maximum range of 28-38 km and is capable of burst firing three rounds in 30 seconds, intense firing of 15 rounds in three minutes and sustained firing of 60 rounds in 60 minutes", stated Colonel Aman Anand, of the MoD. The Army is to raise seven regiments with a total of 145 M777s. Five guns each will be delivered to the Army beginning August 2019 and the entire process will be completed in 24 months. The first regiment will form by October next year.

BAE Systems and Mahindra on the M777

"The Indian Army is receiving an extremely reliable and battle-proven artillery platform," stated Joe Senftle, vice president and general manager of BAE Systems' weapon systems business. "The M777 brings a new level of capability to artillery units by offering rapid deployment and extreme accuracy. It can operate in areas that are difficult to access but is also very easy to maintain."

"The M777 ULH is more than a very effective piece of artillery technology," stated Nik Khanna, Managing Director India, BAE Systems. "With the M777 programme, BAE Systems has made the first step of our substantive Make-in-India commitment, which includes our pledge to develop a network of Indian suppliers for our global supply chain and deepen our relationship with industry in India. We are committed to a strong and collaborative working relationship between BAE Systems, the Indian Armed Forces and Indian industry."

"This is a landmark event with the first M777s being delivered to the Indian Army. It is a product of our long-standing business partnership with BAE Systems," stated SP Shukla, Group President - Aerospace & Defence Sector, Mahindra Group, and Chairman - Mahindra Defence Systems. "In this programme every M777 howitzer has value addition from Mahindra Defence. I believe that this is the first step towards Make-in-India with much bigger programmes to follow."

25th Edition of SIMBEX 18

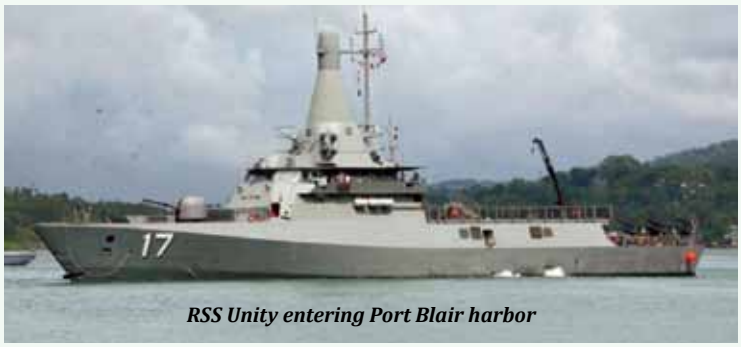
25th edition of SIMBEX, an acronym for *Singapore-India Maritime Bilateral Exercise* was held 10-21 November 2018 off the Andaman Sea and Bay of Bengal. Bilateral cooperation between Singapore and India began in 1994 when RSN ships began training with the Indian Navy. This has in the recent years evolved into a high stakes exercise with both nations attaching premium in terms of time, complex advanced exercises and type of platforms involved.

In marking the Silver Jubilee of SIMBEX, both navies undertook exercises over an extended geographical span. The Indian Navy was represented by the *Ranvir*-class destroyer INS *Ranvijay*, two Project 17 multirole stealth frigates INS *Satpura* and INS *Sahyadri*, the Project 28 ASW corvette INS *Kadmatt*, the Project 25A missile corvettes INS *Kirch*, the OPVs INS *Sumedha* and INS *Sukanya*, the Fleet Support Ship INS *Shakti*, a *Sindhughosh*-class submarine, INS *Sindhukirti*, P-8(I) LRMP/ASW aircraft from INAS 312, Dornier 228 MPAs from INAS 311, Hawk AJTs from INAS 551 and integral helicopters such as the UH-3H, Seaking Mk.42B, Seaking 42C and Chetak utility helicopters.

Dr Ng Eng Hen, Defence Minister of Singapore was present during the SIMBEX 18, hosted by Admiral Sunil Lanba, Chief of the Naval Staff of Indian Navy who welcomed Rear Admiral Lew Chuen Hong, Chief of the Singapore Navy (RSN) and officials from Defence Ministries of both the nations accompanying Singapore's Defence Minister.

In June 2018, on side-lines of the Shangrila Dialogue, Prime Minister Narendra Modi and Prime Minister Lee Hsien Loong of Singapore had signed numerous agreements including those under the 'Defence and Strategic Partnership Sectors'. Both counters agreed to undertake continuous and institutionalised naval engagements in their shared maritime space including establishing maritime exercises with like-minded regional / ASEAN partners. The Prime Ministers of both countries had commended the armed forces for maintaining a high level of annual exercises, goodwill visits and professional exchanges. The previous edition of the exercise was held off Singapore in the South China Sea in May 2017.

The Republic of Singapore Navy was represented by two *Formidable*-Class stealth frigates, RSS *Formidable* and RSS *Steadfast*, one Littoral Mission Vessel, RSS *Unity*, two Missile Corvettes, RSS *Vigour* and RSS *Valiant*, an *Archer*-class submarine, RSS *Swordsman*, a Deep Sea Rescue Vehicle (DSRV), a Fokker F.50 maritime reconnaissance aircraft, embarked S-70B helicopters and Scan Eagle unmanned aerial systems.



RSS Unity entering Port Blair harbor

Navy Day, 2018

"Modernisation of the Indian Navy as per the MCPP and LTIPP"

Admiral Sunil Lanba, PVSM, AVSM, ADC, Chief of the Naval Staff

VAYU : The Indian Navy is reportedly progressing its indigenisation efforts in accordance with Plan 2015-30, augmented further by the Naval Aviation Indigenisation Road Map 2017-22. According to reports, the Navy's long term plan includes acquisition of 198 warships by 2027, 120 of them being 'capital warships', against the current inventory of 140 vessels of which just 70 are offensive combat platforms. Please elucidate on this steps being taken to bridge this 'gap'.

CNS : Modernisation of the Indian Navy is undertaken in accordance with our Maritime Capability Perspective Plan (MCPP) and the Long Term Integrated Perspective Plan (LTIPP). Towards maintaining a well-balanced, multi-

Multiple warships of the Indian Navy on exercises at sea

dimensional force with modern surface, sub-surface and air assets for defending our national interests against potential threats, the present force levels are being augmented and modernised. The future naval force is envisaged to retain the capability to undertake missions across the spectrum of conflict in an increasingly challenging and dynamic security environment.

The Indian Navy accords high priority to developing indigenous shipbuilding capability. Presently, 34 ships and submarines are under construction for the Navy, of which 32 are being built in various Indian shipyards.The new aircraft carrier, IAC-1, is under construction at CSL, Kochi. Four destroyers of Project 15B Class, and seven frigates of Project 17A Class are also under construction in shipyards at Mumbai and Kolkata which will be delivered commencing from 2021. Five Naval Offshore Patrol Vessels are under construction at Reliance Naval and Engineering Limited, Gujarat. In addition, *Kalvari*-class submarines are under construction at Mazagaon Dock Ltd. The first submarine of the Project, INS *Kalvari*, was commissioned on 14 December 2017 and the second is likely to join our fleet soon.

Contract for eight Landing Craft Utility Mk.IV ships was concluded with GRSE and the first four ships have already been commissioned, while the next four ships are scheduled in the coming months.

Further, *Acceptance of Necessity* (AoN) has been accorded for 54 ships and six submarines. These platforms will replace the existing ships and submarines, while also augmenting our force levels.

Modernisation of the Indian Navy is dictated primarily by the principle of optimum balance in the capabilities required for various types of naval operations. It also caters for our present and future threat perceptions based on the assessment of security environment. Access to technologies and availability of resources also influence the physical realisation of modernisation plans. The ongoing modernisation aims to create a full range of capabilities for accomplishing missions across the entire spectrum of maritime threats and challenges. Our force levels will gradually increase to ensure that adequate assets, both in terms of capacity and capability, are available for maritime security of the nation.

We aim to be a 200-ship Navy in the coming decade.

INS Chakra, the Indian Navy's nuclear-powered attack submarine, on long lease from Russia

Potency at Sea : INS Kolkata launches BrahMos supersonic missile

VAYU : According to your statement made earlier this year, work on the Indigenous Aircraft Carrier (IAC-1) is progressing well and that the ship would join the Navy by 2020. Please give an update on the schedule for commissioning of the new INS Vikrant and which aircraft types will initially operate from this carrier.

CNS : Construction of Indigenous Aircraft Carrier (IAC-1) is underway at Cochin Shipyard Limited, Kochi. Presently, the hull construction has been completed and the ship is in advanced stage of outfitting. Ship construction has entered the trial phase with commencement of machinery trials from mid-2018. All the equipment, machinery and ship systems would first be evaluated in harbour followed by sea trials. The sea trials of the ship are expected to commence in early 2020.

IAC-1 is designed to operate 30 fixed and rotary wing aircraft, including MiG-29K, LCA, ALH and Ka-31 helicopters. We are sparing no effort to ensure that the ship joins the fleet in the next few years.

The new INS Vikrant (IAC-1) under outfitting at Cochin Shipyard, with sea trials to commence in early 2020

VAYU : In this context, an RFI for 57 multi-role carrier borne fighters (MRCBF) was issued in late 2016 and after examination of responses, the request for proposal (RFP) was to be issued to selected OEMs. When is this likely to take place, as selection of the type could impact on IAC-1 specifications?

CNS : The RFI of the MRCBF was hosted last year. Responses from the vendors have been comprehensive and are presently under examination. The aircraft selected would be such that changes required to the existing aircraft carriers to operate the aircraft, if any, would be minimal. The RFP is likely to be issued in 2019.

VAYU : Late last year you had stated that the Indian Navy's aircraft inventory would increase from the present 238 aircraft to 500 numbers within a decade. Can you kindly give an indication as to how many of these would be fixed-wing types, both for service on board the aircraft carriers as also shore based?

Kamov Ka-31 AEW helicopter

INS Vikramaditya with MiG-29Ks embarked

Boeing P-8I of the Indian Navy, with a quadrat of Harpoon missiles underwing, and aft bay open to reveal various stores.

CNS : Aircraft acquisition in the Indian Navy is planned to be undertaken in accordance with our capability development roadmaps, the Maritime Capability and Perspective Plan (MCPP) and Long Term Integrated Perspective Plan. The present MCPP caters for the capabilities that the Indian Navy seeks to induct by 2027. These capabilities would require phase-wise induction of Multi-Role Carrier Based Fighters, Long Range Maritime Reconnaissance and Anti-Submarine Warfare Aircraft, Ship-borne Multi-Role and Utility Helicopters.

In addition, Medium Altitude Long Endurance and High Altitude Long Endurance Remotely Piloted Aircraft are also needed to augment existing surveillance and patrol capabilities. The Indian Navy presently has a fleet of around 240 aircraft. With the induction of the various types of aircraft I have just mentioned, the total number of aircraft in the Indian Navy inventory, to meet our operational requirements, is likely to increase significantly in the coming decade. A large component of the naval air arm will be sea-based, and would operate from the aircraft carriers as well as other warships. The shore-based operations would be largely limited to surveillance and patrol aircraft and training squadrons.

VAYU : The Naval Light Utility Helicopter (NUH) has for long been seen as replacement for the obsolescent Chetak. In this context, it is encouraging that the MoD has very recently given the

HAL Chetaks embarked on IN warship at sea

go ahead for progressing the case for 111 NUH under the 'Strategic Partnership Model' as also acquisition of the first tranche of (24) multi-role helicopters. Will this requirement be fast-tracked considering the urgency?

CNS : Considering the urgent need for replacement of Chetak helicopters, the Naval Utility Helicopter is being actively pursued by the Indian Navy. The Expression of Interest have been issued to the OEMs and SPs in October 2018. The RFP is likely to be issued by June 2019. The Indian Navy envisages induction of these helicopters commencing 2024.

For the MRH case, Letter of Request (LOR) for Letter of Offer and Acceptance (LOA) has been issued to US DoD in October 2018. It is being endeavored to formulate and sign the LOA by mid-2019. The first batch of helicopters are likely to be delivered within 12 months of signing of LOA.

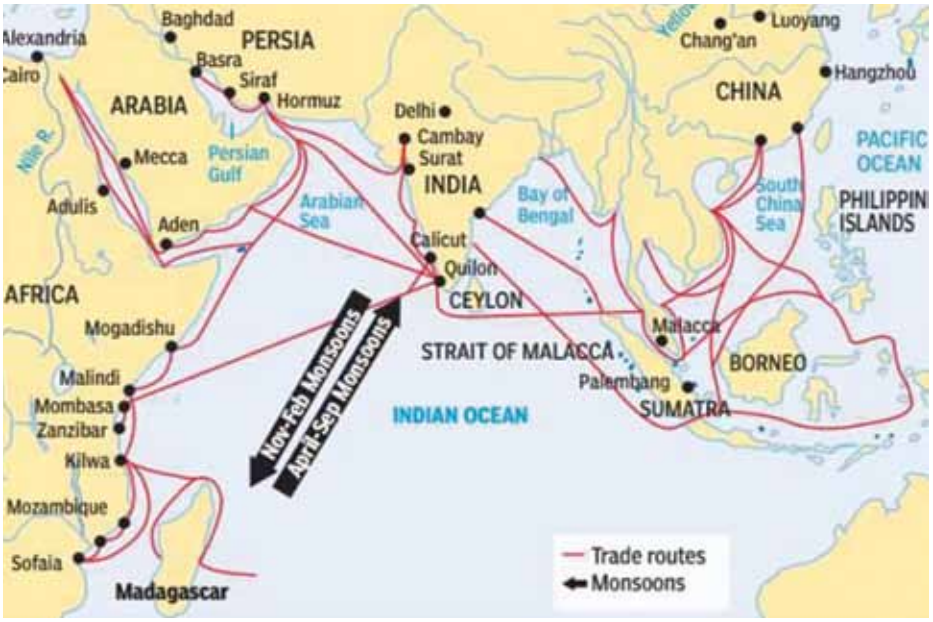
VAYU : You were at the Conclave of Chiefs and the Indian Ocean Naval Symposium (IONS) at Tehran during April 2018, this Indian initiative having grown into becoming a major naval forum. Kindly enumerate on some of the decisions taken to explore new avenues for naval cooperation in the region.

CNS : IONS is held once every two years and it also incorporates the Conclave of Chiefs. It is hosted by the 'Chair' of IONS. Last IONS was held at Tehran, Iran from 22 to 25 April 2018. The deliberations during the Conclave of Chiefs were aimed at deliberating Maritime security concerns of the Indian Ocean Region.

The Indian Navy has also supported efforts at IONS towards establishing standard procedures for enhanced effectiveness through participation in the IONS Working Groups on HADR, Information Sharing & Interoperability, and Maritime Security. We are currently steering the efforts on HADR as well as Information Sharing as the 'Chair' for these Working Groups. In recent months, the guidelines for HADR formulated by the IONS Working Group on HADR have been adopted by IONS. A table-top exercise has also been conducted at Visakhapatnam in September 2018 which was attended by 10 member nations.

We will also be hosting the 10th Anniversary celebrations of the establishment of IONS on 13-14 November 2018 at Kochi. As part of the celebrations a 'Seminar' with the theme 'IONS as a catalyst for *Security and Growth for all in the Region* (SAGAR)', a 'Tall Ship Regatta' and 'Release of Commemorative Stamp' will be undertaken. The Tall Ship Regatta envisages embarkation of 'Observers' as well as participation of Tall Ships from IONS Member and Observer nations, and will be conducted from Kochi to Muscat tracing the '*Project Mausam*' route.

Thank you, Sir !



An old trading map (500-1000 AD) based on wind patterns, showing India as the fulcrum, which has inspired 'Project Mausam'. ***(Image from Internet)***

Gp Capt JC Malik of Vayu with Admiral Sunil Lanba, Chief of the Naval Staff

[Images courtesy @ indiannavy and Captain Navtej Singh]

Significance of the 'Arihant'

Admiral Arun Prakash opines that the Indian Navy's first home-built, ballistic missile-armed submarine makes India's nuclear deterrence credible.

Prime Minister Narendra Modi's palpable pride at the recent completion of a "deterrent patrol" by the Navy's first home-built, nuclear-propelled, ballistic missile-armed submarine (termed SSBN), INS *Arihant,* is understandable. As a nation committed to "no first use" (NFU), it is of critical importance that an adversary contemplating a nuclear (first) strike should never be in doubt about the credibility of India's nuclear deterrent and the assurance of a swift, devastating response.

Given the kind of transparency provided by satellites and other technical means, the land-based legs of our nuclear triad (missile sites and air-bases) remain exposed to enemy attack. The best way for India to provide invulnerability to its deterrent, therefore, was to send it underwater, on a SSBN, the third leg of the triad. Once the submarine disappears underwater, it becomes virtually impossible to locate and can remain on patrol for months, with its ballistic missiles ready for launch on the PM's orders. This is the kind of credibility that *Arihant* and her sisters will provide India's nuclear deterrent in the future.

The successful completion of *Arihant's* maiden deterrent patrol will be analysed threadbare by analysts worldwide for clues and pointers. Apart from demonstrating that the submarine (after a reported mishap in 2017) is fully operational, it is also proof of crew proficiency in operating its nuclear-plant and other complex systems, establishment of standard operating procedures and functionality of the navy's crucial long-range underwater radio communication system. While this is a good augury, excessive jubilation or hyperbole, at this stage, could erode the credibility of the "third leg of the nuclear triad", for three reasons.

First, there is the issue of missile ranges. From a submarine patrol area in mid-Bay of Bengal, Islamabad is 2,500 km, while Beijing and Shanghai are over 4,000 km. Even from the northern-most edge of the Bay of Bengal, Kunming is 1,600 km and Chengdu 2,000 km. Therefore, to target cities and nuclear forces deep inside China or Pakistan, from a "safe haven", India needs a submarine-launched ballistic missile (SLBM) of 6,000-8,000-km range. The missile, reportedly, carried by the *Arihant* is the K-15, whose range falls below 1,000 km. SLBMs of longer range are, possibly the way, but they will equip *Arihant's* successors.

Second, India has, so far, followed an unorthodox system, in which the National Command Authority (NCA) manages the nuclear deterrent through a 'troika' consisting of the Strategic Forces Command (SFC), the Department of Atomic Energy and DRDO. While scientists are the custodians of nuclear warheads and help mate them with the

"With the INS Arihant, the Nuclear Triad is complete"

Prime Minister Narendra Modi received the crew of Strategic Strike Nuclear Submarine (SSBN) INS *Arihant* on 5 November. The submarine had recently returned from its first deterrence patrol, completing the establishment of the country's survivable nuclear triad.

Stressing the significance of the successful deployment of INS *Arihant* for the completion of India's nuclear triad, the Prime Minister congratulated the crew and all involved in the achievement which puts India among a handful of countries having the capability to design, construct and operate SSBNs. Noting that the indigenous development of the SSBN and its operationalisation "attest to the country's technological prowess and the synergy and coordination among all concerned" the Prime Minister thanked them for their dedication and commitment in realising this pioneering accomplishment enhancing immensely the country's security.

India has put in place a robust nuclear command and control structure, effective safety assurance architecture and strict political control, under its Nuclear Command Authority. It remains committed to the doctrine of Credible Minimum Deterrence and No First Use, as enshrined in the decision taken by the Cabinet Committee on Security in its meeting chaired by then Prime Minister Atal Bihari Vajpayee on 4 January 2003.

SFC's missiles and IAF fighter-bombers, the MoD and Raksha Mantri remain out of the loop.

Since *Arihant* and her future sisters will carry 'cannisterised' missiles, with pre-mated warheads, scientists have been eliminated from the chain, with custody and control of weapons devolving on the submarine's captain. No doubt, 'fail-safe' electronic permissive action links (PAL) have been installed to ensure instant compliance with an authorised 'launch' command from the NCA, while preventing accidental launch, structural and doctrinal changes are urgently required too. Which brings us to the third area of concern — an effective command and control structure to cater for this new capability.

The Chairman Chiefs of Staff Committee (COSC) is, notionally, a key functionary in the nuclear command chain, responsible to the PM for functioning of the SFC. With the operationalisation of *Arihant*, his role assumes greater criticality. Under existing rules, the appointment of chairman is tenable by the senior-most service chief who may (depending on his retirement date) serve for durations, varying from 30 days to 18 months. He discharges this duty on a part-time basis, in addition to running his own service. No other nuclear weapon state has such a farcical arrangement, and this certainly impinges on the credibility of our deterrent.

Given the gravity and magnitude of his responsibilities, in the context of the nuclear triad, the Chairman COSC, in his current avatar, needs to be urgently replaced either by a Chief of Defence Staff or a Permanent Chairman COSC, with an independent charter and a fixed tenure. This can come about only through strong political intervention that overrules entrenched bureaucratic opposition.

Apart from its strategic significance, the *Arihant* is a live manifestation of PM Modi's 'make in India' vision. A number of major private-sector companies contributed to the Advanced Technology Vessel (ATV) programme by mastering esoteric technologies to design and fabricate systems for the vessel. This navy-managed DRDO project has also spawned a huge country-wide indigenisation process by which small and medium industries have contributed components manufactured to high precision and reliability specifications.

The nuclear-reactors of our SSBNs will need re-fuelling (with fresh Uranium rods) every few years. The process being a rather lengthy one, India would require an inventory of at least 3-4 SSBNs to maintain one on deterrent patrol off each seaboard. A small force of nuclear attack submarines (SSN) would be required for protection of SSBNs and other roles. Thus, in a 50-60 year perspective, India should be looking at a nuclear submarine force of 8-12 SSBNs and SSNs.

While Indian scientists, engineers and designers have learnt a lot about the complex technologies involved in nuclear submarine construction to ensure that Arihant's successors are substantially made in India, there are key areas of R&D which call for urgent focus and where we may need assistance. These include propellant technology for SLBMs of inter-continental range; the design of a SSBN which will accommodate a battery of 16-24 such SLBMs; and the indigenous development of a powerful nuclear-reactor to drive a 10,000-12,000 ton SSBN.

India's nuclear triad and its accessories are going to cost the nation trillions of rupees in the decades ahead. It would be delusionary to imagine that a large military, and nuclear weapons, just by themselves, can assure India's security and bequeath "great power" status on it. On the other hand, a grand-strategic vision that integrates military power with a national security doctrine will certainly achieve both.

Rotorcraft of the Navy:
past, present, future

To combat increasing threat from submarines in the waters around India, the Navy had first acquired a version of the Alouette III for the ASW role to be embarked on board frigate-sized craft. For the MATCH (Medium-Range Anti-Submarine Torpedo-Carrying Helicopter) role, the HAL-built Alouette III carried two depth charges or two anti-submarine torpedoes, or one of each, and were fitted with a Harpoon attachment for secure-landing on a frigate-deck. However, the MATCH helicopter had no submarine-detection sensors, being guided to the target by its parent ship.

HAL Chetak: photo by Captain Navtej Singh

The first Westland Sea King Mk.42s for the Indian Navy were handed over in November 1970

The Alouette III still proved to be a most versatile and reliable helicopter, acquired in its HAL Chetak guise in increasing numbers by the Indian Navy, which utilised it for SAR duties, communication, light stores transfer at sea, staff transport as well as in the MATCH role. The Navy's fleet tankers, survey ships, *Leander*-class Indian-built frigates (INS *Nilgiri*, *Himgiri*, *Udaigiri* and *Dunagiri*) each carried an Alouette III, requiring the Navy to form INAS 321 ('Angels'), the squadron being commissioned on 15 March 1969 at Goa. In time, INAS 321 was transferred to INS *Kunjali*, on the sea-front in Colaba in the heart of the southern Bombay naval area. With over 20 helicopters on this unit's charge, the MATCH-role Alouette IIIs were then transferred to a newly-raised squadron, INAS 331, one of the helicopters being embarked on each of the first four *Nilgiri*-class frigates. In later years, Alouette IIIs were to also serve with the annual Indian scientific expeditions to the Antarctica.

Over the past half century and more, the Alouette III (HAL Chetak) has given yeoman service to the Indian Navy, which received nearly 80 of this light rotorcraft from HAL's Bangalore Division. The ASW limitations of the MATCH Alouette, however, were apparent and the Indian Navy sent a team to the UK in April 1969 to evaluate the much larger and highly equipped Westland Sea King dedicated for the ASW role with dunking sonar, doppler nay-systems, search radar and range of other specialist equipment. The Sea King also carried sonobuoys and four Mk.46 homing torpedoes, or four Mk.II depth charges. The

IN pilots and observers in the UK for Sea King conversion training

Admiral SM Nanda, CNS at the commissioning of INAS 330 at Dabolim

successful evaluation was followed by an order for six Sea King ASW Mk.42s.

The first IN batch of pilots and observers commenced conversion training on 27 September 1970 and the first two Sea Kings for the Indian Navy (IN 501 and 502) were accepted at Yeovil in England on 3 November 1970. These two Sea Kings arrived at INAS *Hansa*, at Dabolim in Goa on 23 March 1971 to become part of the new squadron INAS 330 (*Harpoons*) commissioned on 17 Apri1 1971, under the command of Cdr MP Wadhawan while the first Sea King landed on the INS *Vikrant* on 26 July 1971.

A second batch of pilots and observers returned after conversion training in the UK on 15 October 1971 and all six Sea Kings were soon in India, INAS 330 forming part of the *Vikrant's* air group along with INAS 300 and INAS 310. However, the Sea Kings were disembarked during the December 1971 war, being based at Bombay to carry out round-the-clock anti-submarine patrols off the strategic harbour.

The Sea King was considered as eminently suitable for the Indian Navy's requirements and a second batch of six Mk.42s was ordered, delivery being completed in 1974. A second Sea King squadron, INAS 336 (*Flaming Arrows*) was commissioned on 9 December 1974 at INS *Garuda*, Cochin, becoming 'standby' squadron for the *Vikrant* and also the conversion training unit. The last two of the *Leander*-class frigates built at Bombay, the INS *Taragiri* and *Vindhyagiri*, were designed to carry a Sea King (instead of the Alouette III) helicopter each and, accordingly, in June 1977, orders were placed for three Sea King Mk.42As, with Canadian-developed Recovery Assist Traverse (RAST) gear for deck haul down capability, permitting operation of these10-ton helicopters from small warships at sea.

In fact, the Indian Navy had pioneered and perfected such a concept, creating multiple 'mini' aircraft carriers in the bargain and bestowing great force multiplication. Then Commodore Ram Tahiliani, Director Naval Air Staff, worked closely with the two officers in-charge of the project, Captain Biloo Chaudhury and Cdr Joe Bakshi, and after developmental trials, the first Sea Kings were not only neatly embarked on the aft deck of these *Leander*-class frigates but two Sea Kings each were accommodated on

Sea King Mk.42B onboard INS Viraat

Westland Sea King Mk.42B (Photo by Angad Singh)

the newer warships being built for the I.N. at various Indian shipyards. The legendry Russian Admiral Gorskhov was actually winched down in a Sea King on an I.N. frigate during one of his not infrequent visits to India-and was mightily impressed.

The Westland Sea King proved an extremely useful ASW weapon-system and the Indian Navy planned further acquisitions. As a follow-on to the *Leander*-class frigates, Magazon Docks at Bombay started a building programme of the *Godavri*-class frigate, an enlarged, Indian developed version, designed to embark two Sea King helicopters, both of which could be accommodated in the enlarged hanger on the aft deck.

To meet requirements of the *Godavri*-class and also supplant the earlier Mk.42s, which had seen two decades of service, the Sea King Mk.42B was selected. Based on the RN's Sea King HAS Mk.5 with updated ASW equipment and the Advanced RR Gnome H. 1400-IT engines, the IN ordered 12 Sea King Mk.42Bs in July 1983, with options for eight more (duly converted). The Sea King Mk.42B anti-ship/anti-submarine helicopter featured the MEL I-band Super Searcher radar, GEC-Avionics, ASN-902 tactical sonobuoy processor, Sintra-Alcatel HS-12 panoramic dipping sonar, Chelton 700 sonics homing unit, Marconi Hermes ESM and a Louis Newmark automatic flight control system. The main surface weapon was the BAe Sea Eagle long-range anti-ship missile or, for sub-surface targets, homing torpedoes, depth charges, sonobuoys and marine markets.

Owing to protracted development of some of the advanced equipment and their integration, deliveries of the Mk.42Bs were delayed, but the bulk of these arrived by sea in late 1989. The first five Mk.42Bs completed acceptance trials at the intensive Flying Training Unit, the first two going to INAS 336 at INS *Garuda*, for training of pilots and observers. Some 40 former Sea King Mk.42 aircrew were trained in the UK, but training courses were later all conducted in India.

The Indian Navy also ordered six Sea King Mk.42C Commandos, being the utility transport version the Advanced Sea King, without the MEL radar, but incorporating a nose-mounted Bendix RDR 1400C radar. The Mk.42Cs were divided between the Western and Eastern fleets, operating in support of the newly-raised Indian Marine Security Force (IMSF), with one Mk.42C was embarked on the LST INS *Magar*. The Mk.42Cs were soon to be in action in Sri Lanka during 1987 and off the Maldives in November 1988, when Indian Marines were flown in to capture a mercenary ship on the high seas.

Sea King Mk.42C returning to IN aircraft carrier (photo by Captain Navtej Singh)

Kamov Ka-28 at INS Dega, Vizakapatnam (Photo by Angad Singh)

However, following the pattern of operating both British and Soviet equipment as an integral part of the overall ship-aircraft system, the Indian Navy also received a sizeable Soviet–origin ASW helicopter component. Five *Kashin*-class guided-missile destroyers were ordered for the Indian Navy in the late seventies, with each embarking an anti-submarine helicopter as an integral part of the ship's weapon system. Accordingly, eight Indian naval aircrew were sent to Kacha, near Sevastapol in Soviet Georgia, for conversion training during 1980. Seven Kamov Ka-25s were on order, all being ex-Soviet Navy and these (IN 571-577) formed the equipment of the new INAS 333 *(Eagles)* commissioned in December 1980. Each operated by a two-man crew, the Ka-25s had search radar, dipping sonar in the cabin rear and a canister of sonobuoys externally, and could carry a homing torpedo plus depth bombs. The Ka-25s were essentially for ASW, with secondary surveillance and SAR duties. Endurance was three hours, but limited night and all-weather sonar-dipping capability resulted in the Soviet Navy progressively replacing the Ka-25 by the far more capable Ka-27. The Indian Navy did likewise, ordering the export version of the later Kamov helicopter, the Ka-28, for operation from the latest *Kashin*-class GW destroyers, the INS *Ranvir* and *Ranijay*, and also eventually to supplant the Ka-25s aboard other vessels.

Four IN aircrew were given conversion training on the Ka-28 at Kacha, HQ of the Soviet Black Sea Fleet, from mid-August 1985, each crew comprising the pilot, tactical co-ordinator and ASW operator. The INS *Ranvir* was commissioned in May 1986 at Poti and the first Ka-28 (IN 581) embarked on this warship in July off Sevastapol, the ship then sailing to Bombay via Varna, Athens, Port Said and Aden, to arrive at its home port on 20 August. A total of 13 Ka-28s were ordered, including three equipped for the tuitional task. The first of the trainers arrived at INS *Hansa* in Goa on 1 July 1989, all conversion training thereafter taking place at this base.

The Ka-28 was considered a quantum jump ahead of the Ka-25 in terms of ASW capability and versatility, with an endurance in the ASW mode of over four hours. There is no commonality between the two types, the Ka-28 representing a 20-year technology leap, being equipped with advanced sensors, search radar, computers, dipping sonar, data-link and MAD equipment. The lower-centre fuselage houses sonobuoys, attack torpedoes and depth charges. The two TV3-117BK engines each of 2,225 shp, drive contra-rotating blades which have been shortened in length by comparison with those of the Ka-25 for better manoeuvrability on deck.

INAS 339 (*Falcons*) which initially operated Sea Kings, were re-equipped with the Kamov Ka-28s in May 1993, moving from INS *Kunjali* to INS *Hansa* thereafter. In 2004, the first Kamov Ka-31 AEW (Airborne Early Warning) helicopters were received by the Navy and these too were allotted to INS 339 which has a triple role : ASW, AEW and operational conversion training.

The Ka-31 is fitted with a NIIRT E-801M Oko (Eye) airborne radar, with the 6 x 1 metre planar array mounted beneath the fuselage. The 200-kg array is stowed flush with the fuselage for take-off and landing, only unfolding once the helicopter is above a certain speed and altitude. Once deployed, the radar can conduct a 360-degreee mechanical scan every ten seconds, and is able to simultaneously track up to 40 air-borne or surface threats. Detection ranges for fighter-sized targets are well in excess of

Kamov Ka-31 in hover (photo by Captain Navtej Singh)

Kamov Ka-31 with radar antenna deployed (photo by Captain Navtej Singh)

Ka-31s on INS Vikramaditya flight deck (photo by Captain Navtej Singh)

100 km, while warships can be detected out to the radar's horizon. Capable of operating between 200-300 km from a parent ship, the Ka-31 significantly extends the air-and-sea picture of a fleet. Target co-ordinates, speed and heading can be transmitted via encrypted data-link to a ship or shore-based command post. Although typically based on the frigates that they were delivered with, the IN now operates 14 Ka-31s, freeing up several to fly from other capital ships, including INS *Vikramaditya*.

With the increasing requirement for helicopter pilots, a training unit was commissioned at INS *Garuda* on 15 September 1971 as INAS 561, with four Hughes 300C helicopters and two Alouette Ills. The light Hughes 300s were phased out in the mid-1980s, and the present INAS 561 has half dozen HAL Chetaks for the training task at INS *Rajali* in Arakkonam.

In April 2007, the Indian Navy inducted the large amphibious transport vessel (or landing platform dock) USS *Trenton* (now INS *Jalashva*) along with six SH-3 helicopters which are embarked on this large ex-USN warship. This considerably augmented the IN's strategic sea-lift capabilities and at a displacement of 16,900 tonnes, became its second largest warship after the aircraft carrier.

The versatile but aging Sea King Mks.42/42A were finally retired from service in the IN some decade back and its replacement particularly for ship-based application, has not been forthcoming, inspite of the Navy's urgent follow ups.

Indian Navy Sea King Mk.42C during exercises with the fleet at sea (photo by Captain Navtej Singh)

Critical requirements : the NMRH and NUH

As per the Navy's *Maritime Capability Perspective Plan* (MCPP) as guiding document, some 300 new helicopters are to be acquired by the Indian Navy, the majority of them being the long awaited Naval Multi Role Helicopter (NMRH) which is required not only for replacing the phased out Seaking Mk.42/42A in various roles but to meet the increased requirement for ship-borne helicopters of this type. The selected helicopter would be mainstay for the Navy's anti-submarine, anti-ship warfare and allied tasks, the case for which was first initiated in 2002 and the acceptance of necessity (AoN) accorded by the Government of India on 13 August 2005 under the 'buy' category. To meet its comprehensive requirements, the Indian Navy has projected the need for 147 NMRH, comprising 90 for the anti-submarine warfare task and 33 for 'Special Operations', planned to be progressed under the *Strategic Partnership* model, to meet the requirement during the period 2025-2050.

The three shortlisted helicopters were Sikorsky's S-70B Seahawk, NH Industry's NH-90 and US Navy International Programme Office (NIPO) MH-60R, which is a Lockheed Martin programme originally known as "LAMPS Mark III Block II Upgrade'.

The MH-60R was originally known as 'LAMPS Mark III Block II Upgrade' when development began in 1993. Two SH-60Bs had been converted by Sikorsky, the first of which made its maiden flight on 22 December 1999. Designated YSH-60R, these were delivered to NAS Patuxent River in 2001 for flight testing. The production variant was redesignated MH-60R to match its multi-mission capability, using the same airframe as the S-70B but with major upgrades to its cockpit and avionics plus modifications to the tail wheel to ease handing on a ship deck. The MH-60R was formally deployed by the US Navy in 2006.

The first IN's RFP was retracted on 12 January 2007 as all OEMs were considered "non-complaint" at the technical evaluation stage itself, relating to the maximum all up weight (AUW) and endurance for the ASW task. A second RFP was issued on 29 August 2008 which was once again responded to by the same three OEMs, the bid of NIPO however being rejected as this was considered to be a 'hybrid case' with respect to the procurement procedure. This was attributed to the takeover of Sikorsky aircraft by Lockheed Martin which impacted on price negotiations as the MoD's Commercial Negotiation Committee had to deal with new management.

The US Administration reportedly offered the S-70B Seahawk to India under G2G, also regarded as a foreign military sales programme. At the same time, the commercial bid of NHI was returned 'unopened' owing to extraneous reasons and the DAC directed that this case now be progressed solely with Sikorsky and price negotiations thereafter commenced, Sikorsky offering its "best and final offer" on 1 June 2016, which expired on 30 September 2016, with the OEM expressing inability to extend the validity of its commercial bid any further. This dilemma was compounded by the CNC then recommending retraction of the RFP itself referring to the higher price compared to the 'bench marking'.

However, as the requirement to induct the NMRH was considered 'critical' the Defence Minister's approval was sought to progress negotiations for one of the two options, in effect clearing procurement of 24 MH-60R helicopters through the FMS route, these including eight helicopters under the option clause. Several warships commissioned after 1997, including the INS *Delhi* and *Brahmaputra, Shivalik*-class, *Kolkata*-class, *Kamorta*-class and the aircraft carrier INS *Vikramaditya* have been operating without integral air ASW capability which has adverse impact on war fighting potential of the Fleet.

LM/Sikorsky MH-60R, originally LAMPS Mark III Block II Upgrade

Just 10 days before the long awaited 2+2 India-US strategic dialogue on security, on 25 August 2018 the Defence Ministry's DAC approved procurement of 24 Lockheed Martin-Sikorsky MH-60R ('Romeo') multirole helicopters for a reported Rs 13,000 crores from the US under a Government-to-Government contract.

The G-to-G deal for 24 MH-60Rs will give the Indian Navy some relief even as acquisition of the 123 follow on helicopters of this type is to be executed under the 'strategic partnership model', with a global tender expected to be floated in 2019. These NMRH are to operate not only from the indigenous aircraft carriers (IAC) but also the present INS *Vikramaditya*, and various destroyer-types *(Delhi*-class, *Kolkata*-class and *Visakhapatnam*-class) and equip the Marine Commando Flight currently operating Seaking Mk.42Bs and UH-3Hs, the latter on INS *Jalashwa*, the amphibious transport dock.

Naval Utility Helicopters (NUH)

Equally urgent has been needed to meet the Navy's requirement for utility helicopters (NUH) to supplant its present, and obsolescent, single-engined HAL *Chetaks* (Alouette III) which have been in service for nearly half a century. An excess of 300 units were built by HAL, the company upgrading this light helicopter and continuing low rate production for various air arms in India over several decades. The HAL *Chetak* continues to serve with all branches of the Indian Armed Forces, including the Army, Navy, Air Force and Coast Guard, the IN having inducted some 80 examples of this versatile light helicopter, including for the MATCH (Medium-Range Anti-Submarine Torpedo-Carrying Helicopter) role.

As earlier recorded, the versatile *Chetak* has been utilised for SAR duties, communication, light stores transfer at sea, and deployed on board the Navy's fleet tankers services, survey ship, *Nilgiri (Leander)*-class frigates as also serving as plane guard on board the aircraft carriers.

The Naval Light Utility Helicopter (NUH) planned as a replacement for the HAL *Chetak* is proposed to be a light weight, twin-engined, wheeled version. The Government accorded an acceptance of necessity (AoN) for 56 NUH on 6 August 2010 to meet the immediate requirement of the Navy, the RFP then issued to eight OEMs of which Eurocopter (heirs to the original Aerospatiale) and AgustaWestland Helicopters (AWHL), responded with technical bids opened on 4 March 2013, the evaluation commencing shortly thereafter. However, owing to extraneous reasons the RFP issued on 3 August 2012 was withdrawn on 13 October 2014 as it had become a 'Single Vendor' situation.

On 29 August 2014, the Ministry of Defence directed that, in order to balance both the criticality of the requirement as also serving the country's strategic interest, the RFP for light utility helicopters for the for both the Army and Navy was to be re-initiated and the Navy directed to initiate a new proposal under the 'Buy and Make (Indian)' clause of the prevailing Defence Procure Procedure (DPP). In early September 2014 the MoD met to determine the way ahead for meeting the requirement of light utility helicopters but considering the Navy's particular requirement of having a utility helicopter with twin-engines for safety at sea, folding blades to facilitate hanger-storage on board ships and wheeled configuration fir ease of deck operations the Navy was to proceed independently and separately from the requirements of Army and Air Force. HAL's Dhruv ALH, received by the Navy in limited numbers, did not meet the special requirements.

The Navy's specification for its NUH is that it should be twin-engined, under 5-tonnes AUW have flotation gear, wheeled landing gear with folding blades and able to carry a torpedo. Helicopter types considered include the AS565 MBe Panther, Bell 429, Super Lynx 300, S-76D and Ka-226 while the SPs reportedly include the Tatas, M&M and L&T, although HAL could also participate.

111 numbers of the NUH are required, the case to be progressed under Chapter VII Amendment of DPP 2016 where an Enforced Project Committee, headed by a three-star Admiral and Joint Secretary Rank officer of the MoD would issue the 'expression of interest' to selected OEMs and at the same time identify strategic partners (SPs) after which the DAC would clear the next step, hopefully by March-April 2019.

A limited number of HAL advanced light helicopters (ALH) serve with the Indian Navy but are not shortlisted for the NUH requirement owing to several features (photo by Captain Navtej Singh)

One of the contenders: Airbus Helicopters AS565 MBe Panther

Admiral Arun Prakash on
Navy Day 2018

Seeking New Horizons

Traditionally, Navy Day is celebrated annually on 4 December, to mark free India's first naval victory in the 1971 War and to remind our fellow-citizens of their forgotten maritime heritage. What makes Navy Day 2018 truly special is the operationalisation of India's first home-built, nuclear-propelled, ballistic-missile armed submarine (termed SSBN), INS *Arihant*. Announced by none less than PM Modi on 6 November, *Arihant's* maiden 'deterrent patrol', with nuclear-tipped missiles, not only demonstrated that the submarine (after a reported mishap in 2017) is fully operational, but also proved the crew's proficiency in operating its nuclear-reactor and other complex systems and establishment of standard operating procedures.

Although an early step in evolution of the 'nuclear triad', this puts the Indian Navy in an exclusive club of five navies that currently are capable of mounting a deterrent SSBN patrol. Apart from its strategic significance, the *Arihant* is a live example of how PM Modi's 'make in India' dream could be actualised. Initiated some decades ago, this DRDO-funded project has been managed entirely by IN personnel and has triggered a country-wide indigenisation process by which small and medium industries have collaborated with the navy to deliver high-quality components for the nuclear submarine programme.

A Navy made in India

A deep-rooted urge to 'make in India' has been embedded in the psyche of India's naval leadership ever since independence. The seeds of self-reliance were planted in the early 1960s, when the government was persuaded by NHQ that the challenge of indigenous warship production had to be taken up. In the face of great scepticism, Mazagon Docks delivered the first licence-built frigate of British design, INS *Nilgiri*, in 1972. In the half century since, Indian shipyards have launched over a hundred warships ranging from patrol boats to frigates and destroyers, from hydrographic vessels to nuclear submarines.

The pinnacle of this admirable endeavour was achieved in 2013, when Cochin Shipyard launched India's first indigenous aircraft carrier (IAC-1). The ship would have been under construction for 13 years when it eventually goes to sea in 2021-22. Building an aircraft carrier, as the navy is learning, is a complex undertaking, beset with technical and management challenges. During a recent visit on board, the author could not help but being impressed by the size and complexity of this steel leviathan, designed by our own naval architects and being constructed by Indian hands. The ship is in an advanced stage of fitting-out, but the pace of work by Cochin Shipyard Ltd (under the Ministry of Shipping) could certainly be accelerated if the MoD were to show signs of urgency about this strategic project.

This prolonged gestation period of IAC-I will have been worth it if the right lessons have been learnt and the priceless experience gained, is ploughed into a bigger and better follow-on ship. The case for the IAC-2, however, remains in limbo, even as the Chinese PLA Navy's (PLAN) second new carrier undergoes sea-trials and reports speak of China's plans to build

4-6 aircraft carriers. The reasons for this indecision, apart from financial stringency, can only be attributed to a lack of expertise in the MoD to take a major judgment-call of this nature. It would set a healthy precedent if the Government of India were to constitute an expert team to undertake a cost-benefit analysis of building and operating aircraft-carriers in the strategic maritime environment likely to prevail up to 2050. Notwithstanding this uncertainty, the IN has put out a 'request for information' (RFI) relating to acquisition of 57 new carrier-based fighters. These will, obviously, be over and above the 45 MiG-29Ks already in IN inventory.

The 44,5,00 ton, former Soviet aircraft-carrier INS *Vikramaditya*, based at Karwar, is now a fully functional ship and regularly undertakes MiG-29K and Kamov-28/31 flying operations by day and night, engaging in fleet-deployments as well as aircrew training. The ship's first dry-docking and routine maintenance were successfully undertaken by Cochin Shipyard and with this, the ship can be considered as completely assimilated in the IN.

Capability Augmentation

In the past few years, the IN has realised many of its long-cherished objectives in all three dimensions of maritime capability. Mention has already been made of INS *Arihant*, a product of the Advanced Technology Vessel (ATV) project that is going to deliver a series of SSBNs as well as nuclear attack submarines (SSN) over the next two decades.

The last decade has seen the IN taking rapid strides in augmentation of its surface warfare capabilities with a focus on indigenous production. Following the success of three destroyers of the Project-15 (*Delhi*-class), the next generation of (stealthy) destroyers of the Project 15-A (*Kolkata*-class) was inducted in 2015-16. What places the 7500 ton *Kolkata*-class ships, well ahead of their international contemporaries, is their advanced multi-function radar and a long-range surface-to-air missile (both joint Indo-Israeli ventures) as well as the supersonic, Indo-Russian BrahMos surface-surface missile that they carry. These ships are being followed by four destroyers of the Project 15-B (*Vishakhapatnam*-class), of similar configuration but equipped with more powerful weapons and sensors.

As far as frigates are concerned, the three indigenous Project 17 (*Shivalik*-class) multi-role frigates India's first stealth warships) were inducted during 2010-2012, and are going to be followed by four frigates of the improved Project 17-A. The six Russian Project 1135.6 (*Talwar*-class) frigates having proved successful in IN service, another four of the (improved) *Admiral Grigorovich*-class have been ordered (two each to be built in Russia and India). In addition to destroyers and frigates, smaller ships, specialised for anti-submarine warfare (designated as 'corvettes') have been designed in-house and will be built in large numbers, indigenously. Three corvettes of Project 28 (*Kamorta*-class) were inducted during 2014-2017 and a fourth one will follow in 2019. At 3000 tons, these corvettes are bigger than most frigates of yesteryear.

In the surface ship domain however, there are three major lacunae that need to be urgently addressed if the IN is not to find itself handicapped in the discharge of key roles and missions. Firstly, there has been an egregious delay, on part of the MoD, in the induction of new mine-sweepers. The IN will soon be de-commissioning the last of its 12 minesweepers (now known as mine counter-measures vessels or MCMV), leaving itself vulnerable to the threat of mines which can bottle-up merchant traffic (and warships) in a harbour.

Secondly, given the extent of India's commitments towards its island neighbourhood as well as its own island territories, there is need for significant amphibious-lift and heli-lift capability; best provided by 2-3 landing platforms dock (LPD) of about 18,000-20,000 tons, which need to be ordered. Finally, given the geographic extent of its area of responsibility IN task forces will need substantial logistic support, in terms of fuel, water, rations and spare parts, while on distant deployment. The navy's present strength of four tankers/ replenishment ships is inadequate and needs to be doubled in the near future.

The Underwater Threat

There has been serious concern for many years in the IN over its dwindling diesel-submarine force, currently down to just 14, some of which are due for or undergoing, overhaul and modernisation. In comparison, the PLA Navy has 55 and the Pakistan Navy 5 deisel submarines today and by 2023, these figures will rise to 70 and 13 respectively.

The good news here is that Mazagon Docks has delivered two newly-built submarines of the French *Scorpene*-class, and four more will follow over the next three years. There is now an urgent need for the government to select a submarine for the long-delayed *Project 75-India* and create facilities for its serial production. The IN is way behind its target of fielding 24 subs by 2030 and will just be able to cope with rapid obsolescence. Having 'lived dangerously' by operating submarines without a proper rescue facility for over 50 years, the induction, this year, of two deep-submergence vessels (DSRV), for this purpose, would have brought a sense of relief to the IN.

With PLA Navy submarines now undertaking frequent patrols in the Indian Ocean, the IN has to be alert to the likelihood of some being nuclear-powered SSBNs or SSNs. Anti-submarine warfare, therefore assumes strategic dimensions and

MiG-29Ks on board

Guided-missile destroyer launches BrahMos long range supersonic missile

the IN needs to urgently upgrade its airborne ASW capabilities. The induction of eight Boeing P-8 (I) maritime-reconnaissance and ASW aircraft (with four more to follow) has provided a major boost in this area, but in the long run the IN will need 24 or more P-8(I) aircraft to provide comprehensive ASW coverage as well as escort for SSBNs in transit. In a related context, the end of the prolonged drought of shipborne ASW helicopters in the IN appears in sight as a contract for 24 Sikorsky Seahawk Mk.60R has been signed under the US Foreign Military Sales scheme. Deliveries are likely to start as early as in 2020.

Emerging Maritime Scenario

In the external sphere, a significant indicator of India's fast-evolving geo-political environment is the rapid addition of new terms, such as 'Indo-Pacific' and 'Quad' to the security lexicon. These terms owe their creation to concerns about growing threats in the maritime domain, emanating from two sources.

The Indian Navy's submarine force needs urgent augmentation

Admiral Arun Prakash on board IAC-I at Cochin Shipyard in November 2018 [Image from author]

'Non-traditional security threats', posed by non-military sources such as terrorism, piracy, natural calamities, human and drug smuggling etc and 'traditional security threats', arising from typical issues of international relations.

China's economic and military rise, its growing assertiveness and its refusal to comply with the existing rule-based order need to be viewed in the latter category. Seven decades ago, Indian historian-diplomat KM Panikkar had presciently observed, *"That China intends to embark on a policy of large scale naval expansion is clear enough... with her bases extending as far south as Hainan, China will be in an advantageous position..."*

Panikkar's prophesy came true in 2000, when China started construction of its southern-most naval base at Yulin, on Hainan Island. Built at colossal cost, Yulin's tunnel-complexes house China's submarine nuclear-deterrent, while its piers will accommodate aircraft carrier strike-groups. This is a maritime hub created for the PLAN to exercise sea-control and power-projection across the Pacific and Indian Oceans, whose waters carry China's vital trade and energy sea-lanes. China has now decided to become a major player in the Indian Ocean Region (IOR).

Given that China is on target to becoming the world's No.1 economic and military power by 2049, the PLA Navy is gearing up, not just to guard China's maritime flank, but also to protect a huge merchant fleet, dominate the seas and project power overseas. Deftly playing its economic and diplomatic cards, China has established a chain of maritime footholds in Myanmar, Sri Lanka and Pakistan and acquired its first overseas military base in Djibouti last year.

Sustained Naval Presence

India, as a significant regional power, with a peninsular configuration and dominant location astride shipping-lanes, has a major role to play in ensuring maritime security in the Indian Ocean. Given its strategic location and its naval capabilities, the earlier notion of an 'Asia-Pacific region' has been extended westwards, to create the 'Indo-Pacific' paradigm, in order to include India in this new construct. The 'Quad' was meant to be a concord of four democracies, USA, India, Japan and Australia, with common concerns and interests in the Indo-Pacific. The grouping, however, earned the displeasure of China, which saw it as an attempt at 'containment', leading to some loss of enthusiasm among participants.

In acknowledgment of the importance of sustained 'naval presence' in India's maritime areas of interest, the IN has implemented a new policy of 'mission based deployments'. This policy envisages the mounting of sustained warship patrols in a number of focal areas, which oversee the entry and exit of shipping traffic into the Indian Ocean, and include the Malacca Strait, northern Bay of Bengal, north Arabian Sea, Gulf of Aden and the south Indian Ocean. Additionally, IN reconnaissance aircraft undertake regular sorties to keep watch over the Indonesian straits and South China Sea. This is a significant commitment, which will place heavy demands on the navy's human and material resources and require speedy build-up of target force levels.

The 1971 Bangladesh War had marked an important milestone in the navy's post-independence history. Still smarting from the ignominy of inaction in 1965, the navy's leadership then ensured that it had a pivotal role to play in the conflict. On Navy Day 2018, the IN can retrospect with considerable satisfaction, having crossed a number of significant markers, signposted by its *Maritime Strategy and Maritime Doctrine*. India's political leadership, however, cannot be credited with a similar 'maritime vision'. National maritime power goes well beyond a 'fighting navy', to include efficient ports and infrastructure, a large merchant fleet, a competent shipbuilding industry and the capability to exploit deep-sea fishery and seabed resources. Lacking most of these, India cannot aspire to become a great maritime nation, a status already attained by China.

Thus, Navy Day is an appropriate occasion to acknowledge the sterling contribution of late Vice Admiral Manohar Awati (1927-2018), to the rejuvenation of India's maritime history and revival of its ancient seafaring tradition. By seeing-off people like Dilip Donde, Abhilash Tomy and Vartika Joshi with her crew of six gallant women on voyages of global circumnavigation, VAdm Awati demonstrated that Indian youth, inspired, motivated and properly trained, are equals of the best sailors worldwide. It is from the ranks of bold men and women such as these, that India's new navy is being created, soon to become a significant force in the Indo-Pacific.

[Images by Captain Navtej Singh, IN]

BOEING : Committed Partner with the Indian Navy

The Indian Navy has been spearheading the nation's increasing strategic and geopolitical responsibility in the Indian Ocean region and Naval aviation plays a crucial role maintaining India's dominance in the region. "Mission ready and capable", Indian Navy's aircraft carry out the entire mission spectrum at sea, ranging from countering piracy and asymmetrical warfare, to neutralising maritime terrorism.

The P-8(I)

Since induction of the P-8(I) by the Indian Navy, Boeing has been supporting the fleet to ensure high rates of mission readiness. With eight P-8(I)s presently active and another four to be delivered from 2020, the Indian Navy is rapidly increasing its capability to seal and protect its 7,000-km long coastline, while playing a greater role in regional maritime security.

Considered as the most potent anti-submarine warfare, armed intelligence, surveillance and reconnaissance aircraft extant, not only can the P-8(I) "fly higher, farther and faster" than any other maritime patrol aircraft, it can also detect, track and report on more targets than ever before.

Through comprehensive maintenance support services, Boeing closely partners with the Indian Navy to ensure that the P-8(I) continues to provide its unmatched capabilities and mission readiness for any mission "anytime, anywhere". Boeing has received a three-year contract for continued support to the Indian Navy's P-8(I) fleet, a testament to the value that its services and training have delivered. This contract continues the support that Boeing provides under the programme's current, initial production agreement as in addition to field and logistics services, also includes engineering, support and planning. The contract includes robust material support, including a Boeing 737-based component services programme, which will be executed in conjunction with Boeing Commercial Aviation Services' Fleet Services division.

In January 2018, India's Defense Acquisitions Committee cleared the acquisition of a P-8(I) training system from Boeing, this customised for the Indian Navy which will offer an integrated learning approach that will combine classroom education with simulation. This ground-based training system for the P-8(I) will allow Indian naval crews to increase proficiency in shorter time, without using up finite fatigue life of the P-8(I), or putting the aircraft at any untoward risks during a training scenario.

A next level of partnership

With its F/A-18 Super Hornet, Boeing sees an opportunity to further strengthen its partnership with the Indian Navy. Having multi-role capabilities, advanced technologies and low acquisition and sustainment costs the F/A-18 Super Hornet is "clear choice for India".

Capable of conducting STOBAR operations with a meaningful weapons and fuel load, the Super Hornet is fully compatible with the Indian Navy's aircraft carriers. With its designed-in stealth, an Active Electronically Scanned Array (AESA) radar and many other advanced technologies that support unique mission

requirements of the naval aviator, the F/A-18 Super Hornet is arguably the most advanced aircraft of its kind in operation today and will provide immense operational benefits to the existing and future force structure of the Indian armed forces.

The F/A-18 Super Hornet was designed from the outset for carrier operations and remains the world's pre-eminent carrier-capable aircraft. It is a combat-proven, supersonic, all weather multi-role fighter with a defined US Navy plan to neutralise threats well into the 2040s. Thus far, every Super Hornet has been delivered on cost and on schedule to the US Navy.

With its twin-engines, the Super Hornet provides a margin of safety that does not exist in a single-engined platform. Its buddy-refueling capabilities extend the time on station, range, and endurance as well. The Super Hornet also provides continuous and comprehensive air support with its (AESA) radar targeting data and reliable data links.

The F/A-18 Super Hornet not only has low acquisition price but also costs less per flight hour to operate than any other tactical aircraft in the US forces inventory. The Super Hornet needs far less maintenance, which translates into high mission availability and its ease of maintenance (supportability) results in lower maintenance man-hours, per flight hour. Additionally, the Super Hornet does not require any scheduled depot-level maintenance while the engine does not require any scheduled maintenance between overhauls.

'Make in India'

Boeing's proposed 'Make in India' plans for the Super Hornet are not just about transferring a production line, but for building an entirely new state-of-the-art production facility that can be utilised for other programmes, including the Advanced Medium Combat Aircraft (AMCA).

Boeing is prepared to bring its global scale and supply chain, its best-in-industry precision manufacturing processes, as well as the company's unrivaled experience in designing and optimising aerospace production facilities to both support India's expanding aerospace ecosystem and help realise the 'Make in India' vision. Boeing's unique approach addresses the infrastructure, personnel training, and operational tools and techniques required to produce a next gen fighter aircraft in India.

Boeing will closely work with India's industry to ensure the very latest technologies, applying lessons learned from the current Super Hornet production line. The programme envisages transitioning airframe and subsystem manufacture to Indian industry in deliberate manner, representing an extraordinary opportunity for technology insertion and growth for India's aerospace industry.

Admiral Arun Prakash on the

'Indian Navy's missing minesweepers'

Harbours are vulnerable for 20 years

Even as India worries about 'barbarians' at our northern and western gates, we need to focus sharply on the 'enemy within'.

This enemy is a pernicious system, which has brought the process of equipping our military almost to a grinding halt. The mainstay of this 'system' is the politician who is indifferent to national security but focused on political survival. This politician uses foreign arms purchases as the 'golden-goose' for election-funding, as well as for settling political scores.

The pernicious system's other prop is the ministry of defence (MoD) bureaucracy, which is unconcerned and unlettered about matters of security and defence, but vested with unfettered decision-making powers. In this context, the tale of Indian Navy's 'missing minesweepers' may be an apt metaphor.

Energy and trade are the lifeblood of India's economy, and an overwhelming proportion of both travels by sea. India consumes 4.5 million barrels of oil a day, requiring three-four giant oil tankers, termed 'very large crude carriers', to discharge at an Indian port every single day of the year. Each day, the country's top 12 ports handle 2.5 million tonnes of cargo, including coal, fertilizer, petrol, food and containers of general merchandise. This trade is carried by 150-200 merchant-ships that enter and leave Indian harbours every day.

Even a brief interruption in the smooth entry and departure of the shipping traffic in any one of these ports would have serious repercussions on India's economy, industry, security and the common man's daily life. Such a possibility is rarely contemplated in land-locked New Delhi where 'sea-mines' is a term, perhaps, unheard of.

A sea-mine is a large, self-contained explosive device, placed in a focal shipping area, to inflict damage or destroy ships that pass in its vicinity. Today's 'smart' mines may lie dormant for months, till activated by a timer, and thus constitute an unseen and insidious menace to shipping.

While navies use ships, submarines or aircraft to lay mines, the same task could be performed clandestinely by merchant ships, fishing boats or even dhows in an unguarded port. A mine explosion (or even the rumour of mining) in a harbour could paralyse shipping traffic and send marine-insurance rates skyrocketing till the harbour is 'swept' of mines and declared safe for shipping.

The Persian Gulf has, in recent times, seen two modern US Navy warships – a frigate in 1988 and a cruiser in 1991 – suffering serious damage from primitive mines deployed by Iran and Iraq. Mine-sweeping and mine-hunting (collectively termed 'mine counter-measures' or MCM) thus remain of critical importance for the navies. Older wooden-hulled MCM ships have been replaced by ships that seek and destroy mines via remotely controlled vehicles.

> Indian Navy's sole remaining mine-sweeping and mine-hunting vessel is due for de-commissioning soon

A prudent Indian Navy (IN), cognisant of the vulnerability of Indian shipping and harbours, has, from its earliest days, maintained an adequate MCM capability on both coasts. The first minesweepers, acquired from the UK in the 1950s, were supplemented by some home-built craft and Soviet vessels, which lasted us till the 1970s.

Aware that the Pakistan Navy had a sizeable stock of Chinese mines (one of PNS *Ghazi's* tasks in 1971 was to mine the Vishakhapatnam harbour), the IN, during the 1980s, acquired two squadrons of six modern Soviet MCM vessels (MCMV) each to safeguard the western and eastern seaboards against mine-laying.

With these ships rapidly approaching obsolescence, the Indian Navy initiated in 2005 a case for indigenous construction of 12 MCMVs equipped with modern mine-detection and destruction devices, with the option for 12 more to follow. The proposal envisaged the project to be undertaken by the small but highly efficient and proven Goa Shipyard Ltd (GSL). A request for proposal (RFP) was initiated, and bids were expected from Russian, Italian and South Korean shipbuilders. All that remained was for the Indian Navy to exercise an option between a non-ferrous metal or composite-material hull, and the requisite technology would be transferred to GSL for serial production of MCMVs.

Imagine one's dismay on seeing a June 2018 news headline announcing: *"RFI for Rs 32,640 crore minesweepers may be issued in four weeks".*

A post-mortem of what transpired between 2005 and 2018 would be tedious, but if the news report is indeed true, it may be a decade before the first new MCMV enters the IN service. Since the Indian Navy's sole remaining MCMV is due for de-commissioning soon, India's shipping lanes as well as its 200-plus major and minor harbours will be vulnerable to mining for nearly two decades. So, what's new? Nothing. Similar examples abound of jet trainers, artillery guns, submarines, fighters, carbines and bullet-proof jackets taking 15-20 years for the MoD to acquire vitally required military hardware. Does anyone care? Journalist Vir Sanghvi recently tweeted the answer: *"No voter cares about defence deals; this is an issue only for the Delhi media."*

What's the bottom line then? Looking back, it is incredible, but true, that of India's 29 post-Independence defence ministers, none has shown the will, vision or intellect to reform the system and to sow the seeds of military self-reliance. The MoD has become a labyrinth of Kafkaesque complexity, where the bureaucracy – ignorant about arcane areas of capability acquisition and weapon procurement – uses the Defence Procurement Procedure as a talisman to stall and impede military modernisation.

One can only hope that sooner than later the voter will start 'caring', and national security will become an electoral issue. Till then, we will continue to live in a parlous security environment, being pushed around by all our neighbours – both small and big.

Indian Navy successfully completes

Sea Trials for first DSRV

The Indian Navy and James Fisher Defence JFD, the world-leading underwater capability provider successfully completed sea trials of the Deep Submergence and Rescue Vehicle (DSRV) in October 2018 for the first of two 3rd Generation Submarine Rescue Systems being delivered to the Indian Navy. The Submarine Rescue Team (West) of the Indian Navy would be operating the system, considered as the most advanced Submarine Rescue System in the world and by April 2019 would have inducted two such capable Rescue systems.

The DSRV carried out underwater mating with a bottomed submarine at a depth of over 300 feet, followed by a target mating and hatch opening at 45 degrees. On successful mating with the bottomed submarine, the Indian Navy then carried out a safe transfer of personnel from the submarine to the DSRV 'DSAR650L'.

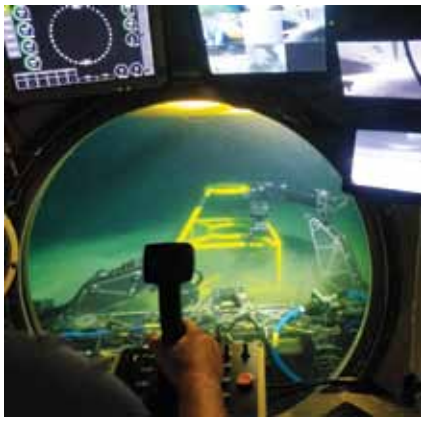
The sea trials have proven the newly inducted 3rd Generation DSRV's ability to undertake rescue operations from a disabled submarine at sea, providing the Indian Navy with such critical submarine rescue capability. In addition to the mating and transfer of personnel exercises, the DSRV conducted a record dive which represents the deepest submergence by a 'manned vessel' in Indian waters, as well as Remotely Operated Vehicle (ROV) operations at a depth of over 770 metres and Side Scan Sonar operations at a depth of over 650 metres, all of which represent significant 'firsts' for the Indian Navy and India as a maritime nation.

DSRV being deployed by the support vessel

"With this the Indian Navy now joins a select league of nations with the capability to search for, locate and provide rescue to distressed submarines by induction of our first DSRV and associated kit, which in a fly away configuration can be rapidly mobilised. The DSRV can be mobilised by the SRT (W) from the naval base at Mumbai to the nearest mounting port by air, land or sea, ready to provide rapid rescue to the submarine in distress," stated JFD officials.

Having already successfully completed harbour trials earlier in 2018, the DSRV has now completed a full launch deployment, dive and recovery in open sea as well as an underwater mating exercise, replicating the operating conditions of a real submarine rescue operation. The completion of open sea trials represents a significant milestone in the ongoing delivery and acceptance of the 3rd Generation Submarine Rescue

DSRV on the surface prior submergence



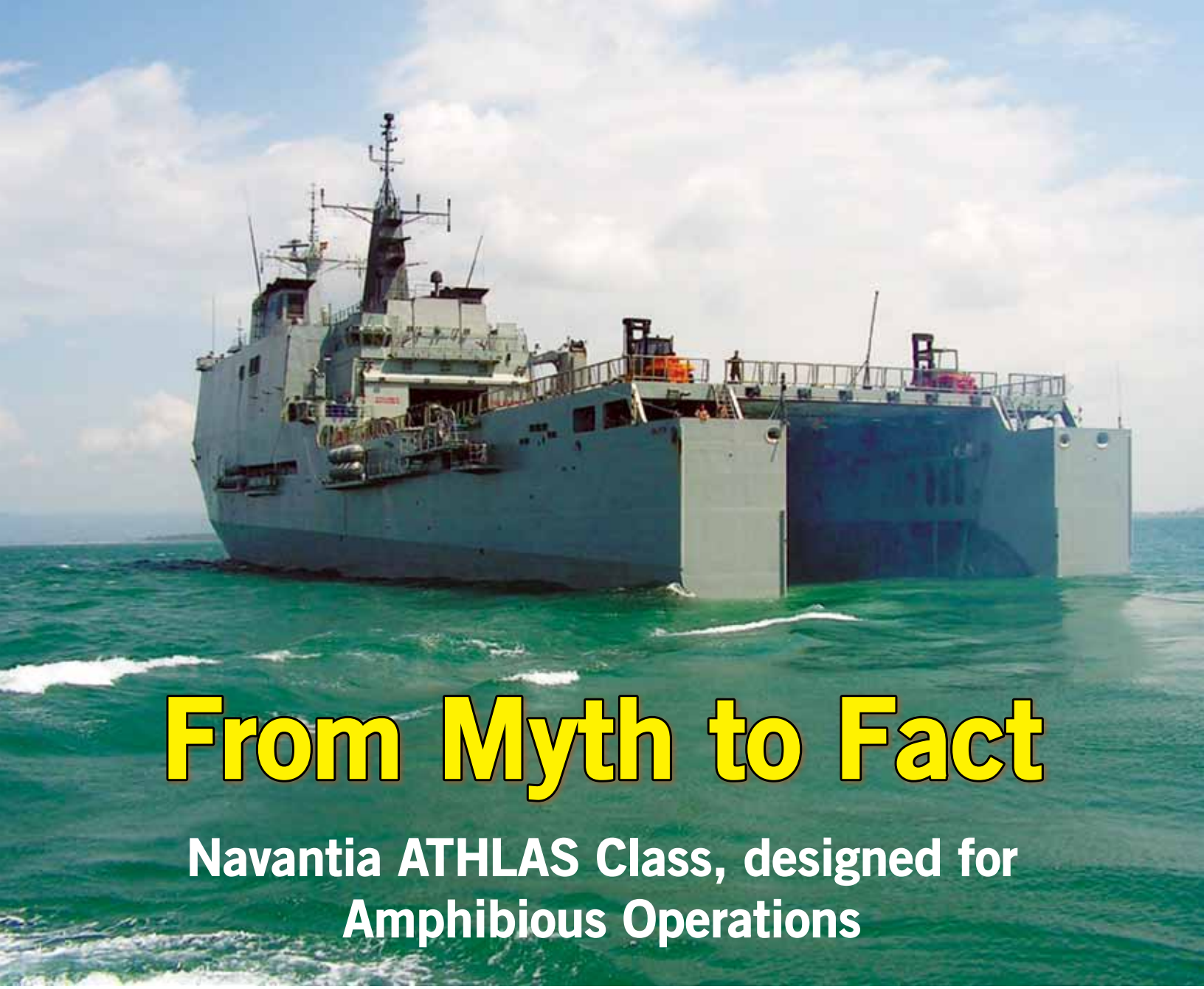
Pilots view from the DSRV, near the sea bottom

System, which is slaved by a rigorous trials and testing process that ensures the highest safety standards are upheld.

The Indian Navy West Coast-based Submarine Rescue Team (West), which will operate the system, were active participants throughout this phase of the trials, so ensuring that they are equipped with the skills and expertise to conduct safe and efficient submarine rescue operations, should the need ever arise. "The sea trials of the DSRV has ushered in a niche capability into the Indian Navy. The DSRV, which is operated by a crew of three, can rescue 14 personnel from a disabled submarine at one time. These sea trials have proven the newly inducted DSRV's ability to undertake rescue operations from disabled submarines at sea and has provided the Indian Navy with a critical capability," stated Indian Navy officials.

Under the £193m contract, James Fisher Defence JFD is delivering two complete third-generation submarine rescue systems, including launch and recovery systems (LARS) equipment, Transfer Under Pressure (TUP) systems, logistics and support equipment, and a 25-year all-inclusive annual maintenance contract.

Real time: shallow water dive at 90 meters on flat target



From Myth to Fact

Navantia ATHLAS Class, designed for Amphibious Operations

According to Greek mythology, Atlas was one of the most outstanding of the Titans, those powerful deities that preceded the twelve Olympian gods headed by Zeus, in governance of the world.

In their fight for divine supremacy, Atlas led to the Titans in a war against the Olympian gods, but were defeated and made prisoner. Zeus, the victorious Olympian god, then imposed upon Atlas a special punishment, holding the heavens upon his shoulders so as to keep the Earth and Heaven separated for eternity. According to legend, Atlas did this extraordinary task at the western most extremity known to the Greeks, which is regarded as being near the Strait of Gibraltar.

Navantia too, which is one of the world's leading naval designers and builders, has facilities near the Strait of Gibraltar, and thus inspired to design a class of ships with extraordinary capacities for amphibious missions: the ATHLAS class (Amphibious Transport Helicopter Landing Attack Ship).

The ATHLAS class vessels are designed for amphibious and aircraft operations during times of crisis but also for humanitarian aid, in disaster relief or refugee evacuation.

The ATHLAS class has been designed for maximum flexibility in operational configuration, and is made of three different families of ships, being the ATHLAS LHD/LHA, ATHLAS LPD, ATHLAS LKA. The ATHLAS family offers Navies flexible platforms adapted for their requirements.

Navantia is a world leader and has long experience, as exemplified by the fact that it "has already built and delivered 3 ships for the Spanish Navy", LPD *Castilla*, LPD *Galicia* and LHD *Juan Carlos I*. Thereafter were exported similar ships to the Royal Australian Navy which ordered two LHDs in 2007. Based on the LHD *Juan Carlos I*, both the HMAS *Canberra* and HMAS *Adelaide* are presently in service, giving excellent performance. The Turkish Navy thereafter selected the *Juan Carlos* I type for their fleet as well and is building one unit at the Turkish shipyard SEDEF, through transfer of technology. In both these countries, collaboration with local companies on these programmes, has been very successful.

As for India, Navantia has partnered with Larsen & Toubro to compete in the tender for construction in country of 4 new

vessels based on the Spanish design and tailored to meet Indian Naval requirements. This ship would provide unrivalled capability in its class, as demonstrated to the Navy in June 2018 when the Spanish Navy LHD *Juan Carlos I* visited Mumbai, and senior Indian Navy officers were given presentation on the ship's capabilities.

Navantia is fully committed to 'Make in India' and offers the Indian Navy the most capable, affordable and low-risk of such platforms, being not only a well proven and flexible design, but also bringing comprehensive transfer of technology and technical support in the areas of design, production, operations and life cycle maintenance.

Images courtesy: Navantia

Fourth generation conventional submarines

Russia's proposal for the Indian Navy

The second Pr.677 conventional submarine (improved *Lada*-class), the *Kronstadt*, was launched in Russia at the Admiralty Shipyards in St. Petersburg on 20 September 2018, the submarine being a *Kalibr* cruise missile carrier. The highly accurate and destructive power of this weapon was recently demonstrated by the Russian Navy during "counter-terrorist operations", and combined the lowest level of hydroacoustic field with high detection ranges for onboard sensors of the carrier.

"It's hard to overestimate the importance of this event. The submarine began to be built in 2005, and although there have been some pauses in financing and construction halts, this lag however has allowed us to use the experience gained in operating the (lead) submarine (of that class), the *St.Petersburg*. The Pr.677 underwater combatant outperforms its predecessor, the Pr. 636 (improved *Kilo*-class) diesel-electric submarine, in major manner. We believe that the Pr.677 will be future of the (Russian) Navy's diesel-electric underwater force and hope for a large series of the submarines (of that class)," stated Admiralty Shipyards CEO Alexander Buzakov during the ceremony.

Kronstadt to fourth generation of the Russian non-nuclear boats. The Pr. 677 and its export derivative *Amur* 1650 are meant to supersede the *Kilo*-class. *Lada* is more

compact: with similar weapons composition (six torpedo tubes with weapons comprising 18 torpedoes and missiles), standard displacement is reduced from 2350 (for Pr. 636) to 1765 tons. Because of increased automation, crew numbers are reduced from 52 to 35 personnel. The *Lada* is equipped with sonar with quasi-conformal large-area antennae and towed array sonar that considerably surpasses series-produced sonars on the earlier Pr. 636 submarines.

Speaking at the ceremony during launch of the *Kronstadt*, Russian Admiral Viktor Chirkov said that due to their noise levels, the earlier *Kilo*-class submarines have been nicknamed '*black hole'* by the western military. Trials of the new boats have demonstrated that their noise levels are several times (four or five, as per calculations of designers) lower than that of the *Kilo*-class. "Given that stealth of *Lada*-class submarines, which can be neither seen nor heard by the enemy, has increased, this submarine may be called an *invisible creature*," he continued. "The new submarine enables us to make a step forward in developing state-of-the-art underwater fleet of Russia," Viktor Chirkov summed up.

The *Amur* 1650 on offer to India has AIP based on fuel cells and the electrochemical generator will covert diesel fuel to produce hydrogen. Rubin Design Bureau CEO Igor Vilnit had earlier expressed his assurance to the Indian Navy, who are anxious to integrate indigenously produced AIP on own ships, would be helped or assistance provided for their development. *Lada*-class submarines for the Russian Navy are also planned to be equipped with AIP developed by the Rubin Design Bureau.

The Pr. 677 leading ship, *St.Petersburg,* is now in service with the Russian Northern Fleet and

long-term sea trials conducted since the Russian Navy flag raising in 2010 have shown that submarines of this class are

suitable for operations conditions of heavy traffic in the confined waters of the Baltic, as well as blue waters of the Barents Sea and the White Sea, with access to the North Atlantic. "*St.Petersburg* has not only proved its characteristics, but even outclassed them", stated Igor Vilnit during launching ceremony of the *Kronstadt*.

The Kronstadt is being built as an improved Pr.677 design, the same as the third *Lada*-class submarine *Velikiye Luki* which is presently under construction at the Admiralty Shipyards. *Kronstadt* and *Velikiye Luki* have radically improved their propulsion, engineering control and navigation systems. Igor Vilnit said: "*Kronstadt* is superior to previous submarines in all technical parameters. Moreover, we have taken into account all required modifications of the lead submarine. Most of the series production equipment, which has passed all tests and complies with the stated technical characteristics, is now installed onboard the *Kronstadt*".

The *Kronstadt* is planned to be commissioned in 2019 and the *Velikiye Luki* in 2021. According to the Russian State Armament programme, contracts for two more Pr. 677 submarines are to be issued by the Russian MoD during next year.

As Deputy Chief of the Russian Navy Shipbuilding Department, Captain 1 Rank Mikhail Krasnopeev, remarked: "The entire history of Admiralty Shipyards, starting from time of Peter the Great, testifies that the company is able to build *unique* ships. And today's launch is a vivid confirmation of this. For Russian sailors, it is an honour to serve on such modern submarines". He also emphasised that the Russian Navy would continue to actively develop the non-nuclear component of its submarine force. "We'll work further to improve and induct new technologies in the construction of non-nuclear submarines, to improve the parameters of stealth and effectiveness of its armament. Special attention is paid to the training of submarines' crews, as they will be operating the most modern equipment", he said.

Photos by Dmitry Sokolov

Second *Yasen*-class nuclear submarine on sea trials

Russia's improved *Yasen*-class submarine, *Kazan*, proceeded for sea trials for the first time on 25 September, sailing out from Sevmash shipyard in Severodvinsk. *Kazan* is the second of the *Yasen*-class nuclear powered fast-attack submarines, but the first modernised vessel. The leading submarine of Project 885, *Severodvinsk* entered service on 17 June 2014, the next six ships in the series being built under improved Project 885M (*Yasen*-M), characterised by an optimised hull shape and upgraded electronic warfare and automation systems. Kazan's keel was laid on 24 July 2009 and launched on 31 March 2017, is armed with *Oniks* and *Kalibr* cruise missiles. As per the Russian Ministry of Defence Spokesperson, *Yasen*-class submarines have the capability to operate not only against other vessels but also to perform deterrence functions because of their advanced missiles, stealth features and speed.

Photos: Oleg Kuleshov

Vice Admiral Shekhar Sinha recalls

The Legendary John Farley

- and the Indian Navy's Legendary Sea Harriers

It was 1972 and we were Midshipmen under flying training with the IAF. Having "survived" the basic and intermediate stages, we were on the last stage at Fighter Training Wing, AFS Hakimpet. 'Lead-in-fighter training' in the IAF was going through critical times, with depleting numbers of Vampire trainers and its replacement not yet finalised . Even before we arrived at Hakimpet we knew that ours would possibly be the last course to train on the venerable Vampire.

We were six Midshipmen and our leader of Naval pilots was a dashing young Lieutenant 'Raju' Sethi. There were numerous rumours floating around as to how the Navy would soon be without a carrier-borne fighter in the foreseeable future. The Sea Hawks were on their last legs post-1971 war, having done outstandingly well to ensure blockade off the erstwhile East Bengal and hastening surrender of the Pakistan Army.

That there was no fighter replacement for the Sea Hawk was extremely discouraging to us, the Naval Aviators of No.112 Flying Pilots Course, particularly when all 7 pilots were being trained for the fighter stream. Then we learnt of the visit of the DASD, Captain Ram Tahiliani (later Chief of the Naval Staff) to FTW. One had heard a great deal about him (nicknamed 'Tally Ho !') as having been the first Indian Navy pilot to land a Sea Hawk on the INS *Vikrant*. He was a Flying Instructor and Test Pilot trained in France. We were looking forward to meeting him, essentially to ascertain what awaited our return to the Navy after we had earned our 'golden wings'.

It was during conversations with him that I had first heard of John Farley, the context being that John Farley had done a demonstration deck landing of the VTOL Harrier onboard INS *Vikrant* in July 1972. Incidentally, this was the first ever deck operation of the Harrier anywhere in the world. John had also flown Capt Tahiliani in the two seater demonstrator (G-VTOL). He was then Deputy Chief Test Pilot of Hawker Siddeley Aviation facility at Dunsfold. We were assured by him that the Indian Naval fighter stream had "great future", with replacement of the Sea Hawk being "round the corner".

John Farley with Shekhar Sinha and Arun Prakash

After earning our wings we joined INAS 551 based at Goa in December 1974. The operational Sea Hawk Squadron INAS 300 'White Tigers' next door to be was our next step, though they had very few aircraft left in their inventory . We, in 551, were the first batch to fly HAL-built Kiran Mk.1s but there were two Vampires T.55s as well. Having flown Vampires at Hakimpet, we were reasonably current and would fly them as and when they came on the flight line.

Admiral 'Tally Ho' Tahiliani and (then) Cdr Arun Prakash

After we finished our OFT, we were still hopeful of getting into Sea Hawk cockpits and this became a reality only in December 1976.

Much later, in 1980, while posted at AFA as an instructor on Kirans, the Chief Flying Instructor one day sent for me and mentioned that I was to revert to the Navy and proceed for the Sea Harrier induction. By early 1982, the Sea Hawk squadron was virtually number-plated with Cdr Arun Prakash as the Squadron Commander of a combined 300/551 Squdron. In April 1982, Cdr Arun Prakash (CO designate of the new Sea Harrier squadron) and Lt Shekhar Sinha, the QFI designate, got their orders to proceed to the UK for Harrier Flying Training.

In the UK, the two of us commenced our flying on the Jet Provost (for UK orientation) at RAF Brawdy in April 1982 and thereafter to the Harrier Basic Conversion at RAF Wittering (233 OCU). The next phase was to undergo Sea Harrier OFT (on Indian Navy aircraft) with British instructors and Technical Staff at the Royal Navy's Air Station at Yeovilton. Our first two Sea Harriers (IN 601 and 602) were still not ready. Therefore, Cdr Arun Prakash and I were deputed to the British Aerospace facility at Dunsfold to acquire factory background experience and test flying techniques. We were later authorised to fly in the prototype two-seater G-VTOL with British Aerospace test pilots, the Chief Test Pilot being the legendary John Farley, this being 10 years after I had first heard of John – and now I actually got to meet him !

We were located at the Chief Test Pilot's office complex which gave us immediate access to the test pilot Mike ('Snagger') Snelling, Heinz Frick and Taylor Scott, who were the other Harrier test pilots.

This phase of our continuation training was extremely educative since we would actually observe the aircraft being built in the manufacturing facility and could get into the minutest of details of "why" and "why not" of every aspect of the Harrier. We could walk into John's office whenever he was not in the cockpit. He was a serious looking, very composed gentleman with an occasional faint smile. He was meticulous in explaining aerodynamics of the Harrier and on its revolutionary VSTOL concept. John would firmly draw the lines between the dos and do nots, having been associated with

Arun Prakash and Shekhar Sinha with Harrier at RAF Wittering

Two-seat Harrier demonstrator (G-VTOL) at Farnborough. This was the aircraft that carried out trials in India during 1972, both with the Navy at Goa and on-board INS Vikrant and later, for the IAF at Safdarjung Airport in the heart of New Delhi

Harrier development since its inception, from the days of the Kestrel P 1117. He was actually the last word in the Harrier Force.

My first opportunity to fly with John Farley was on a cold British winter morning of November 1982 in G-VTOL, (*GVeetol* as it was affectionately called). We had a lengthy pre flight briefing in his office. He was aware that on return to India my task was to train new pilots on the Sea Harrier and therefore the importance of comprehensive understanding of the mighty Pegasus engine and various aerodynamics. The two-seater aircraft displayed relatively greater instability than the single seater since it was bigger in size and heavier but engine thrust was the same. John walked up to the briefing board and explained in great detail, for instance, the phenomenon of *Intake Momentum Drag* (IMD), typical to the Harrier particularly the two seaters. Very often, during the briefing, he would remind us that adverse effect of IMD was controllable but should not be attempted as a flight demonstration. There had been some very tragic losses of lives in the past during this flight regime.

After briefing we would walk upto the aircraft and went round for external checks. He would carefully explain every part of the airframe and its aerodynamics. Nothing of the Harrier's design was without a reason our subsequent start up and taxi was uneventful since we were now qualified Harrier pilots. At Dunsfold we were getting the hang of *GVeetol* which was the only Harrier in the world without a Head Up Display thus requiring frequent reference to head down instruments which made flying a real challenge. John had complete mastery over the Harrier, and could demonstrate a critical test flight point, show as to how things could go wrong - and more critically, how the pilot should go about correcting it.

Back on the circuit then, we practiced different types of landings that the Harrier was capable of. John emphasised monitoring of a number of head down instruments during the approach and simultaneously carry out perfect visual landings. The real seat-of-the-pants flying skill of John was brilliantly on display during the last approach to hover. It was a virtually no winds (good for a vertical landing) with fair amount of snow deposit on the landing pad. He hovered *G Veetol* initially at what looked like 80 feet above the landing pad. During descent to the landing pad we came into ground effect, marked by increased airframe vibrations, when the Harrier is most unstable. This was accompanied with snow being spewed all around the aircraft by its powerful jet blast. Normally one does a reasonably hard landing with the Harrier: the throttle is shut closed short-of touch down in order to kill its entire energy to prevent bounce back and instability in ground effect.

Having entered the ground effect John then demonstrated a perfect spot turn through 360 degrees to prove that the jet was controllable even in an unstable regime. I was speechless – and probably breathless – while John was at home and in complete control of the two-seater. Spot turn in hover itself could be of challenge – and one would not even think of attempting the manoeuvre in ground effect.

During debriefs he cautioned against trying this manoevore as a demonstration but the fact that it was still controllable gave me all the confidence I needed in my subsequent Harrier instructor years when back in India. That was the one and only John Farley.

The first- and the last !

The superlative profile of the Sea Harrier of INAS 300 is seen on hover (above) and from the ground

How it all started in India : the 2-seat Harrier demonstrator (G-VTOL) at Sarfarjang Airport, in the heart of New Delhi, seen above being presented to the Indian Air Force after its successful trials with the Indian Navy in Cochin and onboard the INS *Vikrant.* In the event, the Indian Navy ordered the Sea Harrier which played a dramatic role onboard the INS *Vikrant* and later the INS *Viraat,* but the IAF did not take the case forward for Harriers to operate from hot and high airbases in the Himalayas.

Many years later the first Indian Naval Sea Harrier arrived at INS *Hansa,* flown by (then) Captain Arun Prakash on 16 December 1983. The Sea Harriers thereafter served with INAS 300 (*White Tigers)* till they were supplanted 33 years later by the MiG-29K, on 11 May 2016.

Auld Lang Syne : Sea Harrier being given a fond farewell at INS Hansa in May 2016

The pictures above were taken by Angad Singh of *Vayu Aerospace Review* at Dabolim *On 11 May 2016.*

John Farley, 1933-2018

John Farley, OBE, AFC (1933 – 2018) was a fighter pilot at the Royal Air Force and became an experimental test pilot majorly involved in the development of the Hawker Siddeley P.1127 and latterly the BAe Harrier.

John Farley subsequently joined the Aerodynamics Research Flight at RAE Bedford which had him associated with the Hawker Siddeley P.1127 which in turn led to his long and successful association with BAe Dunsfold, leading to 19 years of Harrier test flying. He joined Hawker Aviation as a company test pilot in 1967 following his service in the RAF, later being appointed Deputy Chief Test Pilot in 1971 and Chief Test Pilot in 1978. In this capacity he began work on the development of the Sea Harrier, being the first pilot to undertake a take off with the aid of the 'ski-jump' and demonstrating this to the general public at the 1978 Farnborough Airshow.

One particularly challenging aspect of the test flying programme on the Harrier revolved around Intake Momentum Drag Yaw, which aspect had the mass of air ingested by the intake of the engine during a crosswind possibly leading to a state of uncontrolled roll. John Farley deliberately flew right into the edge of this condition repeatedly, so that a system to counter it could be developed.

He was involved in the conversion course onto the Harrier of the first United States Marine Corps pilots in 1967, which at that time consisted of neither a two seater version of the aircraft nor a simulator being available, and called heavily on all Farley's experience. He was to continue this association with the USMC, utilising his skill on subsequent developments such as the AV-8B.

Renowned as a display pilot, Farley developed what was to become known as the *Farley Take off*. This would see the aircraft put into the hover at around 100 ft (30.5 m), then using the Reaction Controls, raise the nose to around 60 degrees, adjusting the main engine nozzles to suit, so the aircraft was still hovering, but with a high nose up attitude. He would then apply maximum power and "rocket climb" away. There were no gauges or instruments to aid this; it was all by seat of the pants judgement. However, RAF, Royal Navy and Indian Navy pilots were forbidden from trying this !

John Farley's Autobiography ***A View From The Hover*** *is widely regarded as an aviation classic, and essential reading for anyone aspiring to develop a knowledge of test flying.*

Recalling the Sea Harrier...

F-35B conducts Shipborne Rolling Vertical Landing on HMS 'Queen Elizabeth'

The first ever Shipborne Rolling Vertical Landing (SRVL) was recently carried out with an F-35B conducting trials onboard the new British aircraft carrier, HMS *Queen Elizabeth*. The UK is the only nation currently planning to use this manouvere, which allows jets to land onboard with heavier loads, with no need to jettison fuel and weapons before landing.

The F-35Bs have conducted vertical landings, coming to a hover to the side of the ship, translating sideways over the deck, before gently lowering to land, regarded as a "safer method" to reduce speed before the jet lands in this way, rather than landing on at speed and coming to a stop before it runs out of deck.

An SRVL uses a different approach, with the jet using a more conventional landing pattern, approaching the ship from the aft end at speed, using the thrust from the nozzle and lift created by air over the wings, to touch down and come to a stop as soon as possible.

The first SRVL was conducted by Peter Wilson, a BAE Systems test pilot with the F-35 Pax River Integrated Test Force, which took place on 13 October 2018, off the US east coast. Landing 755 yards back from the end of the carrier's ski jump, the jet came to a complete standstill at the 580 yard mark.

"I'm thrilled to have achieved this, the whole team is," Wilson said. "It's an inherently risky manouvere. We have always understood it is safer to stop before you land than it is to land before you stop and the prime reason for that is that if something goes wrong with the airplane it is far better for it to be stationary than a rolling wreckage. I've worked on this for the past 17 years; it's fantastic to know that it's matched the modelling and simulation we have done over the years. I've flown over 2,000 SRVLs in the simulator, and am honoured to have been able to do the first one onboard HMS *Queen Elizabeth* here today."

Royal Navy Lt. Christopher Mould had the role of Landing Safety Officer (LSO) during Wilson's flight. Taking his place in a packed, but eerily silent FLYCO (Flight Control), Mould was the final say as to whether the jet could land. With seconds to go before touchdown, his call of "happy" allowed the historic landing to take place.

"I'll admit, I was nervous; it was a pretty intense experience," Mould recalled. "It's the first time we've ever done it. As the independent checker, I have to make sure that what we are seeing in FLYCO, is also what the pilot is seeing and call it as I see it."

His test pilot colleague onboard, U.S. Marine Corps Maj. Michael Lippert from *F-35 Pax River ITF*, said that "America was watching this part of the trials onboard the carrier particularly closely." The USMC, which also flies the F-35B variant, will join the ship when she deploys operationally for the first time in 2021. "This is one of the main reasons we are here. It is of interest to the Service at large – we are learning from each other," Lippert said. "I will have the honour of conducting the first SRVL at sea for the US military, so I'm excited; it's what we all join up for. This is truly experimental test flying."

Royal Navy Commodore Mike Utley, Commander U.K. Carrier Strike Group onboard stated "What today's milestone eventually means is that we will give our strategic leaders even more choice. Pushing this ever expanding envelope means we can achieve the effects they require from us. Yet again we have demonstrated the seamless cooperation between the UK and US, but more essential than that, is how it will translate into future operations."

For HMS *Queen Elizabeth's* First of Class Flight Trials Lead Test Pilot, Royal Air Force Squadron Leader Andy Edgell, the first SRVL was the culmination of two years' work and described the emotional moment. Edgell, who is also a test pilot at the F-35 Pax River ITF stated: "I'm feeling an enormous release, two years of concern—have we missed anything? What did we not consider? It's overtaken our lives, to make sure the outcome today was perfect. It couldn't have gone better and it was obvious to anyone, we were watching a moment in history being made for Royal Navy aviation. Now we will focus on putting all four of our test pilots here through the same process to achieve the widest breadth of data possible."

HMS *Queen Elizabeth* continues the Westlant 18 deployment, along with escorts Type 23 frigate HMS *Monmouth* and *Arleigh Burke*-class destroyer USS *Lassen*. She also has embarked Merlin Mk 2 anti-submarine helicopters from Naval Air Squadron 820 from RNAS *Culdrose*, and Mk 4 Merlins from Naval Air Squadron 845 at RNAS *Yeovilton* for conducting Search & Rescue and Helicopter Delivery Services.

HMS Queen Elizabeth

"Celebrating the best of British engineering"

Royal Navy's biggest warship, HMS Queen Elizabeth, in New York mid-October 2018

Fast jets might be stealing all the headlines as aircraft carrier HMS *Queen Elizabeth* conducts trials of the F-35 Lightning II off the east coast of the USA, but British engineering has also been celebrated by sailors, airmen and Royal Marines on-board. A Jaguar F-TYPE Coupe, displayed alongside an F-35B fighter took pride of place on the flight deck. The car had been kept under wraps in the ship's vast hangar until its runway appearance during the 'Westlant 18' deployment where the F-35Bs embarked to conduct trials. The Jaguar Land Rover has been affiliated to both HMS *Queen Elizabeth* and her sister ship HMS *Prince of Wales*, currently in build in Rosyth, Scotland, for the past five years.

British engineering celebrated with both marvels on display: The F-35 Lightning II is the world's largest single defence programme and the UK has played a major role from the outset, UK industry providing approximately 15% by value of every F-35 Lightning II built with the UK to be a major global hub for F-35B maintenance, repair, overhaul and upgrade for avionic and aircraft components.

Commanding Officer of HMS *Queen Elizabeth*, Capt Jerry Kyd said: "The Jaguar F-TYPE alongside the F-35B symbolises the very best of British design and engineering. Bringing the two together in HMS *Queen Elizabeth*, itself a triumph of collaboration between UK industry partners and the Ministry of Defence, is representative of the strong ties we as a ship have developed with Jaguar Land Rover. The technology involved in the aircraft carrier, F-TYPE and the F-35B are all linked; a high quality demanding specification, precision engineering, power and performance. All three represent cutting edge technology that underlines the very best of British innovation and design."

"The Jaguar F-TYPE alongside the F-35B symbolises the very best of British design and engineering"

How AI could save a submarine from attack

Thales CAPTAS-1 Variable depth sonar

Thales CAPTAS-4 Low Frequency Active and Passive Variable Depth Sonar for Large Platform

The underwater ocean world is an ecosystem with many different sounds. So naval forces have traditionally relied on so-called "golden ears," or musicians and other individuals with particularly sharp hearing, to detect the specific signals coming from an enemy submarine.

But given the overload of data today, distinguishing between false alarms and actual dangers has become more difficult. This is why Thales is working on Deep Learning algorithms capable of recognising the particular song of a submarine, much as the *Shazam* app helps one identify a song heard on the radio, says Dominique Thubert of Thales Underwater Systems, which specialises in sonar systems for submarines, surface warships and aircraft.

These algorithms, attached to submarines, surface ship or drones, will help naval forces sort through and classify information in order to detect attacks early on. "Equipping military vessels with a higher-level artificial intelligence is the answer to the increasing size and complexity of data to be processed as well as the need to reduce staff," states Thubert.

More intelligent, autonomous systems are also being developed for mine warfare, to move from conventional autonomy to collaborative autonomy. Instead of just operating on a pre-defined path, for example, several underwater drones will be able to carry out Simultaneous and complex operations to survey and clear the sea mine field.

Naval mines are not just the stuff of old war movies: many nations have stockpiles of these weapons, which remain a major threat to ships since they offer a cheap way for blocking a shipping route or shutting access to harbours and ports.

As a world leader in mine warfare systems, both manned and unmanned, Thales is developing advanced technologies that support the transition from conventional solutions, such as drones and other new solutions based on unmanned systems.

The objective is to let unmanned vehicles take on more difficult roles in military operations, so that servicemen are not exposed to unnecessary risks. Thales is already working on the next step: *Explainable and trustable Artificial Intelligence,* which will allow manned and unmanned systems to Make fully informed decision, which is a clear prerequisite for military applications.

Courtesy: Thales

US Air Force is 'too small' ?

It is not only European, and some Asian air arms, that are going through a crisis of decreasing combat aircraft numbers, but the USAF which considers itself as being "too small" to meet future tasks. Secretary of the US Air Force Heather Wilson has recently detailed plans to increase the Service's number of operational squadrons to reach 386 units in the timeframe 2025-2030.

The USAF's strength has declined from 401 operational squadrons at the end of the Cold War. "We know from analysis that the air force is too small for what the nation expects of us", she said. The "(present) 312 operational squadrons are not enough. The air force we need to implement the National Defence Strategy has 386 operational squadrons."

In the plans, 22 additional units would be allocated for command and control and intelligence, surveillance and reconnaissance, 14 mid-air refuellers, 9 combat search and rescue, 7 fighters, 7 special operations, 7 space, 5 bombers, 2 remotely-piloted aircraft, and 1 for airmen. "It is time to get back to our expeditionary roots" said USAF Chief Gen David Goldfein. "The next phase of work is preparing the air force we need for multi-domain operations; the convergence of military capabilities in any or all domains to achieve military objectives on a global scale".

F-22/F-35 'hybrid' for US Air Force ?

Lockheed Martin are reportedly offering a 'hybrid' fighter type combining systems of its F-22 Raptor and F-35 Lightning II (similar to the proposal for Japan) now for the US Air Force. This coincides with a USAF review of force structure that seeks to tackle future threats as laid out in the National Defence Strategy, outlining a requirement "to strike diverse targets inside adversary air and missile defence networks to destroy mobile power-projection platforms".

The Lockheed F-22/F-35 hybrid would face, possibly compete with Boeing's F-15X Eagle, but LM view the 'upgraded Raptor' as an interim step before fielding an all-new sixth-generation fighter utilising more exotic technologies. The USAF is already studying a future combat aircraft under the *Next Generation Air Dominance* or *Penetrating Counter Air Project*. Lockheed are also looking at other options, including adding directed energy and electronic attack capabilities to its F-16, F-22 and F-35, as well as unspecified 'structural changes' and an enhanced powerplant for the F-35 Lightning II.

Japan's futuristic fighters

The Japan Air Self-Defence Force (JASDF) have been planning to supplant their current fleet of Mitsubishi F-2s with a new generation fighter in the 2030s. There have been reports that Lockheed Martin have offered Japan a stealth fighter, as a hybrid based on its F-22 and F-35 with Mitsubishi Heavy Industries (MHI) to produce the wings while Mitsubishi Electric would work on the avionics (see *Vayu Issue IV/2018*). However, there are reports that the Japanese are also in discussion with the UK on a futuristic fighter project, possibly based on the Tempest which is a sixth generation concept led by BAE Systems (*see Issue IV/2018*).

Upgraded B-52 Stratofortress upto 2050

The USAF is to reportedly upgrade the long-in-the-tooth B-52 Stratofortress bomber to the B-52J variant, modernising the bomber's defensive systems and avionics to keep the aircraft in frontline service till 2050. Other upgrades include crash-survivable

flight data recorder, a weapon system trainer, relocated targeting pod and new ejection seats.

The Stratofortress is being considered to be carrier for the USAF's first-generation hypervelocity strike weapons integrated with the Lockheed Martin AGM-183A Air-Launched Rapid Response Weapon (ARRW) and Hypersonic Conventional Strike Weapon (HCSW), demonstrations of which are being accelerated under the Pentagon's new Section 804 acquisition policy. The ARRW is currently slated for service from 2021 while the HCSW is expected to join the inventory in 2022. Flight tests of the winning HAWC design on a B-52 are expected to begin before Fiscal Year 2020.

USAF order 18 KC-46A mid-air refuellers

The US Air Force has awarded Boeing a $2.9 billion contract for 18 KC-46A tanker aircraft, plus spares, support equipment, spare engines and wing air refueling pod kits. With this fourth production lot, Boeing has been contracted for 52 KC-46A tankers, in two production lots for 7 and 12 aircraft in August 2016. The third lot, for 15 aircraft, was awarded in January 2017. Boeing plans to build 179 of the 767-based refueling aircraft for the USAF to replace its legacy tanker fleet.

USAF LAA competition

The United States Air Force's Material Command has initiated search for undisclosed number of light attack aircraft (LAA), to provide an affordable, non-developmental aircraft intended to operate globally in various irregular warfare environment which have characterised combat operations over the past 25 years. It is anticipated that formal solicitation will be released in December 2018 and a contract awarded in the fourth quarter of FY2019.

The two main contenders for the Light Attack/Armed Reconnaissance or Light Air Support, are Embraer and Sierra Nevada's A-29 Super Tucano and Textron Aviation's AT-6 Wolverine turboprops. "Only one responsible source and no other supplies or services will satisfy agency requirements, among the limited sources. Sierra Nevada Corporation (SNC) and Textron Aviation are the only firms that appear to possess the necessary capability to meet the requirement within the Air Force's time frame without causing an unacceptable delay in meeting the needs of the warfighter" as per the statement.

First Saab Gripens for Brazil in 2019

The first of 36 Saab JAS 39E Gripen fighters for the *Forca Aerea Brasileira* (Brazilian Air Force) will be delivered in 2019 and will initially employed for flight testing. Eleven aircraft will follow in 2021, eight in 2022, seven in 2023 and eight in 2024. The first 13 will be built by Saab in Sweden, the remainder by Embraer in Brazil.

Delivery scheduling details have also been released for Brazil's KC-390 tanker/transport, with the first production aircraft to be delivered in 2019. Following that, annual production rate of KC-390s will be three aircraft in 2019-2023, five in 2024-2025 and two in 2026.

Pakistan's ECC clears sale of JF-17s to Nigeria

Pakistan's Economic Coordination Committee (ECC) of the Cabinet has approved issuance of a 'sovereign guarantee' for the sale of three JF-17s to the Nigerian Air Force, at a reported $184.3 million. Pakistan's Ministry of Defence Production had approached the ECC for issuance of such a certificate in order to process the supply of this Kamra-built multirole fighter for the Nigerian Air Force, in line with the contract signed between the two parties recently.

Qatar expanding air power

The Qatar Emiri Air Force (QEAF) have plans for major expansion of its air assets including those at Al Udeid and Doha. Al Udeid houses the largest US military facility in the Middle East while Doha will now be further developed. A new base at Tamim is also to be constructed. The expansions are required to house the massive new fleet of QEAF fighters currently on order, including F-15QA Strike Eagles, Rafale DQ/EQs and Eurofighter Typhoons.

The QEAF will also receive 24 recently ordered AH-64E attack helicopters from 2019 with deliveries to be completed by end May 2020. The Qataris have options also for up to another 24 Apache Guardians. At the same time, Qatar is to also receive 28 NH90s, with Leonardo acting as overall prime contractor responsible for management of the programme. The contract includes 16 NH90 Tactical Transport Helicopters (TTH) and 12 NH90 NATO Frigate Helicopters (NFH). The NFHs will not be equipped for anti-submarine warfare but will have the European Navy Radar (ENR) maritime surveillance radar, a Safran electro-optical system and an Elettronica DETE-90 electronic intelligence/support measures system.

Israel to order more Eagles

The Israeli Air Force is reportedly ordering additional F-15 strike fighters as part of its modernisation plans, under the US Foreign Military Financing (FMF) package approved by Washington in 2016 which provides $36bn for supplies over a decade. Israel had procured 25 F-15 *Ra'am* fighters in 1994, which are now being upgraded with structural work and new systems planned, which include the AN/APG-82(V)1 active electronically scanned array (AESA) radar.

Upgraded Tu-22M3M

The first extensively upgraded Tu-22M3M long-range strategic bomber was rolled out on 16 August at the Kazar Aviation Plant prior to its commencing ground and flight testing. Once trials are completed, a decision will be taken on mondernising an initial batch of aircraft to Tu-22M3M configuration, with current plans envisaging upgradation of 30 aircraft to this standard. The modernisation programme will significantly expand combat capability of the type. Work will cover a new avionics suite, similar to that on the Tu-160M, replacing 80% of the existing equipment, including new navigation, communications and sighting systems, engine controls, automatic fuel management and electronic equipment.

Su-57 operational tests continue

The Sukhoi Su-57 next gen fighter has reportedly begun tests with the new 101KS-N targeting pod, developed by the

Uralskiy Optiko-Mekhanicheskiy Zavod (UOMZ, Ural Optical and Mechanical Plant) at Yekaterinburg. The 101KS Atoll electro-optical suite for the Su-57 includes a range of sensors, among them the 101KS-N: the N suffix stands for *Nazemnyi,* or ground targeting. UOMZ is also developing a lighter version of the pod for the Yak-130 combat trainer, which is going into service in increasing numbers with a number of Air Forces.

Taiwan F-16V in flight tests

The first F-16V modified by Taiwan's Aerospace Industrial Development Corporation (AIDC) at Taichung has begun flight testing and will be used as technical verification aircraft. The modification programme for Taiwan's existing F-16A/B fleet, announced in September 2011, is locally known as 'Phoenix Rising' at the core of which is a Northrop Grumman AN/APG-83 Scalable Agile Beam Radar (SABR) combined with an Elbit Systems multifunctional high-resolution Centre Pedestal Display (CPD).

Upgradation of Taiwan's remaining 145 F-16A/Bs was confirmed in July 2012. The complete upgrade package, including avionics upgrades, system integration, training and logistics support, having a total value of $5.3bn. Lockheed Martin had upgraded two F-16s ('A and 'B models) in the US to serve as prototypes, while the remainder are being retrofitted by AIDC in Taiwan.

Ex-Russian MiG-29s with Serbia

The first two MiG-29s donated to Serbia by Russia have entered service with the *Ratno vazduhoplovstvo i protivvazduhoplovna odbrana* (RViPVO, Serbian Air Force and Air Defence).

The aircraft have now entered service with the 101 *lovacka avijacijska eskadrila* (101st Fighter Aviation Squadron).

The aircraft had arrived in Serbia last October 2017 following which were installed new navigation and communication devices in line with International Civil Aviation (ICAO) standards at Batajnica's Moma Stanojlovic works. The dated radar screen has been replaced by an MFI-54 multifunction display. Work is due for completion in the first half of next year, leaving the RV I PVO with ten MiG-29s, including four aircraft from the original Yugoslavian order. Another four MiG-29s are expected to be donated by Belarus after their overhaul.

Rafale Cs in 'Operation Chammal'

Armee de L'Air (French Air Force) two-seat Dassault Rafale Bs operating from Azraq Air Base in Jordan, as part of *Operation Chammal* have recently been replaced with single-seat Rafale Cs. Mixed patrols of one Rafale B and one Rafale C will provide fire support and tactical reconnaissance for coalition allied forces in the Iraq-Syria combat zone.

Gripen E missile firing tests

The new gen Gripen E has successfully carried out operational tests to verify the ability to release and launch external payloads. The tests, conducted by the first Gripen E test aircraft (designated 39-8), at Vidsel Test Range in northern Sweden comprised jettisoning of an external fuel drop tank and another firing an IRIS-T air-to-air missile.

The Gripen E has multiple weapons options, including for stand-off precision strike using guided glide bombs, heavy anti-ship and deep strike missiles, and also long-range air-to-air missiles such as the Meteor, apart from pods and sensors for reconnaissance and special missions.

Czech L-159T2 in maiden flight

Aero Vodochody's new L-159T2 made its first flight on 2 August 2018, at the company's Vodochody airport. Ordered by the Czech Air Force, the three L-159T2s are due to be delivered to the 21st Tactical Air Force Base at Caslav by the end of 2018 and used

by the Czech Air Force for advanced flying training and operational missions. The L-159T2 features a new central and forward fuselage, a Leonardo Grifo radar, electronic countermeasures and radar warning receivers.

Aero Vodochody had earlier announced more orders for its L-39 family of trainers, including 12 new-build L-39NG as well as six legacy L-39Cs upgraded to L-39CW standard for RSW Aviator. Portugal-based SkyTech has also ordered ten L-39NGs with an option to purchase six more. With the Senegal order for four armed L-39NGs announced earlier in 2018, this takes the orders for the type to 26 plus six options.

Boeing F/A-18 upgrades

The US Navy is seeking an off board dual band decoy electronic countermeasures and decoy systems for its F/A-18 Super Hornet aircraft. The system will replace the current BAE Systems ALE-55(V) fibre-optic towed decoy and Raytheon's ALE-50 advanced airborne expendable decoy systems. Further, the US Marine Corps would retrofit seven of its F/A-18 Hornet squadrons with active electronically scanned array radars, which are likely to be modified versions of Raytheon and Northrop Grumman radars, the new radars to be installed in 88 aircraft during FY2020-2022. The F/A-18C and F/A-18D model Hornets are to remain in service until the mid-2030s.

Boeing 777-300ER for JASDF

The Japan Air Self-Defence Force (JASDF) received its first Boeing 777-3SBER on 16 August. The 777s will be operated by the *Tikubetu Koku Yusodai* (Special Airlift Group)/701st Hikotai (Squadron) at Chitose. The second is scheduled for delivery in December, and these will be maintained by All Nippon Airways.

RMAF MiG-29s and Su-30MKMs in serviceability issues

It is reported that only four of the 28 MiG-29s and Su-30MKMs in the Royal Malaysian Air Force (RMAF) inventory are presently airworthy. These comprise ten MiG-29N/NUBs and 18 Su-30MKMs, the former grounded since 2016, pending funding for overhaul, while only four of the twin-seat Su-30s are available, as per an official RMAF statement. It was stated that 12 Su-30MKMs had reached their full decade of service and are grounded until the mandatory tenth-year service programme is completed, delayed owing to lack of funding. However, it is mooted that substantial savings could be achieved, should the overhaul take place in-country, for which work would be carried out by a local company, Aerospace Technology Systems Corp, which also operates the Sukhoi Technical Centre at RMAF Gong Kedak.

Philippines to acquire BT-67 gunships

The Philippine Air Force are to acquire two BT-67 gunships to expand its counter-insurgency (COIN) force. The aircraft are being offered by Basler Turbo Conversions and would join four surplus OV-10 Bronco ground attack aircraft that are being supplied by the US. The Broncos will join some eight upgraded OV-10M variants already in service and complement six A-29B Super Tucanos which are due for delivery in 2019. The Phil.AF's fixed-wing COIN fleet is based at Danilo Atlenza, Cavite, but are due to relocate to Lumbia, Cagayan De Oro.

Induction of Chinese Navy JL-10Hs

Formal induction into service of the first 12 JL-10H advanced jet trainers with the People's Liberation Army Naval Air Force (PLANAF) has taken place at Suizhong air base. Hongdu Aircraft Corporation had delivered four batches of three aircraft to the PLANAF beginning at the end of December 2017. With arrival of these aircraft, the first training course is to shortly begin even as the type is already in service with the People's Liberation army Air Force (PLAAF).

Chinese AG600 amphibian in test flights

China's indigenously-designed amphibious aircraft AG600 *Kunlong*, developed by the Aviation Industry Corporations of China and certainly the largest in the world, carried out further tests on 20 October, taking off from the Zhanghe Reservoir and landing at Jingmen in Hubei province. Earlier it had carried out high speed water taxiing trials.

The AG600 is powered by four indigenously-built turboprop engines and with an endurance of 12 hours, this amphibian aircraft will be employed for maritime search & rescue, fighting of forest fires and maritime reconnaissance.

RSAF training continues at Cazaux

The Republic of Singapore Air Force's training detachment at Base Aerienne 120 Cazaux in France continues to use these facilities 20 years after the first A-4 Skyhawks of 150 Squadron arrived in France in 1998. These were replaced by 12 M-346 Masters is 2012.

Chinese Wing Loong II armed UAS for Pakistan

As reported by state-run *Global Times* from Beijing, the Government of China will sell 48 Wing Loong II advanced unmanned aerial systems to Pakistan which will eventually also be manufactured under licence at Kamra in the latter country. The Wing Loon II is an improved version of the Wing Loong 1 Unmanned Aerial Vehicle, and is a Medium Altitude Long Endurance (MALE) system. Manufactured by the Chengdu Aircraft Industrial (Group) Company, the UAV was developed primarily for the PLAAF and for export, with some having already been supplied to a number of countries, in direct competition to the American MQ-9 Repear.

South Korea orders P-8As

The US Department of State has cleared sale of six Boeing P-8A Poseidon maritime patrol aircraft to South Korea. Valuing the proposed deal at $2.1 billion, the US Defence Security Cooperation Agency says the package also includes a range of mission systems, support and training. The South Koreans have operated the Lockheed Martin P-3C Orion for 25 years and will have "no difficulty transitioning its [maritime surveillance aircraft] force to the P-8A".

South Korean presently operates 16 P-3Cs, with the oldest airframe being 32 years old. Other potential types considered by the Koreans were the Airbus Defence & Space's C295 MPA and the Saab Swordfish system using the Bombardier Global 6000 airframe.

Apache upgrades

The Netherlands have signed an agreement to remanufacture and upgrade its current, 28-strong fleet of AH-64D Apaches. The Foreign Military Sales deal will bring the Netherlands Defence Helicopter Command's Apache force to the US Army's E-model standard. Average age of the Dutch Apache fleet is over 17 years, with the type having entered service in 1997. The Netherlands expects to have its rotorcraft fleet modernised by 2025, and for the Apaches to remain operational until 2050.

Key elements of the work will include more powerful GE Aviation 1700 engines, a new drivetrain and rotor blades, updated fire-control and targeting systems, enhanced self-protection equipment and improved communications.

Qatar presents Turkey with BBJ 747-8I

The Qatari Government have "gifted" a Boing BBJ 747-8I formerly used for Qatari VIPs to Turkey. This wide body aircraft features a master state room, a main deck lounge for 14 passengers, a conference room, guest bedroom, medical room and multiple bathrooms. The aircraft is presently undergoing painting and modification at Turkish Technic's HABOM maintenance, repair and overhaul centre in Istanbul. The 747-8I will join Turkey's VIP aircraft fleet, which comprises an Airbus ACJ340, ACJ330, ACJ318, a pair of ACJ319s, a Bombardier CRJ200, four Gulfstream G550s and a G450.

Rafale F.3-R qualified by DGA

On 31 October 2018, the Rafale F.3-R variant was qualified by the French defence procurement agency (DGA) after completion of its development by Dassault Aviation and partners in full compliance with contractual performance, schedule and budget. This also enables the French Air Force and Navy Rafales to deploy the Meteor long-range air-to-air missile produced by MBDA, guided by the AESA radar which will be standard on all Rafales delivered since mid-2013. The Rafale F.3-R will also carry the Thales Talios new-generation laser designator pod and the laser homing version of Safran's AASM Air-to-Ground Modular Weapon.

Eurofighter fleet exceeds 500,000 flight hours

The Eurofighter Typhoon fleet have exceeded the 500,000 flying hours mark, rapidly accumulating hours particularly in recent years, following an increase in the tempo of air policing and combat operations. There are now almost 500 Typhoons with European Air Forces, with potential for this number to grow in the coming decades. The Eurofighter Typhoon will shortly get new AESA radars, an enhanced human machine interface and new weapons.

Clemens Linden, CEO of Eurojet Turbo GmbH, which company provides engines for the aircraft, stated: "We have clocked up more than a million hours of engine performance for the EJ200 which is a major achievement and through countless deployments, both in Europe and internationally, we have enjoyed incredible engine reliability".

Sikorsky / PZL Mielec M28 to Ecuador

An M28 manufactured at PZL Mielec in Poland and owned by Sikorsky, has been delivered to Ecuador following a trans-Atlantic flight from Poland. Delivered five months after contract award, the twin-engine turboprop is to meet the Ecuadorian Army's need for a multi-role STOL transport aircraft to operate in diverse climates and terrain. ZL Mielec had earlier conducted conversion training for Ecuador Army pilots and mechanics.

Royal Thai Air Force orders additional H225Ms

Four Airbus Helicopters H225M (previously known as EC725) multirole utility helicopters have been ordered by the Royal Thai Air Force (RTAF), as part of their fleet augmentation programme, which follow-on order brings the RTAF's H225M fleet to 12 by 2021. Specially equipped with emergency flotation gear, fast roping, cargo sling, search light and electro-optical systems, these four new multirole H225M helicopters will join RTAF's existing fleet

of six H225Ms for combat search and rescue missions, search and rescue flights and troop transport operations. The RTAF will also be receiving two H225Ms from its earlier order by end of this year.

The H225M, with 88 numbers currently in service in six countries across the globe, has surpassed the 100,000 flight hour milestone, following its first delivery to the French Air Force in 2006. The aircraft was deployed by the French Air Force (also known as the Caracal) in Lebanon in 2006. "The 11-metric-tonne H225M has proven its reliability and durability in combat conditions and crisis areas such as Afghanistan, Chad, the Ivory Coast, the Central African Republic, and Mali, while also supporting NATO-led operations in Libya".

Russian Helicopters upgradation plans

Russian Helicopters have announced upgradation of its Mi-28NE, Mi-35M and Mi-35P attack helicopters. Upgrade of the Mi-28NE primarily relates to its weapons capability and includes provision of the new Khrizantema-M anti-tank missile with dual guidance system, enabling engagement at ranges up to 10km. Modernised Ataka missiles with laser guidance are also now fitted to the helicopter, while bombs up to 1,102lb (500kg) can also be carried.

The modernised Mi-35P features an OPS-24N-1L observation-sight system, with a third generation matrix long wavelength thermal imager, TV camera and laser rangefinder. A new digital flight simulator based on the PKV-8 automatic flight control system increases stability and auto piloting. As for the Mi-35M, this has considerably more equipment options and can be further upgraded to integrate Igla-S air-to-air guided missiles.

US Air Force selects Leonardo MH-139

The United States Air Force has selected the MH-139, based on the Leonardo AW139 and offered by Boeing as prime contractor, to replace its fleet of UH-1N Huey helicopters. The requirement is for up to 84 helicopters plus training and supply of associated support equipment. With initial operational capability expected by 2021, the MH-139 will be tasked for protecting intercontinental ballistic missile (ICBM) bases and the transportation of US government and security personnel.

Sikorsky S-97 Raider exceeds 200 knots

The Sikorsky S-97 Raider light tactical helicopter prototype is currently moving through its flight test schedule, recently exceeding 200 knots at the Sikorsky Development Flight Centre. The Raider, developed by Sikorsky, a Lockheed Martin company, is based on the company's X2 Technology demonstrator, enabling speeds twice that of conventional helicopters. Sikorsky continues to demonstrate the application of its X2 Technology as the company prepares its proposal for the US Army's *Future Attack Reconnaissance Aircraft* (FARA) competition as part of the Army's efforts to revolutionide its aircraft fleet as part of what is known as the *Future Vertical Lift programme*.

Norway clears 'duel-role' NH 90

The Government of Norway has determined that its fleet of NH Industries NH90 helicopters will be operated for both Naval and Coast Guard requirements. The Royal Norwegian Air Force's eventual fleet of 14 NH90 NFHs would support both anti-submarine warfare as well as fisheries protection and border production missions. Defence minister Frank Bakke-Jensen has stated that Norway will be operating the NH90 for both missions

by early next decade. However deliveries of the NH90s, ordered in 2001 are "significantly delayed".

Further, the ministry stated that "experience so far shows that operating costs are far higher than planned", but, as the Minister stated, "there is no other 11-tonne helicopter on the market today that will provide us with equivalent capacity. The expected increased operating costs and the need for the armed forces must be addressed in connection with the next long-term plan".

MQ-25 contract to Boeing

The US Navy has selected Boeing to build the MQ-25A Stingray carrier-based unmanned mid-air refueling tanker. The contract calls for four air vehicle prototypes and eventually the navy plans to buy upto 72 Stingrays to relieve the refueling burden on the F/A-18F fleet. Boeing's wing-body-tail UAV configuration was pitched against proposals from General Atomics Aeronautical Systems (GA-ASI) and Lockheed Martin, with Boeing as the only company to build a prototype.

The USN plans for delivery of the first MQ-25A developmental aircraft in 2020, followed by its maiden flight in 2021 and declaration of combat readiness in 2024. The *Nimitz*-class aircraft carrier *George Washington* (CVN 73) will be modified to accommodate the MQ-25 during its four-year refueling and complex overhaul (RCOH) maintenance period at Newport News, Virginia.

TAURUS contract with Spanish MoD

The Spanish Ministry of Defence and TAURUS Systems GmbH have contracted for upgrade and maintenance of the TAURUS KEPD 350 Weapon System used by the Spanish Air Force. The TAURUS KEPD 350 has been in the inventory of the Spanish Air Force for 10 years, and now is operated with EF-18 fighter aircraft. "The advanced stand-off missile provides, with its very long range and a unique intelligent warhead, an important strategic and tactical advantage to the Spanish Armed forces, optimised for attacking deep buried bunkers, infrastructure and aerial targets even in anti-access and area denied environments".

First flight of Embraer KC-390

Maiden flight of the first series production multi-mission medium airlift KC-390 has recently taken place, the aircraft joining the flight test campaign, in which more than 1,900 flight hours have been already logged. Civil certification of the basic aircraft is to be granted by Brazilian aviation authority ANAC (*Agência Nacional de Aviação Civil*), expected to be achieved shortly.

Boeing and Airbus orders flow on ....

Both Airbus and Boeing continue to receive new orders for their airliners, the former including 44 A330s and 35 A350s, with the remaining 304 orders being for the A320 and A220 families. Meanwhile Boeing have announced 108 widebody orders, including a batch of freighters and repeat orders for both 777-300ERs and 787s but the biggest number are for up to 578 B-737 MAX family aircraft.

Boeing plan near 60 737s per month

Boeing is planning to ramp up its B-737 single aisle airliner production to some 57 aircraft per month. Boeing's CEO, Dennis Muilenburg predicts that 737 deliveries will accelerate in the remaining months of 2018. Earlier this year, Boeing boosted 737 output from 47 to 52 aircraft per month, and plans to reach 57 aircraft per month in 2019. However, supply chain problems,

have impacted on Boeing's deliveries, with the company handing over just 29 737s in July and 48 in August 2018. Airbus, which shares many of the same suppliers, has also experienced significant disruption to its narrow body deliveries, but is similarly looking to further increase its output.

Powerplant manufacturer Safran, which is a partner in the CFM joint venture with GE Aviation has reiterated that it would make no decision on any further rate increase until "its current issues are resolved."

Singapore Airlines A350 makes world's longest flight

After receiving its first A350-900 Ultra Long Range (ULR), which is a development of the A350-900, Singapore Airlines made the world's longest commercial flight on 11 October 2018, that of 19 hours from Singapore to New York. The long- range Airbus A350 – 900ULR is configured to carry up to 161 passengers, 67 in business class and 94 in premium economy, with no regular economy seats available. The flight crew which also included two first officers and a 13 cabin crew had their workload staggered and each pilot had a minimum of eight hours' rest during the flight.

Vietjet orders 50 more A321neos

Vietnamese carrier Vietjet has placed a firm order for an additional 50 Airbus A321neo single aisle aircraft. The purchase agreement was signed in Hanoi by Nguyen Thi Phuong Thao, Vietjet President and CEO and Christian Scherer, Airbus Chief Commercial Officer. The new purchase agreement increases the number of A320 Family aircraft ordered by Vietjet to 171, of which 46 have already been delivered, which leaves the airline with a backlog of 125 aircraft on order with Airbus for future delivery, comprising 120 A321neo and five A321ceo.

Embraer and American Airlines contract for 15 E175s

Embraer and American Airlines have signed a firm order for 15 E175 jets in a 76-seat configuration, with deliveries to take place in 2020. Combined with the airline's previous orders for the E175, this new contract results in a total of 104 E175 jets for American Airlines since 2013. American Airlines selected Envoy, a wholly owned subsidiary of American Airlines Group, to operate the 15 aircraft, which will be configured with 76 seats, 12 in First Class and 64 in main cabin.

Helvetic Airways order 12 E190-E2s

Embraer and Helvetic Airways have signed a contract for 12 E190-E2s, announced as a Letter of Intent (LoI) at the Farnborough Air Show in July. The contract includes options for a further 12 E190-E2s with conversion rights to the E195-E2, bringing the total potential order up to 24 of these regional airliners.

Headwinds for Qatar Airways

Qatar Airways has announced a pre-tax loss of $43 million, even as the airline continues to weather the effect of a Gulf blockade on the tiny state. The airline says the year has been "the most challenging" in its history, 10 of the 12 months being affected by the blockade imposed by several Gulf states in June 2017. Qatar Airways says the "illegal" blockade had a detrimental effect of 19% on passenger payload, and earnings were affected by longer flight times. This is a direct result of airspace restrictions arising from the blockade and the airline had to close 18 major routes after its operations to the states involved, including Bahrain, Egypt, Saudi Arabia and the United Arab Emirates, were stopped.

However, Qatar Airways opened 14 new destinations during the financial year but the carrier accepts that such new routes will involve some investment to establish market presence.

Ethiopian A350s/B-787s on China routes

Ethiopian Airlines have plans to operate most of its new Airbus A350s and Boeing 787s on routes to China. "We have more than 60 aircraft on order" said the airline's chief executive Tewolde Gebremariam and that "most of the wide bodies, both A350s and 787s… will be deployed on flights to China".

Ethiopian Airlines presently has nine A350-900s in service with another 15 on order, as well as 18 787-8s and four -9s in service, with no outstanding orders. Growing demand increasingly driven by China's "trade and investment links" with Africa is driving Ethiopian to add capacity to Guangzhou.

Kuwait Airways order A330neo

Kuwait Airways has ordered eight Airbus A330-800 airliners, as part of Kuwait Airways' fleet renewal and expansion strategy. This national carrier of Kuwait also has A350 XWB and A320neo Family aircraft on order, delivery of the new Airbus fleet beginning in 2019.

Manta Air to take delivery of two ATR 72-600s

Manta Air, the new domestic airline in the Republic of Maldives, has received its first two ATR 72-600s through Nordic Aviation Capital (NAC), the first being introduced in November 2018, and the second planned to join Manta Air's fleet before end of the year. The aircraft will enhance connectivity between the Maldivian Atolls, initially operating from the main Velana International Airport to three airports: Kudahuvadhoo in Dhaalu Atoll, Dharavandhoo in Baa Atoll and Thimarafushi in Thaa Atoll (depicted in image above).

First Airbus A330-800 in maiden flight

The first A330-800 made its maiden flight on 6 November at Blagnac; and will be employed for carrying out various tests. "The A330neo builds on the A330neo's economics, versatility and reliability while reducing fuel consumption by a further 14 per

cent per seat". The neo's two versions – the A330-800 and A330-900 – will accommodate 257 and 287 passengers respectively in a three-class seating layout, and are powered by Rolls-Royce Trent 7000 engines.

Russian Helicopters to supply 150 medical helicopters

Rostec State Corporation, which incorporates Russian Helicopters, National Service of Medical Aviation and Avia Capital Services LLC, have contracted to supply 104 Ansat and 46 Mi-8AMT helicopters for medical services. The National Service of Medical Aviation is presently committed for airlift of medical patients in Saint Petersburg, the Moscow Region, the Leningrad Region, the Sverdlovsk Region, the Novgorod Region and Karelia.

The first such Mi-8AMT EMS helicopter, fitted with necessary medical equipment, including an artificial lung ventilation system and a Tele-ECG machine reading an electrocardiogram in real time, was recently handed over to NSMA.

Aeroflot order 100 SSJ100s

Aeroflot and the United Aircraft Corporation have signed an agreement for delivery of 100 Sukhoi Superjet 100s, the

contract signed by General Director of JSC 'Aeroflot' Vitaly Saveliev and President of JSC 'United Aircraft Corporation' (UAC) Yury Slyusar. Delivery of these 100 SSJ100s will be over the years 2019 till 2026, the airliners being in two-class layout (12 seats in the business class and 75 in the economy class).

Biman order 3 Bombardier Q400s

Biman Bangladesh Airlines have ordered three new Q400 turboprops, signing a purchase agreement with the Canadian Commercial Corporation (CCC). Based on the list price of the Q400 aircraft, the firm order is valued at approximately US$106 million.

First Delta Air Lines A220-100

Delta Air Lines` first Airbus A220-100 has "rolled out" from the painting hangar at the A220 final assembly line in Mirabel, Québec. Delta is the first US airline to take delivery of the A220, featuring its "state-of-the art interior and delivering best-in-class fuel performance". Delta's A220s are to begin scheduled services from early 2019.

China's building permanent airport at South Pole

China will be building its first permanent airport at the South Pole, "to provide logistical support to scientists and enhance airspace management in the resource-rich Antarctica." The 35th China's Antarctic expedition was to leave on 2 November whose major task is to build the airport, expected to be located along the ice sheet, 28 kms from the Chinese-built Zhongshan station in Antarctica. The Chinese had earlier built a 4000 metre long runway, for fixed-wing aircraft in 2009 to support its 25th expedition to the Antarctica, which area is "rich in natural resources such as silver, gold, platinum and coal".

According to Zhang Xia, director of the Polar Strategy Centre at the Polar Research Institute of China "the new airport will allow medium and large transport aircraft to operate in the region, not only providing logistic support but enhancing security for the Chinese teams in the Antartica, shortening transport time as well as enhancing efficiency".

Next Generation MICA missile

The French Defence Procurement Agency DGA (*Direction Générale de l'Armement*) has awarded MBDA contract for the MICA NG (*Missile d'Interception et de Combat Aérien Nouvelle Génération*) programme in developing the next generation MICA missile. With deliveries scheduled to begin in 2026, the MICA NG will be available to arm current and future versions of the Rafale combat aircraft, and intended as replacement for the MICA missiles currently in operational service with the French armed forces and exported to 14 countries worldwide. The NG programme includes an extensive redesign of the current MICA family while keeping the same aerodynamics, mass and centre of gravity so as to minimise the amount of adaptation required to operate the new system with existing platforms and launchers. The unique concept has ensured ongoing success of MICA for two decades: the option of two different seekers (infrared and radio frequency) and two launch modes (rail and ejection) in a single missile casing.

The HCSW development

The US Department of Defence have begun a joint programme to develop the Common Hypersonic Glide Body System. This memorandum of understanding "will encourage" the joint-service development of the Hypersonic Conventional Strike Weapon (HCSW, pronounced *Hacksaw*), which is an air-launched weapon design with a glide vehicle capable of being adapted to ground-based and naval launchers. There will be funding of $160 million, including some $40 million for transition of prototype hypersonic glide body vehicles towards series production.

China tests 3 types of hypersonic aircraft

According to reports from Beijing the Chinese have 'successfully tested' 3 types of scaled down models of hypersonic vehicles, being launched on 21 September at the Jiuquan Satellite Launch Centre in northwest China. Three models representing differently shaped designs, are code named D18-1S, D18-2S and D18-3S were lifted and then ejected from a balloon.

New Propulsion systems for Raytheon TOW missile

The US Army has awarded Raytheon Company a $21 million contract to develop a new propulsion system for the venerable TOW missile. The contract funds a three-year effort to make performance improvements to the tube-launched, optically tracked TOW missile, which is a long-range, heavy assault-precision anti-

armour, anti-fortification and anti-amphibious landing weapon system, guided by radio frequency. Performance improvements will be integrated into all TOW missile variants, including the top and direct attack 2B, direct attack 2A and Bunker Buster missiles.

Saab and Raytheon collaborate on new Carl-Gustaf munition

Saab has, in collaboration with Raytheon, received a contract from the US Army to demonstrate a guided munition for the Carl-Gustaf system, with three all-up-round test firings against threat-representative targets. In 2017, Saab had announced its partnership with Raytheon to develop new weapons for infantry forces. The new munition is designed to increase the capability of the combat proven, shoulder-launched, multi-role weapon system Carl-Gustaf built by Saab.

Raytheon, US Army upgrade 'Excalibur' projectile

Raytheon Company and the US Army have completed development of "revolutionary capability" for cannon artillery by upgrading the combat-proven Excalibur® precision-guided projectile. The Excalibur Shaped Trajectory, or EST, variant will enable soldiers to destroy targets in hard-to-reach locations by selecting the projectile's terminal or final phase attack angle. With the Excalibur EST munition, "soldiers can target a bunker positioned on the opposite side of a mountain slope, target a multi-story building from the side rather than the top or defeat enemy assets positioned under highway overpasses".

18 M777 Ultra Lightweight Howitzers for the US Army

BAE Systems has received an order to provide 18 additional M777 155mm Ultra Lightweight Howitzers to the US Army under a new contract from the US Department of Defence (DoD). This order adds to the more than 1,000 M777 gun systems already in service with the US Army and Marine Corps, as well as logistical support contracts received from the DoD. *(The Indian Army is receiving its first batches of M777s, see separate news item).*

MMP 5th Gen missile cleared

The French Army Technical Service (STAT), and the French DGA (*Direction Générale de l'Armement*), with support of MBDA, have carried out evaluation of the MMP 5th generation land combat missile system, the objective being to check suitability of the MMP weapon system in semi-desert conditions (Djibouti in this case). Nine firings were made with all the missiles reaching their target. Two firings were also carried out by Navy commandos from the Rigid-Hulled Inflatable Boat ECUME (*Embarcation Commando à Usage Multiple Embarquable* - embarked multi-purpose commando boat).

Good going for Saab in 2018

GlobalEye off to a flying start

Saab's GlobalEye achieved a number of significant milestones in 2018, commencing with the rollout of first aircraft in February

2018. GlobalEye is an Airborne Early Warning & Control (AEW&C) aircraft that is a 'true swing role multi-mission solution'. It combines multiple sensors and sophisticated data fusion into an intuitive mission system on the Bombardier Global 6000 jet with fully networked communications. This capability gives

'excellent' flexibility across the full mission spectrum in peacetime to warfighting, and particularly benefits joint force commanders managing combined air, sea and land operations.

Gripen E with Swiss pylons

Saab's Gripen E programme continues to make progress. The Gripen aircraft with designation 39-8 has conducted a number of successful flights carrying external stores, including pylons from the Swiss company RUAG Aerostructures. Since the first flight with the Gripen E test aircraft (39-8) last year, an intensive flight trials period has been successfully conducted. The aircraft has shown throughout the expansion of the envelope expected performance and behaviors, with high availability and reliability. Gripen has now taken another big step towards customer delivery next year by flying with external stores.

Gripen E's pylons are installations by which additional tanks for fuel, surveillance systems or guided weapons can be attached under the aircraft. Eight pylons are supplied per aircraft. These technologically sophisticated components include both electronic as well as mechanical systems and must meet the highest demands regarding aerodynamics and load capacity.

The first flights with external stores were conducted over the Baltic Sea at the beginning of July. Besides two of the IRIS-T air-to-air missiles, the aircraft carried five pylons designed and built together with the Swiss company RUAG Aerostructures.

Sweden Submits Gripen Proposal to Bulgaria

On 1 October, the Swedish Defence Material Administration submitted their Swedish Gripen proposal to the Bulgarian Ministry of Defence. The Swedish offer consists of eight new fully NATO-interoperable Gripen C/D fighter aircraft to equip the Bulgarian Air Force, with the latest MS20 configuration, which can be delivered to the Bulgarian Air Force with the first aircraft delivered within 24 months of contract signature. Training of pilots and technicians is included and with the offer full QRA capability will be achieved within the budget framework.

The Gripen C/D is in operational service with the air forces of Sweden, South Africa, Hungary, Czech Republic and Thailand. The UK Empire Test Pilots' School (UK ETPS) uses Gripen as its fast jet platform for test pilots from all over the world. With Gripen, NATO member states Czech Republic and Hungary successfully participate in NATO missions and joint exercises with other NATO countries. The development of the Gripen C/D is on-going and the system will remain operational for at least another 30 years.

Arthur Support Contract from South Korea

Saab has signed a contract with South Korea's Defence Acquisition Programme Administration (DAPA) regarding support for the Arthur Weapon Locating System. This Performance Based Logistics (PBL) contract includes spare parts supply and support for the Republic of Korea Army

and Marine Corps, the contract value approximately 500 million SEK and the contract period 2018-2023. Saab made the first delivery of Arthur systems to South Korea in 2009 and have had annual support contracts for these systems in place since 2012. Saab also participated in delivery of additional Arthur systems from 2012 within a Technical Cooperation Programme (TCP) with the Korean company LIG Nex1.

Surface Launch RBS15 Gungnir

Saab has unveiled the surface launch version of RBS15 Gungnir, the next generation anti-ship missile system. The surface launch version of RBS15 Gungnir uses the all new RBS15 Mk4 Surface missile: it provides greater range, enhanced defence penetration and electronic protection as well as a more advanced target seeker, allowing it to engage any target, in all conditions. The RBS15 Mk4 Surface missile is used in both the sea system and the land system of RBS15 Gungnir. It is designed to provide

commonality through easy integration on both land- and sea-based platforms of almost any size. "The system is fully backwards compatible, so an investment in Mk3 today opens a smooth path to transition into Gungnir tomorrow."

The RBS15 missile family is jointly produced by Saab and Diehl Defence GmbH & Co. KG and serves with various navies, coastal batteries and air forces from Sweden, Finland, Germany, Poland, Croatia, Thailand and an undisclosed country.

New Lightweight Torpedo (SLWT)

Saab's Lightweight Torpedo (SLWT) has been unveiled: the SLWT is 'one of the most advanced and sophisticated torpedoes' in the market and has been ordered by Sweden and Finland. Saab is now pursuing additional customers on the export market. The development of SLWT has the Baltic Sea in mind, which is a marine enviroment with the most challenging factors for littorial anti-submarine warfare.

Boeing-Saab's T-X proposal wins!

Saab has received an order from Boeing for the Engineering and Manufacturing Development (EMD) phase for the Advanced Pilot Training Aircraft, T-X and the order will run until 2022. Saab and Boeing were selected by the US Air Force on 27 September for the T-X programme, which marks a new era in Saab and Boeing's partnership. The T-X programme is divided into multiple phases. This order concerns the first phase, EMD, in which Saab and Boeing industrialise the T-X aircraft together with the customer. EMD includes testing, US military flight certification and delivery of five jets. The EMD phase will be followed by a serial production phase. Saab and Boeing have developed the T-X aircraft together. Saab is a risk-sharing partner with Boeing in the development, Boeing being the designated prime contractor for the advanced pilot training system acquisition by the US Air Force.

Boeing-Saab's T-X proposal wins!

Stunning Show at Zhuhai 2018

The recently concluded biennial Zhuhai Airshow of 2018, held in southern China, has perhaps been the most impressive such event in recent times including as it did impressive performance by J-20 fifth gen fighters, awesome demonstration of the J-10B with thrust vector control (TVC) engines and also by large number of new drones, new radar systems, and much much more.

In late 2017, the J-10B prototype made its first flight with a TVC nozzle-equipped variant of the indigenous WS-10 engine. Just less than a year later, this was among the first such aerial performances, the aircraft demonstrating a spectacular selection of high alpha and post stall manoeuveres which rivaled Pugachev's cobra manoeuvere, the J-turn, and the 'falling leaf'.

The J-10B is arguably the first ever TVC-equipped, non-Russian and non-US aircraft to perform in this manner. China's willingness to display TVC technology in such confident and transparent manner is indicative not only of greater openness on behalf of the PLAAF itself, but also a reflection of the stage that China's engine TVC development has reached, and maturity of the technology.

Whatever be the future of J-10s with TVC engines, Chinese fifth generation fighters such as the J-20 will definitely benefit from TVC technology. The enigmatic Yang Wei, also the J-20's designer, when asked if the TVC technology demonstrated on the J-10B would have applications on the J-20, teasingly suggested that the J-20 had perhaps already integrated a TVC – engine.

Futuristic fighters, including the 'here and now' J-20 could certainly benefit from TVC technology as 'next gen' fighters could well delete additional control surfaces, become tailless as some sixth generation concepts have surfaced.

Pair of J-20s over Zhuhai

The future is here !

During Zhuhai 2018, multiple in-service J-20s carried out at comprehensive flying displays "lasting multiple minutes, on multiple days". The J-20 demonstrations started with a four-aircraft formation flight, including a series of tight turns and impressive vertical climbs. Images have recorded impressive vortex and condensation generation effects atop the J-20 in distinct manner.

Still, many observers felt that the J-10B's TVC demonstration actually overshadowed that of the J-20. However, considering the J-10B was equipped with TVC as well as a powerplant suited to its weight category whereas the J-20s remain relatively underpowered with AL-31s, not to mention likely constraints placed by the PLAAF on the unabashedly public performance of its newest air superiority fighter, the J-20's display was quite impressive. Indeed, after the J-20's rather staid demonstration at Zhuhai 2018, whether this aircraft can now be classified as *dedicated interceptor* or *dedicated strike aircraft* (with reference to the US F-22 and F-35) remains uncertain.

However, long speculated has been the J-20's intended role which was for dominating and maintaining air superiority for with additional missions including interception and strike, confirming what has been widely speculated about the J-20's role since the mid-2000s, when it was initially known as the J-XX.

Candid interviews with the J-20's chief designer Yang Wei and the J-20 test pilot Li Gang provided additional details on this fifth gen aircraft. The former revealed that the J-20 uses a side control stick, the first for a Chinese fighter. Extensive collaboration between pilots and designers was involved in the process of developing the aircraft's cockpit layout. As expected, statements praising the aircraft's stealth were also made, but most revealing was Li Gang's statement that the J-20 boasted excellent agility and handling, "as good as that of the J-10", which in fact further confirms that the J-20 was designed to achieve competitive aerodynamic performance even when using interim engines while awaiting the definitive WS-15s.

The best was yet to come : on last day of the Show, the flying display included a pair of J-20s opening their weapons bays to reveal a full complement of air-to-air missiles, including two PL-10 CCMs and four PL-15 BVR missiles. "Such openness is unprecedented for the PLA, and even rare for other air forces flying their own stealth fighters", said an astonished observer.

Showing their weapons with bays open

Chinese UAVs are now increasingly being exported

UAVs and UCAVs

An array of new Chinese UAVs have been recently ordered by several countries around the world. Many designs, such as the Wing Loong and the Caihong family, are considered very capable and carry a range of weaponary, only equivalents being from the United States and Israel, which offer drones of similar or higher technology and capability.

The most high profile of Chinese RPAS is the stealthy flying wing CH-7 from China Aerospace Science and Technology Corporation (CASC), designers of the CH-3, CH-4, and CH-5 family of UAVs. The CH-7 has a cranked kite flying wing configuration.

China Aerospace Science and Industry Corporation (CASIC) revealed a smaller, 3 ton flying wing called *Tianying,* a UAV intended for reconnaissance in a high threat environment. Chengdu Aircraft Group also revealed their own small flying wing demonstrator, featuring a cranked kite configuration, but no narratives of its role have emerged. Both these flying wings from CASIC and Chengdu could well be demonstrators intended as a stepping stone to larger and more mature designs.

[Detailed review and analysis in *Vayu*'s next Issue].

Rosoboronexport promotes

‘Viking’ air defence missile systems

JSC Rosoboronexport (part of the Rostec State Corporation) has begun promotion of its newest air defence missile system (ADMS) ‘Viking’ (a ‘Buk-M3’ type ADMS) to foreign operators.

“That’s good news for us and our foreign partners. The ‘Viking’ complex preserves the best characteristics of the famous line of the ‘Buk’ air defence missile systems and represents an important milestone in the development of the medium-range ADMS. There are unique characteristics of the system which are in line with current requirements in the area of operation and for protection of infrastructure against strikes from contemporary and future air launched weapons in conditions of radio-electronic countermeasures and counter fire. “The ‘Viking’ has no equivalent today in the world weapons market,” said Rosoboronexport’s Deputy Director General Sergey Ladygin.

The ‘Viking’ multi-missile, highly mobile medium-range air defence system is the next step in development of the well known ‘Kub’ - ‘Buk’ ADMS line. However, in comparison with the ‘Buk-M2E’ ADMS, its effective range has increased by 1.5 times, up to 65 kilometres. Besides, the number of simultaneously fired targets has also multiplied by 1.5 times, becoming 6 by each self-propelled launching installation, while the number of ready-for-launch air defence guided missiles in one firing position, consisting of two combat units, has increased from 8 to 18.

The ADMS ‘Viking’ incorporates a number of unique features, not previously available in any air defence missile system. For instance, it has a capability of integrating launchers from the ‘Antei-2500’ ADMS, which provides for engagement of targets at a distance up to 130 kilometers to boost efficiency of the whole AD grouping in the defence against hostile air-launched weaponry.

The ‘Viking’ was developed and designed taking into account trends in the world market. Its technical characteristics allow the system to be adapted in the most versatile manner to meet priorities of Rosoboronexport’s foreign customers. The combat control station of the ‘Viking’ has possibility of integration with the organic radar system as well as with other radars, including those produced outside Russia, but obviously possessing required characteristics. Besides, the ADMS has autonomous capability for use in firing sections or even separately from self-propelled firing installations, which enlarges the total defended area and increases the number of covered sites. This greatly helps to lower costs of an air defence site.

“Commissioned by the Russian Armed Forces, the ‘Buk-M3’ system and its export version ‘Viking’ have proved a very high level of combat efficiency during their daily operation and exercises. The ‘Viking’ has a very high kill probability in relation to enemy’s aviation, attacking elements of precision-guided munitions, as well as tactical ballistic missiles, maritime and ground targets,” added Sergey Ladygin.

Flight tests of the MC-21-300 airliner

The MC-21-300 test aircraft performed its maiden night landing on 31 August, while undergoing flight tests at the Flight Test Institute named after MM *Gromov*. The functioning of navigation and landing, as well as external lighting equipment was checked during flight. For instrument testing of its systems, the aircraft carried out several passes over the runway from two directions at various altitudes. "The flight mission was accomplished successfully and all systems operated properly."

Currently, two MC-21-300 test aircraft are undergoing flight tests, while a third aircraft is on static tests at TzAGI. Three more MC-21-300 test aircraft are under construction at Irkutsk Aviation Plant, a branch of Irkut Corporation (part of UAC), two of which will join the flight tests programme while the third aircraft will be subjected to endurance tests at TzAGI.

EASA flight test team to participate in certification tests

Two test pilots and a flight test engineer of the European Aviation Safety Agency (EASA) completed training procedures and obtained Russian permission to fly as part of certification campaign of the MC-21-300. In first stage of training, the EASA specialists studied the MC-21-300 design and Flight Crew Operation Manual. Procedures performed on the simulators and test benches included take-off, approach and landing using both landing systems and visual approaches; handling qualities and controllability characteristics of MC-21-300 aircraft in various control modes within the entire range of admissible operating altitudes, speeds, weights and centres of gravity; actions in case of emergency and approaching high angles of attack, when the stall warning activates.

On completion of theoretical and simulator training, EASA specialists performed familiarisation flights to gain familiarity with the basic characteristics of the stability and controllability of the aircraft, landing approach and go around procedures, including simulation of one engine failure. The theoretical and practical training of EASA specialists was provided by test pilots and leading engineers of the Flight Test Facility of the Yakovlev Design Bureau, a branch of the Irkut Corporation.

As Oleg Kononenko, 'Hero of Russia' and test pilot of the Yakovlev Design Bureau, stated, "thanks their vast experience, our European colleagues mastered control of MC-21-300 within a short period." Participation of EASA test crews in testing of the new aircraft is a prerequisite to its validation by EASA.

The new Russian short-medium range, narrow-body MC-21 commercial aircraft is being certified in accordance with both Russian and foreign standards. The application for type certificate of MC-21-300 aircraft was submitted to EASA in August 2016. MC-21 validation is currently underway in 18 panels, established jointly with EASA.

Updates from General Atomics

Testing of ATTS at RIMPAC

General Atomics Electromagnetic Systems (GA-EMS) participated in the *Rim of the Pacific Exercise* (RIMPAC) to conduct demonstrations and testing of the Missile Defense Agency's (MDA) Airborne Tracking and Targeting System (ATTS). The ATTS is integrated with an MQ-9B remotely piloted aircraft to generate precision tracks and imagery of targets of interest. The system was employed throughout the RIMPAC exercises conducted near the Hawaiian Islands. Held every two years, RIMPAC is the world's largest multinational maritime warfare exercise. The RIMPAC 2018 Exercise involved 25 nations, 46 ships, approximately 200 aircraft, five submarines, and 25,000 personnel.

Auto-Land of MQ-9 Block 5 RPA

The USAF has completed the first-ever automated landing of an MQ-9 Block 5 Remotely Piloted Aircraft (RPA), followed by the first auto-takeoff. The new Automatic Takeoff and Landing Capability (ATLC) was developed by General Atomics Aeronautical Systems, Inc. (GA-ASI) to enhance mission capability. By automating the takeoff and landing of the RPA, ATLC increases the safety and efficiency of air crews. The auto launch and recovery during these critical phases of RPA flight enlarges the operational envelope for cross wind operations as well as divert field landing.

French MQ-9 Reapers operated on Bastille Day

The French Air Force operated two of its MQ-9 Reapers simultaneously in support of France's Bastille Day events, one over Paris and the second over Cognac. The French Reaper Remotely Piloted Aircraft (RPA) assisted French authorities by providing airborne surveillance during the national celebration, benefitting from permanent corridor systems connecting all military-dedicated airspace, which enabled the RPA to access restricted areas created over Paris for the Bastille Day celebrations. This MQ-9 Reaper flew over a populated area of seven million people, alongside numerous other military aircraft participating in the flypast. Last year, France received its second MQ-9 Reaper system, consisting of three aircraft and a ground control station (GCS). Two French MQ-9s are based in Cognac Châteaubernard Air Base, where they perform daily training or ISR support to interministerial missions in French airspace. The 1/33 Belfort RPA squadron currently operates six Reaper RPAs to provide intelligence and support capabilities for *Operation Barkhane* and the Special Forces.

Testing of arresting Hook and HDD for MQ-25

General Atomics have concluded performance testing of the arresting hook Hold Down Damper (HDD) for its proposed MQ-25 unmanned aerial refueling aircraft for the US Navy. GA-ASI worked in collaboration with a team from GKN Aerospace's Fokker business unit in Helmond, Netherlands, who supply arresting hooks for the GA-ASI. The test simulated dynamic conditions providing performance characteristics of the HDD, such as damping, spring rate and pressure control functionality.

Second MQ-9B SkyGuardian flight

General Atomics has carried out flight of its second MQ-9B SkyGuardian Remotely Piloted Aircraft, conducted at Laguna Army Airfield in Yuma Proving Grounds. The second MQ-9B SkyGuardian gives the GA-ASI programme team another aircraft to perform important development testing and demonstrations. New capabilities that were not available when the first prototype was completed in 2016, such as lightning protection, an upgraded avionics and software suite and a de-icing system, have been included as part of MQ-9B's roadmap to become the first RPA certified to fly in civil airspace. The upcoming test schedule for YBC02 includes further flight envelope expansion testing, also testing of the Certified Redundant Control Module, flight controller updates, and testing of the Certifiable Ground Control Station (C-GCS).

Saab displayed its SLWT Lightweight Torpedo at Euronaval 2018

Euronaval 2018: Review and highlights

The Euronaval 2018 exhibition was a most successful edition which ran from 23-26 October confirming its status as the world's leading event in the naval industry sector. This 50th anniversary edition was marked by numerous political visits, including by the President of France and by the presence of more than 140 official delegations. With news announcements every day, Euronaval "is truly a driving force behind the preparation of the future, notably with its SEAnnovation space dedicated to start-ups and its Trade Vessel".

For the first time since its inauguration in 1968, the Euronaval exhibition had the honour of receiving the President of the French Republic, on its opening day. Accompanied by Florence Parly Minister of the Armed Forces, and Geneviève Darieussecq, Secretary of State, the President spent four hours at the exhibition, met industry leaders, members of the defence and the State industry, SMEs and start-ups. Ms. Parly inaugurated the exhibition with an extremely positive speech announcing launch of studies for the future aircraft carrier. Minister of Education and Youth Jean-Michel Blanquer, inaugurated the Trade Vessel for the French industry in the presence of Hervé Guillou, President of the GICAN and CEO of Naval Group, Geoffroy Roux de Bezieux, President of MEDEF and Philippe Darmayan, President of UIMM. Also welcomed were Jean-Jacques Bridey, Chairman of the Defence Committee at the National Assembly and Christian Cambon, Chairman of the Committee on Foreign Affairs, Defence and Armed Forces in the Senate, as well as several delegations of deputies and senators including Jean-Marie Bockel.

There were 142 official delegations including 101 foreign ones representing 72 countries from five continents. "The delegations benefitted from specific tour programmes, allowing them to review the naval systems of the future that could equip their countries' Navies:" stated GICAN officials.

Some of the events included an international conference in Paris on the day preceding the exhibition, with an audience of 600 people; an announcement on the creation of a joint venture between Naval Group and Fincantieri; confirmation of the FLOTLOG programme for future logistics ships of the French Navy, with the signature of the Franco-Italian bilateral agreement; reinforcement of Franco-Australian partnerships, in continuity of the submarine contract signed two years earlier and a celebration of the 170th anniversary of the Lacroix group, crowned by the sale of its 10,000th Seaclad decoy system.

Even though there is growth and sound economic health, the French naval industry is still having some difficulties attracting young people to join up. To meet the considerable need for young talent, GICAN, with the help of the Naval Industries Campus (CINAV), has developed the *Trade Vessel,* an innovative scheme inaugurated by the Minister of Education and Youth, with more than 300 students invited to the exhibition. The SEAnnovation space hosted 34 French and foreign start-up businesses, representing diversity of the sector which, for the start-ups present, was a unique opportunity to make themselves known to the shipbuilding industry from all over the world.

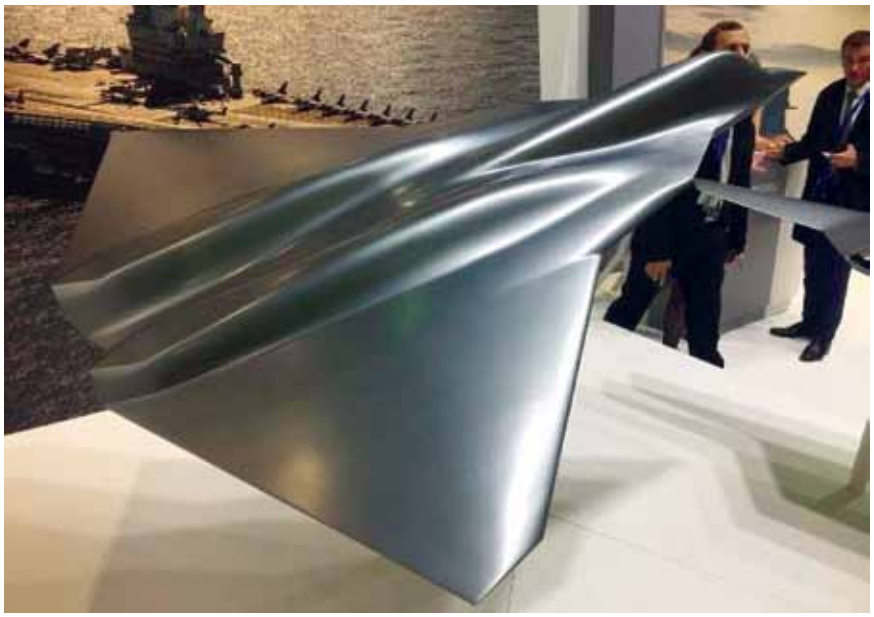
MBDA's 5th generation MMP system

MBDA unveiled its 5th generation MMP ground combat missile at Euronaval. This project follows operational evaluation carried out at end of summer 2018 by the French armed forces in Djibouti to confirm the reliability and operational performance of the MMP system in hot environment, both on the ground and also from a rigid hulled inflatable boat (RHIB) moving at high speed. A total of nine MMP missiles were fired, all demonstrating their accuracy. The success of this evaluation now allows MBDA to extend the integration perspectives of the MMP system and to propose this for fast attack craft or semi-rigid boats for missions against hostile ships, coastal defenses especially in support of a landing of small units or Special Forces.

Dassault unveils New Generation Fighter

Dassault took part in Euronaval 2018 exhibition to display a model of its *New Generation Fighter* (NGF) that will eventually replace the current generation of Dassault's Rafales and Germany's Eurofighter Typhoons by around 2035-2040. Dassault's next-generation aircraft has no tail fin and its swept W-shaped wing design incorporates advanced stealth technologies with integration of information systems. The air vehicle will counter contemporary air threats and exploit the potential of artificial intelligence.

This is part of Europe's *Future Air Combat System* (FCAS) and according to sources, Germany and France have agreed on the central requirements for such a new fighter in the 2040s.



First Project 11356 frigate for Indian Navy in 2023

The first frigate of the Russian project 11356 built under licence in India will be handed over to the Indian Navy in 2023, a representative of Goa Shipyard Limited (GSL) told *Vayu* at the Euronaval naval show. After formal contract, the first will be laid in 2019 and handed over to the Indian Navy in 2023. Yantar shipyard on the Baltic Sea will provide the necessary technological assistance and supply some sections for assembly. Some India-designed onboard equipment will be installed, while the power plant will be supplied by Ukraine, in particular, by Zorya-Mashproekt.

Scale model of project 11356 frigate at the India pavilion

Thales optronics for 'Charles de Gaulle'

The French Navy's aircraft carrier *Charles de Gaulle* has been equipped with high-tech systems as part of a mid-life major refit conducted under the management support of both the French Defence Procurement Agency (DGA) and the Fleet Support and Service (SSF). An important capability upgrade is Artemis, a passive infrared search and track (IRST) system that uses three fixed sensors integrated into the topside architecture for surface surveillance till the horizon at all times, day and night. Developed by Thales, Artemis enhances the level of situational awareness and protection needed to ensure survivability of the ship itself and other vessels in the area. Operating alone or in combination with other sensors, the system automatically detects tracks and classifies a broad array of airborne, maritime and land-based threats. The three fixed sensors provide 360° panoramic surveillance of the surface. "With advanced electronic image stabilisation and data refresh rates 10 times higher than a scanning IRST system, Artemis detects and classifies threats faster than earlier generations of sensors."

Thales takes ASW to the next level

Anti-submarine warfare (ASW) missions are crucial to the ability of naval forces to manage tactical situations of ever-increasing complexity and to make the right choices at decisive moments. The BlueScan integrated acoustics system from Thales gives naval forces a tactical advantage by adopting a collaborative approach on acoustic detection with multiple sensors operating in multistatic mode when needed. "The solution leverages advances in real-time *Big Data* analytics and artificial intelligence to provide automatic fusion, technical analysis and classification of heterogeneous data from acoustic sensors deployed by surface ships, aircraft, unmanned systems and sonobuoys. The sonars in service today deliver increasingly high performance and relay acoustic data in such huge quantities that it is becoming more and more difficult to process by humans. "The BlueScan system will provide sonar operators with an accurate picture of the acoustic situation and transmit only high-value data. With its open, scalable architecture, BlueScan is designed to adapt to evolving operational requirements while keeping through-life support costs under control and accommodating incremental capability enhancements to meet the priority objectives of naval forces."

Naval Group innovations

Naval Group showcased high technology naval solutions to address emerging threats. "As the leading service and system provider, Naval Group is uniquely positioned on the naval defence market allowing its clients to obtain an unequalled level of overall fleet performance during the whole ship's lifecycle", stated the company spokesperson. Naval defence solutions on display were:

Digital combat bridge: Naval Group is innovating Asymmetric Threat Control (LCMA) with a value offer on strengthening tactical situation control under all weather conditions and over 360° vision. The demonstrator on the stand offered a clear, intuitive and ergonomic representation of the situation at sea as well as tools for taking simple and quick actions in the face of threats.

SMX 31 submarine concept ship: Naval Group presented a disruptive submarine to serve a new vision of combat. It has new sensors, a new coating and allows for the use of drones. "This can help navies gather and share valuable intelligence without ever being detected thanks to the powerful acoustic, optronic and electromagnetic sensors."

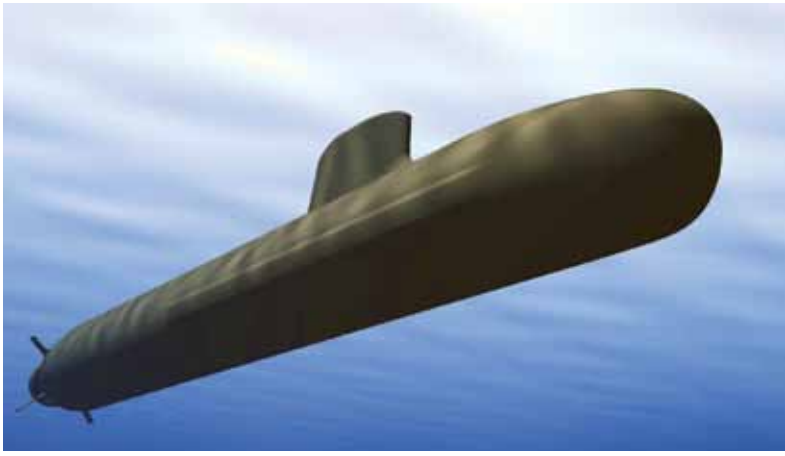
Surface ship design lab: An interactive application proposing different scenarios combining capacity and technological options through a dozen predefined sketches allowing navies to conceive a ship responding to their specific needs.

The Barracuda submarine: Naval Group has designed and is building the *Barracuda,* latest generation of the strategic submarine, developed for the French Navy dedicated to specifically respond to evolving threats. In 2016, Australia has selected Naval Group for the building of twelve submarines, of the *Barracuda* family design.

The Scorpene submarine: This is capable of carrying out various types of missions, including surface vessel warfare, anti-submarine warfare, long-range strikes, special operations or intelligence gathering. This is extremely stealthy and fast, and is equipped with weapon launching tubes, and various weapons (torpedoes, missiles, mines).

F21 Heavy Weight Torpedo: The French Navy's heavy weight torpedo offers advanced self-guided mode, shallow and confined water capabilities. The aluminium silver oxide technology gives the torpedo higher range and maximum speed, "making it a much more lethal weapon than other available torpedoes."

Belharra: Belharra is the new combat ship for naval supremacy and crisis management "designed for navies looking for a compact frigate able to perform a large range of missions stand-alone or within a task force either for high sea duration missions as for shallow water operation in congested and contested operational environment." As the first digital frigate, *Belharra* features advanced capabilities for anti-air, anti-surface, anti-submarine and asymmetric warfare domains.



Elettronica at Euronaval 2018

The Elettronica Group, with its three industrial assets - Elettronica SpA (Electronic Warfare), Elettronica GMBH (Homeland Security & EW), CY4GATE (Cyberwarfare) - showcased its latest naval technical solutions. Elettronica's systems are in service with more than 30 countries performing a variety of key operational missions, from strategic surveillance to

self-protection, SIGINT, electronic attack and operational support for naval, airborne and ground applications. The Elettronica Group has a long-standing tradition in the naval sector and a strong record of successful domestic and international collaborations on various modern military platforms, such as the Italian PPA, the Italian and French *Horizon* and FREMM ship class, the NFH-90 helicopter and a wide range of projects in the Gulf, Middle East and Asia. The distinctive features of its products are high sensitivity, high accuracy, a fully automatic surveillance function, and data processing for intelligence analysis (ELINT function). The performance of Elettronica's last generation products have been further improved, increasing sensitivity and accuracy. In a complex maritime background, the proliferation of commercial traffic at sea dramatically increases the congestion of the electromagnetic environment with unwanted signals. The intrinsically asymmetric conditions of operations need protection against EO/IR guided threats, an increasingly important requirement for active countermeasures in this field. The very concept of operations and user requirements for surface ships are changing, because of the increasing requirement for using these platforms in peace keeping operations, border surveillance against illegal traffic, and support for operations in Exclusive Economic Zones. In a scenario where ambiguity, uncertainty and complexity are the new variable characterising military operations, the deployment of Electronic warfare (EW) assets is changing dramatically.

At Euronaval, spotlight was on the next-generation, fully-European self-protection Infra-Red solution DIRCM (Direct InfraRed Countermeasure) for naval applications. This capability has been successfully tested in many scenarios and utilises Elettronica's experience matured over many NATO operations. The immediate benefit derives from the exploitation of the aforementioned capability to address MANPADS threats, including third generation threats, also used for piracy against surface vessels in an unconventional manner. The DIRCM system, combined with the use of flares according to a sequence of jamming techniques performed by the EW Manager, "represents a really effective way to counter IR missiles (fourth generation)."

Safran launches new naval INS

Safran Electronics & Defense have introduced a complete range of inertial navigation systems for both surface vessels and submarines, designed to meet requirements of today's navies. "Thanks to the HRG Crystal hemispherical resonator gyro, patented by Safran, and complete support packages with minimum guaranteed down times and extended warranties, this new range offers a major step forward in terms of operational effectiveness, product integration and cost of ownership." It also covers the full spectrum of naval requirements in terms of navigation precision, based on a wide variety of models in the family. The new Argonyx product line is designed for all surface vessels, from patrol boats and corvettes to frigates and aircraft carriers, while the Black-Onyx and Black-Onyx Dual-Core product lines cover all submarines, conventional and nuclear-powered, as well as air-independent propulsion (AIP) models.

"These new navigation units are light, reliable and robust for meeting the most demanding requirements for navigation and weapon system stabilisation. They deliver all data needed for navigation: heading, roll and pitch, angular velocities, position and heave, vertical/horizontal speed and acceleration. They also offer high performance in environments without access to signals from global navigation satellite systems (GNSS), allowing submarines to run without surfacing for unprecedented periods. Compatible with Sigma 40 interfaces, they are fully interchangeable, which means they can be selected for modernisation programmes."

RIFAN 2 secure intranet system

More than sixty vessels of the French Navy are now equipped with the *'Réseau Intranet de la Force Aéronavale étape 2' (RIFAN 2)* system, ranging from aircraft carriers and front-line frigates to support ships, patrol craft based overseas, and submarines. With this system, all ships at sea can now establish secure broadband links with each other and with the onshore command centre. RIFAN 2 provides overall network management and cybersecurity incident monitoring capability, which can take place both from an onshore management and control centre, or locally on board the ships, thus providing crews with a degree of independence. The network will become increasingly dense with installation planned for the *Barracuda* submarines under construction, for medium-size frigates (FTI programme), which are to be the French Navy's future front-line vessels, as well as for the future replenishment tankers (FLOTLOG programme). The RIFAN 2 system is regularly upgraded, whether in terms of its central architecture or the integration of new means of satellite broadband communications. Similarly, the cybersecurity incident monitoring and detection system will also be upgraded.

NATO Air Policing

The Peacetime Collective Mission

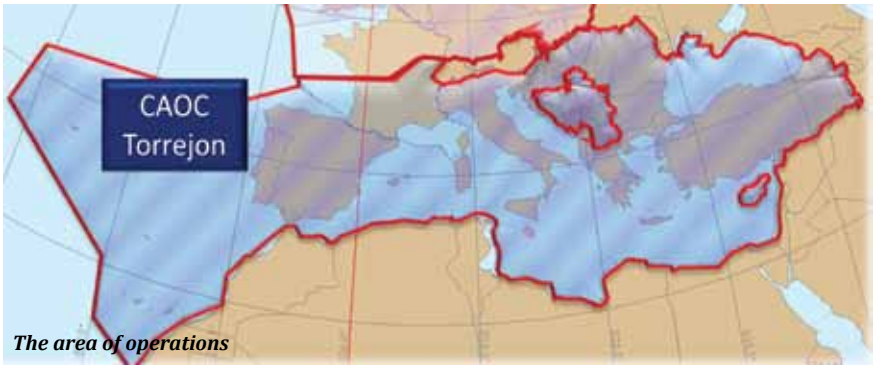
French AF Rafale

NATO Air Policing is a peacetime collective defence mission, safeguarding the integrity of the NATO Alliance member's airspace. The principle of collective defence is the main focus of NATO's founding treaty and it remains a unique and enduring principle that binds its members together, committing them to protect each other and setting a spirit of solidarity within the Alliance. In fact, all member nations contribute in some form to NATO air policing, be it through the use of national aerial surveillance systems, air traffic management, interceptor aircraft or other air defence measures.

On 12 September 2018, a media flight was organised by *Allied Air Command* (AAC) based at Ramstein Air Base, Germany; the European Air Transport Command (EATC) based at Eindhoven Air Base, the Netherlands; the Combined Air Operations Centre (CAOC) Torrejón, based at Torrejón Air Base in Spain and the Belgian Air Force.

A Belgian Air Force Airbus A321 flew the tour, overflying Europe, taking off from Brussels/Melsbroek Air Base (Belgium), flying via Germany, Czechia, Slovakia, Hungary, Croatia, Slovenia, Italy and France to Torrejon Air Base in Spain and back via France and Belgium to Brussels/Melsbroek Air Base, whereby, armed QRA aircraft of various Air Forces were showcased alongside the Airbus A321, and these included:

- Germany: Two Eurofighters from Neuburg airbase
- Czech Republic: Two Gripens (JAS39) from Caslav airbase
- Slovakia: Two MiG-29AS/UBS from Sliač airbase
- Hungary: Two Gripens from Kecskemét airbase
- Croatia: Two MiG-21bisD/UMD from Pleso airbase



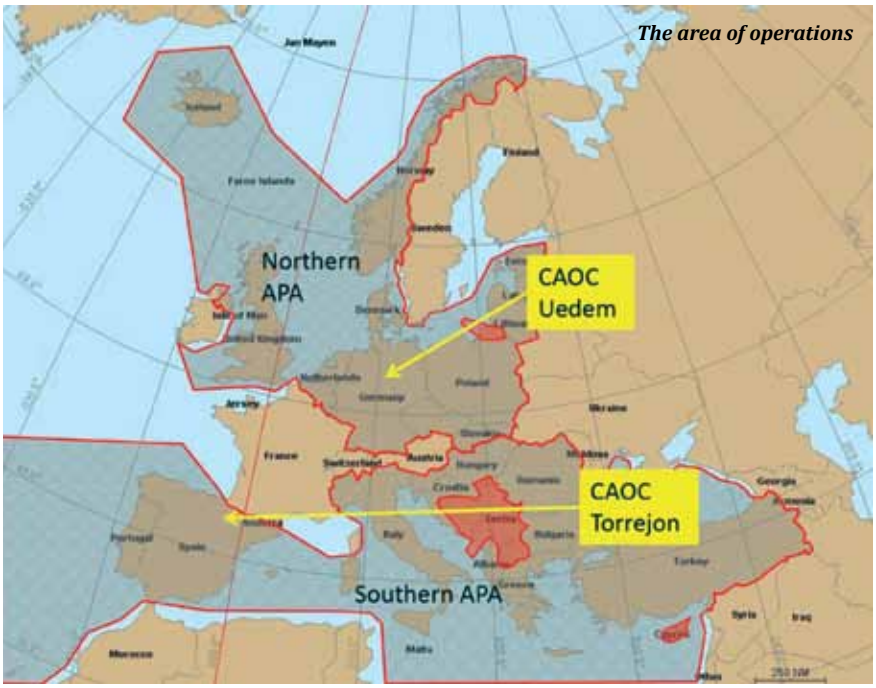
The area of operations

Spanish F-18s

- Italy: Two Eurofighters from 4th Stormo based at Grosseto airbase and 36th Stormo based at Gioia del Colle
- France: One Dassault Mirage 2000C-RDI from BA Orange, One Dassault Rafale C from BA Mont-de-Marsan, One Dassault Mirage 2000-5 from BA Luxeuil
- Spain: Two Boeing F-18s from Torrejon airbase (12 ALA) , Two Boeing F-18s (15 ALA) from Zaragoza airbase
- United Kingdom: One Eurofighter from RAF Coningsby
- Belgium: Two Lockheed Martin F-16s from Florennes airbase

NATO Allied Air Command

NATO Allied Air Command has its headquarters at Ramstein Air Base (Germany) and was commanded by US Air Force General Tod D. Wolters. The Air Command has various tasks to perform including maintenance of NATO's Ballistic Missile Defence (BMD) and carrying out peacetime NATO Air Policing. Allied Air Command also provides Baltic Air Policing and Iceland Air Policing. In order



The area of operations

to fulfill the air operations task, NATO Allied Air Command has three operational units: Combined Air Operations Centre (CAOC) at Uedem, Germany; Combined Air Operations Centre (CAOC) Torrejón at Torrejón Air Base in Spain and Deploy Air Basele Air Command and Control Centre (DACCC), at Poggio Renatico in Italy.

The Combined Air Operations Centre (CAOC) Uedem is headquartered near the city of Kalkar (Germany). The primary mission of CAOC Uedem is to plan, direct,

Czech Gripen

coordinate, monitor, analyse and report on the operations of air policing assigned to it in peace time, following directives of NATO's Allied Air Command. Their Area of Responsibility (AOR) covers the geographic area from mid-France to the Alps, to the Black Sea and northbound to the Baltic states, then to Iceland and the United Kingdom.

Combined Air Operations Centre (CAOC) is headquartered at the Torrejón Air Force Base, north of Madrid, Spain. Its primary missions consist of planning, directing, coordinating, monitoring, analysing and reporting on the operations of air policing assigned in peace time, following the directives of NATO's Allied Air Command. Their Area of Responsibility (AOR) covers the area from mid-France to the Alps, down to Turkey and via Mediterranean Sea to the Canary Islands and via Portugal and Spain back to mid-France. The skies of Spain, the southern half of France, Portugal, Italy, Greece, Slovenia, Croatia, Bulgaria, Romania, Hungary, Albania and Turkey, as well as the Black Sea and part of the Atlantic are covered by CAOC Torrejón and these tasks are carried out by 185 personnel from 16 countries.

The *Deploy Air Basele Air Command and Control Centre* (DACCC), headquartered at Poggio Renatico in northern Italy, is used for surveillance and control of alliance air operations. Its mission is to prepare elements for worldwide operational deployment and together with the combined air operations centres located at Torrejon, Spain and Uedem, Germany, deliver well-trained and specialised experts to supplement Allied Air Command during allied operations and exercises.

Baltic Air Policing is a rotational air defence assumed by the NATO countries, as Baltic countries do not have the facilities to maintain their own air defence fighters on a 24/7 basis. In 2014, for few months, NATO partners deployed their fighters at Amari Air Base (Estonia) and Šiauliai Air Base (Lithuania) and during this period, fighters were shifted to eastern airbase of Malbork in Poland to be operated by NATO partners on a rotational duty so as to protect the eastern NATO flanks.

German Typhoons

Iceland Air Policing is also a rotational air defence role assumed by NATO countries ever since the United States Air Force closed its permanent airbase in Iceland in 2006. For three to four months, NATO partners deployed their fighters to Iceland and since 2014 the aircraft have been placed on Quick Reaction Alert (QRA) status, armed with live missiles. The Iceland Air Policing missions are controlled by CAOC Uedem.

History of Allied Air Command

During the Cold War, NATO maintained various air headquarters in Europe, each responsible for their own region, north, south and centre. NATO air powers in central Europe were divided into two regions: the 2nd Allied Tactical Air Force (2ATAF) covering the northern part of Germany, consisting of air forces of the United Kingdom, the Netherlands, Belgium and Germany (partial) and the 4th Allied Tactical Air Force (4ATAF) covering the southern part of Germany, consisting of air forces of the United States, Canada and Germany (partial)

On a regular basis, 2ATAF and 4ATAF exercises were held to "compete" with each other on a friendly basis, these exercises were called 'Tactical Fighter Meet' for fighter aircraft and 'Royal Flush' for reconnaissance aircraft and later both exercises were merged into an annual 'Tactical Air Meet'. After breakdown of the Warsaw Pact in the 1990s, the NATO Air Forces regrouped into into two regions AIRNORTH and AIRSOUTH and after the latest reorganisation in 2012, only one Allied Air Command (AIRCOM) has remained and is based at Ramstein Air Base, Germany, which is now responsible for all air and space matters within NATO.

Text: Alex van Noye & Joris van Boven
Photos by Joris van Boven

The United colours of QRA / Air Policing by ...

Gripens ...

... Mirage 2000s

... Boeing F-18s

... Eurofighter Typhoons

Dutch NH90s: honing the system

Photo : Jeroen van Veenendaal

In 2000 a production contract was signed by the Dutch MoD for 20 NH90 NFH *(NATO Frigate Helicopter)* maritime helicopters, to replace the aging fleet of Westland Lynx helicopters that the Royal Netherlands Navy was using since 1976.

The NH90 was developed and manufactured by NH Industries, a collaborative company owned by Airbus Helicopters, Leonardo and Fokker Aerostructures. The first prototype made its maiden flight in December 1995 and the type first entered operational service in 2007. In 2010, The Netherlands became the first country to receive the NFH variant.

The NH90 concept arose from the idea of developing a joint NATO helicopter and the Netherlands is a lead nation in the project, together with France.

All 20 Dutch NH90s are stationed at the De Kooy Naval Air Station. There are two squadrons, 7 Squadron for training, and 860 Squadron which is the operational NH90 Squadron. Both squadrons are part of the Defence Helicopter Command (DHC) which has both air force and navy personnel.

In our interview with 860 Squadron Commander Niels Kleingeld and Captains Gerwin and Thijs, the CO stated, "We look at the importance of deployments and of course, the Dutch Navy wants to have a helicopter to perform operations in the Dutch Caribbean and for anti-piracy missions as also in preparation of ships to prepare for the mission area."

To operate the NH90, composition of the crew varies. Besides the pilot and copilot, there are various other tasks to be fulfilled. For tactical operations, there is need to take care of the situation and also coordinate with the ship. This is done by a tactical coordinator (TACCO), based on orders received from the ship which are passed on to DHC.

The sensor operators play a very important role, especially in maritime warfare conditions. There are two sensor consoles at the back used by one or two operators, depending on the mission. Explaining the upgradation, Commander Kleingeld stated, "At the very beginning,


Photo: Jeroen van Veenendaal


Photo: Ralph Blok

we flew with one sensor operator, who had to operate the radar, sonar, FLIR, electronic warfare, sonar buoys and uplink but the task load was too high for one sensor operator, so we are now in the process of doubling the sensor operators."

Mission essential crew for counter piracy and anti drug operations include a Rescue Operator Aerial Marksman (ROAM) trained to perform such tasks. He also operates the sniper gun for multiple purposes and is also trained as a rescue operator. During Search and Rescue action, he goes down first to ensure that the patient is secured on the stretcher; and is accompanied by a doctor who provides medical assistance.

Commander Kleingeld stated, "All kinds of data are shared, varying from maintenance data to various procedures, how to deal with sensors, how to set up sensors, how to get the most out of the radar." There is also an extensive cooperation with the Belgians since the spare parts are shared which reduces costs as the Belgian Navy operates the same variant of the NH90.

As there are different versions of the NH90, it makes sharing and updating difficult. Since there are various options, for example, with sensors one could choose from a German, French or Italian version.

The N5 version which The Netherlands has purchased can be used in either role, combat or transport. Twelve NH90 helicopters were inducted as NATO Frigate Helicopters (NFH) equipped with all necessary system to carry out maritime combat tasks. Eight helicopters are used as Tactical NATO Frigate Helicopters (TNFH) and as a tactical transport helicopters, used both on land and at sea. For the transport task, systems such as the sonar and control station of the sensor operator have been removed to provide additional space and also to reduce the weight of the helicopter.

In describing some of the vital tasks of the NH90, Commander Kleingeld stated, "One of these is surface warfare, the NH90 being perfectly suited to perform reconnaissance at sea, to protect trading routes and to perform anti-piracy operations. We can execute anti-submarine warfare by mapping the underwater areas. Other tasks we carry out with the NH90 are counter drugs operations in the Caribbean, SAR missions, fast-roping and carrying external and internal loads or troops. It is a multi-role helicopter which can be used for various missions, depending on the requirement of the assignment."


Photo: Ralph Blok

NH90s on the flight line Photo: Ralph Blok

Twice a year, an exercise anti-submarine warfare is held at RNAS Culdrose in the United Kingdom. The NH90 helicopter is equipped with a long-range active sonar (HELRAS), but can also work in combination with sonar buoys. Besides the HELRAS, the NH90 has an inverse synthetic aperture radar (ISAR) with which the crew can monitor activities both over and under water. Apart from that, the thermal imaging equipment (FLIR) provides an additional provision to perform various tasks during hostile conditions. FLIR can also visually identify the targets found at great distances with the radar.

The NH90 is armed with a MAG or M3M machine gun and there is also provision to carry torpedoes. Speaking about the future, Kleingeld stated, "We presently have the Mk46 torpedo but it is at the end of its lifespan so we are planning to replace it with modernised version by 2021." The Dutch Navy are also exploring a possibility of equipping the helicopter with an air-to-surface missile, "Being an extended arm of the ship, we must also equip our armoury with the missile that can be carried by a helicopter to destroy surface targets." The NH90 has provisions for a Marte anti-ship missile, but the Norwegians have already tested the Naval Strike Missile with the NH90.

Text by Jeroen van Veenendaal

Photos by Roelof-Jan Gort, Ralph Blok, Jeroen van Veenendaal (DutchAviationPhoto.com)

NH90 on mission: photo: Roelof-Jan Gort

‘Clear Sky 2018’

NATO exercises with the Ukraine

Five Su-25s from Kulbakino participated during the exercise, all upgraded aircraft wearing this new standard pixel colour scheme

During 8-19 October 2018, skies over Ukraine had for the first time United States Air Force and eight other air arms in the Ukraine participate in the country’s largest aviation exercise, *Clear Sky 2018*. This Eastern European training exercise was aimed to “enhance capabilities in the region to secure air sovereignty with NATO partners and other allies.” *Clear Sky 2018* focussed on air interdiction, air-to-ground exercises, air mobility operations, aeromedical evacuation, cyber defence and personnel recovery. Aircraft participating in *Clear Sky 2018* were distributed across several bases in the region, making this a true multinational and real-life exercise.

Su-27P1M from Myrhorod Air Base takes off

Locally based Su-24 lands after a mission

Some 700 personnel took part in the exercise, half of them from NATO member countries including Belgium, the Netherlands, Poland, Romania, the United Kingdom and the United States. Denmark and Estonia, not NATO members, also participated. Ukraine contributed some 350 military personnel from five tactical aviation units. *Clear Sky 2018* aimed for NATO and allies to work together with the Ukraine, all this in close proximity to Russia.

Establishing and further developing such partnership in the region is the objective of NATO. As Major General C Garrison, United States Exercise Director for *Clear Sky 2018,* explained; "This is the first time we conducted an exercise maintaining NATO standards—and this close to the Russian border. Working according to high NATO standards and procedures during the exercise was aimed to make the Ukrainian Air Force interoperable with other NATO countries and their regional partners".

Exercise goals

Speaking about the exercise conducted from the Starokostyantyniv Air Base in Ukraine, Colonel Evgen Bulatsyk, Commander of the 7th Tactical Air Brigade stated, "The Ukrainian Air Force's main goal during the exercise was to enhance interoperability with the United States Air Force and other air forces of NATO. In addition, this was an ideal opportunity for our air and ground crews to improve their level of training. This exercise provided an unique opportunity to work closely with our allies and learn from them on how they operate and employ their aircraft in hostile situations. Exchanging experiences and skills is vital for the development of crews on both sides".

Exercise operations

With bulk of the aircraft flying from Starokostyantyniv Air Base, operational planning was also conducted there. With upgrades performed over the last years on Ukrainian Air Force's current fighters and bombers, each type was represented at the base. MiG-29MUIs from Vasylkiv, Sukhoi Su-25MIs from Kulbakino, six McDonnell-Douglas F-15Cs from the 144th Fighter Wing and Sukhoi Su-27P1Ms from Myrhorod joined the locally based Sukhoi Su-24M/MRs. Operating from Vinnytsia Air Base, together with the locally based Antonov An-26s and Mil Mi-8s, was a single Lockheed C-130J from the 146th Airlift Wing. Tanker support was provided by Boeing KC-135s of the 126th Air Refuelling Wing operating from Powidz Air Base, Poland, and KC-135s from the 100th Air Refuelling Wing.

Major General Garrison explained; "The vast majority of participants from the United States were from the California Air National Guard, with six F-15s from 144 Fighter Wing, we were mainly focussing on air interdiction, air sovereignty and air-to-air combat manoeuvring. All these missions were flown in accordance with NATO standards". Apart from the personnel from Air National Guard units, the exercise also witnessed participation from the US Army and US Air Force.

Directly operating from Poland were Lockheed Martin F-16C/Ds from 31 *Baza Lotnicza Taktycznego.* Also participating from their home base were the recently, acquired Lockheed Martin F-16AM/BMs from *Baza 86 Aeriana* in Romania. There

On the flightline: Su-24s, Su-27s and MiG-29s

US Air National Grand F-15C takes off on mission from Starokostyantyniv Air Base

was cooperation between United States Air Force General Atomics MQ-9s and Ukrainian Air Force UAV-America PD-1 Unmanned Air Vehicles. The MQ-9s operated from Miroslawiec Air Base, Poland, these Reapers having begun operations from Poland in May.

"25 years of partnership"

The *State Partnership Programme* (SPP) has been building relationships for 25 years and now includes 75 partnerships with 81 nations around the globe. Major General Garrison, stated; "The California Air National Guard has a long standing, 25-year relationship which is sponsored by the US Chief of Mission (UCoM). We came here to train together with the Ukrainian Army and Air Force. *Clear Sky 2018* is the second air-centric exercise that we have done in the Ukraine within that 25-year period, the last air exercise participated being in 2011 and called *Safe Sky*. This exercise was focussed on air sovereignty and air defence procedures in preparation for the Euro Cup 2012. *Clear Sky 2018* was completely on different scale since it covers a much broader spectrum of missions and was at the request of the Ukrainian Air Force, completely aligned with NATO interoperability. This exercise is built on those initial standards so that the Ukrainian Air Force can train and operate better with NATO and with its neighbours and regional partners".

Text: Erik Bruijns and Paul Ridgwell. All photos Erik Bruijns

This MiG-29UB was used for familiarization flights by US pilots

US troops worked together with their Ukrainian counterparts, flying in Ukrainian Mi-8s during the exercise

F-15C painted in special colours to celebrate 75 years of the USAF 195th Fighter Squadron

Striving to keep relevant

The Lebanese Air Force today

The bolt-on armour plating is clearly visible on this grey coloured Super Tucanos of the Lebanese Air Force. Photo: Arjen Weterings

With the arrival of six A-29B Super Tucanos, the Lebanese Air Force *(Al Quwwat al-Jawwiya al-Lubnaniyya)* has added a new type in its inventory. Combined with the AC-208 Combat Caravan the fixed wing component of this small air force has now added 'teeth'.

The A-29B Super Tucanos at Hamat Air Base mark completion of delivery to the Lebanese Air Force. Operating from Hamat, 7 Squadron's aircraft can reach the furthest point in Lebanon. With low operating cost, the Super Tucano has bolt-on armour plating and flare dispensers for self-defence, the aircraft carrying a payload of 1500 kg including M3M .50-inch machine guns, 70mm rocket pods, Mk81 and Mk82 unguided bombs and GBU-12 and GBU-58 laser guided bombs. This aircraft gives Lebanon counterinsurgency (COIN) capabilities.

The A-29s have joined the three AC-208 Combat Caravans, operating from Beirut with 4 Squadron. The Cessnas are used for a variety of roles, besides cargo and passenger transport, also for attack and ISR missions. For the latter roles the crew consists of two pilots and a Mission System's Operator (MSO). For attack mission the aircraft carries the AGM-114 Hellfire II missile.

The Lebanese Air Force withdrew its last Hawker Hunters in 2014, and the A-29 and AC-208 can in fact be considered as fixed wing replacement aircraft, while there are three Scottish Aviation Bulldogs for training with 1 Squadron at Beirut.

Hamat is a small airbase some 60 kilometres north of Beirut. For the six A-29 Super Tucanos, new hangars were constructed. Photo: Frank Grealish

Helicopters

The rotary wing element consists of several types. At Beirut, 12 Squadron operates UH-1H-IIs, 16 Squadron flies S-61As (as fire fighters, funded by the Akhdar Dayem Association) and the single AW-139. Former UAE AF IAR330SM Pumas are operated by 9 Squadron at Hamat. The Puma is used for medevac, SAR and CSAR. Both Rayak and Kleyate are helicopter-only bases. Rayak is home to 8 Squadron (SA342L Gazelles in the attack role) while15 Squadron is the training unit (operating the R44 Raven II and UH-1H), while 14 Squadron at Kleyate operates the UH-1H.

The versatile Huey/Huey II are used for numerous tasks (troop transport, VIP transport, crop spraying, firefighting, etc.). Six MD530G helicopters, supplied by the US (as were the UH-1s) will be added from 2020.

Three Bulldog basic frames came back into service around 2008. Photo: Frank Grealish

The Super Tucanos arrived in the country after the operations to remove ISIL from Lebanese territory had ended. 7 Squadron is currently training to keep it that way. Photo: Anton Rutten

Puma gunship: Isolation and Ingenuity

Being cash-strapped, isolated and challenged, the Puma gunship was developed with local modifications including two Aden 30mm cannon and two Matra SNEB 68mm rocket pods. The Aden cannons were taken from the Hunters, while the SNEB was used by Mirage IIIs Lebanon once owned. The Puma can carry two bombs (one 1000lb and one 500lb bomb) on each side being involved in the 2017 operations.

4 Squadron at Beirut was majorly involved in the Qalamoun offensive, their three AC-208 Combat Caravans proving a valuable asset. The AC-208 can carry two Hellfire missiles and is equipped with high-tech equipment for its ISR missions. Photo: Stefan Goossens

Recent operations

Since in end of the civil war in Lebanon 1990, its Air Force has been "seriously involved" in two major operations. In 2007, fighting broke out between the Lebanese Armed Forces and the Islamist militant group Fatah al-Islam. The Lebanese Air Force deployed Gazelles with HOT missiles and gunpods against the hostiles. The UH-1H helicopters were modified to carry unguided bombs and rocket pods.

In 2011, the on-going Syrian civil war spilled over to Lebanon. Between 2011 and 2014, there were several clashes and bombings within Lebanon and Syrian military operating inside Lebanese territory. The Lebanese Armed Forces managed, more or less, to stay out of this conflict, but this changed in August 2014 during the Battle of Arsal, where fighters from the al-Nusra Front and ISIL had taken control of the Lebanese town, also capturing nine Lebanese soldiers. Then LAF got involved in taking back control of Lebanese occupied areas which culminated in the Qalamoun offensive in July/August 2017 when the Lebanese Armed Forces, Hezbollah and the Syrian Armed Forces all launched (non-coordinated) attacks on al-Qaida and ISIL on the Lebanon/Syria border, leading to a ceasefire between the LAF and ISIL on 27 August 2017.

This small Air Force played a major role in the offensive. Attack helicopters were used (Gazelles and modified Pumas) and the three Combat Caravans were heavily involved, firing AGM-114 Hellfires at targets and designating targets for M712 Copperhead laser-guided artillery shells.

Stefan Goossens / 4Aviation and Jim Walg

9 Squadron operates a number of IAR330SMs from Hamat. Photo: Anton Rutten

Gazelle helicopters are based at Rayak Air Base and operate with 8 Squadron. Photo: Sonya Cooley

Lebanese Air Force SA330 Puma gunship. Armed with machine guns and rocket pods this was used against the ISIL in 2017. Photo: Sonya Cooley

The UH-1H Huey is workhorse of the Lebanese Air Force, its tasks including firefighting, crop spraying and VIP transport. Photo: Anton Rutten

The Lebanese Air Force operates both the UH-1H and the UH-1H II. Photo: Arjen Weterings

T-2 Buckeyes (still) train Hellenic pilots

T-2 Buckeyes were inducted by the Hellenic Air Force about 42 years back when Greek military aviation was undergoing major transformation. At that time, a massive modernisation programme took place with A-7 Corsair II, F-4 Phantom II and Mirage F.1 being inducted into the Hellenic Air Force. Consequently, there was a need for new jet trainers for pilot training and a contract was signed in 1974 for the delivery of 40 T-2E Buckeyes. The aircraft entered service in 1976 at Kalamata Air Base, on south side of the Peloponnesus peninsula in Greece. In 2018, 42 years on, the type is still based at Kalamata with the 120 Air Training Wing.

Pilot training phases

In the first phase, screening of trainee pilots takes place at Deklia-Tatoi Air Base on Cessna T-41D aircraft of 360 Squadron. It was recently announced that the Hellenic Air Force has selected the Tecnam P2002JF aircraft to replace the T-41 but delivery date of the 12 aircraft is yet to be finalised.

In Phase two, students move to Kalamata, where they receive initial and basic training on T-6A Texan II aircraft. Kalamata has two Air Training Squadrons *(Mira Ekpedefsis Aeros* or *MEA)* with T-6s, being MEA 361 'Mistras' and MEA 364 'Pelops' where pilots complete 110 flying hours plus 40 simulator sorties.

Phase three consist of advanced jet training on the T-2E Buckeye. The T-2s are part of other two squadrons of the 120 ATW, being MEA 362 'Nestor' and MEA 363 'Danaos'. The sylabbus prescribes 60 flying hours on the Buckeye along with another 25 simulator sorties. The final 'Operational' Phase (four) also takes place at Kalamata Air Base and here trainees have to complete 60 flying hours on air-to-air and air-to-ground missions using T-2 Buckeye aircraft. For simulator sorties, 15 missions are added in this phase.

Trainee pilots undergo four year academic and flying training courses, before they move to a fighter squadron. Some get assignment in the Hellenic Transport Command for heavy transport aircraft, in which case, the trainee pilot completes an extra course which includes additional 30 sorties on the T-6 Texan II. The 120 ATW has some 60 instructor pilots, the Hellenic Air Force Academy receiving some 50 cadets annually who attend the academic and flight training course.

The Buckeye in Greek service

Since 1976, some 40 Buckeye Es entered Hellenic military service, being an export variant of the US Navy operated T-2C aircraft. During its career in the HAF, 7 T-2s were written off due to accidents. Although there have been few crashes during the operational life of the aircraft (almost 42 years) in the Hellenic Air Force, it is assumed that currently only around 5 T-2 aircraft are operational. The majority of Greek Buckeyes are stored because either the airframe was out of flight hours or are now being used as a source for spare parts. Over the years, Kalamata received more than 10 former US Navy T-2C aircraft but they are mainly used for spare parts.

Captain Divaris, Chief of T-2 maintenance, stated that former US Navy aircraft are very important for the maintenance of HAF's Buckeyes since these are the only source of spare parts as no more new parts have been produced because the US Navy has long ceased T-2 operations. Captain Divaris stated that it is an advantage that the T-2 has such a strong airframe and the two J85-GE-4 engines are easy to maintain. Nevertheless, the maintenance crew has to adapt creative and flexible means to maintain the decreasing T-2 force. Under given circumstances, they do a great job and have enough aircraft available to fulfill flying training requirements.

Several years ago, the Hellenic Air Force started the process for replacing its ageing T-2s since the aircraft is approaching the end of its lifespan. In any case a new modern trainer will be more suited for HAF front line fighter aircraft like the F-16s Block 30/50/52 and their future upgrade to F-16V 'Viper' standard as well as the upgraded Mirage 2000s. As no budget has been released for new trainer aircraft, a decision for this remains on hold.

Meanwhile, over the past 10 years, the Hellenic Air Force and the Italian Air Force (*Aeronautica Militare Italia* – AMI) have maintained close partnership through which both the countries work closely on various pilot training programmes. These programmes help Italian students to follow the training course at Kalamata and fly on Greek T-6 Texan II aircraft and for Greek cadets to fly their training phases on AMI MB-339 aircraft of the 61 Stormo based at Lecce AB in Italy.

Buckeye on take-off

T-2E instructor with 120 ATW Commander Colonel Petalas in the backseat

T-2 Buckeye returning from training flight over the Greek Pelloponesos peninsula

T-2 doing engine tests after maintenance

T-2E Buckey leaving Kalamata for training mission

The 120 ATW flight line

Photos and text by Peter ten Berg

Air Vice Marshal Cecil Parker recollects...

IAF Vampire T.Mk.55

Reflections on a blue shirt

Because it is associated with our graduation, my memories in the month of August invariably return to our trainee pilot days. In early 1951 fifty of us young lads, most of whom were straight out of school / college, reported to No. 1 Air Force Academy (AFA) in Ambala and formed No. 58 Pilots Course (PC). A new Indian Air Force (IAF) was being built up on the remains of World War II aircraft while simultaneously inducting our very first jet aircraft, ie the Vampire Mk 52. At that time Ambala housed our Flying Instructors School (FIS), the Conversion & Training Unit (CTU) equipped with Spitfire Mk.IX & Tempest IIA for the Applied stage of training and the Advanced & Basic stages of flying training on Harvard II B and Tiger Moth respectively, each of 9 months duration.

A few of us new coursemates with a boarding school background, were comfortable with the rules, regulations and routine of life at the AFA. The daily schedule divided itself into ground subjects in the class room, drill on the parade square and flying in the fabric-covered, propeller-driven biplane in which the instructor sat in the front and the pupil at the back. As a youth used to regular games in the evenings, I was a little disappointed at the lack of facilities or emphasis on organised team games. However, our Chief Ground Instructor (CGI) was a keen tennis player and a couple of us flight cadets who played the game, were invited occasionally to play at the Sirhind Club. After the initial 'breaking-in' period, as in any military training unit, we were permitted to 'book-out' on weekends but only in uniform. Apart from a change from mess food at the *Deluxe Dhaba*, there was really not very much to do in the Ambala of those days.

We had barely commenced our flying training when it was decided to relocate all air force training down south and build Ambala up as an operational base. We were given a months leave and instructed

to report to a place called Secunderabad down south. The Advanced and Basic stages were now at Begumpet airfield, the Applied stage at Hakimpet while FIS was relocated to Tambaram. We recommenced our flying training and I was most fortunate to be a pupil of Navroze Lalkaka. He not only taught my co-pupil and self in the cockpit but took equal interest in developing our soft skills with great patience. He had the gift of making us really enjoy the act of flying while learning it's skills and, for me, continued to remain a mentor and friend to the end.

Financially we flight cadets were restricted to Rs. 40 per month for our personal expenses; this amount was remitted directly from our homes to the CGI's office. While this amount was more than adequate in Ambala, Secunderabad offered more activities but we managed as the cost of living was not unreasonable. For example: on booking-out days I cycled to the home of the young lady I was courting, was given permission to invite her for the matinee show followed by a dosa-and-coffee at our 'Taj'; all for just under Rs 5 for two! Meanwhile our flying training took us into the Advanced stage where standards were equally strict. With a wastage of 40%, only 30 of us won our wings and were commissioned on 30 August 1952. 66 years later, 10 of us aged mid-to-late 80s are very much around – at least at the time of writing! It may be of interest to mention that, the flight cadets of today get a stipend of Rs 56,100 per month from the government!

On a personal note, the most important event during my training days was meeting the aforementioned young lady who, though three years my junior in age, drew her first salary as a teacher in St. Georges Grammar School Hyderabad six months before I did as a Pilot Officer – a rank now defunct. From her first pay she gifted me a blue shirt. We married in 1956 and she has been my constant companion and support through 13 postings in 30 years while raising two wonderful children, teaching, running a home and waiting patiently for the many years it took to build our own house. Now in the 63rd year of our marriage we enjoy our quiet retirement blessed with good health, family, friends and finances that enable us to help others less fortunate in life. Though it of course no longer fits me, the blue shirt is still in my wardrobe as a symbol of the best thing that ever happened to me since my flight cadet days.

An IAF Hawker Tempest II

A Non-Surgical Strike

In mid-August this year, some unexpected events occurred in rapid succession. I experienced sudden and severe pain in my upper right thigh which my wife and I felt was an attack of sciatica. When it worsened, we sought medical help and were advised to have an immediate x-ray of the right hip joint. Though the x-ray was normal, it did indicate some wear and tear in the joint owing to my age. I was referred to the army orthopedist (AO) at MH who was very helpful and listened patiently to my symptoms, i.e. pain (location/intensity/duration) while studying the x-ray. He concluded that it was a case of osteoarthritis and gave me two options. Either (a) Have an operation to replace the right hip joint, or (b) Cope with the pain. I explained that, at the ripe old age of 86 years, I was not too keen to undergo any invasive surgery and would prefer help to cope with the pain, at least to begin with. He immediately prescribed the necessary medication and added, 'Cts-O4wks' (more on this later).

We are grateful to the large number of friends and well wishers who got in touch and called over to share, not only their concern, but also own medical experiences of a similar nature. One of our own granddaughters, herself a doctor in the UK undergoing specialisation, came up on skype to assure me of the safety and ease of this surgery now very common with elders of my vintage. We learned a great deal from all the advice and support we received and also obtained a second opinion at a well known corporate hospital whose orthopedist fully endorsed our AO's diagnosis and suggested some additional medication. The ingestion of all this pain killer medication however, followed the law of unintended consequences and generated side effects, i.e. loss of appetite, feeling of weakness and numbing of lower extremities in both legs. When this was brought to the attention of our AO, he immediately stopped all medication, left me a small supply in case of emergency, and asked me to report again after four weeks or an 'SOS' if required.

With the stoppage of all medication, I braced myself to cope with the reappearance of pain but miraculously there was none, the side effects gradually wore off and I returned to normal life again – at a pace dictated by my age. With my next appointment with the AO coming up, I asked my many doctor-friends as to just what 'Cts-O4wks' meant; they were almost unanimous in interpreting it as a requirement for a CT Scan in four weeks ! I reported to the AO who was happy at the absence of pain, disappearance of the side effects and my return to normality. I then asked him as to whether I was still required to have the CT scan endorsed in his original prescription? He laughed and said it was only a medical shorthand for 'ConTinue Same for Four weeks'!

It is possible that my experience might be of help to some elderly readers of the AAA column, hence have encapsulated the events of the past six weeks into this Anecdote. At the time of writing, I still have the emergency painkiller medication unused ('Just in Case') and am back to normal life with no pain which I hope to Cts till final take off for the aviator's Valhalla in the sky!

25 Years Back

From Vayu Aerospace Review Issue VI/1993

MiG-21bis upgrade

The Indian Air Force requirement for upgrading some 120 of its MiG-21bis fighters has stimulated various proposals from overseas, the main competitors to win this contract being the MiG-MAPO organisation teamed with two, alternate, French avionics specialist companies as also the Israeli-Romanian combine. The former designated MiG-21-93, and intended for the third-world retrofit market, combines sophisticated Western avionics with the most advanced Russian weaponry, and intended to counter a modernisation project proposed by Israel Aircraft Industries and Aerostar of Romania and designated the MiG-21-2000.

ALH programme in turbulence

The Advanced Light Helicopter (ALH) programme has run into a new set of difficulties. Conceived by Hindustan Aeronautics Limited, the project is now subjected to a new set of conditionalities by the French engine manufacturer, Turbomeca. HAL had ordered 65 Turbomeca TM 333B engines for the prototypes and initial production batch. Adding to HAL's problems, the Indian Air Force, the Army and the Navy want these helicopters to be produced faster. The IAF has asked for 60 helicopters (it had initially ordered 180 but scaled down the demand anticipating higher costs and delays) as a part replacement for the Chetak (Alouette III) and the Russian Mi-8.

Jet Airways stakes with Gulf Air and Kuwait Airways

Gulf Air and Kuwait Airways have now been "officially" cleared to each take a 20 per cent stake in *Tailwinds* which owns the Indian private airline Jet Airways. Although this scheme was well known as per bazaar gossip for sometime, Jet Airways are now legally connected with the two Middle East carriers, the link being through Naresh Goyal, the Baharain-based NRI who retains the balance (and controlling) 60 per cent of *Tailwinds*. Jet Airways began services in early May 1993 with four leased Boeing 737-300s, serving 12 destinations from its main Bombay base, connecting Ahmedabad, Bangalore, Baroda, Coimbatore, Cochin, Calicut, Dabolim (Goa), Delhi, Hyderabad, Madras and Mangalore.

Defence Debt is $ 11 billion

India's defence-related external debt stood at nearly $ 11 billion at the end of March 1993, having come down from $13.6 billion at the conclusion of fiscal year 1990-91. This has been disclosed (for the first time) in an official publication recently released by the Ministry of Finance which provides data relating to the defence debt for the last four years.

Civil Aviation reorganisation

The Government has decided to restructure the Directorate of Civil Aviation by creating certain additional posts, these being an Additional Director-General and four Deputy Director-Generals. At present, there is only one post of Director-General and one Deputy Director-General. The restructuring and strengthening of the civil aviation is being done in anticipation of increased work-load. The appointment of a regular Director-General, Civil Aviation, will be made only after the rules of recruitment for the new posts are formally approved.

Indigeneous aircraft carrier design on anvil

According to the CNS Admiral L Ramdas, the Rs 1,000 crore project to build an aircraft carrier for replacement of the ageing INS *Vikrant* will soon be formally launched. Also, indigenous production of submarines, as replacement for the obsolescent *Foxtrots*, should be taken up during the next Five Year Plan. About the same size as the *Vikrant*, a proven design was available and he added that the *Vikrant* would be maintained in an operational condition until its replacement was commissioned. The Navy's doctrine is based around one carrier operating on each seaboard, and so it would eventually would have three aircraft-carriers.

Domestic construction would be more economical than buying a vessel from abroad and the Admiral did not consider Rs.1000 crores to be a colossal amount, pointing out that a modern destroyer cost about Rs.600 crores. With the Navy already holding aviation assets worth Rs.7,000 crores, the expenditure on a new carrier "was not excessive."

El Al flights to India

El Al, the national carrier of Israel will, from 9 December, fly to India connecting Tel Aviv with Bombay. This follows a bi-lateral agreement signed last year between the Indian and the Israeli Governments, which gives landing rights to El Al in India and for Air India in Israel. The Israeli carrier's foray into this country will herald a number of firsts, especially in the area of passenger security checks. The airline will have its own security staff at Bombay's Sahar International Airport, who will operate independently from the present set-up.

PAF F-16s "In Suspense"

Prime Minister Benazir Bhutto has referred to the vexed status of the 71 additional F-16 fighters ordered for the PAF but not being made available to Pakistan under the Pressler Amendment, has stated that "we would soon decide how we can ensure the defence of the country in a better way". The "suitability and purchase" of alternate aircraft for the PAF was under study, including that for more F-7Ps.

Tale Spin

'Fatten Me Up', Jason !

Researchers looking for renewable jet fuel have zeroed in on a rendered form of animal fat, which is byproduct of processed meats, as a potential, sustainable alternative to fossil fuels. In this way, airlines trying to cut costs and curb their emissions amidst the boom in air travel will not only dramatically reduce carbon emissions but use up waste including tallow. Jason Aintabi, who owns Paramount refinery, is pleased with his success in getting such a reliable, renewable energy source which would also protect airlines against price spikes in the energy market.

Scotty would surely approve !

USAF 'mugged'

The US Air Force has found itself in a brewing scandal after it emerged that the service has been spending more than $1,000 to replace high tech coffee cups

with fragile handles. The mugs aren't the usual porcelain caffeine containers, rather a special copper-and chrome plated beaker that can plug into aircraft electrical systems to keep the cherished contents nice and warm. According to Travis Air Force Base in California, which has "poured" over the numbers, the cups have risen in cost from $693 each in 2016 to $1,220 in 2018, due to a lack of replacement plastic handles.

Its time for coffee !

Wake up Chiefy !

Commander of the twin-engined Piper PA-31 Navajo Chieftain, on his flight to an Australian Island, overflew his destination and was then urgently contacted by air traffic control. Apparently, the pilot had gone to sleep, leaving the aircraft on autopilot during this crack of dawn flight.

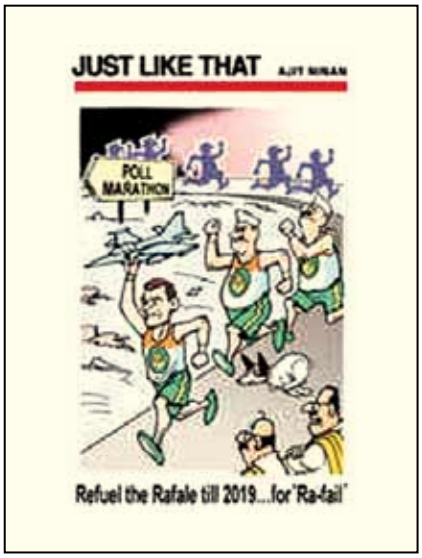
Snore !

Inspiration from the Vayu ?

Even as the *Vayu Aerospace Review* moves into the 45th year of its publication, New Delhi's air quality level is improving with a new device called WAYU (*Wind Augmentation Purifying Unit*), installed in the heart of New Delhi, with multiple such devices to be placed at busy intersections. This is developed by the Council of Scientific and Industrial Research (CSIR), who are also presently engaged in design & development of India's new 70-seat regional airliner.

May the wind be with you !

Politically incorrect ?



From the Times of India

Afterburner

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