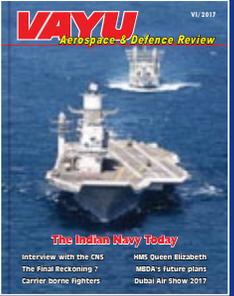
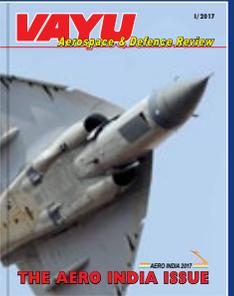
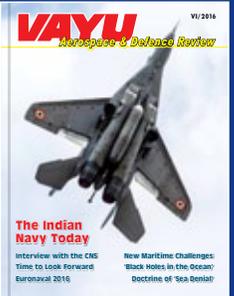
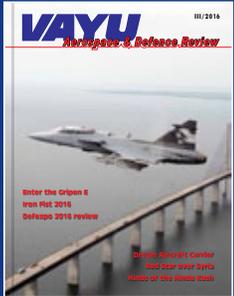
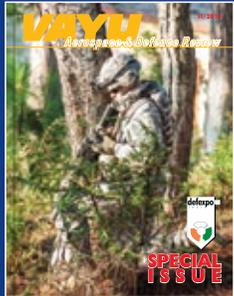
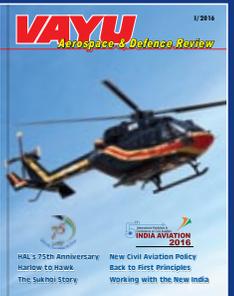


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Aerospace & Defence Review

VI/2019

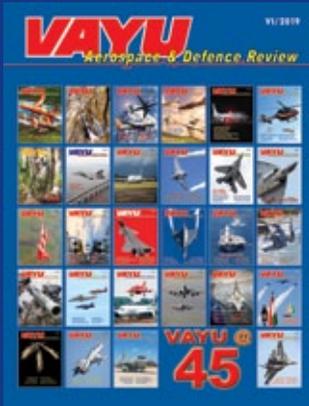




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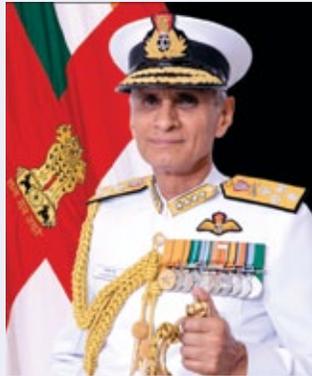
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VAYU

Aerospace & Defence Review

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29 Future of Aircraft Carriers



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37 Watching Indian Waters 24x7



In this article, Atul Kumar examines the Indian Navy's ISR capabilities, which includes space borne sensors, air, surface and underwater surveillance assets, also introducing the game changing VC 11184 Ocean Surveillance Ship to enhance electronic surveillance and air sanitisation of the IOR.

43 The NMRH and NUH



In a companion piece Atul Kumar writes on the vital need to augment the helicopter force of the Indian Navy.

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November 2019 marks completion of the 45th year of *Vayu Aerospace Review*, with a 15-page section giving readers a virtual pilot's eye view of aviation & aerospace developments that have impacted on India over the past near half century.



68 70 years of the People's Republic of China



On 1 October 2019, the Chinese Government celebrated 70 years of Communist party rule and its rise to global superpower status with a massive military parade down Tiananmen Square in Beijing. Apart from the marching columns, and various weaponry including ICBMs, some 160 aircraft took part in the fly-past also showcasing J-20 fifth generation fighters.

Coincidentally, Vayu's Editor was in Beijing on eve of the big event and posts a "behind the scenes" report as well.

76 Dubai Air Show 2019



Accompanying this *Vayu on-the-spot* report on the Air Show itself, is focus on EDGE "an advanced technology conglomerate, poised to transform defence industrial capabilities".

Vayu was a special invitee for the inaugural at Abu Dhabi.

Also : Poseidon Watch; Kamov Ka-31AEW helicopter; Exercise Varuna 19; "Sting like a Hornet"; Navantia and the IN; The 'Suffren' SSN; The PN's MPA; HMS Queen Elizabeth; Irkut's MC-71; MBDA; 'Operation Market Garden'; 'Operation Atlantic Resolve'; The Sanicole Airshow; 'Sparrowhawk'; Requiem for Phil Camp.

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"No Pigeons"

The New York Times published an article titled 'Tanks, Missiles and No Pigeons: China to Celebrate 70th Birthday of the People's Republic.' The article, written by Steven Lee Myers, said Chinese authorities have banned homing pigeons before the upcoming National Day parade. Pigeons are a symbol of peace. By deliberately placing the words "tanks," "missiles" and "pigeons" together in the title, the article was trying to create an atmosphere of Chinese oppression and to meaningfully convey the idea that China's upcoming parade is only a show of muscle and power. Some Western people should review their history. Many Western countries' development resulted from invasion and plunder especially in the 18th and 19th centuries. *The New York Times* is using imperialism and expansionism to observe China.

China's development has always remained stable and peaceful. Pigeons have been flying through People's Republic of China's history over the past seven decades. The country's great achievements, including the giant leap in economy, national strength and people's livelihood, have been realised in a completely peaceful way.

This is the major difference between China's rise and the Western countries' industrialisation and modernisation. However, Western countries are not willing to admit it, even though most of them achieved prosperity through wars and colonialism. These Western countries' development was based on other countries' suffering and humiliation. Now that most Western countries are enjoying the development dividend, they have become selectively blind to history and to China's peaceful rise.

Military strength is of great importance to China's stable development over the past seven decades. The country's defence power has increased substantially after decades of rapid military development. Today, China has already become one of the three nuclear triad powers. Thus, it is impossible for China to be carved up by other countries today, and other big powers are unlikely to use military force to make China yield.

However, China will only use its military for strategic deterrence and defence of national security. The "tanks" and "missiles" that Western media hyped will not be a threat to any other country or region in the world. On the contrary, China has shouldered the responsibility as a major power to maintain peace and stability worldwide and to oppose global and regional hegemony. This has made China's military strength an important guarantee of world peace and stability.

Military muscle is not a bad thing. The key is how to use such muscle. After seven decades, it is time for China to show some muscle to the world. China's strength is a reliable guarantee of national unity and world peace. It is also a solid foundation to act against any force that tries to sabotage regional peace and development. China has always pursued a defensive national defense policy, and the 70 years of peaceful rise is China's greatest contribution to the development of mankind.

Li Qingqing from *Global Times*

Deliberating the CDS

Consequent to Prime Minister Narendra Modi's announcement from the ramparts of Red Fort, the proposed structure for the Chief of Defence Staff (CDS) has been deliberated upon. We should soon be seeing the first CDS take charge. The proposed charter of the CDS, his powers and status, etc, has been debated intensely. One school of thought recommends an evolutionary, incremental expansion of the role, while some feel he should be given greater operational control *ab initio*. Like many bureaucratic approval processes, turf battles often cloud judgements, the resistance to change tends to only marginally alter the existing status quo. In this case, too, Service HQs prefer to retain their powers, resources and establishments. Hence, to avoid a dilution of their spheres, they are in favour of the CDS taking charge of new organisations, domains, and also to handle the integrated structures. Existing single-service responsibilities would remain largely undisturbed.

What should be the answer to this dilemma? A logical appraisal is warranted: Retention of existing warfighting structures, while the CDS takes control of newer organisations being set up for tackling future threats, has some merit. Development of future technologies and means to face emerging threats in the cyber, space, missiles domain, nurturing of AI-based platforms, usage of drones for various roles and such modern conflict realities is indeed important. These advancements are extremely costly, and the CDS can facilitate optimal, cost-effective integrated development and deployment of such structures.

Modern war and warfighting has tremendous economic costs. Defence budgets are invariably inadequate to meet the "wishlists", and intense prioritisation of capabilities is inevitable. The CDS can be the vital fulcrum to undertake such prioritisation and rationalisation, and, therefore, can play a stellar role in the perspective planning and development function. Considering the high cost of future technology, the CDS can also contribute towards optimisation of existing structures. Such review of existing establishments and manpower should also be an assigned task for him.

But should the CDS be utilised only in capability building and cost cutting, and optimisation measures? Future conflict situations would possibly need integrated application of fighting formations and resources, with unitary operational control of deployed elements. The CDS would be better placed for integrated employment of war fighting potential, and therefore logically needs to be part of the operational control chain.

In the debates on CDS, one often heard the designated profile as "providing single-point military advice". National security decisions are always taken after a multitude of advisory inputs from a number of agencies, duly analysing ramifications and end state probabilities. The CDS is better termed as the primary military advisor, with the service chiefs also remaining important military advisors. The CDS should not become another interposed level between the Raksha Mantri and the service chiefs, whose access to the minister should remain as prevalent.

In effect, the CDS should be in charge of newer domains and organisations, and be well poised to optimise, cut costs and prioritise different service demands. He could be an effective mentor for realising our military-industrial power potential, and for modernisation and capability enhancement. His tri-service position makes him the most suited driver for the integrated application of warfighting resources and facilitates unitary control in integrated operations. The CDS also has a primary advisory role, and therefore should not be boxed into administrative efficiency roles, but must be in the operational control chain. In the interim, the CDS may

not override the operational responsibility of the service chiefs, and in due course, his operational responsibility can expand and become more “hands-on”.

Thus, it is clear that the CDS would play a far more critical role in the national security apparatus, than the three service chiefs. Our higher defence organisation would finally mature, and be more in tune with our rising power ranking. From being the “first among equals”, I would like to see the CDS graduate to “first above the others”.

Lt Gen (R) JS Sandhu from *The Indian Express*

Projection of military power

“No piece of hardware better exemplifies America’s military might than an aircraft carrier,” declare the memoirs of Ashton Carter, America’s defence secretary in 2015-17. Nor does any other piece of hardware so plainly exemplify what is wrong with America’s military thinking. Aircraft carriers are the largest and most expensive machines in the history of warfare. A new American *Ford*-class ship costs \$13bn—more than the annual defence budget of Poland or Pakistan. However, as precision missiles become faster, more accurate and more numerous, these beasts look increasingly like giant floating targets.

Although America has by far the world’s largest fleet of carriers—11 of the full-sized sort, plus half a dozen smaller ones—their appeal is global, and growing. China’s first domestically-built carrier will be commissioned within months. Britain’s second modern carrier began its sea trials in September. Even pacifist Japan is converting two destroyers to carry jets, for the first time since the second world war.

Aircraft carriers have proved their worth in recent years. Many armed forces watched admiringly as American naval jets did the lion’s share of bombing in the early months of war in Afghanistan in 2001 and Iraq in 2003 (and again in 2014). Land bases were often unavailable because of awkward geography or recalcitrant allies.

But the seas off enemy shores look ever less safe. Russia and China are both developing long-range missiles that are manoeuvrable and accurate enough to hit large ships at sea. China’s DF-21D, an anti-ship ballistic missile that can travel over 1,500km (950 miles), is already a threat. Several countries are building cheaper anti-ship cruise missiles, which fly shorter distances but can be launched from planes. Anti-ship missiles are growing in range, precision and number. By one estimate, an American naval force within 2,000km of China might have to parry 640 incoming weapons in a single salvo.

Though guiding such missiles onto a distant moving target is tricky, no navy will be keen on putting several billion dollars and thousands of sailors in peril. Carriers have become too big to fail. As a result, they will probably have to remain at least 1,000km away from shore, a distance that their warplanes cannot cross without refuelling. That could have grave implications for America’s ability to project power across the Pacific—and so for all its allies. Carriers will also have to be cocooned with destroyers and frigates, which will absorb most of the resources of smaller navies, like those of Britain and France.

Carriers are not entirely obsolete. Most wars will not be great-power clashes. They will remain useful against foes which lack modern missile systems. Even in intense conflicts, warships will require air power to protect them from the predations of enemy ships and aircraft. As long as navies have surface ships, they will want to be able to fly planes above them.

But what sort of planes? Even as missiles force carriers farther offshore, the average combat range of their air wings has shrunk, from 2,240km in 1956 to around 1,000km today (modern munitions travel farther, but do not make up the difference.) The obvious remedy is to use drones that can fly longer, riskier missions than human pilots, allowing their host carriers to keep a safe distance away. But the Pentagon unwisely scrapped its programme for such a drone in 2016, replacing it with one that would merely refuel inhabited planes.

Aircraft carriers, like the warplanes on them, belong to a class of large, vastly expensive weapons that military types call “exquisite”. A more homely approach to military technology is warranted. Smaller, cheaper and, where possible, unmanned systems could be procured in larger numbers, dispersed more widely and used more daringly. Such forces may lack the prestige of massive warships. But they are better adapted to a world in which the projection of military power is growing ever harder.

From *The Economist*

A quintessential diplomatic event

The Modi-Xi Chennai Connect is a quintessential diplomatic event — meant to keep talking, keep engaged, and keep the channels open, to prevent disagreement on some issues obstructing agreement where it is possible. To expect more of these talks would be to underestimate the complexity of the relationship between the two countries. Therefore, the optics of an evening surrounded by history and hugely personalised gifts should not divert us from the issues that are at the core of the India-China relationship. What the Mamallapuram talks have demonstrated is that both countries are committed to keeping open the channel for communication at the highest political level.

The second informal summit was not a stand-alone visit for President Xi Jinping. From India, President Xi went to Kathmandu, for a State visit by a Chinese President to Nepal after a gap of 23 years. There, he proposed to seal agreement on a train service between Lhasa in Tibet and Kathmandu, which would reduce Nepal’s dependence on India. New Delhi would be watching how China behaves at the meeting of the *Financial Action Task Force* as it meets in Paris to assess whether Pakistan should be blacklisted as a country that launders money and funds terror. At Mamallapuram, India and China discussed trade, terror, defence/security and developmental priorities. Setting up a mechanism to boost Indian exports to China, jointly headed by India’s finance minister and China’s vice-president, is the most tangible outcome. On the border, the two sides would continue to talk, as they have been. Neither side brought up Beijing’s overt support for Pakistan in its attempts to take Kashmir out of the Indo-Pak bilateral ambit.

The gap in economic heft between India and China is large. This parlays into asymmetry of power, to address which India must tackle the structural problems that repress the economy’s growth below its potential. The symbolism of these high-level summits should not distract us from the real task of building the economy, and improving partnerships with other powers and in the neighbourhood.

From *The Economic Times*

Admiral Arun Prakash on

Strategic culture and state behaviour

Strategic culture is said to have a significant impact on national security and state behaviour. In 1992, the RAND Corporation analyst, George Tanham had pronounced that a combination of “lofty Hindu philosophy and a fatalistic outlook” had prevented the development of a strategic culture in India, and that “... Indian elites showed little evidence of having systematically thought about national strategy”.

Tanham’s contentions were contested by those who asserted that being heirs to the rich philosophy of Vedic literature, epics like the *Ramayana* and *Mahabharata*, and the wisdom of Chanakya’s *Arthashastra*, Indians had never lacked a strategic culture. They also, stressed that, right from independence, India had followed a pragmatic grand strategy, scripted by Jawaharlal Nehru. Its elements included, domestically, secular federalism, a socialist command-economy, pursuit of self-reliance and externally, and a policy of non-alignment to avoid military conflicts.

This Nehruvian legacy was accompanied by a utopian proclivity for pacifism and disdain for the armed forces, rooted in phobia about military coups. According to Yale University professor, Steven Wilkinson, the Congress party evolved “specific coup-proofing strategies to balance the power of the military during India’s first decade”. Most of these measures have remained in place ever since: the military continues to be excluded from the government’s policy/decision-making process and the armed forces HQs are still subordinated to a civilian Department of Defence. Wilkinson suggests that the growth of the Central Armed Police Forces from 29,000 in 1961 to 1.1 million in 2017 is another “coup proofing” measure to “balance” the 1.3-million army.

The past five years have seen the last vestiges of the Nehruvian legacy being progressively swept away. Conclusive proof of this came when the present government

ordered retaliatory raids, in peace time, on Pakistani soil. These not only marked a major shift of political focus that brought national security to centre stage, but also shattered two shibboleths: first, that India’s timidity, disguised as “strategic restraint”, was a chronic affliction; and second, that any armed incursion into Pakistan, ran the risk of a nuclear response. The latter, in any case, was an excessively alarmist view, given that the nuclear “red lines” informally signalled by Pakistan are far more stringent.

With the 2019 election-campaign behind us and politics having resumed normal tempo, there has been speculation whether the NDA government’s newfound focus on national security signifies a strategic transformation or is merely a vote-garnering election gambit. Such scepticism was not unjustified, given that the BJP’s 2014 election manifesto, had promised to “address the issue of organisational reforms” in defence, and to “ensure greater participation of armed forces in the decision-making process of the MoD”. While the ensuing five years saw no change in South Block, some recent “straws in the wind” may indicate growing political interest in national security issues. The most significant of these and one that demands our close attention is the long awaited initiation of national security reforms. One hopes that the April 2018 appointment of the National Security Adviser (NSA) to head the newly constituted Defence Planning Committee and his post-election elevation to cabinet rank were harbingers of this reform-process.

A lack of transparency, however, raises larger questions about the roles of the Raksha Mantri (RM), the Chiefs of Staff and the Defence Secretary vis-a-vis the NSA in the new ambit of national security decision-making. While Prime Minister Modi’s announcement, about creation of a Chief of Defence Staff (CDS), received widespread welcome, it adds a new and

complex dimension to India’s national security paradigm.

A CDS must not be created in isolation because, normatively, it carries with it a whole eco-system that could transform India’s national security, if correctly implemented. In theory, as the senior-most armed forces officer and Chairman Chiefs of Staff Committee, the CDS would be the military adviser to the PM and RM. Apart from his key role in the nuclear command chain, he would evolve a prioritised tri-service perspective plan for force modernisation and enable fiscal support. This task would be immeasurably facilitated by the issuance of a national security doctrine/strategy which highlights national aims, objectives and interests, and clearly defines the military wherewithal required to achieve them.

The CDS would oversee the integration of the armed forces HQs with the civilian MoD and implement “jointness” amongst the three armed forces, progressively ushering in the theatre command concept. In reality, however, if not empowered adequately or if found in conflict with the NSA, the CDS could easily be reduced to an inconsequential “paper-tiger”.

Another topic that two RMs, in succession, have dwelt upon — albeit in passing — is the principle of “no first use” (NFU) of nuclear weapons embedded in India’s 2003 Nuclear Doctrine. NFU was adopted, not merely as a token of nuclear restraint and responsible conduct, on India’s part, but also because it is, by far, the least burdensome and inexpensive form of nuclear-deterrence.

While ambiguity and doctrinal unpredictability may be useful to keep one’s adversary off-balance, nuclear deterrence is far too serious a matter to be the subject of off-the-cuff public utterances by senior politicians. On the other hand, a formal review of the nuclear doctrine (including the NFU undertaking) is long overdue and must be undertaken. 

Lt Gen Kamal Davar on

The Chennai Connect

The second “informal summit” between Chinese President Xi Jinping and Indian Prime Minister Narendra Modi took place on October 11-12 at the historic and picturesque shore temple town of Mamallapuram (also known as Mahabalipuram). Since then both nations and strategic analysts have been assessing its outcome for the future of India-China relations and South Asia. As is customary, differing interpretations have emerged about results of this summit, which was a follow up of the first “informal summit” in Wuhan in China in April 2018. Characteristically, Modi effusively dubbed this meeting as “The Chennai Connect”.

That symbolism ingrained into both these summits was extraordinary cannot be overstated. However, a balanced appraisal of this summit needs to be factored in to clear the paths for the often vexed and competitive relationship between India and China, notwithstanding the optics. Though there was no joint statement, India’s views about the summit deliberations were provided by Foreign Secretary Vijay Gokhale while the Chinese perspective came from Foreign Minister Wang Yi.

Both the “informal summits,” at Wuhan and Mamallapuram, were held after tension-racked moments between India and China. Wuhan came months after the 70 day stand-off between China and India at Doklam, while Chennai came after Chinese protestations against India’s actions in Jammu & Kashmir post 5 August. Over the past months China, clearly supporting Pakistan, has protested India’s abrogation of Article 370 from J&K and the state’s division into two union territories. China strongly expressed opposition, especially to Ladakh being made a UT. Historically and since India’s independence, China has no locus-standi in Ladakh.

As is well known, China displays a propensity to distort history and is in adverse occupation of 38,000 sq kms of Indian territory in the Aksai Chin region

and 5,180 sq kms of territory in J&K’s Shaksgam Valley, illegally ceded to it by Pakistan in November 1963.

Not surprisingly, China took the 5 August Indian move to the UN Security Council, though it did not get support from any other member. Even in the UN General Assembly, almost all countries supported India, calling it India’s “internal matter,” with the exception of China, Turkey and Malaysia.

The last few months have witnessed China engaged in a serious trade war with the US, apart from being beset with serious law and order problems in Hong Kong, in its restive Xinjiang province, besides problems with Taiwan and nations embracing the East and South China seas. The globally ambitious Belt and Road Initiative (BRI) has also not taken off with the momentum the Chinese would have desired.

Though not exactly chastened by its geopolitical problems, an overbearing and assertive China would not want its global image to take a beating, especially in India’s backyard. Thus it was not surprising that China consented to holding the second “informal summit” with India. That it formally announced its acceptance just two days ahead of the dates also conveys a point!

Beijing invited Pakistani Prime Minister Imran Khan and his Army Chief, Gen Qamar Bajwa, to Beijing for talks a few days before this summit, clearly indicating its priorities and its close relations with Pakistan. From the Mamallapuram summit, Xi flew directly to Nepal, upgraded ties with the landlocked nation and signed many agreements, including construction of the Lhasa-Kathmandu rail link, clearly outlining China’s expanding strategic footprint in India’s neighbourhood.

Prior to the informal summit, India has, for decades, had its hands full with myriad problems vis-à-vis the Chinese. Apart from the long outstanding and unresolved border dispute with China, India faces a major and burgeoning trade deficit with

China, opposition to its membership of the Nuclear Suppliers Group and membership of the UNSC, China’s strategic penetration into India’s neighbourhood and, critically, China’s all-embracing military and political support to Pakistan. In addition, China’s maritime assertiveness in the Indian Ocean region also concerns India both in its eastern and western sea-boards. Thus, such ‘informal summits’ have their unique utility in managing differences and preventing conflict between the two nations.

According to Xinhua, at Chennai, Xi spoke of the need, notwithstanding all disputes, to ‘hold the rudder and steer the course of Sino-Indian relations to a 100 year plan.’ He also emphasised how both nations must have ‘timely and effective strategic communication’ which would properly handle ‘differences and sensitive issues.’

Overall, it is beneficial for both China and India to maintain friendly relations despite their major and even irreconcilable differences. However, the Chinese, who are masters of realpolitik and have deep pockets, will not shy away from determinedly pursuing their global, regional ambitions encapsulated in their ‘core interests’. Their unstinted support to Pakistan will continue as Islamabad is towing Beijing’s dictates unreservedly and has virtually leased territory in Gilgit-Baltistan, POK and Balochistan for the \$ 62 billion China-Pakistan Economic Corridor. India’s security establishment will have to factor in this strategic collusion between China and Pakistan and also China’s efforts at India’s strategic negation in Nepal.

Despite monumental differences between nations, diplomacy endeavours to bridge divergences and conflicting interests. Thus, as India strives to strengthen itself to match up to the currently oversized Dragon, it will be well advised to earnestly bridge the chasm between them, both in economic prowess and combat capabilities, with unflinching determination. Only then will the nation be able to carry forward the ‘Chennai Connect’.

LCA (Navy) in major milestone



Image : Deb Rana

In a major milestone achieved on 29 September 2019, LCA Naval Prototype-2 was “launched” off the ski ramp at the Shore Based Test Facility SBTF at 1621 hours and then subsequently “trapped” at 1631 hrs on the arresting gear site, both locations situated at INS Hansa in Dabolim, Goa. This was the first occasion when the complete cycle of launch and recovery required for aircraft carrier operations was accomplished in a single sortie, the LCA NP-2 flown by Commodore Jaideep Maolankar who heads the National Test Flight Centre, ADA at Bangalore.

FOC for HAL Jaguar DARIN III



Certifying agency RCMA (A/c) has accorded Final Operation Clearance for the HAL-built Jaguar DARIN III strike fighter. So far, three Jaguars have been modified at HAL Bangalore to DARIN-III standard and subjected to a series of ground and flight trials for the full navigation and attack capabilities. The upgrade incorporates new generation avionics systems including the in-house developed Open System Architecture Mission Computer (JD3MC), Engine and Flight Instrument System (EFIS) replacing traditional electro mechanical instruments, Solid State Video Recording System, INS/GPS System with GPS + GLONASS, Multi-Mode Radar, EW Suite, Autopilot and Glass Cockpit. Some 61 Jaguars are to be upgraded to DARIN III standards.

Finale for MiG-27s in IAF service



The last remaining squadron of MiG-27UPG swing wing fighters with the Indian Air Force will be ‘stood down’ as the type is phased out of service on 31 December 2019. The Indian Air Force received some 150 of the variant, licence produced by HAL at its Nasik Division and these equipped six squadrons of the IAF. 40 of these were consequently upgraded by HAL to serve with Nos.10 and 29 Squadrons, the latter being the last to operate the type.

CAS flies HTT-40

Air Chief Marshal RKS Bhadauria, CAS and a test pilot himself, undertook his maiden flight in the HAL-designed and developed Basic Trainer Aircraft HTT-40 at Bangalore on 14 November 2019. “During the sortie he assessed the aircraft flying characteristics including stall and spin, being airborne for an hour, with HAL’s Chief Test Pilot (FW), Gp Capt (Retd) KK Venugopal in the cockpit”.



The HTT-40 has completed major test points to meet the Preliminary Staff Qualitative Requirements (PSQR) issued by Air Headquarters for the BTA requirement. The HTT-40 (fondly named ‘Phoenix’) has now completed stalls, engine relights, inverted flying, acrobatic flying and systems testing and the basic operational clearance and user evaluation trials readiness is expected shortly.

VACS on HAL's Hawk-i



The HAL-built Hawk-i has been integrated with indigenous Voice Activated Command System (VACS) making its first sortie on 26 July, 2019, being the first indigenous Artificial Intelligence based system to be integrated on an military aircraft in the country. The VACS, designed and developed by the SLRDC is a Speech Recognition System which recognises pilot voice commands and sends the recognised commands to the Mission Computer for required action. This reduces the pilot workload and allows more focus on critical tasks.

HAL Dornier 228s with Glass Cockpit



Integration of the Glass Cockpit in a Navy Dornier 228 (IN-255) aircraft has been certified, being the fifth aircraft of 12 additional Dornier 228s ordered by the Indian Navy, high speed taxi trials of IN-255 carried out on 5 September, 2019. The IAF's first Glass Cockpit configured Dornier 228 (KD-720) has also completed high speed taxi trials and integration of two more IAF aircraft (KD-710) (retro fitment) and KD-722 (line compliance) have been completed and the aircraft signaled out.

IAF operates Su-30MKIs from civilian airports in the NE



According to an IAF spokesperson, the Indian Air Force has operated Sukhoi Su-30MKIs from several civilian airports in the northeast of India including Dimapur, Imphal, Guwahati and Kolkata in the first phase, with Pasighat and Andal added in the second phase. "The exercise will familiarise the IAF crew with the procedure of flying from these busy airfields and coordinate with their civilian counterparts. It will also help familiarise the civilian functionaries at these airfields with the conduct of military operations". IAF Su-30s are based at Chabua and Tezpur in Assam, with Hawks at Kalaikunda in West Bengal.

BrahMos fired at Trak Island



The BrahMos supersonic missile was trial fired at Trak Island in the Andaman & Nicobar group of islands, the twin firings carried out by the IAF which service had previously fired land version of the BrahMos missile at Pokhran ranges. The IAF has also recently launched air version of the BrahMos missile from Su-30MKI fighter aircraft in May 2019 in the same area.

Colours to Army Aviation Corps



President of India Ram Nath Kovind presented colours to the Army Aviation Corps on 10 October 2019 at a ceremonial parade, held at Army Aviation Base, Nasik Road. Immediately after its raising in 1986, the Army Aviation Corps was involved in operations during 'Operation Pawan' in Sri Lanka, but the Siachen Glacier has been the ultimate operational frontier for the Corps since 1984. "Routinely operating at 20,000 feet above sea level in extremely challenging conditions, the highly skilled and motivated pilots of the Corps have been supporting *Operation Meghdoot* with skill and dedication".

HAL's LUH in high altitude trials



The HAL-designed and developed Light Utility Helicopter (LUH) has successfully demonstrated high altitude capability in the Himalayas, the trials carried out by test pilots from HAL, IAF and the Army in August and September, 2019. A comprehensive test plan was executed at Leh (3300m) in temperatures up to ISA +32 degree C which included envelope expansion, performance and flying qualities. The LUH then lifted off from Leh and demonstrated its hot and high hover performance at Daulat Beg Oldie (DBO) at 5000m followed by another forward helipad (5500m at ISA +27degree C).

Meanwhile, in the process of obtaining EASA certification for the Dhruv ALH (civil variant), High Intensity Radiated Field (HIRF) testing has been demonstrated in compliance with EASA requirements.

Colours to Corps of Army Air Defence



The President of India Ram Nath Kovind awarded President's Colours to the Corps of Army Air Defence at Gopalpur Military Station on their completion of 25 years an independent arm. The Corps has, till date, been awarded two Ashoka Chakras, two Kirti Chakras, 20 Vir Chakras, nine Shaurya Chakras, 113 Sena Medals and 55 Mention-in-Despatches in addition to four battle honours awarded after the 1971 Indo-Pakistan war.

India presents 2 more Mi-35s to Afghanistan



The Government of India delivered two additional Mi-35 attack helicopters to the Afghanistan Air Force at a ceremony in Kabul. These followed four Mi-24 gunship helicopters given in December 2015 and two Mi-35 attack helicopters in May 2019.

Export and Import of Defence Equipment

As detailed by the MoD, during last three financial years (2016-17 to 2018-19), 149 capital acquisition contracts have been concluded, of which 58 contracts worth about Rs. 1,38,727.16 crores and 91 contracts worth about Rs.76,955.73 crores have been placed on foreign vendors and Indian vendors respectively for procurement of defence equipment and includes from Russia, USA, Israel, France and United Kingdom. As for defence equipment exported during the last three years by India to foreign countries, are patrol vessels, helicopters, sonars and radars, avionics, radar warning receivers (RWR), small arms, small calibre ammunition, grenades, telecommunication equipment, coastal surveillance radar, simulators, bullet proof jackets and body armour.

S-400 delivery to India “on track”

According to reports from New Delhi, “the timeframe for the supply of S-400 missile defence systems by Russia to India remains on track with the first payment tranche of \$850 million made for this major defence programme which is 15% of the total which is more than \$5 billion”. It is learnt that India and Russia have focused on alternative payment mechanisms to overcome the impact of potential US sanctions, including trade through a rupee-rouble mechanism (in which payments are made in rupees and roubles) or payments in euros for military hardware.

Phase III contract of IAC-1



Cochin Shipyard Limited has signed the Phase-III contract for construction of the Indigenous Aircraft Carrier (IAC-1) which covers the operational and harbour acceptance trials of various equipment and systems installed onboard and also sea trials of the carrier. The contract also covers some activities which are to be undertaken post delivery of the vessel including support during weapon & aviation trials.

IN's first aircraft-carrier dry dock

On 28 September 2019 Defence Minister Rajnath Singh inaugurated the Indian Navy's first aircraft-carrier dry dock (ACD) in Mumbai which is the largest dock of the Indian Navy measuring a massive 281m in length, 45 m in breadth and 17m in depth, and which can accommodate the aircraft carrier INS *Vikramaditya*. The ACD is also the first Indian dry dock built into the sea, unlike the conventional docks, which are built on land, thereby conserving premium land space and providing the Navy with 0.5 km of crucial berthing space.

DAC clears 3 indigenous frigates

The Defence Acquisition Council (DAC), chaired by Defence Minister Rajnath Singh, has accorded approval for Capital Procurement amounting over Rs. 3300 crore for indigenously designed and developed equipment. These include third generation Anti-Tank Guided Missiles (ATGM) and Auxiliary Power Units (APUs) for T-72 and T-90 tanks, while the third project pertains to discrete Electronic Warfare (EW) systems for mountain and high altitude terrain.

MK 45 Gun Systems for Indian Navy



The US State Department has approved a possible Foreign Military Sale to India of up to thirteen MK 45 5”/62 calibre (MOD 4) naval guns and related equipment for an estimated cost of \$1.0210 billion. The Government of India had requested procurement of such naval guns plus three thousand five hundred D349 projectiles, 5”/54 MK 92 MOD 1 ammunition plus spare parts, personnel training and equipment training, publications and technical data, transportation, US Government and contractor technical assistance and other related logistics support. The principal contractor will be BAE Systems Land and Armaments, Minneapolis, Minnesota with gun manufacturing in Louisville, Kentucky.

New stealth frigate INS ‘Nilgiri’ launched

Defence Minister Rajnath Singh has launched INS ‘*Nilgiri*’, first of the Navy's seven new stealth frigates, at Mazagon Dock Shipbuilders Limited in Mumbai. INS *Nilgiri* is the first ship of Project 17A, a design derivative of the *Shivalik*-class stealth frigates with much more advanced stealth features and indigenous weapons and sensors. The P17A frigates incorporate new design concepts for improved survivability, sea keeping, stealth and ship manoeuvrability.



The Raksha Mantri has highlighted that the Directorate of Naval Design has so far designed over 19 classes of ships to which more than 90 ships have been built. “Out of total 51 ships and submarines on order at various shipyards as on date, 49 are being constructed indigenously. This contributes to our target of building a five trillion dollar economy by 2025 and 70% defence indigenisation by 2027”, he said.

Indian warships visit Manila



Continuing the Indian Navy’s overseas deployment to South East Asia and the Western Pacific, INS *Sahyadri* and *Kiltan* have made a port call at Manila in the Philippines, the warships part of the Indian Navy’s Eastern Fleet based at Visakhapatnam. INS *Sahyadri* and *Kiltan* are the latest, indigenously-designed and built multi-role Guided Missile Stealth Frigate and Anti-Submarine Warfare Corvette respectively, equipped with a versatile array of weapons and sensors and embarking multi-role helicopters.

India–Bangladesh coordinated patrols in Bay of Bengal

Second edition of the Indian–Bangladesh Navy Coordinated Patrol (CORPAT) took place in the northern Bay of Bengal in October 2019. Guided-missile destroyer INS *Ranvijay* and missile corvette INS *Kuthar* participated along with BNS *Ali Haider*, a Type 053 frigate and BNS *Shadinota*, a Type 056 stealth guided missile corvette. The two-day CORPAT was followed by maiden edition of the IN-BN Bilateral Exercise at Visakhapatnam in mid-October 2019.



The sea phase was followed by professional interaction between the navies and visits to the Indian Naval training and maintenance facilities at Visakhapatnam. The exercise also included air familiarisation of BN aircrew on MPA operations at INS *Dega* plus a ten-day training exercise between IN Marine Commandos and BN SWADS. Interestingly, both Navies deployed the Dornier 228 maritime patrol aircraft in the exercises, the Indian Navy operating HAL-built Dornier 228s and the Bangladesh Navy RUAG-supplied equivalent, the latter having received major assemblies from HAL.

GSL launches 3rd Coast Guard OPV



The Offshore Patrol Vessel ordered for the Indian Coast Guard *Sajag* was launched on 14 November 2019 at Goa Shipyard Limited. The ongoing shipbuilding project for 5 Offshore Patrol Vessels is one of the biggest orders being executed by GSL for the Indian Coast Guard, launched by the Prime Minister on 13 November 2016. Entirely designed in-house by GSL, these OPVs will be used along the Exclusive Economic Zone of Indian territorial waters.

51st L&T-built warship commissioned



The 51st Larson & Toubro-built vessel ICGS *Varaha* was commissioned into the Indian Coast Guard by Defence Minister Mr Rajnath Singh at Chennai “ahead of schedule”. ICGS *Varaha* is fourth in the series of seven Offshore Patrol Vessels (OPVs), indigenously designed and built by L&T, following the ICGS *Vikram* (April 2018), ICGS *Vijaya* (August 2018) and ICGS *Veera* (February 2019).

GRSE delivers ICGS 'Annie Besant' to ICG



Garden Reach Shipbuilders and Engineers Ltd., (GRSE) have delivered ICGS *Annie Besant*, second in the series of five Fast Patrol Vessels (FPV) to the Indian Coast Guard. The FPV is a medium-range surface vessel designed for a maximum speed of 34 knots with an endurance of more than 1500 nautical miles, equipped with 3 MTU engines, 'Water Jet' units and an 'Integrated Bridge System' integrating all communication and navigation systems. The design of these FPVs has been developed in-house by GRSE as per specifications of the Indian Coast Guard.

GRSE currently has an order book of around Rs 27, 400 crore including 22 warships at various stages of construction. Under five projects of the Indian Navy and the Indian Coast Guard. GRSE is also preparing response to RFPs for construction of 12 Air-Cushion Vehicles (ACVs) for the Indian Coast Guard and Indian Army and construction of six New Generation Missile Vessels (NGMVs) for Indian Navy.

Exercise Eastern Bridge-V

The Indian Air Force participated in the bilateral joint exercise with the Royal Air Force of Oman (RAFO), Exercise Eastern Bridge-V, from 17 to 26 October 2019 at Air Force Base Masirah in Oman. The last such exercise, was held in 2017 at AFS Jamnagar. For the first time, MiG-29 UPG fighters participated in an International Exercise.



The IAF contingent comprised MiG-29s reportedly from Nos. 47 and 223 Squadrons supported by a C-17 Globemaster III, while the Royal Air Force of Oman fielded Eurofighter Typhoons, F-16s and Hawks so as to "enhance inter-operability during mutual operations between the two Air Forces and will provide an opportunity to learn from each other's best practices"

Indo-Kazakhstan Joint Military Exercise KAZIND 2019



Fourth edition of "joint Indo-Kazakhstan military exercise KAZIND-2019 was held at Pithoragarh in Uttarakhand, the exercise including joint training in mountainous as well as jungle terrain. As part of the validation exercise on 15 October 2019, troops of both armies carried out specialised joint counter terrorist operations including cordon and search operations reviewed by Maj Gen Kabindra Singh, GOC, Uttar Bharat Area and by Maj Gen Daulat Ospanav, Chief of Staff of Kazakhstan.

Indo-Mongolian Exercise 'Nomadic Elephant XIV'

In the series of joint bilateral exercises between India and Mongolia it was fourteenth edition *Exercise Nomadic Elephant* 2019 which took place at Bakloh. The exercise provided an ideal platform for both contingents to share their operational experience and expertise while also being instrumental in broadening the interoperability and cooperation between the armies of India and Mongolia.



MAITREE – 2019



MAITREE-2019, the joint military training exercise between Indian and Royal Thai Armies took place at the Foreign Training Node in Umroi (Meghalaya). “Contingents of both armies shared their expertise and experiences in counter terrorism operations and enhanced interoperability”, the exercise encompassed operations in urban and jungle environment.

Indo-Japan Joint Exercise : Dharma Guardian 2019

In the series of joint bilateral Exercises between India and Japan, the second edition of which culminated on 31 October 2019 at the Counter Insurgency and Jungle Warfare School (CIJWS) Vairengte, Mizoram. This was attended by General Goro Yuasa, Chief of Staff, Japanese Ground Self Defence Forces and Lieutenant General Rajeev Sirohi, GOC, III Corps. The primary focus of the exercise was to train and equip the contingents in counter insurgency and counter-terrorism operations in mountainous terrain, the curriculum planned in progressive manner wherein the participants initially familiarised with each others’ organisation, weapons and combat skills before moving on to joint tactical exercises.



Indo-French Joint Training Exercise Shakti 2019

Joint military exercise *Shakti* 2019 between Indian and French Armies, was held at Mahajan Field Firing Range in mid-November 2019, the exercise conducted in two phases. Combat conditioning and tactical training was followed by the validation stage, which included establishment of observation posts, cordon and search operation and house clearing drills including evacuation of



casualties using helicopters. The Indian Army also deployed HAL Rudra helicopters, weaponised version of the Dhruv ALH. The French platoon group were from the 21st Marine Infantry Regiment.

Indo-Maldives Joint Exercise Ekuverin 2019

The 14-day joint exercise culminated on 20 October 2019 at the Foreign Training Node, Aundh Military Station, Pune. The exercise included joint training of contingents in counter insurgency and counter terrorism operations in semi urban environment under the UN mandate, developing interoperability and cohesion between both the contingents.



Exercise Dustlik 2019

The inaugural Indo-Uzbekistan Joint Field Training Exercise (FTX)-2019 (*Exercise Dustlik-2019*) culminated on 13 November 2019 after 10 days of joint training which focused on counter insurgency and counter terrorism operations in urban scenario. The joint exercise was conducted in the Chirchik Training Area, Uzbekistan.



Indo-US Exercise ‘Tiger Triumph’

The India–US joint Tri services Humanitarian Assistance and Disaster Relief (HADR) Exercise ‘Tiger Triumph’ took place along India’s eastern seaboard from 13 to 21 November 2019. Participating were INS *Jalashwa*, *Airavat* and *Sandhayak*, with Indian Army troops from the 19 Madras and 7 Guards, plus Indian Air Force Mi-17 helicopters and Rapid Action Medical Team (RAMT). The US was represented by USS *Germantown*, with troops from US 3rd Marine Division. On completion of the Harbour Phase at Visakhapatnam the ships, with troops embarked, sailed for the Sea Phase to undertake Maritime, Amphibious and HADR operations, the HADR area near Kakinada.



Joint Exercise Za'ir-Al-Bahr ("Roar of the Sea")



Indian Navy Frigate INS *Trikand* and a P-8I MPA were positioned at Doha for inaugural edition of the Bilateral Maritime Exercise *Za'ir-Al-Bahr* ("Roar of the Sea") conducted from 17 to 21 November 2019 between the Indian Navy and Qatari Emiri Naval Forces. INS *Trikand* is commanded by Captain Vishal Bishnoi, equipped with a range of weapons and sensors. The Qatari Emiri Naval Forces participating in this Exercise included the versatile anti-ship missile-equipped *Barzan*-Class Fast Attack Craft along with Rafale multi-role fighters.

Indian-Indonesian Navy Exercise 'Samudra Shakti'



The anti-submarine warfare corvette INS *Kamorta*, exercised with the Indonesian Warship KRI *Usman Harun*, a multi-role Corvette in the Bay of Bengal as part of the Indian Navy – Indonesian Navy Bilateral Exercise 'Samudra Shakti' in early November 2019. The joint exercises included manoeuvres, surface warfare exercises, air defence exercises, weapon firing drills, helicopter operations and boarding operations.

'Defence of Andaman and Nicobar Islands' Exercise 2019



The Andaman and Nicobar Command (ANC) conducted the second edition of the *Defence of Andaman & Nicobar Islands* 2019 (DANX-19), a large scale joint services exercise from 14 to 18 October 2019. Elements of the Indian Army, Navy, Air Force and Coast Guard carried out mobilisation and field manoeuvres to validate defensive plans of Headquarters ANC "towards pursuance of the Command's responsibility, which is for ensuring territorial integrity of the A&N Islands". In addition to resident forces at ANC, additional forces from the Indian mainland including ships and aircraft, Special Forces from the newly formed Armed Forces Special Operations Division (AFSOD), also participated.

Exercise MALABAR 2019



2³rd edition of the Trilateral Maritime Exercise MALABAR, took place between the navies of India, Japan and USA from 26 September to 4 October 2019, off the coast of Japan. Two Indian Naval warships, INS *Sahyadri* and ASW Corvette INS *Kilban*, with Rear Admiral Suraj Berry, FOC Eastern Fleet in command, participated in the Exercise. In addition to the ships, a Boeing P-8(I) LRMP aircraft of INAS 312 also took part in the Exercise. The US Navy was represented by USS *McCampbell*, a *Los Angeles*-class Attack Submarine and a P-8A Poseidon LRMP. The JMSDF participated with its *Izumo*-class helicopter destroyer JS *Kaga*, guided missile destroyers JS *Samidare* and *Choukai* and P-1 LRMP aircraft.

IndiGo orders 300 A320neo Family aircraft



In what is considered as perhaps the largest order for aircraft in recent times from a single airline operator, IndiGo has placed a firm order for 300 A320neo Family aircraft. This latest IndiGo order is for a mix of A320neo, A321neo and A321XLR, taking IndiGo's total number of A320neo Family aircraft orders to 730. IndiGo is among the fastest growing carriers in the world, and since its first A320neo aircraft was delivered in March 2016, its fleet of A320neo Family aircraft has grown into becoming the world's largest, with 97 A320neo aircraft, operating alongside 128 A320ceos.

Boeing forecasts USD770 billion India market through 2038



In its forecast, Boeing has projected that in India will need 2,380 new commercial airplanes, valued at US \$ 330 billion, to handle the growing demand for air travel over the next 20 years. To operate and maintain the expanding fleet, operators are expected to spend US \$ 440 billion on aviation services, including ground, station and cargo operations, along with maintenance and engineering. The forecast is part of Boeing's annual *India Commercial Market Outlook* (CMO). While many of the new airlines will replace aging aircraft, most will help operators grow their network as India's airliner fleet is projected to quadruple in size to approximately 2500 airplanes by 2038.

Air passenger traffic falls for fourth month

The number of domestic air passengers in India fell by 2.20% in September 2019, the fourth straight month of decline which analysts put down to market uncertainties in a slowing economy and a lean travel season. According to data issued by the Directorate General of Civil Aviation (DGCA), "monthly passenger traffic fell by 0.94% in August. Domestic airlines carried 11.53 million passengers in September, compared with 11.79 million in August, 11.90 million in July and 12.02 million in June. However, the number of passengers carried by domestic airlines during January-September 2019 stood at 105.89 million as against 102.79 million during the corresponding period of 2018, marking a growth of 3.01%. The numbers are disappointing. They have pulled down our projection and we now peg (the yearly growth) for 2019 at 4 to 6%. The good news is that we have managed to withstand the sad exit of Jet Airways (India) Ltd and maintained a positive growth despite three months of negative or almost flat growth. The shrinking of the fleet size of Indian commercial airlines on account of Jet Airways' grounding has been largely reversed."

Qatar Airways and Indigo in Codeshare Partnership

Qatar Airways has signed a codeshare agreement with Indigo, the first such flights to operate from 18 December 2019. This agreement will enable the airline to place its code on Indigo flights between Doha and Delhi, Mumbai and Hyderabad and is the first step in strengthening cooperation between the 'World's Best Airline' and the 'Best Low-Cost Airline in India', according to the spokesman.



Nine A321neos delivered to IndiGo

CDB Aviation, a wholly owned Irish subsidiary of China Development Bank Financial Leasing Co., Limited, has delivered first of a batch of nine Airbus A321neo aircraft to IndiGo, as part of a purchase and leaseback transaction. As IndiGo continues to increase connectivity across its network, the A321neo aircraft, equipped with Pratt & Whitney PW1133G turbofan engines and configured with a 222-seat layout, are expected “to generate lower operating costs, while availing the carrier of the advantages of reduced environmental impact and enhanced passenger experience”.

IndiGo expands services to East and SE Asia



Now regarded as one of the world’s fastest growing airline, IndiGo has expanded its international air network in recent months to include new destinations in China, Vietnam and Thailand. With remarkably low return fares offered, IndiGo is now operating scheduled services to Chengdu and Guangzhou in China, Bangkok and Phuket in Thailand, Yangon in Myanmar, Ho Chi Minh City and Hanoi in Vietnam as also Kuala Lumpur, Colombo and Singapore in South East Asia apart from Istanbul in Turkey.

GoAir plans expansion

GoAir has invited bids from Airbus and Boeing for 20 wide body and 200 narrow body airliners as it prepares for the next phase of growth. Although GoAir has been cautious in its expansion plans in comparison with its peers, has rapidly expanded in the past two years, doubling its fleet to 53 Airbus A320s which operate over 325 flights daily. GoAir has 144 Airbus A320neo aircraft on order.

Managing Director Jeh Wadia had stated the airline would continue with its rapid expansion. “Our plan is to add at least one aircraft on average every month. GoAir has flown 76 million passengers since inception and our aim is to achieve 100 million passengers in the next two years. Our daily flights have grown by 41 per cent to over 325, as compared to 230 daily flights same time last year.”



Vistara selects Airbus FHS-TSP solution



Vistara, the joint venture airline between Tata Sons and Singapore Airlines, has signed a long-term contract with Airbus for their Flight Hour Services - Tailored Support Package (FHS-TSP), the contract covering engineering and maintenance for 62 aircraft, including 23 existing ones. The FHS-TSP contract provides integrated and guaranteed services ranging from the supply and repair of components to the manufacturer’s unique Fleet Technical Management service.

Vistara orders Leap-1A engines

Vistara has finalised an engine order for 26 LEAP-1A engines to power their 13 new Airbus A320neo aircraft, in addition to the 37 leased aircraft of the A320neo family, ordered in July 2018 and the ten leased aircraft already in service. Alongside this engine order, Vistara signed a long-term Rate Per Flight Hour (RPFH) agreement for the maintenance of 120 LEAP-1A engines that power 60 Airbus A320neo and A321neo aircraft in service or are on order.

Vistara receives three new Airbus A320neo



Vistara has received three new Airbus A320neo as part of its latest order of 50 aircraft from the Airbus A320neo family, placed in July 2018. The new aircraft come with enhanced operational performance and cabin features including in-seat AC Power Outlet, USB Charging Ports and PED (Personal Electronic Device) holders. A majority of Vistara’s new A320neo aircraft that will be subsequently inducted will feature enhanced performance, and all of them will offer the enhanced cabin features. As Vistara continues to receive new aircraft it will operate them on the Delhi-Singapore and Mumbai-Singapore routes with effect from 24 November 2019, replacing the Boeing 737-800NG being used currently on these routes.

Boeing 737-800 converted freighter for SpiceXpress



SpiceXpress, SpiceJet's cargo division, has taken delivery of its first Boeing 737-800 Converted Freighter (BCF) as the carrier expands its air cargo operation to serve one of the world's most populated regions and offer new route options. The standard-body freighter, which is the first 737-800BCF to be operated in South Asia, is on lease from NGF Alpha Limited, a division of Spectre Cargo Solutions.

SpiceJet plans to launch airline in UAE



Indian low cost carrier SpiceJet has announced plans to launch a new airline with the Ras Al Khaimah (RAK) International Airport as its base, as well as set up its first overseas hub here in the UAE. SpiceJet CMD Ajay Singh has stated that "the carrier is looking to make the Emirate its stepping stone into Europe, and has been mulling an international hub as India's airports become ever more congested. By making Ras Al Khaimah, the northernmost Emirate of the United Arab Emirates (UAE), as its international hub, the airline aims to boost its connectivity to the Gulf as well as to European destinations. The new airline will help connect India with Eastern and Western European destination using RAK as the hub". SpiceJet will be the sixth airline to operate from the UAE after Emirates, Etihad, Air Arabia, flydubai and the recently-announced Air Arabia.

Myanmar airline services to Imphal

Even as India's UDAN plans for regional air services have yet to show results, a Myanmar company Air KBZ (Air Kanbawza) which began operations with a Yangon-Bagan-Nyaung Oo-Mandalay-Heho-Yangon flight in April 2019 will now connect Imphal, capital of Manipur, using operating ATR-72s. Imphal-based tour operators have urged Indian Civil Aviation to grant permission for regular Imphal-Mandalay flight services to enhance air connectivity in the region. Air KBZ is already connecting Yangon with Chiang Mai in neighbouring Thailand. On the other hand, several private airlines under the UDAN scheme have discontinued services within India, including Tezpur-Kolkata, Pakyong-Kolkata, Pakyong-Guwahati, Lilabari-Kolkata and Lilabari-Guwahati.



Meanwhile, after a gap of 40 years passenger flights commenced from Chennai to Jaffna in northern Sri Lanka, with an Alliance Air ATR 42 initiating the services on 17 October 2019.

A320 neo simulator at FSTC

A new Airbus A320neo simulator has been inaugurated at the Flight Simulation Technique Centre (FSTC), in Gurugram to support requirements of trained pilots. This A320neo simulator which comes with both CFM Leap 1A and Pratt & Whitney engine type is the first A320neo simulator in north India, another already operating at FSTC's Hyderabad facility. This FSTC has become training institute for pilots from South East Asia and Africa having recently conducted training sessions with pilots from Air Tanzania, Nok Air and Biman Bangladesh. FSTC currently provides full flight simulators to the majority of airlines in India and conducts type rating programme on B 737 NG, A320, Q400 and ATR aircraft for airlines and self-sponsored individuals.

GoAir selects Pratt & Whitney GTF engines

GoAir has signed an agreement selecting the Pratt & Whitney GTF engine for the airline's 72 A320neo family aircraft. Pratt & Whitney will also provide GoAir with a long-term EngineWise Comprehensive service agreement, the India-based airline currently operates a fleet of 38 GTF-powered A320neo family aircraft, part of the initial GoAir order of 72 GTF-powered A320neo aircraft announced in 2012.

Airbus Helicopters plans for India



Airbus has partnered with Mahindra Defence for production of the H135M multi-role and the H225M medium lift transport helicopter under the

'Make in India' programme. The partnership envisages establishing of final assembly lines in India for these products, Transfer of Technology (ToT) focused on the aeronautical domain, industrial investments, support to local supply chain development and skilling of people for employment in the aviation sector. It is learnt that Airbus has responded to both RFIs issued by the Ministry of Defence for 111 Naval Utility Helicopters (NUH) and 123 Naval Multi Role Helicopters programme (NMRH) under the government's *Strategic Partnership Policy*.

In the picture above are Ashish Saraf, Head of Helicopters, Airbus India & South Asia (centre) along with Company Executives.

DRDO work on 'next-gen' hypersonic weapon

According to a spokesperson, the DRDO is working on developing a hypersonic missile capable of Mach 5 speeds. Wind tunnel tests have begun with the "next-gen" weapon system, with China, Russia, and the United States already testing hypersonic weapons of various types to enhance strategic nuclear deterrence. Lt Gen (ret) Vinod Bhatia, former Director General of Military Operations has stated that "Hypersonic weapons will become very critical in the near

future. China has demonstrated that it has the technology. Others like US and Russia may already possess such weapons. It's time that India also starts working on these technologies."

India-US SOI "to strengthen dialogue on defence technology cooperation"

The Governments of India and the US have signed a Statement of Intent (SOI) "to strengthen dialogue on defence technology cooperation by pursuing detailed planning and making measurable progress" on several specific Defence Technology and Trade Initiative (DTTI) projects including Lightweight Small Arms Technologies (LSAT). The SOI was signed during the ninth meeting of DTTI Group, which held on 24 October and was co-chaired by Subhash Chandra, Secretary Defence Production, and Ellen M Lord, Under Secretary of Defense for Acquisition and Sustainment.

It was also stated that significant progress has been made on developing a DTTI Standard Operating Procedure (SOP) for the identification and development of cooperative projects under DTTI. The SOP will serve as the framework for DTTI and allow both sides to reach and document a mutual understanding on how to define and achieve success.

Defence FDI may be hiked to 74%

The Department for promotion of industry and internal trade (DPIIT) and the MoD have reportedly discussed means to ease many conditions to encourage foreign investors to set up

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establishments in India, which may also restructure the offset and export policies. Presently, as per the automatic route, up to 49% foreign direct investment (FDI) is permitted for defence items and government approval is required to go beyond. Should this change, policy could be expected to raise the limit for automatic clearance to 74% along with relaxation in other conditions.

Decade of Boeing R&T in India

Boeing has marked the 10th anniversary of its research and technology presence in India, “playing an important role in Boeing’s technological advancement”. The centre, in addition to

building internal capabilities, has also been working closely with Indian R&D organisations, driving innovation and contributing to the aviation industry.

Over the past ten years, Boeing Research & Technology-India has delivered commercially viable solutions for Airplane Health Management (AHM) and Air Traffic Management (ATM). Its ATM experts are currently working with Airports Authority of India to develop a roadmap for modernisation of air traffic management in the country. The research centre is using artificial intelligence and machine learning to improve quality using Internet-of-Things (IOT) technologies with engineers finding ways to improve passenger experience during air travel.

DAC clears Rs 23,800 crore defence procurements

Six more Boeing P-8s for IN



On 28 November 2019, the Defence Acquisition Council (DAC), chaired by Defence Minister Rajnath Singh accorded approval for capital procurement totaling Rs 22,800 crore for the Services. This includes six more Boeing P-8 long range maritime patrol and ASW aircraft which would augment the present fleet of 12 such aircraft, including 4 in the pipeline for delivery. In their maritime capability perspective plan, the Navy has projected requirements for upto 36 such aircraft, had requested for ten which have presently been trimmed to six.

AON revalidated for indigenous AEW&C aircraft



The DAC has revalidated the Acceptance of Necessity (AoN) for procurement of additional Airborne Warning and Control System (AWACS) aircraft for the Indian Air Force which presently has a mixed fleet of Beriev A.50s (*Phalcon*) and the indigenous *Netra*, featuring fuselage mounted planar arrays on the ERJ-145. The aircraft of choice is the Airbus A330 wide-bodied aircraft, which platform the Centre for Air Borne Systems (CABS), as part of DRDO will be developed as an AEW&C aircraft, the first two aircraft to be followed by another four. (*Image of model at DRDO stand at Aero India 2019*).

Twin-engined helicopters for Coast Guard

Also approved by DAC on 28 November is procurement of 14 twin-engined heavy helicopters (TEHH) for the Indian

Coast Guard for “to prevent maritime terrorism, infiltration of terrorists by sea routes as well as Search & Rescue operations”.

DAC has also approved the indigenous design & development manufacture of thermal imaging night sights for assault-rifles of the Army.

Commissioning of INAS 314 ‘Raptors’

The sixth Dornier 228-equipped squadron of the Indian Navy (INAS 314) was commissioned at Naval Air Enclave, Porbandar on 29 November 2019, with Vice Admiral MS Pawar, DCNS as the Chief Guest who stated that, “commissioning of Indian Naval Air Squadron (INAS) 314 marks yet another milestone in our efforts towards enhancing maritime security and our surveillance footprint in the North Arabian Sea.” Owing to its strategic location, the Do-228s of INAS 314, commanded by Captain Sandeep Rai, “will act as the first responder in this crucial region”. The Squadron’s insignia is that of a ‘Raptor’, the large bird of prey known for excellent sensory capabilities, powerful and sharp talons and strong wings.



The Indian Navy has ordered 12 new Dornier 228s from HAL “with state-of-the-art sensors and equipment including glass cockpit, advanced surveillance radar, ELINT, optical sensors and networking features”. The squadron is the first to accept and operate four of these newly inducted next generation Dornier aircraft.

APPOINTMENTS

Air Marshal Harjit Singh Arora is Vice Chief of the Air Staff

Air Marshal Harjit Singh Arora took over as Vice Chief of the Air Staff on 1 October 2019. Commissioned in the Indian Air Force as a fighter pilot in December 1981, he has diverse experience of accident free operational flying which includes the MiG-21, MiG-29 and other aircraft in the inventory, including helicopters. He is a graduate of the Tactics and Air Combat Development Establishment, Defence Service Staff College and National Defence College, holds Master of Science in Defence Studies and Master of Philosophy in Defence and Strategic Studies.

As an Air Marshal, he has held the appointments of Director General (Inspection and Safety) and Director General Air Operations at Air HQ. Before taking over as Vice Chief of the Air Staff, he was Air Officer Commanding-in-Chief, South Western Air Command.



Air Marshal B Suresh becomes AOC-in-C WAC

Air Marshal B Suresh took over as the Air Officer Commanding-in-Chief Western Air Command on 1 November 2019. An alumnus of the RIMC and NDA, he was commissioned as a fighter pilot on 13 December 1980, is a 'Sword of Honour' awardee from the Tactics and Air Combat Development Establishment, a graduate of the Defence Services Staff College, Wellington and a post graduate from Cranfield University, United Kingdom. He is a highly experienced fighter pilot and has flown almost all fighter aircraft types and helicopters of the IAF. Before taking over his new assignment, he was AOC-in-C Southern Air Command.



Air Marshal Amit Dev appointed APO

Air Marshal Amit Dev took over as Air Officer in Charge Personnel at Air Headquarters Vayu Bhawan on 1 November 2019. In his career spanning nearly 37 years, the Air Officer has flown a wide variety of fighter and trainer aircraft types in the inventory of IAF, including MiG-21s and MiG-27s.



Air Marshal Manavendra Singh is DG Inspection and Safety

Air Marshal Manavendra Singh has taken over as Director General Inspection and Safety at Air Headquarters RK Puram. The Air Marshal was commissioned in the flying branch as a helicopter pilot and has flown a wide variety of helicopters and trainer aircraft, with over 6600 hours of flying in various sectors including the Siachen, the Northeast, Uttarakhand, the Western desert and the Democratic Republic of Congo.



Professor Annapurni to head IIA

Professor Annapurni Subramaniam, a leading observational astronomer, has taken over as Director of the Bangalore-based Indian Institute of Astrophysics (IIA), one of the oldest scientific institutions in India and engaged in research on astronomy, astrophysics and related physics. IIA is among three Indian research institutes participating in the 30-metre telescope project (the world's largest) being established in Hawaii in a partnership between the Universities of California, Canada, Japan, China and India.



ISRO's PSLV-C47 successfully launched

On 27 November 2019, India's Polar Satellite Launch Vehicle (PSLV-C47), successfully launched Cartosat-3 along with 13 Nanosatellites of USA from Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota. PSLV-C47 was the 21st flight of PSLV in 'XL' configuration (with 6 solid strap-on motors). This was the 74th launch vehicle mission from SDSC SHAR, Sriharikota and 9th satellite of Cartosat series.



The Second Coming



Rafales for the Indian Air Force

8 October 2019 was special for many reasons, some cultural, others martial, some in Southern Asia another in Western Europe. This year on that date, Dussehra was celebrated, a major Hindu festival observed in the Calendar month of Ashvin or Kartik and marking Rama's victory over Ravan. 8 October 2019, also marked 87th Anniversary of the Indian Air Force which celebrated its foundation with parades at Air Force Station Hindan in the morning and an 'at home' hosted by the CAS at Air House in New Delhi in the evening.

Some 7000 kilometres away to the west is Merignac, a suburb of Bordeaux in France, where another ceremony took place with the Indian Defence Minister Rajnath

Singh formally accepting the first Dassault Rafale fighter for the Indian Air Force. Rafale means 'gust' or 'squall' in English and certainly the selection of this superlative multirole combat aircraft has created much turbulence in Indian political circles.

But then a flash back to 1953 when the first French-origin fighter was inducted by the Indian Air Force : Dassault's Ouragan which translates as 'hurricane' or 'storm' in English and so the title of this article! In fact, the Rafale is the sixth Dassault aircraft type to adorn Indian markings, the Ouragan (*Toofani*) being followed by the Mystere IVA, then the Alize carrier-borne ASW aircraft, the Jaguar DPSA (jointly with BAe) and Mirage 2000, the latter currently subject of an intensive upgrade programme.

At Merignac, as Defence Minister Rajnath Singh officially accepted the first Rafale (RB 001) for the Indian Air Force, he stated "Our air force is the fourth-largest in the world and I believe that the Rafale aircraft will make us even stronger and will give a boost to India's air dominance exponentially to ensure peace and security in the region".

He was speaking at a formal handover ceremony along with his French counterpart Florence Parly at the Dassault facility in Merignac, southwestern France. The minister then performed a *shastra puja* on the new aircraft as he emblazoned it with an 'Om' *tilak*, laid flowers, coconuts and lemons (*which was subject of much comment in India*) He was also given a flight in a



Command (now VCAS) while the CO of No.17 Squadron Gp Capt Harkirat Singh explained features of the cockpit to the Minister (see also news items in *Vayu Issue VI/2019*). 

twin-seat Rafale, later exclaiming that “I had never imagined that I would be flown at supersonic speed; a very comfortable and smooth flight during which I was able to observe the many capabilities of the jet, its air-to-air and air-to-ground combat capabilities”.

The occasion was attended by M.Eric Trappier, Chairman and CEO of Dassault Aviation, who stated that he was “particularly honoured to host this ceremony today as India is part of Dassault Aviation’s DNA. The long and trustful relationship we share is an undeniable success and underpins my determination of establishing for the long term, Dassault Aviation in India. We stand alongside the Indian Air Force since 1953, we are totally committed to fulfill its requirements for the decades to come and to be part of India’s ambitious vision for the future”.

Defence Minister Rajnath Singh was accompanied by Air Marshal Harjit Singh Arora, AOC-in-C South Western Air





INS Khanderi commissioned

“The Government is deeply conscious of the requirements of the Armed Forces and remains committed in providing requisite focus and financial support for its modernisation”, stated Defence Minister Rajnath Singh on 28 September 2019 at the commissioning ceremony of indigenously-built submarine INS *Khanderi* in Mumbai. Mr. Rajnath Singh said that due impetus had been given for timely acquisition of state-of-the-art weapons, sensors and platforms, adding that the Government had given more freedom and support to armed forces in taking decisions in the nation’s interest. “We are committed to far-reaching changes in our defence preparedness. You cannot *buy* a confident Navy. A confident Navy is always *built* by a confident Government”, the Raksha Mantri said, adding that the Indian Navy had the confidence which no other country in the Indian Ocean possessed.

Describing INS *Khanderi* as a “potent combatant”, Mr. Rajnath Singh congratulated the Navy and the Western Naval Command on its induction and for achieving very high levels of operational

preparedness prior its commissioning. He said it was a matter of great pride that India was one of the few countries capable of constructing their own submarines.

INS *Khanderi* is the second of *Kalvari*-class diesel electric attack submarines of the Indian Navy. It has been built in India to the French *Scorpene* design (by Naval Group) and is the second submarine of the Project-75. Built indigenously by Mazagon Dock Shipbuilders Limited, INS *Khanderi* is designed for silent and stealthy sub-surface operations.



Naval Group and MBDA laud the commissioning of INS *Khanderi*

“MBDA is proud to share this moment with the Indian Navy as INS *Khanderi* is commissioned into service: many congratulations to all involved in the taking of this step. As she patrols the high seas she will carry the advanced Exocet SM39 anti-ship missile to protect India’s interests”, stated Loïc Piedevache, Country Head India, MBDA (picture on the right).



Exocet SM39 being loaded in the submarine



Olivier de la Bourdonnaye, Senior Executive Programme Director at Naval Group stated: “The rise in competencies that MDL completed is very inspiring. It is the first time in history that such a large scale technology transfer has taken place for the making of one of the most complex products found in the world. The commissioning of the second *Scorpene*-class submarine constitute a new milestone for this unique and one of a kind industrial programme. The additional unit of this stealthy submarine will further contribute to self-reliance of the Indian Navy”.

INS *Khanderi* is follow-on to INS *Kalvari*, which was the first French-origin *Scorpene*-class submarines indigenously constructed in India and commissioned in 2017. First put out to sea in 2017, INS *Khanderi* has undergone comprehensive sea trials, torpedo and missile firings to validate her fighting capability and was handed over to the Indian Navy on completion of trials on 19 September 2019. At 67.5 meters long and 12.3 meters high, *Khanderi* “embodies cutting edge technologies that ensure stealthy, silent operations underwater and is equipped with an array of torpedoes, missiles and sensors that enable her to detect, identify and destroy enemy targets”. 🛩️



Photos: Indian Navy



EASA Certification Received

Safran's Ardiden 1U helicopter engine for HAL's LUH



HAL's Light Utility Helicopter LUH (photo: Phil Camp)

Safran Helicopter Engines has received EASA type certification for its Ardiden 1U engine, now installed in India's LUH (Light Utility Helicopter). The LUH, a new three-ton, single-engine, multi-purpose rotorcraft designed by Hindustan Aeronautics Ltd. made its maiden flight in September 2016. Since its first ground test in 2015, the Ardiden 1U certification campaign has accumulated around 1000 of hours of operation, in test beds or in flight, "to confirm the high reliability and performances inherited from the previous variant."

Benoit Gadefait, Vice President Medium Helicopter Engines Programmes, stated: "this certification marks a major milestone in both the Ardiden 1 programme and our long-lasting partnership with HAL. The engine performs extremely well and has contributed to the success of the flight test campaign. The helicopter has conducted hot & high tests in the Himalayas, proving its abilities to operate in this demanding environment. It took off from remote areas at more than 5,500 meters elevation in hot conditions (up to 30°C), lifting more than the expected payload. The engine revealed high level of reliability and performance,

to the satisfaction of Armed Forces and Indian MoD representatives witnessing the tests. We remain fully committed to supporting HAL and their end customers as this Ardiden approaches entry-into-service."

The 1U is a derivative with increased power of the 1,400 shp Ardiden 1H1 and includes an innovative control system specifically designed for single-engine rotorcraft. The Ardiden 1H1 was co-developed by Safran and HAL and designed to power HAL's Dhruv and Light Combat Helicopter, with presently more than 250 units in service. (Safran Helicopter Engines

supplies engines to all new-generation HAL rotorcraft.)

"With more than 65 years of experience working in its core aerospace and defence markets, Safran has a long-standing presence in India. The Group is committed to remaining a full-fledged technology partner in these sectors, predominately as a supplier of engines and/or equipment and support services for airplanes and helicopters. With more than 1,500 units in service, we are the leading supplier of turboshaft engines to Indian Armed Forces helicopters", stated company officials. 🦋



The Ardiden 1H1 'Shakti' co-developed by Safran and HAL powers the Dhruv and Light Combat Helicopter (photo: Phil Camp)



Pipistrel delivers 194 'Garud' microlights to India

In October 2015 Pipistrel was awarded a contract for supply of 194 microlight trainer aircraft for the Indian Air Force (IAF), Indian Navy (IN) and National Cadet Corps (NCC) for different applications, which was the world's largest single contract for the delivery of light aircraft to date.

the next 15 years, a large number of Indian military pilots and NCC cadets will be trained on the Pipistrel microlight.

The deliveries were made to 85 locations, where the Indian team assembled the aircraft in presence of end user representatives and also flight tested there.



Naval Base in India at the end of training

Deliveries began in 2016 and on 20 September 2019, the company's Indian partner Skytec Solutions announced that last batch of the 194 aircraft had been delivered to the end user customer by Pipistrel.

The contract also included training of a large number of technicians and engineers from all three branches of Indian services. Training was conducted by the Pipistrel Academy of Slovenia with their instructors along with their Indian partner Skytec Solutions, but customer support, guarantees, servicing and delivery of spare parts will continue from Slovenia. During

Ivo Boscarol, the CEO of Pipistrel stated, "At the beginning, many big players in the aviation business warned me that working with India is not possible and we would never bring the contract to an end successfully, but all of us, working together as a strong team, succeeded in achieving our goal. We have proven to our customers, competitors and the entire world that we are capable to carry out even the most demanding of contracts. This deal has opened many doors for us in the future."

Wg Cdr Sanjay Thapar CEO of Pipistrel partner Skytec Solutions, stated, "Winning the contract in tough



CEO of Pipistrel India presenting a Garud aircraft model to the base commander after delivery

competitive environment was easy for Pipistrel as they offered the best product at the lowest price. But execution of the contract was full of challenges, biggest being large number of delivery locations spread all over India from Srinagar to Trivandrum, Chabua to Naliya and Port Blair. As a proud Indian and a veteran air warrior, I am happy that India at last has best-in-class microlight fleet, which will meet aspiration of all users in respect of their expectations from this aircraft."

The CEO of Pipistrel, Ivo Boscarol, had been specially invited to India by President of India Mr. Ram Nath Kovind during his official visit to Slovenia. 🇮🇳

VAYU Interview with

“Poised for Quantum Growth”

VAYU : Congratulations on your taking over as the 24th CNS, and the fourth Naval Aviator to do so. With your flying background and vast operational experience, would you kindly enumerate on priorities for the Navy's expansion and modernisation over the next few years, including its air arm.

CNS : Thank you. The Indian Navy's Air Arm is poised for a quantum growth over the next few years.

There is a comprehensive plan to augment the number and enhance the capability of ship-borne helicopters through midlife upgrades and role enhancement on the existing fleet of Kamov 28 and Sea King 42B. Procurement of eight Chetak and sixteen ALH helicopters to enhance Coastal Security has commenced. Further, we also have plans to procure additional multirole helicopters to meet ship-borne helicopter requirements.

To meet Deck Based Fighter requirements, a RFI for MRCBF (Multi Role Carrier Borne Fighter) has been hosted on the MoD website. The case is being progressed in accordance with DPP-16. Further, a case for MiG-29K midlife upgrade is being progressed. Delivery of four additional P-8Is will commence from April 2020 onwards. The Government has also accorded AON for 6 additional P-8Is.

We have added four new Dornier 228 aircraft ex HAL, four are scheduled to be inducted by end of this year. We



have also commissioned new Dornier Air Squadrons at Meenambakkam (Chennai) and Porbandar (Gujarat). At the same time, we are progressively upgrading our air infrastructure at Naval air bases across the country, as well as on the island territories.

In addition to Dornier aircraft, we are extensively utilising RPAs for coastal surveillance. Three RPA Squadrons have been commissioned at Kochi, Porbandar and Ramnad. Procurement of HALE RPAS as a joint tri-Service case is also on the cards.

VAYU : At a recent FICCI Seminar, you were careful in reacting to the PLA Navy's White Paper on its expansion, with India "watching this carefully and responding within our budget and constraints". Could you kindly elaborate in broad terms on how this will impact on the Indian Navy's own long term planning.

CNS : We are closely watching developments in relation to China in the region. The commissioning of the Chinese Military Base at Djibouti in 2017 has augmented their sustenance capability in the Indian Ocean. In 2018, an average of seven PLA (Navy) ships and submarines were deployed in the Indian Ocean Region every month. Chinese investments in various projects across IOR are also known.

The Indian Navy is aware of the security implications of the enhanced presence of Chinese ships and submarines in the Indian Ocean Region and maintains a constant and close watch on such developments. We are assessing our concept of operations and acquisition plans to meet the challenges. The operational outcomes of developing strategic imperatives in the IOR are factored in our planning to ensure that the Indian

Navy remains poised to meet all maritime contingencies.

VAYU : You have stressed on the Indian Navy's shipbuilding initiatives and its linkage to nation building. Of the 51 ships and submarines currently on order, 49 are being constructed indigenously. However, what are your views on future 'strategic partnerships' and the present arrangement where state-owned shipyards receive more favourable consideration?

CNS : The Indian Navy has always encouraged mutually beneficial partnerships with industry. There has also been a constant endeavor to encourage indigenisation and self-reliance. Wherever feasible we have opted for indigenous defence products, provided they meet the SQRs.

The Strategic Partnership (SP) model has been promulgated by the Government to progressively build indigenous capabilities in the private sector to design, develop and manufacture complex platforms for the future needs of the Armed Forces. This is an important step towards meeting broader national objectives, encouraging self-reliance and aligning the defence sector

with the 'Make in India' initiative of the Government. The cases being progressed by the Indian Navy under SP Model, include six Project 75(I) submarine, and the Naval Utility Helicopter projects.

However, the experience and challenges faced in Survey Vessels, Cadet Training Ship (CTS) and Naval Offshore Patrol Vessel (NOPV) projects awarded to private shipyards in the past have not been very encouraging. Therefore, the Defence Acquisition Council (DAC) has recently revised norms for capacity and financial assessment of shipyards while facilitating enhanced competitiveness in Naval warship building.

As on date, there are 10 AoN accorded and shipbuilding cases at various stages. Of these, most are being progressed on competitive basis involving private shipyards. Further, no shipbuilding case has been accorded AoN on Nomination basis since March 2015.

VAYU : On the indigenous aircraft carrier II (IAC-II), it is understood that this will be of the 65,000 tonnes class, with electric propulsion and EMALS for conventional launch and recovery of aircraft. What is the forecast for its 'go

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ahead', even as IAC-1 is expected to be delivered in early 2021.

CNS : Indian Navy envisages IAC-2 to be a 65,000 tonnes carrier with Integrated Full Electric Propulsion (IFEP) employing Catapult Assisted Take-off But Arrested Recovery (CATOBAR) concept of flying operations. At present, the case for IAC-2 is being deliberated at MoD.

VAYU : *Recently confirmed is an order for 24 MH-60R multi-mission helicopters but the requirement is for multiple times this number. Are there any plans for this or any other Type to be licence-built in India?*

CNS : Acceptance of Necessity (AoN) for 24 Multirole Helicopters was accorded by DAC and Letter of Acceptance (LoA) is likely to be signed in the near future. In addition, Indian Navy also plans to procure Naval

Utility Helicopters (NUH) through the Strategic Partnership Model to boost *Make in India*. The NUH are likely to be inducted in a phased manner commencing 2025. The most significant aspect of the Strategic Partnership is that it will facilitate absorption of niche technologies by private industries in helicopter manufacturing segment.

VAYU : *The Japanese ShinMaywa US2i amphibian aircraft has been offered to the Indian Navy for some years and the Japanese Government is reportedly keen to progress this case. What is the status of this programme and do such amphibian aircraft play a role in the Indian Navy's blue water projections?*

CNS : The induction of amphibious aircraft would significantly enhance Indian Navy's capabilities in terms of Operational Logistics (provision of technical assistance and supply of spares to the fleet at sea), long range Search and Rescue (SAR), Casualty Evacuation (CASEVAC), and HADR missions. The proposal for the procurement of six amphibious aircraft from Government of Japan is under deliberation.

Thank you Sir !



Admiral Arun Prakash on

The Kuznetsov mishap and the future of Aircraft Carriers

As accidents go, Russia's sole aircraft-carrier, the *Admiral Kuznetsov* being put out of action on 29 October 2018, was indeed bizarre news. But what missed the headlines was an even more dramatic event that preceded it: sinking of the world's largest floating dry-dock, the PD-50, in the north-western Russian port of Murmansk.

United Shipbuilding Corporation had, optimistically, declared that the damage would be repaired "soon". But the non-availability of PD-50 may have put paid to hopes of restoring aircraft carrier to service in the near future. Serious questions are also arising whether it is worth attempting to salvage the warship, given its history of machinery breakdowns and poor reliability.

maritime deterrence or reliable power projection. The ship infrequently went to sea and seems to have been maintained as a symbol of national prestige that kept alive hopes of a Russian maritime resurgence.

The high point of the ship's career was its 2016 deployment in the Mediterranean. Her air-group undertook 400 operational missions against Syrian rebels, but the loss of two fighters, in quick succession, reportedly owing to arrestor gear malfunction, cast doubts on its reliability. What really served to detract from its image and credibility was the continuous presence of a tug in its company, as measure of abundant precaution against breakdowns far from home.

From all accounts, the *Kuznetsov's* fate now hangs in the balance, for many reasons. Whether the ship is scrapped, repaired or replaced, given the Indian Navy's (IN) linkages with Soviet/Russian carrier-aviation, it is appropriate that we delve into their recent history and reflect on what the future holds.

The Soviet 'Aviation Cruisers'

The post-WW II Soviet Navy had considered aircraft carriers as expensive instruments of 'capitalist imperial aggression', and tactically, as vulnerable "sitting-ducks" for their submarines and air-launched anti-ship missiles. However, this prejudice



The Russian aircraft carrier Admiral Kuznetsov.
(Photo: Norway Royal Airforce, via European Pressphoto Agency)

Since all seven Soviet-era aircraft-carriers had been built at the Ukrainian shipyard of Nikolayev, the Russian Federation has lacked an aircraft-carrier building and repair facility. The PD-50 was the only dry-dock, in Russia, capable of hosting the 67,500 ton aircraft-carrier for its scheduled 30-month repair and refit programme which commenced in September 2018.

The un-docking of a ship from a floating dry-dock is a complex operation, since it involves the 'controlled sinking' of the dry dock to permit the berthed ship to float out. Any malfunction of the large pumps and valves involved in flooding and pumping out can have serious consequences – as indeed happened.

Even with the apparent damage to the *Kuznetsov*, a large gash on the deck caused by a falling 70-ton crane, Russia's

During its 29-year existence, the *Kuznetsov* could never, really, perform her assigned missions of conventional



A Yak-38 with folded wings on the deck of a Soviet aircraft carrier

was breached by the launch, first of the anti-submarine warfare (ASW) helicopter carriers of the *Moskva*-class in 1968, and then, starting in 1973, of four fixed-wing carriers of the *Kiev*-class.

Designed by the Nevskoye Bureau of St Petersburg, these ships were the largest ever built by the Ukraine's Nikolayev shipyard, and took Western observers by surprise. The Soviets disguised the *Kiev* as a 'bolshoi aviatsionnyy kreyser' or 'large aviation-cruiser', in an attempt to delude NATO and to circumvent provisions of the Montreux Convention which forbade passage of aircraft carriers through the Bosphorus Straits. Equipped with Yakovlev Yak-38 ('Forger') fighters and Kamov Ka-28 helicopters, the intended missions of these ships were fleet air-defence, anti-shipping-strike and ASW.

Unlike the single-engine Sea Harrier which could perform a short take-off and land vertically (STOVL), the 3-engined Yak-38 could take-off and land only in the vertical mode (VTOL), and, therefore, had limited range and endurance. While the *Kievs*, did represent a radical change for the Soviet Navy, it became obvious by the 1980s that their VTOL concept, and the Yak-38 family of aircraft, had severe limitations.

The STOBAR Paradigm

Ruling out the steam-catapult route, the Soviets then chose to adopt the ski-jump - a British innovation - and took up the challenge of adapting shore-based fighters for shipboard operations. By end-1989, they had succeeded and a new class of carriers, led by the 67,500 ton *Tbilisi* (later re-named *Kuznetsov*) was seen carrying out deck trials with conventional (non-VTOL) aircraft in the Black Sea. The three types chosen for this bold experiment were the Sukhoi Su-25, the Sukhoi Su-27 and the MiG-29.

This mode of operations added a new term to the lexicon of naval aviation - STOBAR, which stood for 'short take-off but arrested landing'. These developments happened to coincide with the collapse of the USSR, and all new projects were halted. By the early 1990s the first three of the *Kiev*-class were de-commissioned. Of these, the *Novorossiysk* was scrapped and *Kiev* and *Minsk* were sold to China. The fourth ship, *Baku*, was placed in reserve fleet and re-named as *Admiral Gorshkov*. The *Kuznetsov* joined the Russian Navy, but the construction of a sister ship, the *Varyag*

was abandoned half-way through (later sold to China, it was to become the *Liaoning*).

After extensive STOBAR deck trials, the navalised version of Sukhoi's fighter, the Su-33 was accepted for service on board the *Kuznetsov* and the MiG-29K prototypes put away in a hangar.

Enter the Indian Navy

Following the first Russian offer to sell the *Gorshkov* to India in 1994-95 a number of expert teams had examined the ship, especially since she was reported to have suffered damage because of a major boiler room fire. The pros and cons of acquiring the ship, highlighted by the naval experts, were so finely balanced that it led to half a decade of uncertainty within Naval HQ and MoD whether or not it was a good idea to buy this 1982 vintage hull.

The final decision came from the political level, through the signing of an Indo-Russian Inter-Governmental Agreement, which, apart from the 'gift' of an aircraft-carrier, also offered a nuclear attack-submarine and some supersonic 'maritime-reconnaissance bombers' on lease. When the time came for the IN to short list aircraft for the *Gorshkov* project, there was tremendous keenness both in the Russian Navy as well as the Sukhoi Bureau (for different reasons) that the Su-33 be chosen.

The Su-33 vs MiG-29

During a 'snap' evaluation of a MiG-29KUB prototype, that I flew in September 1999 at the MiG flight test centre in Zhukovsky, I found it to be an agile aircraft with excellent handling qualities, demonstrating good manoeuvrability and high turn rates in the horizontal/vertical planes. During a number

of simulated carrier circuits and overshoots, the aircraft showed good engine and control response, and had good forward visibility.

Parked in the hangar was the MiG-29K prototype which had participated in the certification trials, with its folding wings, a tail hook, a refuelling probe and extra dorsal fuel tanks. The design team, headed by the chain-smoking Valery Buntin, appeared sanguine about optimising the aircraft and radar to IN requirements and putting it into production in 36-48 months.

To fly the Su-27, I had to visit NITKA (the Soviet owned Aviation Research and Training Complex) located in a Ukrainian Navy aviation base near Sevastopol. The base was an eye opener: the Russians had re-created all the ingredients of an aircraft carrier ashore, in order to impart STOBAR training to their pilots. One short runway had a concrete ski-jump for launch, and another was equipped with an electro-optical landing sight, and a sophisticated hydraulic arrester gear for arrested recovery. (NITKA has since been replicated in the IN/DRDO 'shore-based test-facility' in Goa.)

With the famous Viktor Pugachev at the controls, I flew in a Su-27KUB trainer, and after a few of his famed 'Cobra manoeuvres', we got down to some serious flying in the airfield circuit. The Luna landing-sight was a very good aid, and brought us down to almost exactly the same touch-down spot on successive circuits. Finally the hook was lowered and the huge fighter was smoothly 'arrested' in about 100 feet. This was my first 'arrested' landing after 24 years. (see my 'Souvenir' photo below)

The Sukhoi Su-27 was, no doubt, an excellent aircraft, and ahead of the MiG-29 in many parameters. Later re-designated as



Autographed photo given to Admiral Arun Prakash at NITKA



MiG-29K prototype

the Su-33, it is deemed to be the progenitor of the Chinese J-15. Almost 50% bigger and heavier than the MiG-29K, it was, however, dimensionally incompatible with the *Gorshkov*. The tail was 1.5 meters too high to fit in the ship's hangar, and during the take-off run, the wing-tip clearance from the superstructure would have been unsafe.

Russia's Carrier-building expertise?

Since the Russian Navy, was already operating the Su-33 from the much bigger *Kuznetsov*, our preference for the MiG-29K over the Su-33, seemed to upset them.

I recall that during a farewell call on Admiral Vladimir Kuroyedov, the visibly annoyed Navy Chief, even offered to have the *Gorshkov's* hangar modified to accept the Su-33! In hindsight, it was just as well that we stuck to our guns, for two reasons.

Firstly, the Sevmash shipyard, nominated by the Russians, was a facility dedicated to building nuclear submarines during the Cold War. The shipyard's total lack of familiarity with aircraft carrier design and construction philosophies saw it struggling with the huge challenge of converting *Gorshkov* from an 'aviation-cruiser' to a through-deck carrier

with arrestor gear. As a consequence, the ship's delivery was delayed by four years, and the cost more than doubled the contracted figure. Kuroyedov's proposed 'modification' would have certainly sunk the yard and the project!

Secondly, for a variety of reasons, a decade of Su-33 operations appeared to have convinced the Russian Navy that the

MiG-29K was a better bet than the Su-33 for the *Kuznetsov*. In 2009, they ordered 20 MiG-29KR and 4 MiG-29KUBR to replace or supplement the bigger, heavier and more demanding Su-33.

The Carrier Conundrum

Returning to the *Kuznetsov* and whether it is revived and rehabilitated or scrapped, depends on a number of key factors :

- ★ The financial health of Russia's economy;
- ★ Putin's resolve to restore Russia to 'super-power' status and his perception of the carrier's role in this; and
- ★ The Russian Navy's priorities for capability acquisition. However, there is also a larger academic debate under-way, whose outcome will have far-reaching consequences for the survival of aircraft-carriers as class of warships.

Post-WW II, the aircraft-carrier has remained at the vortex of controversy, and has continuously drawn fire from its many



INS Vikramaditya (photo: Indian Navy)



The Chinese aircraft carrier Liaoning

detractors. Apart from heavy budgetary and manpower demands, the continued relevance of the carrier is challenged, mainly on grounds that it presents a large and vulnerable target in an increasingly transparent but hostile maritime battlespace. In this ongoing debate, China's PLA Navy (PLAN) seems to be playing "both sides against the middle".

Obsessed by re-possession of Taiwan, China has, for years, been evolving its 'anti-access, area-denial' (A2AD) strategy

to thwart a possible intervention by US Navy aircraft-carriers. The outer-most layer of China's A2AD strategy is based on the DF-21/26 'anti-ship ballistic missile' (ASBM), which could, purportedly, target an aircraft-carrier 1000-1500 miles away. The A2AD strategy came as a rude 'wake-up' call to carrier adherents.

In parallel with the A2AD strategy, PLAN also unfolded a carrier induction strategy, heralded by commissioning of the re-furbished Russian carrier *Varyag* in 2012, followed by the indigenously designed and built *Shandong* in 2018. Current plans seem to indicate that China will field a force of 4-6 carriers, including a nuclear-powered ship, in the next 15 years.

In the West, while Britain has strongly endorsed the carrier concept by investing six billion pounds in two 65,000 ton *Queen Elizabeth*-class carriers, France, which considers itself a major maritime player, continues to toy with the idea of a replacement for the *Charles de Gaulle*. As far as the US is concerned, the Pentagon and State Department have—so far—remained committed to retaining 11-12 carriers. For them, aircraft carriers are 'five acres of sovereign territory', to be used for leveraging state policy, as potent, mobile air-bases which can be positioned off any shore, worldwide.

And the future?

All navies of significance, including those of USA, Russia, UK, France and India, have to reflect, carefully, on the continuing viability of the carrier in tomorrow's battlespace and to re-evaluate the utility of their current aircraft-carrier assets. This will have important implications for decisions relating to future investments in this expensive weapon-platform.

Every new weapon system has been, inevitably, followed by one or more counter-measures, and thereafter, by prophecies of its early demise. The carrier has managed to survive both, and to dominate the maritime scene for close to a century. However, the question in everyone's mind is as how much more time does the carrier have, both in terms of its relevance in the future battlespace, as well as its ability to withstand threats from emerging technology?

The fact that China, the creator of the A2AD anti-carrier paradigm, is investing so heavily – financially and doctrinally – in an aircraft-carrier force (of possibly of upto

10 ships) shows that the case against carriers is not as simple as it is made out to be. While no weapon-platform can be termed 'invulnerable', some consider that undue significance is accorded to the carrier's vulnerability in combat.

Once the initial panic about A2AD had subsided, it also emerged that a number of counter-measures are available to degrade or defeat the effectiveness of an ASBM attack; ranging from destruction of targeting sources to use of lasers and directed energy weapons against the missile. Moreover, the carrier-borne unmanned combat aerial vehicle (UCAV), promises to radically change the calculus of carrier employment because it offers double or triple the range and many times more endurance than manned aircraft.

Moreover, the carrier's putative vulnerability in combat must be weighed against its immense prestige value in peace and its coercive/persuasive worth in less-than war situations.

India's options

Against the backdrop of this discussion, what are the likely implications of the *Kuznetsov* incident for the IN ?

Given the *Vikramaditya*'s commonality of machinery, systems and aircraft, the IN has much to learn from the reliability, track-record and eventual fate of the *Kuznetsov*. Scrapping of Russia's sole carrier could also have an adverse impact on the availability

of *Vikramaditya* which is heavily dependent on the Sevmaash shipyard and Russian industry, neither of whom is known for adroit customer-support.

The retirement of *Kuznetsov* would also throw 24 MiG-29s (KR/KUBR), into the market and the Russians are bound to mount pressure for the IN to accept these purpose-built aircraft. Here, we need to bear in mind, the IN's 2016 'request for information' (RFI) for 57 'deck-based fighters' meant, ostensibly, for the 2nd indigenous aircraft-carrier or IAC-2.

The fate of IAC-2, however, remains in limbo because the MoD is yet to apply its mind to the undertaking contained in the 2015 Indian Maritime Strategy which emphasised the need for, "...two carrier task forces, each comprising of one or more carrier battle groups" for exercising power-projection and sea-control in 'blue waters' of the Indian Ocean.

One can only conclude on the melancholic note that India's MoD appears to lack the comprehension or capacity (or both), to reflect upon and decide the significance (or, indeed, the irrelevance), as well affordability of aircraft-carriers in India's Grand Strategy. Otherwise, what can possibly explain the 17+ year's hiatus between metal-cutting and completion of IAC-1 (to become INS *Vikrant* on commissioning), when China can design and construct, at home, the *Shandong* in a mere 42 months. 🇮🇳



Aerial view of HMS Queen Elizabeth off Scotland
(photo: Wikimedia Commons)

Imperatives of India's future aircraft carrier

Rear Admiral Devender Sudan on the IAC-2

The Defence Minister Mr Rajnath Singh, who was recently onboard the Indian Navy's aircraft carrier *INS Vikramaditya* in the Arabian Sea, witnessed the multi-dimensional operational capability of the Navy and its capacity to undertake a wide range of offensive and defensive missions. The Indian Navy has a proud legacy of being a three-dimensional navy, with capability to conduct operations on, above and below the surface. With its balanced fleet, and following a strategy of 'Sea Control', the Indian Navy is capable of conducting operations in a chosen area as required. Relatively smaller Navy's work on the 'Sea Denial' approach, attempting to deny the use of sea areas to an adversary. On the other hand, aircraft carriers are main platforms for conduct of 'Sea Control' operations, and thus a vital component for the Indian Navy.

The aircraft carrier is a moving airfield at sea on which is based the core of sea-borne air power, which can be utilised according to demands of the situation. The presence of integral fighter aircraft and other air platforms provide the nation with

unmatched ability to influence and intervene at a time and place of its political choice.

Air power is ubiquitous and highly effective, be it over land or sea, an important constituent and a key enabler of maritime power. Application of air power in conjunction with maritime forces increases operational effectiveness at sea by considerable magnitude. Offensive operations by aircraft are the biggest threat to the enemy, be they warships, submarines or even merchant shipping. Employed for surveillance, air defence, anti-ship, anti-submarine, or long range strike, ashore or at sea, air power has a preeminent role in engaging threats and creating space for the Navy's freedom of operation.

Of course, the aircraft carrier also is a symbol of national power and an expression of the nation's will to pursue its foreign policy objectives, making a major contribution in all roles, military, diplomatic or constabulary. By its mere presence, the aircraft carrier can influence events and be a major manner of deterrence. The aircraft carrier plays a role in various situations - benign, humanitarian assistance

and disaster relief (HADR), from low intensity conflict to full military operations. In naval operations on the high seas, survival of the surface fleet is severely compromised without integral air support. The aircraft carrier provides an extensive surveillance 'bubble', protects ships from the threat of enemy aircraft, hunts and prosecutes submarines at extended ranges, engages enemy warships even while serving as a command and control centre. The aircraft carrier provides air power across the oceans, without requiring friendly air bases on land, but of course can also project power over swathes of land.

At the dawn of India's independence, Sardar KM Pannikar had stated that "the long term policy should be to develop India as a 'naval power' capable by itself of defending its interests in the seas as vital to it and of maintaining supremacy in the Indian Ocean Region". The first perspective plan for the Indian Navy, made in 1947 itself, envisaged at least two aircraft carriers for India. The Indian Navy has now been successfully operating carriers continuously for six decades.



INS Vikramaditya, with MiG-29 and Ka-31s on deck

The Indian Navy's experience with aircraft carriers began with INS *Vikrant*, a 17,500 tonne light fleet carrier, which was acquired in 1961 and served until 1997. The *Vikrant's* 'moment of glory' was during the December 1971 war, when its aircraft sank over twenty ships and destroyed storage facilities in Chittagong and Cox's Bazar, as also interdicted shipping along the rivers. With its aircraft on continuous combat air patrol, a successful blockade to cut off all supplies and personnel was implemented. The second carrier to join the Indian Navy was INS *Viraat*, a 28,000 ton STOVL light carrier, formerly the HMS *Hermes*, in 1987 which served until 2016, with the unique V/STOL Sea Harriers embarked as also Sea King ASW helicopters.

With induction of the present 44,500 ton carrier INS *Vikramaditya* in 2013, the Indian Navy has graduated to operating a medium-sized aircraft carrier, embarking multi-role MiG-29Ks which enhance capability with their range of weaponry, so projecting power over extended ranges. The new INS *Vikrant*, a 40,000 ton aircraft carrier, built at CSL, Kochi is presently undergoing outfitting and likely to be inducted in the 2021-22 timeframe.

In accordance with the Indian Navy's *Maritime Capability Perspective Plan* (MCP) a third aircraft carrier has been planned, to ensure that at any given time there are two carriers operationally available. The CNS Admiral Karambir Singh has strongly advocated this case when he stated, "Our overall strategy is centred around the operation of Carrier Task Groups supported by multi-dimensional, state-of-the-art surface and air platforms... an aircraft carrier is central to IN's operating philosophy... accordingly, we are pursuing induction of the third carrier to ensure we have the requisite force levels to meet all operational imperatives".

An aircraft carrier brings tremendous value to a nation in times of peace or conflict, notwithstanding the relatively high cost and perceived vulnerability which have been a matter of discussion and debate since the very early days of the carrier. The life span of an aircraft carrier is in excess of 40 years, and in our context, the question is would the aircraft carrier remain relevant in the future?

Geopolitical Environment

The emerging world order is witnessing substantial geo-political charges with the possibility of military conflict ever existent.

Big Power competition is on the ascendant with accelerated arms buildups with and major investments in weapons, platforms and the infrastructure. The Indo-Pacific region is where such competition for control of the seas is most likely to be manifest.

For over a decade, China has established near permanent military presence in the Indian Ocean Region (IOR), with major new bases, which support increasing naval activity. This has changed dynamics in the Indian Ocean and the maritime scenario is becoming increasingly complex.

Because of its geographical location and growing profile, India has an important role in maintaining stability in the IOR. Seeking to be a 'net-security provider', India has its own set of connotations in the military, and in particular naval, domain. The Indian Navy has continually increased its large ship inventory which is giving it enhanced presence in the Indo-Pacific Ocean.

Vulnerability ?

The vulnerability debate centres on cruise missile and long range ballistic missile (DF-21D) threats. Missiles of course raise risks to aircraft carriers and large surface combatants, as much as they do to land based installations. However, counters to such threats are also soon developed by way of weapons, platforms and tactics.

At sea, a layered defence concept provides protection to the Fleet, the aim being to engage the missile launch platform – warship, aircraft or submarine – prior to launch of the missile. Effective surveillance and long range engagement with available organic air, on alert to tackle emerging threats 24x7, is possible because of the aircraft carrier itself. In addition, a variety of long, medium, short and close-in range missiles and other terminal defence weapons are available to engage any incoming missile.

Efforts are also ongoing by some nations to operationalise new weapons including *Directed Energy* to counter missile threats. In any event, size of the carrier, its build philosophy and extensive damage control arrangements onboard are intrinsically designed to absorb damage. Aircraft Carriers are mobile, adaptable—and durable!

Affordability ?

The cost of building the 65,000 ton IAC 2 at present prices would be approximately Rs 40,000 crore, a large sum no doubt,

but then the country gets a capital ship which provides unmatched capability and continues in service for much longer than most other surface combatants. In fact, the cost per ton of building an aircraft carrier is lower than other naval platforms. In any case, the money would not be spent upfront but staggered over the build period. For a 2035 commissioning, the cost would be spread over 16 years, and of this, in the initial years, the spend would be very much within our means.

It is obvious that the deteriorating security environment around India requires effective military means so as to maintain stability in uncertain times. The aircraft carrier is one such which would provide air power at the time and place of one's choosing. Vulnerability has always been an issue which affects expensive platforms, be they on land, air or sea, but there are numerous counter measures extant. The aircraft carrier is a relatively costly platform but its utility in peace, no less than in war, hybrid or combat situations provides immense value to the nation. Its ability to influence, deter and dissuade on one hand and to be diplomatic and friendly on the other are of great value which can hardly be quantified.

Despite the debates on 'vulnerability-affordability' (in the future geo-political environment) the utility of carriers is compelling for emerging powers to have that capability. Major navies, specifically those of the UN Security Council, have aircraft carriers, with plans to induct more in the near future.

In the Indo-Pacific region, China already has one 65,000 ton carrier, the *Liaoning*, with another indigenous 65,000 ton, *Type 001A*, now undergoing sea trials with a third carrier, *Type 002*, under construction. Reports indicate that China plans to build four 80,000-ton nuclear-powered aircraft carriers by 2035 and develop new carrier-based multi-role fighters to operate from them – all this despite its 'carrier killer' DF-21D missile boast which is invoking spirited discussion on the viability of aircraft carriers!

After a 'gap' of over 70 years, the Japanese are getting back to having aircraft carriers, initially converting its two 27,000-ton *Izumo*-class helicopter destroyers into 'carriers', capable of operating fixed-wing aircraft by 2023. Japan would be operating the fifth generation F-35B from these.



PLAN's Liaoning will be followed by several new, indigenously-built aircraft carriers

South Korea has announced that it would be building a new 30,000-ton LPH-II (Landing Platform Helicopter) and is considering procurement of 20 F-35Bs for the purpose.

The IAC-2

With two aircraft carriers in service by 2020, the Indian Navy is focused on the larger 65,000-ton, CATOBAR (Catapult Assisted Take-Off Arrested Recovery) carrier, for the near future. This would have an air complement of around 55 aircraft, which is an optimum number for an aircraft carrier considering the capability-cost-vulnerability conundrum.

Naturally the capability of an aircraft carrier is intrinsic with its air wing, the size of which is dependent on its size. Larger the carrier, higher the number of aircraft it can sustain onboard. The IAC-2 will operate larger sized aircraft with longer ranges and higher weapon carrying capacity as also fixed wing AEW&C aircraft. Studies have confirmed that to carry such an air complement with adequate capacity to accomplish missions and tasks - both of offence and defence, including power projection – the carrier's size requires to be around 65,000 tons, smaller than those of the US Navy and possibly China in the future, but still large enough to cater for

required missions, thereby keeping costs down within limits.

The IAC-2's CATOBAR configuration will enhance the rate of sortie generation through rapid launch and recovery cycles as compared with any STOVL configuration. This is of course a major step as India would be designing and building a CATOBAR carrier of this size for the first time. While experience exists in-country to do this independently, it would surely be prudent to imbibe lessons from the experience of others. In this context, India has been working closely with the United States through the *Joint Working Group on Aircraft Carrier Technology Co-operation (JWGACTC)*



Artist's impression of IAC-2



under the DTTI. The range of discussions encompass various aspects of aircraft carrier development, including design, integration, test, evaluation, management and oversight of carrier construction. Meanwhile, BAE Systems, builders of the Royal Navy's latest aircraft carriers, the 65,000 ton *Queen Elizabeth*-class, have also offered design consultancy to India.

Considering that the IAC-2 would take 12-15 years for commissioning from 'AON', and would then be in service for the next 40 years, it should be "future proofed" and incorporate the latest technology. IAC-2's equipment must be chosen for greater automation with reduced manning. The operation of UAV/UCAVs should be planned with IAC-2 having the capability of operating a wide variety of aircraft, generating higher launch and recovery rates by fitment of Electromagnetic Aircraft Launching System (EMALS) and Advanced Arrestor Gear (AAG). These have been fitted on the latest US aircraft carrier *Gerald R Ford* and are presently overcoming their initial problems.

With an adverse maritime situation developing in the Region and with requirement for India to retain capability to meet demands of the emerging uncertain and complex maritime environment, the IAC-2 would be of tremendous value. Little progress has however been made with regard to granting 'Acceptance of Necessity' (AON), whose formal issue would kick-start the process, beginning

with feasibility of design study, followed by scope of work and execution timelines could then be drawn.

The estimated cost of IAC-2, at a time of declining defence budgets is believed to perhaps be the main reason for withholding of approval and this is understandable. However, we must look into the future and with the Prime Minister putting the nation on the path to become a \$ 5 trillion economy, any such doubts are transient and India's rising economy would surely bring budgetary support. As earlier enunciated, the cost towards IAC-2 development activity in the initial years would be relatively small, even as its impact on overall strategy would be immense. A further advantage to beginning the IAC-2 development sooner rather than later is that the expertise gained on IAC-1 remains current and the design teams would gain having with involvement with a reputable design consultant.

Thus, considering the politico-military scenario emerging in the Indo-Pacific region, and the growing power status of India, it is important that we be prepared for all emerging contingencies. Induction of the IAC-2 would ensure that requisite capabilities are resident with the Indian Navy. We must not only be in reaction mode to national security challenges as foreign policy is determined by geo-political realities. Lead time to design and construct IAC-2 would be fairly long, and India's

As per the public domain, the Indian Navy has been in touch with four international defence companies on design aspects of IAC-2 including BAE Systems, DCNS, Lockheed Martin and *Rosoboronexport*. Earlier, information was sought on the EMALS, which could enable the launching of larger aircraft as well as unmanned combat aerial vehicles. A *Joint Working Group on Aircraft Carrier Cooperation* was also formed between the Governments of India and the United States to collaborate on the design and development of aircraft carriers, with the first meeting between Indian Navy and United States Navy held in August 2015.

In May 2019, it was suggested that the Governments of India and the United Kingdom were in discussions to adopt plans of the *Queen Elizabeth*-class as basis for the IAC-2 design.

maritime security would be best served if the 'AON' for the IAC-2 is forthcoming soon. Certainly we should begin with detailed feasibility studies so that 'low cost but high impact' work commences on this project which is imperative for national security. 🦋

Watching Indian waters 24 x 7



The Indian Navy and its ISR capabilities

Oceans are multi-dimensional battle-space – air, on-surface and underwater – where threats can emerge from any dimension. International maritime forces around the world, are now massively investing in ISR (Intelligence, Surveillance and Reconnaissance) systems for amassing actionable and in-depth information of combat-zones. ISR networks involve functioning of various sensors with integration and analysis of comprehensive information which is critical for decision making, effective planning and execution of maritime operations. Vitrally, these systems are indispensable for maritime forces in establishing substantial mechanism for maritime domain awareness (MDA).

The Indian Navy has a credible operational doctrine and security architecture in the Indian Ocean Region, keeping watch on adversaries' moves, utilising a reliable force of ISR sensors that involve an array of maritime and national assets which include spaceborne, airborne, shipborne, ground and underwater systems.

Spaceborne sensors ...

Like other modern navies, the Indian Navy too has spaceborne sensors for maritime security and surveillance of the waters. Jointly with the IAF and Indian Army, the Indian Navy wields a constellation

of space-based sensors under the newly established 'Defence Space Agency'. The constellation encompasses HysIS, high-resolution X-band synthetic aperture radar (SAR)-based RISAT-series (RISAT 2&2B), electro-optical CARTOSAT-series (primary



Cartosat-2 image courtesy ISRO

Cartosat-2 series—*see image*) and IRNSS (Navic) satellites. The Navy leans on these joint space assets for imagery, locations and navigation in unfavourable weather situations in the immediate Indian and the larger Indo-Pacific Oceans. While the GSAT-7 *Rukmini* provides precise communication amongst Indian Navy establishments, aerial and surface fleets, it supports the Navy's high-speed networked fleet out at sea.

radar stations in their coastal areas. The Indian government has also recently sealed an MoU with Bangladesh for installing 20 such radar systems in the littoral areas of Bangladesh, these stations to be jointly operated by the Indian and Bangladesh Navies. Eventually, all these sensors sites will be supervised by the Indian Navy's Information Fusion Centre - Indian Ocean Region under Information Management Analysis Centre at Gurugram in the NCR.

Air, Surface and Underwater Surveillance

Indian Naval Aviation has various aircraft types employed for the purpose: Dornier 228s, Ilyushin Il-38 Sea Dragons and Boeing P-8Is for medium and long-range surveillance and maritime reconnaissance tasks in the Arabian Sea and the Bay of Bengal. These specialist aircraft are variously fitted with 360° surveillance multi-mode radar and (the Il-38s and P-8s) with magnetic anomaly detector (MAD) systems for detecting, monitoring and locating hostile surface and underwater objects in the waters. For short-range operations, the Indian Navy also employs helicopters, including Sea King Mk.42s, Ka-31s and Ka-28s, Chetaks and naval ALHs which are assigned tasks to include traffic monitoring and sea observation missions.

Eight Boeing P-8Is are presently the 'jewel in the crown' of the Indian Navy's long range MR/ASW force with four more to be inducted shortly. 10 additional P-8Is are sought which, along with 24 multi-mission MH-60R Seahawks being contracted for the Indian Navy, will further empower maritime surveillance capability in



Watch tower along the coast

In the future, a more advanced GSAT-7R will replace the *Rukmini* to augment sensor-to-shooter connectivity for the Indian Navy. Moreover, the DRDO-built EMISAT, a SIGINT satellite, sustains the Navy's electronic surveillance capabilities in the IOR. ISRO plans to launch more LEO-based satellites (like Emisat, Cartosat and RISAT) that will deny sea shelters to the Pakistan Navy or the PLA-N in the Indian Ocean region.

... and Coastal Surveillance Network

After the Mumbai terror attacks in 2008, it was imperative to establish a 24x7 watch mechanism across the extended 7500 km coastline. The Indian Navy, alongside the Indian Coast Guard and Bharat Electronics Limited have been working to construct the Coastal Surveillance Network that integrates some 84 ground radar stations, 46 under phase I and 38 in Phase II. Besides, 32 more radar systems would be installed in "friendly Island nations" by the Indian Navy and BEL to augment India's surveillance spectrum. The Seychelles, Maldives, Indonesia, Sri Lanka and Bangladesh will get combined



Dornier 228 (photo: Angad Singh)



P-8I (photo: Angad Singh)



IIL-38 Sea Dragon (Photo: Angad Singh)

line with operational doctrine of the Indian Navy in the IOR.

The Indian Navy also exploits AI-based unmanned air systems for real-time actionable intelligence, operating Israeli-origin Heron and Searcher-II UAVs for near continuous surveillance of waters leading to Indian ports and harbours. The Navy is currently working with the Aeronautical Development Establishment on the indigenous Rustom-2 long range drone. For long-endurance, high-altitude ISR missions, the IN has been pursuing induction of the General Atomics SeaGuardian.

With its ship-based sensors and sonars, a 24x7 surveillance mechanism is provided for the Navy in all three dimensions. Frontline warships of the Indian Navy incorporate a

suite of sensors including multi-functional air defence and surface surveillance radar, hull-mounted and towed array sonars, optical director systems and electro-optical fire control systems.

The Indian Navy deploys an array of Russian, Israeli, French-origin as also indigenous shipborne air and surface surveillance radars including IAI's S-band MF-STAR, Thales D-band LW-08, Russian Frigate-MAE, Terma's SCANTER 6002, BEL 3D S-band Revathi, etc. Fusion of the high-definition sensors onboard the Navy's surface ships delivers inputs to augment the comprehensive air and sea-surface images to enhance situational awareness. Onboard active and passive sonars such as the indigenous Humsa-NG, Thales Passive

Towed Array Sonar (PTAS) and Atlas Elektronik low-frequency Active Towed Array Sonar (ACTAS), assist navy warships to detect and track lurking submarines in both the shallow and deep waters.

Submarines, equipped with modern sonars (both active and passive) and surface-radars, are deemed as the best intelligence tool with the Naval forces. The Indian Navy currently operates a fleet of 16 submarines comprising 14 SSKs, one SSN and one SSBN employed to carry out underwater surveillance and provide crucial intelligence-gathering capabilities to the Navy. INS *Chakra*, India's nuclear-powered attack submarine (SSN), is considered as an intelligence force multiplier in the Indian Navy arsenal. The newly inducted *Kalvari*-class boats, featuring modern detectors and low-observable stealth characteristics like advanced acoustic silencing technique, will further enhance such capabilities. It is understood that two midget submarines, primarily for MARCOS special missions, are also in the plans and will be constructed at Hindustan Shipyard Ltd (HSL).

The Indian Navy is also keen on acquiring high-endurance Autonomous Underwater Vehicles, and two indigenous torpedo-shaped AUVs - L&T *Adamyia* and DRDO's ASV - are being developed for the Navy.



INS Chakra (Photo: Indian Navy)

Airborne Early Warning

The Indian Navy operates a number of Kamov Ka-31 early warning helicopters, incorporating a six square metre E-801M OKO Planer array radar, capable of detecting aircraft and surface ships at long-ranges (air targets upto 150 km and surface target of 100-200 km). More than a dozen Kamov Ka-31 AEW&C helicopters are in active service



Indian Navy Kamov Ka-31 (photo: David Osborn via aame.in)

with the Indian Navy with 10 additional systems to be procured from Russia.

Arguably, the most important advancement for the Indian Navy's ISR capability will be induction of a 10,000-ton VC11184 ocean surveillance ship that is being built at HSL at Visakhapatnam. The VC11184, equipped with three indigenously developed high-definition

AESA sensors (a primary X-band and two secondary S-band), electronics and communication systems, will be the most advanced tracking and surveillance ship in the Navy's inventory. This is being built under a 'top-secret programme' and has the same significance as the Advanced Technology Vessel (ATV) project under which *Aribant*-class SSBN boats are being constructed.

All these will support India's multiple initiatives including strategic weapon development, Phase-II of India's Ballistic Missile Defence System, Electronic intelligence instruments and Information Superiority. The Indian Navy will operationalise this missile tracking boat in collaboration with the National Technical Research Organisation (NTRO), which is directly under the Prime Minister's Office. Sea trials of the VC11184 are currently "progressing satisfactorily" and the ship will be ready soon for induction into the Indian Navy. At present, only another four nations (the US, Russia, China and France) have such a surveillance system in their arsenal. The VC11184 early-warning and airborne assets, will serve as a 'hefty force-multiplier' for the Indian Navy, enhancing electronic surveillance and air sanitisation of the Indian Ocean Region. 🦋

Atul Kumar



Rare photo of the Indian Navy's future tracking ship VC-11184 'Ocean Surveillance Ship', currently being built at Hindustan Shipyards Ltd in Vishakhapatnam. (photo: navalnews.com)

The Indian Navy's long reach



It was in January 2011 that Boeing Defense, Space & Security received the Low-Rate Initial Production (LRIP)-I award from United States Navy (USN) for six P-8A Poseidon Multimission Maritime Aircraft (MMA). Overall, the USN plans to purchase 122 Boeing 737-based P-8A MMAs as replacement for its 196 P-3C Orion fleet.

In February 2012, the P-8A made its mission debut during *'Bold Alligator 2012'* annual littoral warfare exercise. The Indian Navy was the first international customer as on 1 January 2009 the Indian Government and Boeing signed a \$2.1 billion contract for the delivery of eight P-8I MMAs, essentially Long Range Maritime Patrol/Anti-Submarine Warfare (LRMP/ASW) platforms with further options for more platforms. A further four P-8Is have subsequently been ordered pushing up the contract to \$ 3.1 billion. More acquisitions for the IN are likely as IN reportedly an optimum requirement of thirty MMAs.

On 19 December 2012, the first P-8I was handed over to an Indian naval team at Boeing's Seattle facility, the Indian Navy inducting its first P-8I on 15 May 2013. The second and third P-8Is were received on 16 and 22 November 2013 respectively.

The aircraft with INAS 312 are based at INS *Rajali*, in Tamil Nadu. The fourth, fifth and sixth aircraft were delivered in May, September and November 2014 respectively, the seventh and eighth aircraft in February and November 2015 respectively.

The P-8 is based on Boeing's 737-800 commercial jet with the wings of the 737-900ER (Extended Range), with the design of the P-8 wingtips changed from the

blended winglet to a backswept wingtip to improve performance for low-level flight.

Designed to operate in designated areas within the Network Centric Warfare (NCW) concept in addition to its formidable ASW suite, the P-8I is equipped with upgraded Raytheon APS-137D(V)5 maritime surveillance radar redesignated AN/APY-10 used to facilitate advanced reconnaissance missions over



an area of 600-nautical miles. The radar offers Synthetic Aperture Radar (SAR) mode for imaging, detection, classification and identification of stationary ships and small vessels and for coastal and overland surveillance, Inverse Synthetic Aperture Radar (ISAR) mode for imaging, detection, classification and tracking of surfaced submarines and small, fast moving vessels that operate in coastal waters as also Moving Target Indicator (MTI) modes for long range surface search.

The SAR provides multiple resolution strip maps and allows high resolution for target identification, battle damage assessment and for weapons targeting. Periscope detection needs high scan speeds, high pulse repetition frequency and high resolution mode with advanced sea clutter rejection. Situational awareness is further facilitated by Raytheon Integrated Identification Friend or Foe (IFF), jam proof Global Positioning System (GPS) and Broadcast Information System (BIS) and secure Ultra High Frequency (UHF) Satellite Communications (SATCOM) capability. Additionally the ‘canoe’ fairing under the aircraft is expected to house a mission bay to include the Raytheon-Boeing APS-149 Littoral Surveillance Radar System (LSRS), later to be replaced by the Advanced Airborne Sensor (AAS), designed to provide targeting-grade tracking of moving targets on land and at sea, with performance standards that match or exceed the United States Air Force Boeing 707-based E-8C J-STARS battlefield surveillance aircraft.

While two CFM56-7B27A high-bypass turbofan engines (each providing 120 kN of thrust) provide higher cruise speed (490 knots) and service ceiling to reach its area of operation rapidly, the P-8 is capable of operating 1,200 nautical miles from its base for an extended period of four hours besides arriving at station one hour earlier than any turboprop type. The aircraft have demonstrated a loitering speed of 180 knots over the sea at a low altitude of 60 metres. Various armament is carried on four wing pylons, two fuselage pylons and an aft weapon bay for a total of 5,700 kg payload.

The P-8 crew of just nine reduces the Multi-Mission Aircraft (MMA) fleet’s overall manning requirements by some fifty-percent compared with the past (Tu-142s) and can rely on private contractors to provide maintenance & logistic support. The aircraft, in spite of being derivative of



a commercial airliner designed for constant cruise at high altitude, has surprisingly displayed low-speed, low-altitude sharp manoeuvres required by LRMP/ASW operations with loiter speed of 180 knots over the sea at a low altitude of 60 metres as mentioned earlier.

For the ASW role, the P-8 is fitted with the same acoustic processor as adopted for the British Nimrod MRA Mk4. In IN service, another sensor is the CAE AN/ASQ-508A Advanced Integrated Magnetic Anomaly Detector (MAD) in a much shorter “sting” although their effectiveness can be nullified by submarine hulls made of titanium or non-magnetic steel. Still, CAE’s AN/ASQ-508A MAD system represents one of the most advanced MAD systems in the market that will be integrated with the P-8I’s mission system and will be used operationally during ASW missions. The MAD system provides the capability to detect, locate, and confirm subsurface targets by identifying magnetic variations

or anomalies, such as those caused by a submarine, in the Earth’s magnetic field.

The ITT/EDO reloadable rotary sonobuoy launchers with pneumatic ejection are installed with a capacity for 120 sonobuoys of different types. ASW weaponry includes up to six Mk46, Mk50 or Mk54 lightweight ASW torpedoes while up to twelve free fall Mk82 bombs can be converted to ASW depth bombs by changing the fuse mechanism. The Mk 54 lightweight torpedoes are possibly to be equipped with the Longshot/High Altitude Anti-Submarine Warfare Weapon Capability (HAAWC) Air Launched Accessory (ALA) kit to turn them into GPS-guided glide weapons that can be launched from high altitudes, which would allow the P-8 to remain within its preferred aerodynamic envelope of high-altitude cruise, and so reduce the fatigue and corrosion associated with low-level flight over the sea. 🦋

Sayan Majumdar
[Images Courtesy Boeing]



The NMRH and NUH



The SeaKing with tail rotor folded (photo: Simon Watson)

Vital helicopter augmentation for the Indian Navy

All major maritime forces across the globe are highly dependent on navalised helicopters and aircraft for a wide range of operations including the utility and strike roles (both on surface and underwater). Naval helicopters are tasked to tackle most threatening and high-risk of such missions in adverse sea conditions. These airborne vehicles, powered by modern turboshaft engines are capable of operating from small decks (offshore vessels, corvettes, frigates) but also from destroyers and aircraft carriers as advanced scouts. The new modular mission-specific systems allow the same helicopter type to be assigned diverse naval operations.

The Indian Navy, now fifth-largest in the world, currently operates a combined fleet (fixed wing and rotary) of some 240 aircraft, of which about half are rotary-wing. The Indian Navy presently has a fleet of 140 warships including one aircraft carrier, ten guided-missile destroyers, over a dozen frigates, 22 corvettes and several offshore vessels. These frontline assets are however facing acute shortage of naval utility and

multi-role helicopters and consequently, these surface vessels could be vulnerable to enemy submarines in the absence of

efficient shipborne ASW assets and this handicap could well impact on the Navy's basic operational capabilities.



Kamov Ka-28 (photo: Simon Watson)



Ka-31 AEW (Photo: Indian Navy)

The Indian Navy's Air Arm includes several decades-old Westland SeaKing Mk.42s, Ka-28s, UH-3Hs and HAL Chetak helicopters for utility, SAR, ASW anti-ship and utility roles. There is also the Ka-31 for AEW and recently ten more have been ordered from Russia. There are a sizeable number of Dhruv ALHs in the Navy's inventory too.

The helicopter numbers—and thus capabilities—are patently inadequate to support the Navy's current and future surface fleet, for which the Indian Navy has a full-fledged master plan, according



IN Chetak (photo: Indian Navy)



Naval ALH (photo: Indian Navy)

to which, it plans to induct over 250 naval utility and multi-role helicopters, worth over \$15 billion under the two separate procurement programmes: 111 Naval Utility Helicopters (NUHs) and 123 Naval Multi-Role Helicopters (NMRHs). Both the NUH and NMRH are to be built-in-India by selected Indian aerospace companies in collaboration with foreign OEMs as per the 'Strategic Partnership' model of DPP 2016.

Over and above these, seventeen naval ALH Dhruv helicopters will also join the Indian Navy in the next few years. Acquisition of 24 MH-60R helicopters from the US is also being finalised, which will be part of the 123 NMRHs required.

The MH-60R Seahawk

In April 2019, the US State Department cleared supply of 24 MH-60R helicopters to India at an estimated cost of \$2.6 billion. This package will include delivery of numerous critical equipment besides the basic helicopter such as Telephonics' AN/APS-153V multimode maritime surveillance radar, Raytheon's AN/AQS-22 Airborne Low-Frequency sonar and AN/

missions of the Indian Navy, which include support of marine commandos (MARCOS) and tri-service AFSOD.

Major frontline warships of the Indian Navy including INS *Vikramaditya*, *Kolkata*-class and *Delhi*-class destroyers and *Talwar*-class frigates will embark the Seahawk helicopters.

Powered by T700-GE-401C turboshaft engines, the Seahawks will also be used



US Navy Seahawks (photo: Lockheed Martin)

AAS-44C(V) Multi-Spectral Targeting System, AVS-9 Night Vision Devices, ARC-210 RT-1990A(C) radios with COMSEC, ARC-220 High Frequency radios, APX-123 IFF transponders and embedded GPS/INS (EGI) with selective availability/anti-spoofing module (SAASM).

The US will also deliver associated weapon systems for the Indian Seahawks that includes SSQ-36/53/62 sonobuoys, Mark 54 lightweight torpedoes, Naval Strike Missiles, AGM-114 Hellfire missiles, Advanced Precision Kill Weapons System (APKWS) rockets and M-240D & GAU-21 crew-served guns.

The Indian Navy is buying these US Seahawks in an urgent purchase under the Foreign Military Sale (FMS) route to replace the decades-old SeaKings and Russian Ka-28s, the induction of this new-generation helicopter definitely giving unmatched anti-submarine and anti-surface warfare capability to the Indian Navy. These will also carry out highly versatile special

for combat search and rescue, maritime surveillance and reconnaissance, naval gunfire support, electronic warfare and intelligence and communication relay.

The agreement to supply these could be soon. "The LOR (Letter of Request) and LOA (letter of Acceptance) procedures (are on track) and we should be ready by the end of the year," Indian Navy Chief Karambir Singh has recently stated.

The Naval Multi-Role Helicopters (NMRH)

The Indian Navy will have a total of 123 Naval Multi-Role Helicopters including the 24 MH-60Rs while the other 99 will be produced by an Indian partner in a 'Strategic Partnership' with the foreign helicopter manufacturer under the 'Make in India' scheme. Besides ToT, Navy seeks flight and maintenance simulators, training, shore and engineering support, 10 years performance-based logistics (PBL), weapons and sensors under the agreement.

The 12-ton twin-engined medium multi-mission helicopters are primarily designed to perform anti-ship and anti-submarine warfare. As per the Navy's RFI, the Indian Navy NMRH will be in two configurations: Multi-role and for Special Ops. The multi-role variant will have capabilities to carry out tasks such as ASW, ASHw, ELINT, SAR, external cargo-carrying over 2.5 ton and limited casualty evacuation, and the Special Ops version will deploy MARCOS and AFSOD, troop carriage, maritime interdiction including counterterrorism raids and anti-piracy operations. Both variants will be capable of conducting night-missions both from warships and shore-bases.

The NMRHs with their modern sensors and weapons such as surface search and attack maritime surveillance radar, dipping sonars and magnetic anomaly detector (MAD), electro-optic pod, self-protection suite, SDR-based communication suite, advanced IFF transponders, lightweight torpedoes, sonobuoys, short and long-range anti-ship missiles and depth charges would enhance the IN's capability in detecting, tracing and attacking warships, UUVs and submarines. These naval helicopters will be force multipliers for the surface fleet of the Navy.

Besides Lockheed Martin's MH-60R, NHIndustries NH-90 Sea Lion, Airbus' H225M Caracal and Russian Kamov Ka-27M are other contenders for the Indian Navy's NMRH requirement. In 2018, Airbus had offered its H225M platform and is currently working with the Mahindra & Mahindra Group for its helicopter programme. Airbus has its H225M Caracal in the contest and is pitching critical technology transfer to Indian industry. However, the NMRH-deal still could take years to finalise, even as the Navy is pushing hard to expedite them.

Meanwhile, HAL has initiated its own programme to develop a 10-ton class multi-role helicopter, but the government has not yet approved this project.

Naval Utility Helicopters (NUH)

Naval Utility helicopters (NUH) are considered as backbone of the naval force and are employed for all manner of maritime operations. The Indian Navy presently continues with the HAL Chetaks for utility duties, however, some new ALHs have entered into service to supplement these.



Airbus Helicopters H225M

After satisfactory experience with the naval Dhruv, in 2017 the Indian Navy ordered 17 more of these under two separate contracts, being equivalent to the IAF's ALH Mk.III version, but fitted with XtraVision 2004 maritime airborne surveillance radar and dipping sonar, LWT and depth charges. Presently, the ALHs are being used for advanced search and rescue, heliborne ops, armed patrol with night-vision devices, coastal security and low-intensity maritime missions. The first new ALH is to be inducted in 2020.

The Navy has a requirement for some 111 NUHs which, along with requisite equipment, training and weapons would be at an estimated cost of around \$3 billion. The contract for 111NUHs will be executed in the same manner as to NMRH, under the 'Strategic Partnership model' of DPP 2016. Of the 111 utility-helicopters, 16 could be supplied by the selected foreign OEM partner with the remaining 95 built by the selected Indian SP. Indian firms such as Tata, Mahindra Defence, Larsen & Toubro, Kalyani Group, Adani Defence, Reliance Infra, Godrej Aerospace as well as HAL, could participate in the contest with their selected foreign partners.

These five-ton shipborne helicopters will conduct virtually all types of naval tasks including limited ASW, ASHw and ELINT role. The Navy wants the NUHs fitted with major sensors and subsystems

comprising EO-pod, maritime-radar, data-link, self-protection, IFF transponders and software-defined radios. The helicopters will be twin-engined with wheeled landing and blade-folding features.

In response to the Navy's RFI, three foreign companies have submitted their bid: Airbus has offered two utility platforms in its H145M and AS565 Panther. Airbus and Mahindra & Mahindra Group had earlier announced their collaboration for both NMRH and NUH requirements. Russian export agency, Rosoboronexport and the PSU HAL have offered the Ka-226 helicopter for the Indian Navy, while US-based Lockheed Martin-Sikorsky proposes its S-76D utility helicopters, Sikorsky has

a JV with Tata Advanced Systems for the programme. Besides these three OEMs, South Korean KAI and US-based Bell Helicopters could also participate in this multi-billion 'tournament'.

HAL has recently showcased its 5-ton shipborne Advanced Light Helicopter with a modern maritime cockpit, blade-folding and tail-boom folding capabilities for use on naval ships. The naval ALH with new capabilities could be available within two years as per sources at HAL.

All these major helicopter inductions will provide a much-required boost to the Indian Navy operating in the littoral, the IOR and Indo-Pacific region. 

Atul Kumar



The AS565 MBe naval version of Airbus' Panther family of helicopters



The naval ALH with blade-folding and tail-boom folding capabilities displayed by HAL at Aero India 2019

Indian Navy's Rotary Sentinel



The Kamov Ka-31 AEW helicopter

The Government of India has recently cleared the proposal for procuring an additional ten Kamov Ka-31 Airborne Early Warning (AEW) helicopters for aircraft carrier operations and deployment on various warships, the decision having been taken at a meeting of the Defence Acquisition Council (DAC).

The Indian Navy had first ordered four Ka-31 AEW helicopters in 1999 with a further five in 2001. The first batch entered service with the IN in April 2003, the second batch in 2005 plus another five in 2013. INAS 339 'Falcons' operates the type, with a fleet of 14 helicopters based at INS Hansa in Goa.

Optimised for AEW operations from major surface combatants, Kamov JSC which is based in Moscow, began development of the Ka-31 AEW naval helicopter in 1980 with the first flight taking place in 1987. Powered by twin Klimov TV3117VMAR turboshaft engines (rated at 1,633 kW each), essential mission of the helicopter is long-range detection of airborne threats including fixed-wing

aircraft and helicopters. Surveillance, target tracking and transmission of target data to command posts is carried out onboard the helicopter, thereby increasing the combat efficiency of associated naval units concerning interception of aerial threats plus Over-The-Horizon (OTH) strikes against hostile units.

Airframe of the Ka-31 is based on the proven Kamov Ka-27 helicopter which has co-axially mounted contra-rotating main rotors. The distinctive antenna of the AEW radar either rotates when operational, or remains folded and stowed under the fuselage. The Ka-31 has a maximum take-off weight of 12,200 kg, the operating altitude being up to 3,500 m, with a patrol speed of 100km/h and operational range, with the antennas in the stowed position, of 600 km. The mission duration is two hours 30 minutes.

The flight deck of the Ka-31 helicopter is wider than that of the Ka-27 and accommodates the pilot and navigator in an armour protected cockpit. The navigation suite includes a Kronstadt Kabris 12

channel Global Positioning System (GPS), digital terrain mapping, ground-proximity warning and obstacle approach warning. In IN service, the helicopter has an Abris GPS system featuring a 12 channel receiver with option to employ Differential GPS references, designed by the Kronstad itself.

The key sensor, its E-801M Oke ('Eye'), AEW radar, was developed by the Nizhny Novgorod Radio Engineering Institute, the 6m² radar antenna stowed flat against underside of the fuselage until deployed. The navigator switches on the radar system and the antenna then extends, turning through 90° from the horizontal to the vertical plane. In operation, the antenna rotates at 6 rpm. Once the navigator has switched the radar system to operational mode, the system works autonomously, the navigator monitoring the target observation on a display.

The radar has 360° azimuthal coverage, the surveillance range against a fighter aircraft size target bring up to 150 km, while surveillance range against a surface ship is typically 100km to 200km. The radar is capable of simultaneously tracking



40 targets. Power for the radar and antenna is provided by an auxiliary power unit, type TA-8Ka, installed above the rear section of the engine bay. When the radar surveillance phase of the mission is completed the antenna is retracted to the storage position. The antenna is fitted with explosive bolts enabling it to be jettisoned quickly in an emergency, such as in preparation for a forced landing.

*Sayan Majumdar
(Photos by Angad Singh)*

Indian and French navies in ‘Exercise Varuna 19’



The biggest Indo-French naval exercise, *Varuna-19*, culminated with close range manoeuvres conducted by the carrier task forces of both the navies. This 17th edition of the exercise which was conducted off the Goa coast witnessed participation of the French Navy’s aircraft carrier FNS *Charles de Gaulle*, two destroyers, FNS *Forbin* and FNS *Provence*, the frigate FNS *Latouche-Treville*, the tanker FNS *Marne* and a nuclear submarine. From the Indian side, the aircraft carrier INS *Vikramaditya*, destroyer INS *Mumbai*, the *Teg*-class frigate, INS *Tarkash*, the *Shishumar*- class submarine, INS *Shankul*, and the *Deepak*- class fleet tanker, INS *Deepak* participated in the exercise.

The bilateral naval exercise was initiated in 1983 and christened as ‘Varuna’ in 2001, forms a vital part of the Indo-French strategic partnership and has grown in scope and complexity over the years. “Dignitaries from both navies visited the French carrier task force and were briefed on the conduct of the exercise. An impressive flypast consisting of four Rafale, five MiG-29Ks and one Hawkeye was witnessed by Flag Officer Commander in Chief of the Western region

along with French Ambassador to India and nine French dignitaries onboard the French Carrier *Charles De Gaulle*,” the Indian Navy stated.

The exercise was conducted in two phases. The harbour phase at Goa which included cross-visits, professional interactions and discussions and sports events and the sea phase comprised of

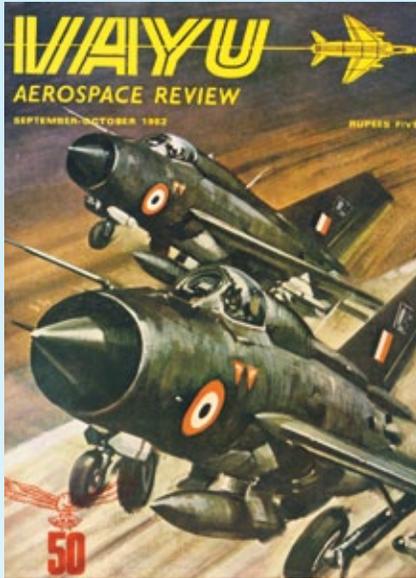
various exercises across the spectrum of maritime operations. “The *Varuna* exercise aims at developing interoperability between the two navies and fostering mutual cooperation by learning from each other’s best practices to conduct joint operations. The exercise underscores the shared interests and commitment of both nations in promoting maritime security.” 🇫🇷







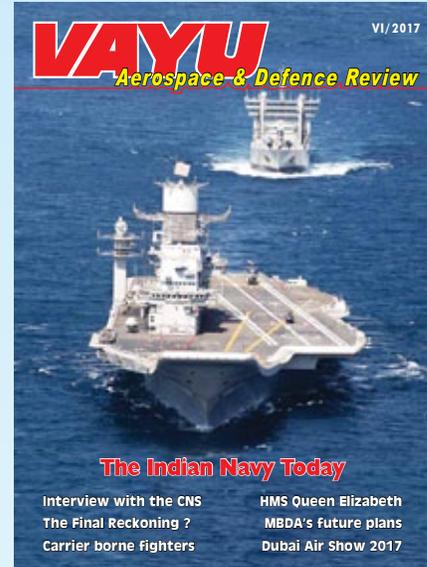
(photos: French and Indian Navies)



that trends could be identified, analysed and perhaps, eventually, even shaped.

45 years on, the Journal has striven to maintain its *raison d'être* and is regarded, both within the country and globally, as such, not only reporting on contemporary aerospace matters, but becoming an invaluable reference for posterity. The *Vayu* has been recognised for its professionalism by leading organisations such as the *Royal Aeronautical Society* and others, receiving honours repeatedly at international forums, and regarded as amongst the leading aerospace journals of the world.

Essentially, however, the *Vayu* keeps its Indian flavour, concentrating on matters that concern the country, be it on the national aviation industry, the services, the airlines and space research. Thus, as

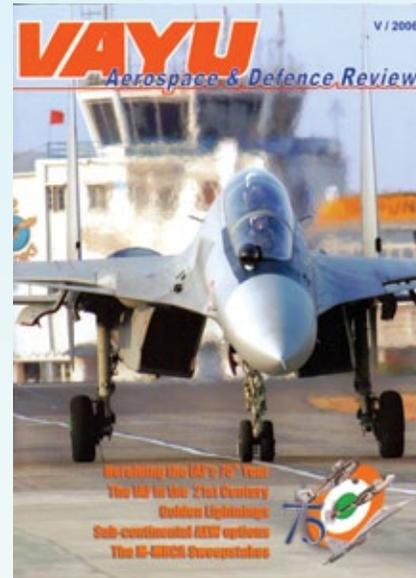


When India's Defence Minister officially launched this journal in New Delhi on 7 November 1974, he had hoped that this journal 'would give professional satisfaction to those would be associated with this ... serving to disseminate real knowledge in-depth ... touching the chord of those people who are serious minded and who want to go deeper'.

Editorial of the premiere issue proclaimed that *the Journal, was intended to span, appropriately, the gap for a specialised Asian aviation magazine. Conscious of the environment constraints and the limitation in which we function, it will nevertheless be our endeavor to offer the highest standards of accuracy presenting solid fact and data recorded in an informative and readable manner.*

The journal would strive to report with objectivity which is as important as professional knowledge and skill, style and a capacity to keep up with change. From reports on air arms and their sophisticated weapon-systems, the highly organised air transport industry and space research to those on historical events that have shaped man's flight, the Journal would provide for concentrated reading by those involved or associated with aviation and, hopefully, given an impetus to the air-minded.

Although international in flavour, the magazine would have a strong Asian bias... with the hope that the vantage point of New Delhi, as geographic centre of the arc from West Asia to the Pacific, would enable it to heighten its impact on Governments and industry, making each the better informed on aviation parameters and programmes so



the years and decades go by, readers can review as to how the Air Force expanded and modernised in the 1980s, began endeavours to supplant obsolescent aircraft types from start of the 21st century, how the Indian Navy has progressed in keeping up with stated Maritime Capability Plans, foundation and expansion of the Coast Guard, formalisation of the Army Aviation Corps, even as the 'Open Skies' policy spawned a rash of startup private airlines with, in the event, many disappearing sooner or later. Other are expanding.

Some short but sharp conflicts in the sub-continent were analysed in-depth, from Kargil in 1999 to Balakot in 2019 and the *Vayu* remains unique in having

covered at first hand *Operation Pawan*, the 33 months of Indian armed involvement in northern and eastern Sri Lanka, also flying in helicopter gunships during some actions there. *Vayu* was also uniquely positioned on the heights overlooking Drass on last day of that action, 20 years back.

In the international arena, the *Vayu* has continuously covered on-the-spot air shows at Farnborough, Le Bourget, Changi, Dubai, Zhukovsky, Langkawi as also visited leading international aerospace companies in America, Britain, France, Germany, Sweden, Italy, Spain, Russia, Brazil ... China is a hopeful next !

But essentially, it is India. The *Vayu* has very assiduously reported on and analysed national endeavours for achieving self-reliance not only in the production of aircraft but *de novo* design and development of various types ranging from motorised gliders, basic trainers, light transport aircraft, advanced helicopters to new generation multi-role fighters, as also space launch vehicles.

The next 15 pages are a virtual 'pilots eye view' of aviation and aerospace developments that have impacted on India over 45 years but to go into depth, readers are urged to visit <http://www.vayu.aerospace.in> for hundreds of selected articles – or order copies from the past in digital format as are available.

With *Vayu Aerospace Review* on the way towards completing its half century in 2024, readers are assured that the standards they have grown to expect, will be maintained, with uprightness, professionalism and style.

Vayu Editorial Team



1974



→ A significant development is the setting up of a Design Organisation in HAL headed by a whole time Director responsible for planning and co-ordinating all the design and development activities of the Company. Development of the HF-24 Marut will continue with new engines and systems.

→ The HF-24 Mk. II is virtually rejected as the Indian Air Force has not confirmed its initial interest in the afterburning Orpheus 703. HAL have submitted firm proposals for the Mk. III or HF-73, and this aircraft would reportedly exhaust the growth potential of the HF-24.

→ The second Indian-built *Leander*-class frigate, INS *Himgiri* was commissioned at Bombay on 23 November. Similar to the INS *Nilgiri*, the first such type to be built at Mazagon Dock Yard, the *Himgiri* carries a MATCH Alouette III helicopter and is equipped with Seacat short-range anti-aircraft missiles amongst other armament.

→ Air India has ordered its fifth Boeing 747B for delivery in December 1975. During the Fifth Plan, Air India was to procure three wide-bodied jets and the DC-10 was strongly considered but its lower operating cost was outweighed by additional investment in new engineering facilities, ground support equipment and crew training which would have been entailed.

→ HAL Kanpur will be delivering the 69th, and last, Avro 748 to the Indian Air Force in 1975 but owing to the delay in submission of the Dhawan Committee report, plans for the production of the freighter version (30 HS 784Ms) and development of a maritime reconnaissance variant at the insistence of the IAF, has resulted in an inevitable break in production and idle capacity at Kanpur, “causing serious concern and the matter is being pursued with the Government for an expeditious final decision”.

1975

→ Defence Minister S Swaran Singh stated that it would be incorrect to say that the Indian Air Force was facing difficulty in equipping itself “properly” owing to foreign exchange shortages. “Our effort has always been to keep our defence preparedness at a satisfactory level within our resources.”

→ Soviet Defence Minister, Marshal Andrei Grechko, accompanied by Chiefs of the Soviet Air Forces and Navy, Air Chief Marshal PS Kotakhov and Admiral SG Gorshkov, respectively, visited India for three days in February. Considerable significance has been attached to this high powered defence visit to India as detailed talks covered the whole gamut of present co-operation and collaboration between the two countries concerning India’s security requirement.

→ According to reports from London, the keen Indian interest in procuring Jaguar strike fighters has been toned down because financial problems could “not be satisfactorily resolved”.

→ Indian Naval missions visiting Moscow recently have discussed a comprehensive list of requirements, which includes more submarines, *Kresta*-type helicopter carriers as well as long-range maritime reconnaissance aircraft.



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

→ The Satellite Introduction Television Experiment (SITE) began from 1 August with a message from the Prime Minister. About 2,400 villages in six different states- Andhra Pradesh, Madhya Pradesh, Karnataka, Orissa, Rajasthan and Bihar have got the benefit of the TV programmes.

→ Aryabhata, India’s first satellite, completed six months in orbit on 19 October 1975.

1976

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

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

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

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

→ The lone aircraft carrier INS *Vikrant* is to undergo modernisation but no decision has been taken concerning new flying equipment on board.

→ The Indian Navy’s first long-range maritime reconnaissance unit, INAS 312, was formally commissioned at INAS Hansa, Goa on 18 November, equipped with ex-Air India / ex-Indian Air Force Lockheed L.1049G Super Constellations fitted with ASV-21 radars.



→ The first of three Airbus A.300 B2s on order by Indian Airlines was delivered to the Corporation on 30 October, 1976, with the second and third airliners reaching Bombay in monthly intervals thereafter.



VAYU @ 45



1977

→ The Defence Minister has stated that the long awaited decision for a Deep Penetration Strike Aircraft (DPSA) for the Indian Air Force “was likely to be taken soon” which will allow the IAF to start replacement of the Canberra, Hunter and Sukhoi Su-7.

→ Substantial expansion and capability upgrading of Indian Naval Aviation is anticipated throughout remainder of the decade and a major increase in maritime patrol effectiveness is expected towards the end of the year when a new squadron (INAS 315) completes working up on the Ilyushin Il-38 at Dabolim, Goa.

→ Growth of the helicopter component of Indian Naval Aviation is continuing with the follow-on contract for five Westland Sea Kings. The Sea King is currently operated by two shore-based squadrons, INAS 330 and INAS 336, and the additional helicopters will be deployed aboard the three new frigates which are following on the Seacat-equipped *Leander*-class frigates in the Bombay shipyards.



→ The Indian Air Force recently received its first Tumansky R-25-powered MiG-21bis fighters from the Soviet Union and No. 21 Squadron (formerly mounted on the Gnat) is now converting to this type.

→ First prototype of the HAL HPT-32 primary trainer (X 2157) made its maiden flight at Bangalore at 6 January, flown by Wg Cdr Inder Chopra, CTP.

→ One of the first actions of the newly-elected Government under Prime Minister Morarji Desai was cancellation of orders for the VIP-configured and specially-equipped Boeing 737s to be operated by the IAF's Air Headquarters Communication Squadron.

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

1978



→ Air India's latest Boeing 747 'Emperor Kanishka' arrived in Bombay on 2 July, 1978, with whose addition the Airline now has six Boeing 747s.

→ On 6 October 1978, after years of evaluation, deliberation and final negotiations, the Government of India announced selection of the Sepecat Jaguar International as the strike aircraft to replace the aging Canberras and Hunters of the IAF.

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

→ Following the long anticipated decision on the Indian Air Force's DPSA, the Government of India announced the procurement of yet another combat aircraft, this being the Sea Harrier V/STOL fighter.

→ After several rounds of meetings Hindustan Aeronautics Limited (HAL) and Dornier GmbH of West Germany have signed a MoU on 31 May to prepare feasibility studies on the joint design and development of the 19-24 seater Light Transport Aircraft (LTA).

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

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

1979

→ Formal agreement for acquisition of the Sea Harrier V/STOL fighter for the Indian Navy was signed at New Delhi on 23 November between the Government of India and British Aerospace (Kingston Division).

→ The first two Jaguar International aircraft for the IAF were formally accepted by Mr. IP Singh, India's Acting High Commissioner in London from Sir Frederick W. Page, Chairman of British Aerospace at Warton aerodrome in Lancs, on 19 July.



→ The new Indian Defence Minister, C Subramaniam, has strongly defended acquisition of the Jaguar by the IAF, and has stated that any criticism against it is “ignorant and ill-informed” and that his predecessors are “patriotic and not ignorant in importing Jaguar technology”. Further, he remarked that “though the credibility of politicians may be low, the capability of our scientists and technologists cannot be underrated”.

→ The second prototype HPT-32 primary trainer made its maiden flight at Bangalore in mid-March. Incorporating minor modifications and a faired over landing gear, the aircraft joins the first prototype in flight development which includes spin trials. The HPT-32 is to supplant the HT-2s in the primary training role from 1982.

→ In the 25th year of nationalisation, Air India made a record net profit of Rs 25 crores, largely attributed to increased load factors, stable fuel prices, increased operations to the Gulf and optimum utilisation of its fleet

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



VAYU @ 45



1980

→ Defence Minister C Subramaniam has announced a number of decisions on the induction of modern equipment and weapons for the Air Force. Apart from induction of the Jaguar as a long range strike aircraft, the Government has also taken the decision for acquisition of new medium transport aircraft (Antonov An-32).

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

→ There are reports that orders have been placed with HAL for the first phase production of Jaguar in India, comprising 45 aircraft.

→ Following evaluation in the Soviet Union of both the interceptor and ground-attack versions of the MiG-23 swing-wing fighter by senior pilots of the IAF, the MiG-23MF and MiG-23BN are to be procured to augment the all-weather air defences of India.



→ The Indian Coast Guard have placed orders for six patrol vessels to be built in Indian dockyards, for delivery in 1981-82. Three of the 1000-ton offshore vessels, embarking a HAL-built Alouette III helicopter each, will be built by the Mazagon dockyards at Bombay whilst three of the smaller 200 ton inshore patrol vessels are being built by the Garden Reach Workshops at Calcutta.

→ A follow-on batch of three Sea King Mk.42A ASW helicopters has been delivered to the Indian Navy at INS *Garuda*, Cochin by Belfasts of TAC Heavy Lift.

→ Indian scientists have designed an advanced version of the Satellite Launch Vehicle which can put into orbit a payload weight up to 3,500 kg.

1981



→ Air Chief Marshal Dillbagh Singh took over as CAS Indian Air Force on 31 August 1981, having earlier been Vice Chief of Air Staff and AOC-in-C Western Air Command.

→ The first Jaguar airframe components destined for final assembly in India left Warton in Lancashire by air on 5 May, loaded aboard a Belfast freighter aircraft and airlifted out on the first stage of their journey to HAL in Bangalore.

→ Singapore has requested India to continue assistance in training the Island's fledgling Air Force. The Indian Air Force started the training programme in 1979 and a 10-man IAF group has completed its tour of duty in July 1981.

→ An advanced Boeing 737 in IAF colours with special interior configuration for flying VVIPs was officially received by the HQ Communication Squadron on 26 August.

→ With the selection of the Antonov-32 to fulfil the IAF's METTAC (Medium Tactical Transport Aircraft) requirement, replacement of the Antonov An-12 heavy transport aircraft from the late-eighties is now in process of review.

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

→ The Indian Navy would soon acquire another aircraft carrier and choose an anti-submarine warfare helicopter according to the Chief of Naval Staff, Admiral RL Pereira, who has said that the "half-life modernisation" of the Indian Navy was a regular process and the Navy was equipping itself with necessary sophisticated vessels and armaments.

→ *Vindhyagiri*, the last of the six *Leander*-class frigates built by Mazagon Dock Limited was commissioned by Mr. Shivraj Patil, Minister of State for Defence at Bombay on 8 July.

1982



→ During a meeting of the Parliamentary Consultative Committee for Defence in July, the Defence Minister Mr Venkataraman hinted that India was going to acquire "an advanced version of the MiG" which has been claimed by the Soviets to be superior to the F-16s being acquired by the PAF.

→ Deliveries of 80 MiG-23BN fighters (plus 15 MiG-23UM two-seat trainers) to the IAF for the equipment of Nos 10, 220 and 221 Squadrons will be completed during the course of this year, and earlier plans to procure the MiG-23MF air-air version have now been resurrected.

→ In the fiscal year that ended in March, the Nasik facility of HAL delivered 40 MiG-21M and MiG-21bis fighters to the IAF despite a three-month lock-out of employees suffered during the course of the year.

→ The prototype tandem-seating Ajeet jet trainer made its first flight at Bangalore on 20 September, flown by Wg Cdr MW Tilak, HAL's Chief Test Pilot.

→ Vayudoot commenced air services in Northern India from March, connecting Delhi with Ludhiana in the Punjab with a wet-leased HAL/BAe 748.

→ Between 9 and 23 November, the Dornier 228-200 demonstrator aircraft (D-IDCO) was involved in strenuous and comprehensive flight test and technical evaluations under formal invitation from the GoI. IAF, Navy and DGCA pilots flew the Dornier 228 to the limits of its design performance, carrying out some 32 sorties, flying over 15,000 kilometres ranging from Srinagar to Kanpur to Bagdogra to Paro Valley (Bhutan), Vishakapatnam and over the Bay of Bengal.

→ The Swedish Parliament has given its approval to development of the JAS multirole combat aircraft which calls for delivery of some 140 aircraft by the year 2000.



1983

→ The Government of India has formally selected the West German Dornier 228 to meet the varied requirements of a Light Transport Aircraft (LTA) for India, the detailed contracts, covering transfer of technology for a progressive programme to manufacture the Dornier 228 versions in India.

→ It has been officially announced that the Ilyushin Il-76 heavy duty military freighter and strategic airlift transport has been selected to meet the Heavy Tactical Transport Aircraft (HETAC) requirement of the IAF.

→ According to the CAS Air Chief Marshal Dilbagh Singh, India is to develop an indigenous AWACS aircraft system, commenting that “no developed nation was prepared to provide AWACS aircraft and that as such a type was essential to safeguard national territorial integrity India was developing its own system”.

→ First booster launch of the Pilotless Target Aircraft (PTA) configuration, coded as the ELV (Experimental Launch Vehicle) 01, was successfully carried out at the Kolar range in late October.

→ The third *Kashin*-class guided weapon destroyers for the Indian Navy, INS *Ranjit* has joined its earlier sister ships, INS *Rajput* and *Rana* as part of the Indian Navy's 11th Destroyer Squadron.

→ INS *Godavari*, the first of a series of Indian-designed and built multi-purpose frigates, was commissioned on 10 December, 1983 at the Naval Dockyard, Bombay by the Defence Minister Mr R Venkataraman.

→ An initial production order for 40 HAL HPT-32 primary trainers has been placed by the IAF against a total requirement of between 100 and 150 aircraft.

→ The DGCA-designed motorised glider (MG-1) was first flown on 30 May with Capt. Karminder Singh ('Ralph'), Civil Aviation Advisor Punjab at the controls.



→ The Indian Navy's first three BAe Sea Harrier FRs 51 VTOL fighters arrived at Dabolim naval air station, Goa on 16 December 1983.

1984

→ A new operational Air Command (Southern) was officially established with headquarters at Trivandrum, Kerala in South India, on 19 July 1984 with Air Marshal Terence D'Sa as first C-in-C.

→ On 21 July, the Government of India and MBB of the Federal Republic of Germany formally signed the contract for joint design and development of an Advanced Light Helicopter to be undertaken by HAL and MBB.

→ The HTT-34, turboprop version of the HPT-32, made its initial flight at Bangalore on 17 June 1984, piloted by HAL's test pilots Wg Cdr Ashok and Apte.

→ Squadron Leader Rakesh Sharma, test pilot of the Indian Air Force, became India's first man in space when, along with two Soviet Cosmonauts, he orbited the earth in the USSR's Salyut 7 orbital station.

→ Three new Russian-built inshore minesweepers of GRP construction were commissioned into the Indian Navy by Vice Admiral KK Nayyar, FOC-in-C, Southern Naval Command at Cochin on 10 May.

→ The Prime Minister of India, Indira Gandhi inaugurated the country's first submarine construction facilities at the state-owned Mazagon Dockyard Limited (MDL) at Bombay on 6 May. The collaboration between HDW of Kiel, West Germany and MDL envisages comprehensive transfer of technology for the construction of Type 209 SSKs in India, including full know-how, training of Indian personnel at Kiel and deputation of German specialists to Bombay.



→ The first three of a total of 95 Antonov An-32s on order for the Indian Air Force were officially received in India on 10 July at Palam (Delhi), enroute to their base at Agra, replacing the venerable C-119 Packets in service.

1985



→ The first batch of IAF Mirage 2000s was officially inducted into the IAF at Gwalior AFS on 29 June 1985 by Defence Minister PV Narasimha Rao and Air Chief Marshal LM Katre.

→ The first MiG-27M strike fighter to be assembled by Hindustan Aeronautics Limited at the Nasik Division was officially handed over in January.

→ An important milestone in the transfer-of-technology programme involving HAL's licence-production of the Dornier 228 light transport aircraft was recorded on 3 March, when the first Phase I kit was delivered to the Kanpur Division of HAL.

→ President Giani Zail Singh presented standards to Nos.10 and 11 Squadrons of the Indian Air Force at a combined ceremony at Jodhpur air base on 18 March.

→ First scheduled flight by a Vayudoot Dornier 228 was on 2 January, from Delhi to Rae Bareilly and on to Lucknow and Dehra Dun and return.

→ Defence expenditure during 1985-86 has been put at Rs. 7686 crore, which is Rs. 511 crore more than the revised estimates for the current year.

→ The Ilyushin Il-76 long range heavy transport aircraft has been christened the *Gajraj* (King Elephant) in Indian Air Force service.

→ A new engine test bed, designed, developed and fabricated by Hindustan Aeronautics Ltd., for the Garrett TPE-331 turboprop engine was inaugurated at the HAL Bangalore complex on 31 August by the Chairman of HAL, Air Marshal MSD Wollen (Retd).

→ The Polar Satellite Launch Vehicle (PSLV) four stage, space rocket, programmed to place IRS satellites in 900 km polar sun-synchroniser orbits from the late 80s, has entered development phase at the Vikram Sarabhai Space Centre (VSSC) at Trivandrum.



VAYU @ 45



1986

→ Formal agreement for the sale to India of HMS *Hermes* was signed on 19 April 1986, with the aircraft carrier to be delivered to the Indian Navy in spring next year.

→ The Government of India and the Soviet Union have finalised an MoU for the supply of MiG-29s for the IAF.

→ Addressing members of the consultative committee attached to the Defence Ministry, Prime Minister Rajiv Gandhi has defended the Light Combat Aircraft (LCA) and said that “if India did not invest in the project now, it might not be possible to develop the multi-mission tactical fighter aircraft which would be required for the IAF from the mid-nineties”.



→ The first five HAL-built Dornier 228 light transport aircraft were handed over to Vayudoot, the regional airline at HAL's Kanpur Division on 22 March.

→ HAL's Korwa Division was formally inaugurated by Prime Minister Rajiv Gandhi on 3 April.

→ Indian Airlines have ordered 19 Airbus Industrie A320s in a deal worth Rs. 1,238 crores, which brings a modern fuel efficient 160 seater shorthaul jet aircraft capable of operating from most current airports in India.

→ The United States has reportedly granted licence to India for General Electric F-404 engines for the Light Combat Aircraft (LCA).

→ The first two Dornier 228 Coastal Surveillance Aircraft, fitted with special sensors, were formally handed over to the Government of India by Dornier GmbH at their Oberpfaffenhofen airfield southwest of Munich, on 7 July.

→ The Indian Air Force is acquiring Mi-26 heavy-lift helicopters from the Soviet Union, the “heaviest and most powerful helicopter in the world”.

→ The foundation stone for India's largest future naval base was laid on 24 October 1986 at Karwar, in Northern Karnataka on India's western coast by Prime Minister Rajiv Gandhi.

1987



→ During the Republic Day Parade, there was no flypast by the Indian Air Force. Official reasons given include the danger of bird-hits on the low flying aircraft in formation but it is unofficially known that the IAF was extensively involved with preparations for Exercise *Brass Tacks* along the western border.

→ The Indian Navy's second aircraft carrier, the INS *Viraat* (R-22), formerly the Royal Navy's HMS *Hermes*, arrived at its home port at Bombay on 22 August.

→ The advanced performance MiG-29 air superiority fighter was formally inducted into the Indian Air Force by the Defence Minister, KC Pant, during a ceremony at Lohegaon AFS (Poona) on 6 December.

→ The Indian Foreign Secretary, AP Venkateswaran has stated that in the event of the US providing AWACS to Pakistan, India would be forced to seek similar capability from the Soviet Union.

→ Swedish aerospace company Saab-Scania have offered transfer-of-technology to India on the Light Combat Aircraft project.

→ France has offered “help” to India on the Light Combat Aircraft (LCA) and Avions Marcel Dassault-Breguet Aviation had carried out an independent study, according to Arun Singh, MoS for Defence (R&D).

→ The Aviation Research Centre (ARC) of the Research and Analysis Wing (RAW) has acquired two of the five remaining Air India Boeing 707s for Rs. 9 crores, including spares and landing equipment.

→ The first batch of Dornier 228-201s for the Indian Air Force was completed by Hindustan Aeronautics Limited, Kanpur Division by the end of March 1987.

→ Air India has finalised purchase of one Boeing 747-200 from Singapore Airlines, for \$48 million. This replaces the B-747 which was lost off the Irish coast in 1985.

1988

→ Prime Minister Mr Rajiv Gandhi inducted the first Soviet-origin SSN nuclear propelled submarine INS *Chakra* into the Indian Navy at Vishakhapatnam naval base on 3 February.

→ INS *Ranvijay*, the fifth and last of the modified *Kashin*-class destroyers acquired by the Indian Navy from the Soviet Union, has arrived in Bombay.



→ The Tupolev Tu-142M (*Bear-Foxtrot*) long-range MR/ASW aircraft was formally inducted into the Indian Navy on 16 April at a ceremony held at INAS *Hansa* Goa.

→ First of the final Phase Jaguars representing indigenous standard aircraft to be built under licence by HAL at their Bangalore Complex was formally handed over to the IAF by Defence Minister KC Pant on 28 January.

→ First test-firing of indigenous Prithvi, tactical surface-to-surface missile, took place at Sriharikota space station in Andhra Pradesh on 25 February.

→ The IAF's fleet of heavy lift Soviet-built Mi-26 and Mi-17 helicopters is being augmented by further numbers in order to support the ground forces deployed in the Siachen glacier area.

→ Mi-25 helicopter gunships of the IAF rocketed and destroyed by cannon fire a major camp of the LTTE in Eastern Sri Lanka on 15 October.

→ India and the United States have signed a ‘Letter of Offer and Acceptance’ (LOA) opening up the possibility of US cooperation in the projected Rs. 2,000 crore Light Combat Aircraft (LCA) project.

→ The IAF will begin to phase out its MiG-21 fighters from 1992, indicated by the CAS Air Chief Marshal SK Mehra. Several versions of MiG-21s were first inducted in early 1963, followed by licence-manufacture by HAL.

→ The Agriculture Aviation Wing was formally taken over by Vayudoot, on 18 January following its transfer to the Aviation Ministry as directed by the Union Cabinet.

→ The INSAT-1C satellite, designed by ISRO to complement the earlier INSAT-1B, was launched into geostationary orbit above the Indian Ocean on 21 July.



VAYU @ 45



1989



→ A contract has been signed with a French Government-owned design bureau to carry out project studies on development and construction of the third aircraft carrier for the Indian Navy.

→ The first of a batch of 20 Westland Sea King Mk.42B ASW helicopters was formally accepted by the Indian Navy at Yeovil in West England in mid-January 1989.

→ “The first prototype of the light combat aircraft (LCA) will fly in 1992 and its production version will be ready in 1996”, according to Dr Kota Harinarayana, LCA programme director, ADA.

→ Second test flight of the Prithvi surface-to-surface missile was successfully carried out on 15 September.

→ On 30 September, as the first SSK Type 1500 submarine was undocked and put to sea at Bombay, India joined a select group of ten other technologically advanced countries in the world who build their own submarines.

→ National Aeronautical Laboratory (NAL), which plays an important role in indigenous aerospace efforts, has, in a significant achievement last fiscal year (1988-89) commissioned its second transonic tunnel, designated H3.

→ France has offered India the technology of its HM-7 cryogenic rocket engine for the geosynchronous satellite launch vehicle (GSLV) which is expected to be ready for tests some time during the second half of the '90s.

→ India has entered into an agreement with the French for the carrier's design concept, which is expected to be completed by end-1989 and this would be then subjected to detailed design by the Indian Naval Design Organisation.

1990

→ The first Demonstrator aircraft of the Aerospace Surveillance Warning and Control System (ASWAC) Project has been test-flown in Bangalore.

→ The IAF is equipping two of its units with the HAL-Dornier 228, being Nos. 41 and 59 Squadrons earlier flying DHC Otters in the light logistics support and communications role.

→ The DRDO will soon undertake flight-testing of the indigenously manufactured medium-range, surface-to-air missile *Akash*.

→ In a deal worth US \$ 236 million, the Pakistan Air Force has ordered 50 ex-Royal Australian Air Force Dassault Mirage IIIOs.



→ The Comptroller and Auditor General's (CAG) has reported that the Mirage 2000 in IAF service has been without its key weaponry for two years after induction.

→ In a major development with great security implications for India, the Chinese and Soviets have reportedly made progress on the matter of advanced-technology combat aircraft supplies to the PLA Air Force which currently has a large, but obsolescent, fleet of fighters and attack aircraft.

→ British Secretary of State for Defence Tom King has outlined proposals for reduction in RAF strength under the overall 18 per cent reduction of the armed forces over the next five years approved by the Government.

→ After 32 months of development work, the Chinese Government has terminated its Agreement with the US company Grumman Corporation for upgrading its Shenyang J-8II all-weather fighters including the fire control systems, radar, computers displays, a power system and environmental control systems.

→ The Pakistan Air Force has announced that 95 Chinese-built F-7P Skybolt fighters will be received by them along with a small number of FT-7 operational conversion trainers.

1991

→ INS *Dega*, the Indian Navy's new Naval Air Station, was commissioned at Vishakhapatnam on 21 October by the Chief of Naval Staff Admiral Laxminarayan Ramdas. A brief ceremony involved reading of the Commissioning Order of INS *Dega* hoisting of the ensign and unveiling of a plaque marked the formal commissioning of the Air Station.

→ India made a record purchase of more than \$21 billion worth of arms, largely from the Soviet Union in the 1980s, registering a massive increase in the volume of its arms deliveries from 1983-1986 to 1987-1990 rising from \$8.3 billion in 1983-1986 to over \$13 billion in 1987-1990.

→ On 7 August, India's guided missile programme, crossed yet another milestone with the fifth successful launch of the surface-to-surface missile Prithvi from the Sriharikota space complex.

→ The Bush Administration has threatened to intensify economic sanctions against China if it goes ahead with the planned sale of M-11 missiles to Pakistan.



→ The Pakistan Air Force is to receive an additional batch of 40 F-7P fighter aircraft from China.

→ It is confirmed that the Chinese Air Force has received a first, small quantity, of Sukhoi Su-27 long-range air superiority fighters from the Soviet Union.

→ The world's longest range airliner, the Airbus 340, made its maiden flight at Toulouse, France, on 25 October, in a highly successful mission lasting four hours and 47 minutes.

→ “The LCA will be ready for its first test flight in 1995” according to Dr VS Arunachalam, SA to RM and DG DRDO. He said that advanced technology posed some problems and the experience of solving these was invaluable whatever the time spent.



VAYU @ 45



1992

→ The IAF's Diamond Jubilee was marked by ceremonial parades and other functions but the Service faces inevitable reduction in force levels unless its pressing requirements are urgently addressed and the picture appears "even more bleak when one considers the aspect of continuous obsolescence and the need to keep up the ongoing process of re-equipment and modernisation".

→ Prototype of HAL's Advanced Light Helicopter will be test flown "positively" by September 1992 according to Chairman HAL.



→ Indian Naval Air Squadron 310 *Cobras* has recently been re-equipped with the Dornier 228 Maritime Patrol Aircraft.

→ Nine women flight cadets will enter the portals of the Indian Air Force Academy at Dundigal, near Hyderabad, on 6 July, 1992.

→ In a significant development, France has agreed to sell 40 Mirage 2000E multi-role fighters for the Pakistan Air Force. The Defence-sale agreements also include the sale of submarines, minesweepers and air defence radars to Pakistan and is seen as a direct consequence of the suspension of all US economic and military aid to Pakistan since October 1990.

→ The Rafale Marine 01 prototype for the French *Aeronavale*, made its maiden flight at Istres on 12 December.

→ Nearly 9 years after the light combat aircraft (LCA) programme was launched, there have been varied reactions to development delays, these varying from cautious optimism to outright adverse commentary.

→ The disappointing performance of India's 3rd level airline Vayudoot has been attributed to "lack of professional management, tilt towards individuals self interests, supported by the bureaucracy and the politicians to advance their personal interests at the cost of the State".

1993

→ Dr Abdul Kalam, SA to the RM, informed the Committee that the "first roll out" of the light combat aircraft was expected in June 1996, "about six months ahead of schedule".

→ Second prototype of the Advanced Light Helicopter (ALH) was test flown at Bangalore on 8 April 1993 in the presence of General SF Rodrigues and Dr APJ Abdul Kalam SA to the RM.



→ First production JAS39 Gripen made its first flight in Linköping, on 4 March.

→ 40th anniversary of the Indian Naval Air Arm was marked by parades and flypasts at INS *Garuda* at Wellington Island, Cochin.

→ Dassault has delivered the first 2-seat Rafale (B01) to the Istres Flight Test Centre for various tests which will be followed by ground run-ups and taxiing tests before the first flight scheduled for the spring of 1993.

→ The CAG has revealed poor record of the MiG-29's RD-33 engines in that 74 per cent of the engines had "failed prematurely".

→ 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.

→ Air Chief Marshal Swaroop Krishna Kaul took over as CAS of the IAF on 1 August 1993.

→ The first ever International Air Show in India (*Avia India '93*) took place at Yelahanka Airfield Bangalore 15-18 December, organised by Convex, a private sector company with considerable experience and expertise in such expositions.

→ Pakistan PM Benazir Bhutto has stated that in view of the continuing impasse concerning supply of the additional 71 F-16 Fighting Falcons long contracted for but withheld by the United States Government under the Pressler Amendment, the Pakistan Government would have to implement new plans to enhance its defence potential.

1994

→ It has been officially announced that upgradation of the IAF's MiG-21bis fleet will be responsibility of the MiG-MAPO Bureau of Russia, thus setting to rest much speculation about the possibility of Israeli or US companies being given the task.

→ India and Pakistan have not agreed to pull back their forces from the Siachen Glacier, the world's highest battlefield.

→ The Clinton administration has urged India to consider the "dangerous consequence" of deploying its indigenously developed medium-range surface-to-surface *Prithvi* missile. The US ambassador to India said that the US hopes "India will consider very carefully the wisdom for deploying the missile." Replying to a question about the intermediate range 'Agni' missile, the ambassador-designate said, "Agni is an experimental rocket system".

→ The UK and Swedish Governments have signed a MoU which will form the framework for British Aerospace and Saab to co-operate on defence projects, initially concentrating on Saab's JAS39 Gripen fighter.

→ Maiden flight of the Eurofighter 2000 took place on 27 March 1994 at the Deutsche Aerospace Flight Test Centre at Manching in Germany.

→ The United States have decided to repay Pakistan the \$ 658 million deposited as advance for 71 additional F-16s.



→ Jet Airways, the start up airline headquartered at Bombay has gone global with interline agreements with 31 leading international airlines to fly their passenger and cargo in India.

→ The Government will neither allow foreign airlines to operate in the domestic circuit nor will it allow air taxi operators (ATOs) to fly on international routes, as per the Minister of Civil Aviation and Tourism.

→ The Tata Group and Singapore Airlines are planning to established a new airline in India, which is likely to start off with an initial capitalisation between \$150 million and \$300 million.



VAYU @ 45



1995

- In a severe criticism of the DRDO, Parliament's Standing Committee on Defence has called for a "review" of the Light Combat Aircraft (LCA) project, which, according to it, was taken up without proper ground work.
- The Minister for Defence has stated that the Indian Navy would receive greater financial allocations to make up for reduced effectiveness owing to obsolescence and serviceability problems.
- India plans to be the third partner (along with China and South Korea) for development of the 100-plus seater 'Asian Express' jetliner.
- Following the American volte face on the F-16 deal, the Pakistan government is now considering the Swedish JAS 39 Gripen as a possible replacement. According to reports, the Pakistan government has already sent a letter to Sweden, and intends to follow it up shortly with an evaluation of the type.



- The US Air Force has declared its 17th Airlift Squadron at Charleston AFB, South Carolina, equipped with 13 McDonnell Douglas C-17 Globemaster IIIs, as fully operational.
- Hyderabad based VIF Airways new generation Dornier 328 regional airliners with the first aircraft flying on scheduled service out of Begumpet (Hyderabad) airport in May 1995.
- Mr Russi Mody, Chairman of Air India and Indian Airlines, visualises merger of both the airlines in two to three years time as the emerging aviation scene will make this imperative.
- Boeing has decided to double the amount of business it gives to HAL from \$ 5 million to \$ 10 million. HAL began with components for the B-747 and has now moved on to manufacture the overwing doors for the A.320.

1996

- Sources in Moscow indicate that India and Russia are 'on the brink' of a deal covering the sale of 40 Sukhoi Su-30MK multi-role fighter aircraft.
- Senior BJP leader Atal Behari Vajpayee has sharply criticised the outgoing Congress government's reported decision to buy an initial eight Sukhoi Su-30s at a staggering cost of Rs 1,200 crores and darkly hinted at the possibility of "huge commissions" in the deal.
- "Two prototypes of the Light Combat Aircraft (LCA) Technology Demonstrators will fly in the middle of next year" according to Dr Kota Hari Narayana, LCA Project Director.
- The Government of India has ruled out licensing of any new foreign or domestic airline except for operations on short-haul routes, at present.
- Pakistan has confirmed that the 'mid-tech' Super-7 fighter will be produced in a joint venture by China and Pakistan, and is meant to replace all Chinese-origin aircraft on the inventory of the PAF.



- Pakistan may have acquired 15 *Scud* ground-to-ground ballistic missiles captured by the Taliban in Kabul, which can be equipped with nuclear warheads.
- An Airbus Industrie survey estimates that airlines in India will acquire some 275 aircraft worth \$20 billion between now and 2014, whilst 78 ageing aircraft will be retired and replaced.
- Indian Airlines have stalled plans to acquire 50-seater turboprop airliners to select for the north-eastern sector. The technical evaluation committee was unable to justify selection of the three types short-listed: Saab 2000 has airfield limitations, Fokker have closed down and DHC (Bombardier) "are very casual".

1997



- The first four Sukhoi Su-30Ks for the IAF, disassembled and in crates, have been flown to Poona by special Antonov An-124 aircraft, arriving during the second week of March 1997.
- Formal contract for the Su-30s (worth US \$ 1.8 billion) was signed by Mr TK Banerji, Secretary for Defence with representatives of the Irkutsk Aviation Industrial Association on 30 November 1996 which also provided for licence production of the Su-30 in India by Hindustan Aeronautics Limited.
- The new *INS Delhi*, guided missile destroyer being indigenously built under 'Project 15' was commissioned at Bombay on 15 December.
- Developed under the Integrated Guided Missile Programme (IGMDP), two test firings of Trishul SAMs took place on 25 November from the Chandipur Interim Test Range (ITR).
- The Chinese Government is reportedly considering acquisition of the Rafale, with an official visit to Dassault in 1996, while, more recently, French representatives including those from Rafale's engine manufacturer Snecma, "have spent time in Beijing".
- Three regional airliner manufacturers have submitted commercial bids to Indian Airlines, with the airline set to purchase six aircraft initially and 12 more at a later date.
- Maiden flight of the first Boeing F-22 Raptor (billed as the "USAF's air dominance fighter for the 21st century") took place on 7 September 1997.
- On 8 October, the German *Bundestag* finally cleared procurement of 180 Eurofighter 2000s for the Luftwaffe.



1998



- India's integrated ballistic missile programme had received a major boost with the BJP Government taking a decision to develop and produce a full-fledged missile system based on the Agni technology.
- The Pakistan Air Force, which has been desperately looking for a new fighter aircraft to replace the obsolescent fighter-types in its inventory, has been keen on Russian aircraft types for some time, particularly the MiG-29 and Su-27.
- Naval version of the *Trishul* surface-to-air missile was tested from an Indian naval establishment near Cochin on 3 June.
- The Indian Navy is to acquire 50 more Russian-made Kh-35 anti-ship missiles for its three new 6,700 tonne INS *Delhi*-class destroyers at a cost of \$150 million.
- The first MiG-21bis of the Indian Air Force (MiG-MAPO designation MiG-21-93) made its first flight at Enizhny Novgorod (formerly Gorky) on 7 October 1998.
- Belgium has agreed to sell 24 Mirage 5s to Pakistan, these aircraft being in varying storage conditions after being phased out of service.
- Air Chief Marshal Anil Y Tipnis, will take over as next Chief of the Air Staff IAF from 1 January 1999.
- Russia is currently executing an order to build six frigates for the Indian Navy, a submarine programme is underway and some maritime reconnaissance/attack helicopters are also understood to have been ordered.
- Russia has outlined a new \$700 million defence package to India for the sale of the "modernised" 44,500-tonne aircraft carrier *Admiral Gorshkov* equipped with 24 MiG-29K fighters.

1999

- Indian defence deals with Israel worth near \$200 million are in the offing, with the visit to Israel by Brajesh Mishra, National Security Advisor to the Vajpayee Government, in the first week of September to endorse Indian requirements.
- Air Chief Marshal AY Tipnis said that "induction of the Advanced Jet Trainer must be accorded the highest priority to ensure operational preparedness of the IAF."



- IAF fighter-bombers and helicopter gunships went into action on 26 May 1999, with strike missions launched against heavily armed, Pakistani-led infiltrators occupying the higher reaches of Kashmir's Dras and Kargil sectors.
- In the second half of June, four more Su-30Ks were airlifted to India and another six are to follow even while more *Tungushka* air defence systems have been shipped, along with T-90 tanks for field trials.
- In a major setback to India's own Airborne Early Warning development programme, the HAL (Avro) 748 Airborne Surveillance Platform (ASP) technology demonstrator aircraft had a fatal crash some 2.5 km short of the runway at INS *Rajali*, near Arrakonam.
- Mr George Fernandes accepted the fact that the LCA programme had suffered a setback after the US had imposed sanctions "but the great Indian spirit has prevailed" and the country will find a solution to the embargo on avionics, flight-control systems and the power plant, he stated.
- Seven more Dornier 228 MPAs have been ordered by the Indian Coast Guard, equipped with state-of-the-art mission sensors required for maritime patrol operations and the surveillance of India's 3500 km long coastline.

2000

- Air Chief Marshal AY Tipnis has said that the IAF is considering an alternative to the Light Combat Aircraft (LCA), including purchase of new aircraft.
- The MoD's Standing-Committee has tabled reports on the *Demands for Grants* (2000-2001) on 19th April. The foremost is for the Advanced Jet Trainer (AJT), 66 of which are to be acquired for the IAF.
- The already long-dragged out programme of the IAF for an AJT may have run into new and unexpected problems with the newly constituted Parliamentary Standing Committee on Defence demanding that the Government virtually "throw open" the competition to aircraft manufacturers world-wide.
- The Indian Navy plans to enhance its maritime surveillance and strike capabilities by upgrading its existing fleet of Tupolev Tu-142M and Ilyushin Il-38 maritime patrol / ASW aircraft and acquiring "some numbers" of supersonic Tupolev Tu-22M3 bombers on lease from Russia.



- Eight more ships of the Indian Navy would be commissioned during the year according to Defence Minister George Fernandes, the first in the series being the fleet tanker INS *Aditya* which was commissioned in Calcutta recently, followed by another first in the series, *INS Brahmaputra* glided missile frigate.
- An agreement was signed on 28 December 2000 between the Irkut Aircraft Production Organisation (IAPO) HAL for licence-production of Sukhoi Su-30MKI multi-role combat aircraft in India, the programme to span 17 years according to the Interfax news agency of Moscow.
- After six years of introspection, the GoI has decided to privatise Indian Airlines by 31 March 2001 by selling 51 percent of its equity. Of this, a block of 26 percent will be sold to a strategic investor in the joint venture. According to Arun Jaitley, the Minister concerned, the Cabinet Committee on disinvestment approved the case on 24 January, which conclusively overturns the earlier policy of selling only minority stakes in public sector undertakings.



VAYU @ 45



2001



→ The first Technology Demonstrator (TD-1) of the Light Combat Aircraft (LCA) made its maiden flight on 4 January 2001 from HAL's Bangalore airport. Piloted by Wg Cdr Rajiv Kothiyal of ADA's National Flight Test Centre, the flight lasted 18 minutes and was "uneventful".

→ As part of protocols signed at Moscow on 6 June was one to "jointly develop fifth generation fighter" which would fly by 2006 and be ready for induction by 2009. Observers feel that this new fighter could be an attractive option for India, which has a definite requirement for such a new generation fighter.

→ The Agni II 2000-km. range ballistic missile (IRBM) with a one-tonne payload was successfully test launched on 17 January 2001 from the Interim Test Range at Inner Wheeler Island.

→ India has embarked upon a major submarine building programme to manufacture 24 'Hunter' and 'Killer' submarines as part of efforts to make underwater, surface and air wings of the Navy more potent by equipping them with long-range missiles.

→ India's plan to launch an unmanned mission to the moon has received a boost with scientists at the Ahmedabad-based Physical Research Laboratory (PRL) supporting the convention that the country has the technological capability for the project.

→ ADA "is studying accelerated development of the LCA after the US Government lifted sanctions on 22 September". The LCA development had been severely hampered by the sanctions imposed in 1998 after India and Pakistan tested nuclear weapons.

→ Flight tests of the two IAF MiG-21bis fighters, upgraded to MiG-21bis UPG standard (earlier Russian designation was MiG-21-93) have now been completed by RSK MiG. Another 123 MiG-21bis in the programme will be upgraded over the next four years at HAL Nasik.

2002



→ The Cabinet has given "go-ahead" for the country's nuclear arsenal to be placed under a new Strategic Nuclear Command (SNC), which will function under the Integrated Defence Staff set-up, with the first C-in-C of the SNC likely to be from the Indian Air Force.

→ With successful test-flight of the supersonic missile BrahMos at the Interim Test Range at Balasore on 28 April, the Indian Navy is all set to launch this from a surface ship in a few months.

→ India ranked second only to the United Arab Emirates (UAE) in arms transfer agreements made by developing nations during 1998-2001, according to a report prepared for the US Congress.

→ To secure surveillance of the Line of Control (LoC) in J&K, the Indian Army is importing man-portable radars capable of detecting movements across the border.

→ The medium range surface-to-air missile *Akash* was test-fired from the interim test range (ITR) at Chandipur-on-Sea, the *Akash*, which is one of the five missiles under various stages of development by the DRDO, has a range of 25km and the capability to carry a payload of 55kg, supported by state-of-the-art radar named *Rajendra*, which can keep track of 64 aircraft simultaneously within a range of 40 to 60km.

→ In a complete reversal of its existing policy, the Indian Government will allow entry of foreign airlines into domestic aviation with a foreign equity of up to 49 per cent.

→ The Indian space programme took another leap forward on 24 January with successful launch of the third generation Communication satellite INSAT-3C. A 'multi-purpose space system', the satellite is expected to sharply boost telecommunication and broadcasting facilities in the country.

2003

→ Over four years after India declared itself a state with nuclear weapons, the Cabinet Committee on Security (CCS) on 4 January 2003 adopted and made public the key elements of its nuclear doctrine and command structure.

→ Absence of Advanced Jet Trainers (AJTs) was the key reason for frequent crashes of MiG-21s. "It is penny wise and pound foolish to not go in for the AJTs," was stated by an MP, while pointing to a statement of Defence Minister George Fernandes that "mysterious elements" were preventing the purchase of the jet trainers.



→ At a ceremony in Tashkent on 28 February, the first of six Il-78s equipped mid-air refuelling, was officially handed over to the Indian Air Force.

→ Even as the Tejas LCA (TD-1) scored a century of test flights on 6 September, being flown by Gp. Capt. Rakesh Bhadauria, the former ADA Director responsible for development Dr Kota Harinaryana has mooted development of its spin-off, the Medium Combat Aircraft (MCA) which being projected as a replacement for the Jaguar and Mirage 2000 which the IAF operates and which will be phased out by 2020.

→ INS *Trishul*, commissioned at St. Petersburg last June, has arrived in India.

→ In the largest scale naval exercises held between India and Russia, major warships from the former's Western and Eastern Naval Commands and frontline warships from the Russian Pacific and Black Sea fleets, began manoeuvres off the Yemeni island of Sokotra in the Western Arabian Sea during the fourth week of May.

→ Air India has announced its biggest one-time plan to acquire 28 new aircraft as part of fleet expansion at the cost of over Rs. 10,000 crore.



2004

- Admiral Arun Prakash has taken over as the new Chief of the Naval Staff.
- The much awaited MoU between the Governments of India and UK was signed in New Delhi on 19 March 2004, “for the effective and uninterrupted implementation of the contracts regarding acquisition of 66 Hawk Advance Jet Trainers (AJTs) from BAE systems and other equipment manufacturers of UK.”
- The Indian Air Force has begun work on developing an Aerospace Command to bring the country’s space-based assets under one umbrella.
- The stealth frigate INS *Tabar* was commissioned in mid-April, the third of the *Talwar* class of guided missile frigates being built by Russia for the Indian Navy.



- First prototype of the NAL *Saras* light transport aircraft powered by twin PT6A-66 turboprop pusher engines, flat rated to 850 s.h.p. each, made its maiden flight at HAL Airport Bangalore on 29 May 2004, piloted by test pilots from the ASTE, who flew the *Saras* for 22 minutes and reached an altitude of 7,000 feet.
- The Indian Navy commissioned its latest Guided Missile Frigate INS *Betwa* on 7 July 2004 at Kolkata.
- Over a year after its induction into the Indian Army, the Agni II intermediate range ballistic missile (IRBM) was test fired from the launch site on Wheeler Island in the Bay of Bengal on 29 August 2004.
- An improved version of the Prithvi-II missile, having higher accuracy, was launched from the Interim Test Range (ITR), Balasore in mid-March. The shore-based and down range tracking system like radar, EOTS and telemetry of ITR at Balasore tracked the flight path of the missile till impact, validating the accuracy of the missile guidance.
- Air Marshal Shashindra Pal Tyagi, earlier AOC-in-C Western Air Command has been appointed as next Chief of the Air Staff.

2005

- In a major defence deal announced on 12 September 2005, the Government of India confirmed acquisition of French *Scorpene*-class submarines worth \$3 billion.
- The GoI has approved construction of an Air Defence Ship (ADS) at Cochin Shipyard Ltd. (CSL), which has signed two contracts with Fincantieri, an Italian shipyard for undertaking design, integration, installation, and commissioning of the propulsion system for the ADS.
- Production of *BrahMos*, supersonic cruise missile co-developed by India and Russia, has begun in the country and the Indian Navy has placed orders for it, the Navy had identified such vessels on which the *BrahMos* missiles would be integrated.
- On the eve of Indian Prime Minister Dr Manmohan Singh’s visit to Moscow in early May 2005, the Russian Government confirmed its offer to replace the first batch of 18 Sukhoi Su-30Ks with new build Su-30MKIs of the definitive standard selected by the Indian Air Force.



- InterGlobe Enterprises Limited has launched the new low-cost airline IndiGo and has committed for 100 A320 family of aircraft with Airbus, the venture being jointly promoted by InterGlobe Enterprise Limited and Rakesh Gangwal, globally recognised for his management skills and expertise in the airline industry.
- India and Israel have entered into military purchases worth Rs. 11,882.54 crores.
- Jet Airways’ first Boeing 737-800 with winglets was delivered in late November, making it the first regularly scheduled commercial airplane with winglets to operate in the country.

2006

- In one of the biggest defence deals with the US since 2002, the government has approved purchase of the amphibious transport warship USS *Trenton* to bolster the Indian Navy’s strategic sea-lift capabilities.
- Release of RFPs for Medium-Multi Role Combat Aircraft (M-MRCA) has been further delayed. Six companies have expected for receive an invitation to tender for the 126 aircraft fighter requirement and the document had reportedly been scheduled for release 6 months back.
- CNS Admiral Arun Prakash commissioned INAS 342, the Navy’s first UAV Squadron at Cochin on 6 January 2006.



- On 9 March 2006, the Cabinet Committee for Security cleared the proposal for acquisition of 12 HJT-36 intermediate jet trainers by the Indian Air Force from HAL at a cost of Rs. 486.82 crore.
- Almost exactly nine years after the first batch of Sukhoi Su-30Ks were received by the Indian Air Force from Russia to re-equip No.24 Squadron at Poona, these 18 aircraft are to be returned to their country of origin for transfer and further service within the air arm of Belarus.
- Defence Minister Pranab Mukherjee released the Joint Doctrine prepared by Headquarters Integrated Defence Staff, which is considered a “landmark” for the three armed forces for developing a truly ‘joint’ capability.
- The Navy has successfully integrated anti-missile defences into its operational capability and now wants to have Baraks on additional warships, starting with the INS *Brahmaputra* missile frigate.
- Vice Admiral Sureesh Mehta has been appointed as next Chief of the Naval Staff, taking over from Admiral Arun Prakash, who retires on 31 October 2006.
- Jet Airways has concluded negotiations to buy Air Sahara for Rs. 2500 crore (\$560 million) thus creating the largest airline in India in terms of fleet, turnover and evaluation.



VAYU @ 45



2007

- Defence Minister AK Antony has dispelled misgivings about acquisition of 126 MMRCAs for the IAF, an RFP for which is yet to be issued, this assurance to be seen in light of the concerns addressed by the CAS in July 2006 to the then Defence Minister on the depleting force levels of the IAF and urging expeditious remedial steps.
- Maiden flight of the Indian Navy's first MiG-29KUB took place in January at the Gromov Flight Research Institute, Zhukovskiy.
- Air Marshal Fali Homi Major has taken over as Chief of the Air Staff, IAF prior to which he was AOC-in-C, Eastern Air Command.
- The Indian Air Force has embarked upon acquisition of longer range air-to-air missiles, its dominance in offensive air superiority operations presently being "dented" by the supply of similar performance BVR missiles to Pakistan by the USA.
- The first Tejas LCA of the Limited Series Production batch (LSP-1) with tail number KH2010, made its maiden flight from HAL's Bangalore airfield on 25 April 2007.
- Second prototype Saras light transport aircraft (PT-2) with registration VT-XRM (for 'Raj Mahindra') made its maiden flight on 18 April 2007 from HAL Airport, Bangalore.
- The USS *Nimitz* docked in Chennai in early July, the first ever port call in India by a US aircraft carrier and a "landmark event in US-India bilateral relations."



→ In its tenth flight conducted from Satish Dhawan Space Centre (SDSC) at Sriharikota on 10 January 2006, ISRO's Polar Satellite Launch Vehicle PSLV-C7, successfully launched four satellites into a 635km high polar orbit.

2008

- The first step towards meeting the IAF's requirement for 126 medium-multi role combat aircraft, (MMRCA) which has excited much international interest, was taken on 28 April when representatives of six companies supported by respective Government officials, submitted their proposals in response to the RFPs received in August 2007.
- Dassault have reportedly made an offer to supply the IAF with 40 Rafales as "a short term measure to augment its combat force."
- The government has ruled out any plans for "a strategic partner" of the Tejas LCA programme, a total of Rs. 4806 crore having been spent till date on development.



- The Cabinet Committee on Security has approved procurement of 159 Dhruv ALH at a cost of over Rs. 14,000 crore, for the Army and the Air Force.
- The IAF has undertaken trials of the Agusta Westland AW101 and Sikorsky S-92 in January 2008, these types competing for the IAF requirement for a new medium-lift and VIP transport helicopter.
- The Agni-1 strategic missile launched on 23 March 2008 from the Island Launch Complex in Orissa had "textbook performance" in terms of range, accuracy and lethality.
- The IAF has initiated processes for inducting the medium-range Akash SAM and is expected to place an order soon, initially for "two squadrons" worth.
- The PSLV-C9, India's versatile Polar Satellite Launch Vehicle, launched ten satellites including the country's latest remote sensing satellite CARTOSAT-2A, from ISRO's Satish Dhawan Space Centre on 28 April.

2009

- First of the six contenders for the IAF's M-MRCA tender began flight trials at Bangalore on 17 August 2009, being a pair of F/A-18F Super Hornets.
- India's first indigenously built nuclear-propelled strategic submarine INS 'Arihant' was launched on 26 July 2009, at the Ship Building Centre, Visakhapatnam.
- The GoI have cleared the largest ever indigenous defence contract, worth Rs. 45,000 crore, for the production of seven advanced stealth frigates for the Navy at Shipyards in Kolkata and Mumbai.
- The Government of India has selected Boeing IDS to provide eight P-8(I) long-range maritime reconnaissance and anti-submarine warfare aircraft to the Indian Navy.
- The Government has appointed Air Marshal Pradeep Vasant Naik (presently Vice Chief of the Air Staff) as the next Chief of the Air Staff with effect from 31 May 2009.



- The first of three IIL-76TD AWACS aircraft fitted with the Israeli 'Phalcon' system for the Indian Air Force (IAF) arrived in India on 25 May 2009, with first landing at the Air Force Station, Jamnagar.
- Even as Tejas LCA development flight trials have continued at Bangalore, with the 1100th sortie being flown in end-April 2009, bomb dropping trials were successfully conducted by three aircraft at the Jamnagar ranges.
- Russian shipyards have begun full-scale construction of three more *Krivak*-class stealth frigates to be armed with anti-ship version of BrahMos cruise missiles for the Indian Navy, the new warships to be delivered to India in 2011-2012.



VAYU @ 45



2010

→ On the eve of President Barak Obama's visit to India, the Government has acquiesced to the IAF's request for increasing the number of Boeing C-17 Globemaster III's heavy airlift aircraft required, from ten to sixteen.

→ The Governments of India and Russia have signed several agreements to deepen co-operation on the T.50 (or PAK-FA) fifth-generation fighter. Alexander Klementiev, vice president and deputy director general at Sukhoi Aviation Holding stated, "The joint venture is going very well. Both parties are happy now".



→ In what has virtually become a pattern, the Indian Air Forces' steadily expanding fleet of Sukhoi Su-30MKI fleet of 'air dominance' fighters is to be augmented by another batch of these aircraft, increasing contracted numbers by another 42 aircraft.

→ The IAF intends to equip its Sukhoi Su-30MKIs with air-launched BrahMos supersonic anti-ship missiles even as the development of a BrahMos Mk.II has been announced which will be hypersonic (Mach 5-7).

→ The Government of India has confirmed a \$2.2 billion deal with France to upgrade the fleet of 51 Mirage 2000 fighters, "to enhance their combat capabilities and increase service life."

→ "India has agreed to buy 250-300 advanced stealth fighters from Russia, to be jointly developed and manufactured," stated Defence Minister AK Antony on 7 October.

→ An additional four Boeing P-8I long range maritime patrol/anti-submarine warfare aircraft will be acquired by the Indian Navy to supplement the 8 similar aircraft ordered earlier, for \$2.1 billion.

2011

→ Even as the last MiG-21FL (Type 77), in service with the IAF since 1996, is to be retired by 2012, the remaining five MiG-21MF squadrons will follow into retirement two years later, with the last of the six MiG-21 bison squadrons phased out by 2017.

→ Concerning 'Initial Operational Clearance' of the Tejas LCA at HAL in Bangalore on 10 January 2011, the Minister for Defence handed over the 'Certificate of Release to Service' to the IAF.

→ The MoD has issued a global RFI (request for Information) for procuring integrated computer and communication systems (ICCS) for the infantry, which arm constitutes well over one-third of the 1.13 million-strong Indian Army.

→ The Government has announced that Air Marshal NAK Browne will take over as the next Chief of the Air Staff on retirement of the present incumbent Air Marshal Pradeep Naik on 31 July 2011.

→ On 27 April 2011, just days before the commercial bids submitted by the six contenders for the M-MRCA programme would have become invalid, the Ministry of Defence, asked Eurofighter and Dassault to extend the validity (or re-submission) of their offers till end of the year.

→ The Indian Army's Aviation Directorate is to be expanded with attack and tactical assault helicopters embedded with the three Strike Corps.



→ The third and fourth of six Lockheed Martin C-130J Super Hercules for the Indian Air Force departed the company's facility in Marietta en route to Air Force Station Hindan in mid-June.

→ The Government has cleared acquisition of eight LCUs (landing craft utility) capable of 'hard beaching' on shores, to improve the Navy's amphibious warfare and island projection capabilities.

2012

→ On 31 January 2012 Defence Minister AK Antony announced that acquisition process had begun for the Dassault Rafale which was selected to meet the IAF's MMRCA requirement.

→ Air Chief Marshal NAK Browne confirmed a number of decisions taken by the GoI which concerned IAF modernisation and expansion. These include the decision on procurement of 22 Boeing AH-64 Apache attack helicopters and induction of more Sukhoi Su-30MKI air dominance fighters.

→ On 3 May 2012 the Cabinet Committee on Security (CCS), gave approval for procurement of 75 Pilatus PC-7 Mk.II basic training aircraft from the Swiss company.

→ The Cabinet Committee on Security (CCS), chaired by Prime Minister Manmohan Singh, cleared the acquisition of 500 MICA air-to-air missiles from European firm MBDA.

→ Lt. Gen Bikram Singh, presently GOC-in-C Eastern Command, has been appointed as the next Army Chief from 31 May 2012 to succeed General VK Singh.

→ The Defence Acquisition Council has cleared 14 additional HAL-built Dornier 228 light transport aircraft for the Indian Air Force.

→ As a prelude to the acquisition of Boeing Apache helicopters by the Indian Air Force, the US Government is offering 245 Stinger missiles and 56 launchers to India as part of the weapons package.

→ Maiden flight of the first Jaguar strike fighter modified to DARIN III standards took place on 28 November, 2012 at HAL's Airport Bangalore.





VAYU @ 45



2013

→ The Airbus A330 MRTT (Multi Role Tanker Transport) has been selected to provide six in-flight refuelling tankers to the Indian Air Force, chosen instead of the Ilyushin Il-78MKI, six of which are already operated by the IAF. The RFP for the new tankers was reissued in September 2010 after nine months after a similar contract featuring the same competing aircraft was withdrawn. Final contract is expected during FY 2013-14.

→ Test flights by MiG-29K/KUB fighters have been carried out by Russian test pilots from the carrier *Admiral Gorshkov*, before its commissioning as the INS *Vikramaditya*.



→ The Indian Air Force received its first Boeing C-17 Globemaster III in-country when the first of this new heavy transport aircraft landed at Air Force Station Hindan on 18 June 2013.

→ Some 90 aircraft, mostly helicopters, of the Indian Air Force, Army and civilian operators evacuated thousands of stranded pilgrims and local inhabitants from the Uttarakhand hills following the 'Himalayan Tsunami' in June.

→ The Agni 5, India's long range inter-continental ballistic missile and designed to deliver nuclear warhead with high precision, was successfully launched on 15 September 2013.

→ The first Boeing P-8I LRMR/ASW aircraft of INAS 312 arrived at INS Utkrosh airfield in Port Blair on 6 August 2013.

→ The Pilatus PC-7 Mk.II basic trainer aircraft was formally inducted into IAF service at the AFA, Dundigal on 31 May 2013.

→ The Government has appointed Air Marshal Arup Raha, presently VCAS as the next Air Chief on retirement of the present incumbent on 31 December 2013.

2014

→ Lt. Gen Dalbir Singh has been appointed as the next Army Chief, to succeed General Bikram Singh, due to retire on 31 July.

→ Following the dramatic resignation of Admiral DK Joshi on 26 February 2014, claiming moral responsibility for a spate of accidents affecting the Navy's warships, the Indian Navy functioned without a chief for close to two months before Admiral Robin K Dhowan assumed charge.

→ Five modernised Antonov An-32s arrived at Kanpur from the Ukraine on 29 March 2014, being the seventh batch of upgraded An-32s delivered to India, bringing the total number to 35.



→ Boeing has delivered the fifth P-8I maritime patrol aircraft to the Indian Navy "on schedule", fulfilling the first half of a contract for eight aircraft.

→ The Border Security Force (BSF) is to procure eight more helicopters from Russia to enhance mobility of troops engaged in anti-Maoist operations.

→ The Indian Government has signed a £250 million contract with European missile manufacturer MBDA to equip the Indian Air Force's Sepecat/HAL Jaguar strike aircraft with the company's ASRAAM short-range air-to-air missile.

→ On 29 August 2014, the Government's Defence Acquisition Council (DAC) approved the procurement of 22 Boeing AH-64E Apaches and 15 CH-47F Chinooks, for an estimated US \$2 billion.

→ The new Tata-SIA joint venture airline *Vistara* marks the return of Tata's in the airline industry after 1953 when Air India was nationalised. *Vistara* will initially have five A320-200s in its fleet by the end of 2014.

2015

→ Indian Prime Minister Narendra Modi announced that he had "requested" the French Government to make available 36 Dassault Rafales for the Indian Air Force to meet its urgent requirements.

→ On 9 January 2015 HAL delivered the first overhauled Su-30MKI to the Indian Air Force at HAL Nasik. Dr RK Tyagi, Chairman HAL stated that they would 'act as a single window OEM for supporting the Su-30MKI fleet'.

→ On 17 January 2015, Defence Minister Manohar Parrikar formally handed over the first series production (SP-1) Tejas light combat aircraft to the Indian Air Force at HAL Bangalore.

→ On 25 March 2015 Dassault handed over the first two upgraded IOC-standard Mirage 2000 I/TI aircraft to the Indian Air Force in Istres, southern France.

→ The fourth anti submarine warfare (ASW) corvette of Project-28, INS *Kavaratti*, was launched at Kolkata on 19 May 2015 with RRM Rao Inderjit Singh presiding as Chief Guest at the occasion.

→ The Defence Acquisition Council has selected the Ka-226T as the RSH to be licence-built in India as successor to the HAL Chetak/Cheetah.

→ The first of six *Scorpene*-class diesel-electric attack submarines on order for the Indian Navy was floated out at Mazagon Dock Limited (MDL) in Mumbai on 29 October 2015.



→ The Indian Air Force has re-established its aerobatic display team, the Surya Kirans, with new BAE Hawk Mk.132 aircraft, as part of No.52 Squadron.

→ Slovenian light aircraft manufacturer Pipistrel will supply 194 micro light aircraft to the IAF, IN and NCC.



VAYU @ 45



2016

- The Defence Acquisition Council (DAC) has cleared purchase of the Russian S-400 Triumf air defence system involving five units at an estimated cost of Rs 40,000-crore.
- Sweden has offered to manufacture the next generation Gripen MRCA 'with comprehensive technology transfer to India' as also development of futuristic programmes with the ADA to 'consolidate such capability for next 100 years'.
- Civil Aviation Minister P Ashok Gajapathi Raju launched the Ministry's much awaited Regional Connectivity Scheme UDAN in New Delhi.
- The first IAF formation with the Tejas LCA (No.45 Squadron) was formally established at Bangalore on 1 July 2016 with two series production fighters handed over.
- The Indian Navy has commissioned its first nuclear-powered ballistic missile submarine (SSBN) INS *Arihant* in August 2016.



- HAL's HTT-40 basic trainer aircraft made its first official flight on 17 June 2016.
- The Indian Air Force commissioned its first women fighter pilots on 18 June 2016, AFA Dundigal when a total 130 flight cadets were commissioned.
- On 23 September, Indian Defence Minister Manohar Parrikar and his French counterpart Jean-Yves Le Drian signed a formal agreement for purchase of 36 Rafales for the IAF. Reliance ADA Group will pursue a JV with Dassault on Rafale offsets.
- The US Government is in 'full support' of Lockheed Martin and Boeing respectively offering their F-16 Block-70 and F/A-18 Super Hornets to India.

2017

- Air Chief Marshal Birender Singh Dhanoa took over as 25th Chief of the Air Staff on 31 December 2016 and General Bipin Rawat took over as the 27th Chief of the Army Staff on the same day.
- The CCS has approved procurement of 12 more Dornier 228 surveillance aircraft for the Indian Navy, equipped with new sensors and systems. Meanwhile, MoS Civil Aviation Jayant Sinha, inaugurated assembly of the first HAL Dornier 228 for the civilian market at HAL Kanpur.



- The first indigenous AEW&C aircraft, based on the Embraer EMB-145 regional airliner, was officially handed over by the Minister of Defence to the CAS on 14 February during Aero India 2017.
- The Indian Navy test-fired a land-attack version of the Brahmos supersonic cruise missile on 21 April.
- The first of the *Scorpene*-class submarines, INS *Kalvari*, was formally delivered to the Indian Navy by Mazagon Docks on 21 September 2017.
- A modified Sukhoi Su-30MKI of the IAF air-launched a BrahMos ALCM supersonic cruise missile on 22 November 2017 against a sea-based target in the Bay of Bengal.
- The Indian Navy has issued RFI for 57 multirole carrier-borne fighters (MRCBF), this exploratory document preceding an eventual RFP.
- IndiGo is to purchase 50 ATR-72-600 regional airliners based on 'certain conditions', beginning regional services to Hyderabad, Chennai, Bengaluru, Mangalore, Madurai and Nagpur.
- The CAS has restated that new fighters for the IAF was a priority and that the RFI was to be issued "very soon".

2018



- CNS Admiral Sunil Lanba has projected that the Indian Naval Air Arm will expand to some 500 aircraft 'within a decade'.
- The IAF is to receive 48 more Mi-17V-5 medium lift helicopters to augment its considerable inventory of the same. 90 Mi-17 are to be upgraded by No.3 BRD at Chandigarh.
- India and Russia have finalised contracts for 4 new stealth frigates of the *Upgraded Krivak III-class*.
- Vistara are ordering new airliners including Boeing 787 Dreamliners in preparation for international schedule services plus additional A320/321neo for augmenting the present fleet.
- The Defence Acquisitions Council (DAC) has issued an RFP to HAL for 83 Tejas LCA Mk.1As, production of which is planned to begin from 2019-20.
- The MoD has confirmed that the RFIs for Predator 'B' Sea Guardian [drones] was issued to the US Office of Defence Cooperation on 14 November 2017 "but no transfer of technology is envisaged".
- On 6 April 2018, the Indian Air Force formally issued a 'Request for Information' concerning procurement of 110 aircraft of which 75% would be single-seaters and the balance twin-seaters, "but having full operational capability."
- For two weeks in April 2018, the Indian Air Force carried out its largest exercise extant, the aim of *Gagan Shakti* 2018 being "deployment and employment of IAF assets in a short and intense battle scenarios."
- 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).
- IAI will supply Barak 8 LR-SAMs for installation on seven warships of the Indian Navy, the contract being with BEL which is main contractor for the project.



VAYU @ 45



2019

And so to 2019. With 45 years of publication behind it, the *Vayu* entered the last lap towards completing its half century. The year literally started with a 'bang', with several "live" matters concerning air power in the region, including the IAF's precision strikes against terrorist targets in Khyber Pakhtunkhwa, the short but sharp air battles the next day, all being preceded by the IAF's 'routine' fire power demonstration at the Pokhran range, in between which was the biennial Aero India Show at Bangalore.



→ Tejas LCA Mk.1 was accorded 'limited' final operational clearance (FOC) by CEMILAC at Bangalore on New Year's eve. HAL is to deliver all IOC Tejas LCA Mk.1s to the IAF by 31 March 2019.

→ At Aero India 2019, Lockheed Martin unveiled its F-21 multirole fighter, configured for the IAF and offered as "*For India, From India*".

→ MoD issued Expression of Interest(s) for shortlisting of potential Indian Strategic Partners (SP) and foreign OEMs for the 'Procurement of 111 Naval Utility Helicopters (NUH) for the IN.

→ On 25 March 2019, the IAF formally inducted CH 47F(I) Chinook heavy lift helicopters into service at AFS Chandigarh.

→ The first batch of Boeing AH-64E (I) Apache attack helicopters were inducted at AFS Pathankot in September 2019.



→ Admiral Karambir Singh took over as the 24th Chief of the Naval Staff, Indian Navy on 31 May 2019, the 4th Naval Aviator as CNS.

→ India's first indigenously designed and developed long-range sub-sonic cruise missile *Nirbhay* was launched on 15 April 2019 from the Integrated Test Range (ITR) at Chandipur in Odisha.



→ The first IAF Rafale (RB001) was 'technically accepted' at Dassault's manufacturing facility at Bordeaux-Merignac in France on 20 September 2019. Defence Minister Rajnath Singh formally inducted the Rafale into IAF service at a ceremony in France on 8 October 2019.



→ The Navy's fifth Dornier 228 squadron, INAS 313 *Sea Eagles*, was commissioned by the CNS Admiral Karambir Singh on 22 July 2019 at Meenambakkam and was followed by INAS 314 *Raptors* at Porbandar.

→ Discussions are reportedly taking place between the Indian and UK Governments on the design and construction of the Indian Navy's 65,000 tonne indigenous aircraft carrier-II.

→ First arrested landing of the LCA Navy took place at the SBTF in Goa on 13 September, paving the way for carrier landings on INS *Vikramaditya*.

→ Air Marshal RK Bhaduria took over as CAS, IAF on 30 September 2019.

→ Perhaps the largest order for airliners in recent history is that placed by IndiGo for 300 Airbus A320neo family aircraft.



China celebrates years of the People's Republic



Led by a KJ-2000 AEW&C aircraft, are eight J-10 fighters

On 1 October 2019, the Chinese Government celebrated 70 years of Communist party rule and its rise to global superpower status with a massive military parade showcasing the country's prowess and a statement from President Xi Jinping that "no force can shake the status of this great nation".



President Xi Jinping reviews the troops lined up before marching down Tiananmen Square

Xi announced this as he stood at the Tiananmen Square gate where Mao Zedong had declared the *People's Republic of China* in October 1949, 70 years earlier.

China's leadership, past and present, had gathered to watch the military parade of some 15,000 troops and various weaponry including new hypersonic drones and intercontinental ballistic missiles. The People's Liberation Army displayed its newest hardware, including the DF-41 nuclear-capable intercontinental ballistic missile and the DF-17 launcher for a hypersonic glider.

Some 160 aircraft took part in the flypast, which was sobered by overcast skies. Fighters including the J-20 fifth generation fighter, barely seen through the smog-choked skies, plus other types including several AEW&C aircraft. This was followed by a civilian parade, featuring tributes to national icons from founding leader Mao Zedong and the bicycles that China was known for before it became an economic juggernaut, to the cities that have sprung up since the reforms of the 1980s.

Hewing to tradition, Xi wore a grey Mao suit and watched the parade from the same place where Mao had stood to announce establishment of the People's Republic of China on 1 October, 1949.

Order of the Parade at Tiananmen Square, Beijing on 1 October 2019



Troops and equipment before the parade

Ground Combat Segment



Type 99A main battle tanks roll down Tiananmen Square

- Main Battle Tanks : Type 99A
- Light Armour : Type 15, Type 04A infantry fighting vehicle
- Amphibious Assault Vehicle : Type 05A assault vehicle
- Airborne Vehicle : Type 03 airborne IFV
- Self-Propelled Artillery : PLC-181 truck-borne 155mm howitzer, PHL-16 long-range multiple rocket launchers
- Anti-Tank Missile : HJ-10 vehicle



'Hunting Eagle' Autogyros of the Special Operations Force

- Special Operation Equipment : CS/VP4 *Lynx* all-terrain vehicle, *Hunting Eagle* assault autogyro
- Counterterrorism Assault Formation : *Warrior* counter-terrorism assault vehicle, WJ-03B anti-riot armoured vehicle of the People's Armed Police

Naval Operations Segment

- Coastal Anti-Ship Missile : YJ-12B
- Ship/Submarine-to-Ship Missile: YJ-18 anti-ship missile, YJ-18A submarine-launched anti-ship missile
- Shipborne Air Defence Weapon : HHQ-9B long-range anti-air missile, HQ-16 medium-range anti-air missile, HQ-10 short-range anti-air missile, H/PJ-11 CWIS

Air Defence/Anti-Missile Defence Segment

- Early-Warning Radars
- 1st Surface-to-Air Missiles : HQ-9B long-range anti-air missile, HQ-22 long-range anti-air missile
- 2nd Surface-to-Air Missiles : HQ-12A medium-range anti-air missile, HQ-6 short-range anti-air missile
- Field Anti-Air Missiles : HQ-17A short-range anti-air missile, HQ-16B medium-range anti-air missile

Missiles : Strategic, Conventional, Nuclear



DF-17 conventional missiles

- DF-17 Conventional Missiles
- CJ-100 Cruise Missiles
- DF-26 Nuclear/Conventional Missiles



DF-5B nuclear missiles

JL-2 Missiles Formation
 DF-31AG Nuclear Missiles
 DF-5B Nuclear Missiles
 DF-41 Nuclear Missiles

The Flypast



HY-6 aerial refueller with two J-10B air superiority fighters

Command Echelon

One KJ-2000 AEW/C aircraft, eight J-10 fighters from the *August 1st Aerobatics Team*
 Five J-20 stealth fighters, five J-16 strike fighters, five J-10C multirole fighters
Early Warning & Control Echelon in three formations :
 One KJ-500 AEW/C aircraft, four J-16 strike fighters



J-20 fifth generation fighters over Tiananmen Square

One KJ-200 AEW/C aircraft, four J-16 strike fighters
 One Y-8 C&C aircraft, four J-16 strike fighters

Maritime Patrol Echelon

One KJ-500H AEW/C aircraft, two Y-8G ASW patrol aircraft
 One KJ-500H AEW/C aircraft, two Y-8G reconnaissance aircraft

Transport Echelon

Three Y-20 strategic airlifters, three Y-9 tactical airlifters

Support Echelon

One Y-9 electronic-warfare aircraft, one Y-9 psychological warfare aircraft, one Y-9 aeromedical aircraft
 One Y-8 long-range support jammer aircraft, one Y-8 electronic-warfare aircraft, one Y-8 electronic reconnaissance aircraft

Bomber Echelon

Three H-6N long-range strategic bombers
 Three H-6K bombers
 Three H-6K bombers

Airborne Refuellers

One HY-6 tanker aircraft, two J-10B air superiority fighters

Carrier-Based Echelon

Five J-15 carrier-based fighters



Helicopters in '70' formation

Air Assault / Reconnaissance / Attack Helicopters

Five Z-9 armed reconnaissance helicopters
 Nine WZ-10 attack helicopters
 Three WZ-19 light attack helicopters,
 Six Z-20 general utility helicopters
 Nine Z-8B transport helicopters
 Eight WZ-19 attack helicopters

Trainer aircraft

Five JL-10 trainers
 Five JL-9 trainers
 Twelve JL-8 trainers

Behind the Scenes in Beijing

Preparing for the 70th Anniversary Parade



Dancers on the streets of Beijing on eve of 1 October 2019

In brief, this would be the biggest Chinese military parade ever held.

“We believe you will not be disappointed,” said Maj Gen Tan Min, deputy chief of staff of the Central Theatre Command of the People’s Liberation Army, unable to suppress a proud smile. With 160 fighters, bombers and various aircraft support aircraft, the parade on 1 October 2019 will be grander than the one that marked the founding of the People’s Republic of China in 1949, when just 17 aircraft could be found and China’s first premier, Zhou Enlai, ordered that they fly over twice. “Premier Zhou, we have enough fighter planes now” ! trumpeted a *China Daily* headline (*see separately*).

The parade however had a serious objective, not only to project China’s might as a rising military power, but also to project Xi Jinping’s consolidation of power within the Communist Party, 18 months after he ushered in a move to remove presidential term limits that means he can perhaps rule for life. The parade aimed to drum up a sense of unity, energy and political purpose at a time when China faces multiple domestic and global challenges: a slowing economy, the trade war, a multi-pronged U.S. attack on its champion tech giant

They were not there to brag, but when three Chinese military officials laid out plans for China’s super-sized 70th anniversary parade to be held on 1 October 2019, they couldn’t help sounding a teensy bit smug. “There will be more generals, more planes, more Chinese-made rockets and advanced military equipment showcasing Chinese know-how than ever before – 580 pieces of equipment, to be exact – there will be the usual aircraft flying in formation with colorful contrails, and not-so-usual helicopters forming a giant number ‘70’, brightly hued flags representing the revolutionary spirit of Chinese military martyrs, and 15,000 military personnel all in top shape physically, morally and of course politically, each man at least 5’9” but not more than 6’1”, and for the first time, there were two Chinese female generals marching in step”.



PLA women contingent during practice for the parade



Security was very tight in Central Beijing those days

China. “It seems that there are always some people who are playing this issue up, where there’s no issue. They would say when we show our weapons to the public that we are flexing our muscles but if we don’t show our weapons they will say we’re not being transparent.”



Armed Police at metro station Beijing underground

Down to earth, one of the most serious domestic problems actually are soaring pork prices, seen by Communist officials as highly sensitive because it is a key part of Chinese diet, having been caused by an African swine fever epidemic that has swept the nation and wiped out millions of hogs.

Maj Gen Cai Zhijun said the parade will be “stately” and “solemn.” More than 50 patriotic songs will be performed by a military orchestra of thousands. “The message is to uphold the absolute command of the party and to show unwavering loyalty and willingness to defend the leadership,” he said.



Unobtrusive, but obvious, police presence near the Forbidden City on eve of the parade

Huawei, a political crisis in Hong Kong, criticisms over its detention of more than a million members of the Uighur Muslim minority in the western region of Xinjiang and pushback from many countries against Chinese influence operations.

“All the militaristic pomp is not a sign that China is a global threat”, said Senior Col. Wu Qian, spokesman for the Ministry of National Defense of the People’s Republic of



Almost every dwelling in Beijing flew the red flag

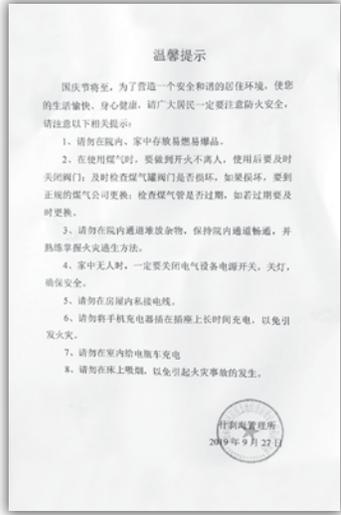
China's military and Beijing authorities had been in feverish preparation for weeks. The internet, often unreliable, slowed to a trickle, constantly dropping in and out. On 28 September, the city was in virtual lockdown, with the city centre blocked off and subways bypassing stations to make way for a full dress rehearsal with tanks, soldiers, aircraft in formation with red, blue and yellow contrails, and helicopters – the third city-stopping rehearsal then. Traffic was gridlocked. People were stranded. A modern dance performance planned months ago was ordered canceled – although officials relented at the last minute. Flags and red lanterns had been put up all over the city and intricate artwork depicting scenes such as galloping horses and camels have been constructed of colourful flowers and plants.

This obsession with perfection certainly produced a dazzling parade, but put out some Beijingers, notably Hu Xijin, the editor of the Communist Party-owned *Global Times*, one of China's best known tweeters, although Twitter, Facebook and other Western social media and media sites are banned under China's strict censorship laws. Those who access such sites usually use a virtual private network, illegal in China – but most Chinese see only what censors allow. Hu, who usually tweets about inside gossip on the trade war or how China's leaders are losing patience with Hong Kong pro-democracy protests, was obviously fed up when he vented about his trouble getting access to foreign websites.

"The Chinese national holiday is approaching and accessing foreign websites has become extremely difficult," he complained on Weibo, China's version of Twitter, forgetting that most Chinese can never access them. "It even affected the *Global Times*' daily work. In my opinion, such action is a bit too much. I hereby make a suggestion and hope it will be heard," he wrote calling on authorities to "trust the masses" and allow more access to foreign websites. He later must have thought better of it, as the post was swiftly deleted.

The generals described logistical arrangements and rehearsals in detail. For example, food for soldiers taking part in the parade was scrupulously tested three times a day to make sure it was safe, and there were boot-cleaning stations to ensure a mirror shine on marching boots. They marched up and down for many hours, sometimes all night – as did the civilians rehearsing flag-waving performances. Some 60,000 civilians took part and the total number involved in the parade was 100,000, according to the *Global Times*. People had been practicing since July. One participant told the newspaper that he had recently been practicing all night. 🦋

By absolute co-incidence, *Vayu's* editor was in Beijing just days before the big event on 1 October 2019 and, as a tourist, could vouch for much of what is written in the article.



Notice on every door in Hutong

70 years earlier



PLA troops at Tiananmen Square on 1 October 1949

When the Chinese Nationalist Forces retreated to Taiwan in 1949, they left behind considerable amount of military equipment, including aircraft which the People's Liberation Army (PLA) incorporated into their inventory. Amongst the aircraft were P-51 Mustangs, Mosquitoes and PT-19 basic trainers, some of which took part in the historic 1 October 1949 parade at Tiananmen Square in Peking (now Beijing).



Captured P-51 Mustangs in PLAAF markings

In 1949, the PLAAF had less than 3000 personnel including 200 pilots, 30 navigators, 2373 mechanics and miscellaneous personnel. There were a total of 160 aircraft of 21 different types some of which were then used during the Tibet campaign of 1950 with a few C-46 and C-47 transports also air dropping supplies. Over the next two years, the PLAAF got Tu-2 bombers and La-9 fighters plus Il-12 transports from the Soviet Union.

The PLAAF was very rapidly expanded following China's intervention in the Korean War, expanding to over 1000 aircraft by mid-1951, including the first generation MiG-15 jet fighters.



Profile of MiG-15 in PLAAF colours



The enigma of China's Z-20 medium utility helicopter

China's state media has given some details about the Harbin Z-20 medium-lift transport helicopter, a fortnight after it made its public debut at the military parade in Beijing on 1 October 2019. The Z-20 has a fly-by-wire flight control system, according to Li Linhua, chief technology expert at the Helicopter Research and Development Institute of China's Aviation Industry Corporation, or AVIC, the Chinese state-owned aerospace and defence conglomerate of which manufacturer Harbin Aircraft Industry Group is a subsidiary.

Li added that its fly-by-wire technology reduces the Z-20's overall weight and "makes it easier to fly". Chen Guang, Vice General Manager of AVIC's helicopter subsidiary Avicopter, stated that the Z-20 was an indigenous product designed and built exclusively by AVIC whose officials provided some information during the fifth China Helicopter Exposition in China which showcased PLA's Z-20s in both flight and static display.

The Z-20 programme was first known of to in 2013, and sightings of a likely prototype

plus satellite photos began to emerge soon after. Following a development and test phase, the Z-20 was reported to have entered limited service with the People's Liberation Army's aviation arm in early 2018.

Powered by two 1,600 kW turboshaft engines, a display board accompanying the exhibited engine noted that the power plant (WZ-10) was suitable for medium and large helicopters. Performance of the engine, which is claimed to have been independently developed is reportedly comparable with those produced by leading international manufacturers. No further information was released about the active vibration control system, nor of the rotor design features. Images indicate that a de-icing system is integrated into the main rotor blades, to enhance the helicopter's all-weather capabilities.

China has meanwhile been negotiating to acquire a major share in the Ukrainian company Motor Sich which is one of the largest engine manufacturers for aircraft and helicopters worldwide. In 2017 Beijing Skyryzon Aviation had purchased 41% holding in Motor Sich, but in September

2017 a Ukrainian court froze the holding for national security reasons. Beijing Skyryzon Aviation wanted to set up an assembly and servicing plant in Chongqing in southwest China, but US resistance to the sale has kept the matter pending so far.

There have been numerous suggestions that the Z-20 is in fact a "cloned Black Hawk", whose development actually kick-started after the US operation in Abbottabad that took out al-Qaeda leader Osama bin Laden in 2011. According to reports at the time, Pakistan's intelligence service gave Chinese engineers access to one of the Black Hawks, which had crashed during the operation, even though the Marines had tried to destroy the downed helicopter. Many have dubbed the Z-20 as 'Copyhawk', with features of the Sikorsky S-70C-2 helicopter, 24 of which were procured in the 1980s, this being a civilian version of the UH-60 Black Hawk.

It is also learnt that the PLA has been deploying the Z-20 in Tibet to supplement and eventually supplant the large numbers of Russian-origin Mi-17 medium lift helicopters in the high plateau region. 🦁

One, Two, Three ... Go !



“We have recently named a new airline. *One Two Three Airlines Co., Ltd.*, previously known as China Eastern Business Jet Co., Ltd., and wholly owned by China Eastern (CES). In the future. *One Two Three Airlines* will be responsible for operations with domestic aircraft, first the ARJ21, and then the first domestically developed and produced large passenger jet, the C919.”

“We have named the company *One Two Three* to signify ‘a future of unlimited hope’. As Lao Tzu said, that ‘Tao begets One, One begets Two, Two begets Three, and Three begets all things’. I think this has two meanings. First, Tao is the mother of the universe and the energy to give birth, which breeds everything and means there are unlimited possibility for everything. Second, Tao is a constant, the law and the unique will. As an early adopter of the made-in-China jets, *One Two Three Airlines* should first have confidence in China’s aircraft manufacturing industry, and respect the laws of aircraft manufacturing and aviation operations. Confidence reinforces confidence; order underlies order. Nature allows unknown life to produce unlimited possibilities, and we should let the cause of unknown results breed unlimited hopes.”

“The past 70 years have witnessed the evolution of China’s transportation networks from virtually nothing. When ‘New China’ came into being, roads were uneven, trains were crowded, routes



were limited, and transportation was underdeveloped. Transportation between villages was non-existent, let alone that between cities. After 70 years of unremitting efforts, transportation in China has taken on a new look.” According to the data recently released by the National Bureau of Statistics of China, as at the end of 2018, China’s railway mileage and highway mileage are now 5 times and 59 times those of 1949 respectively; mileage of scheduled flights is 734 times that at the end of 1950; mileage of high-speed railways and the total mileage of highways is today longest in the world.

Over the past 70 years, the development of civil aviation in China is also a self-made story

of growth out of nothing. China began with assembly of foreign-design aircraft and with each new generations’ there was belief and determination to take on the “impossible” and make it “possible”. The ARJ-21 is a 70+ seater jet airliner, with a planned version seating 105 passengers while the C919 will have a capacity of 168 economy seats and the CR929, jointly developed with Russia, will be a 250-300 seater. ✈️

Liu Shayong, Chairman China Eastern Air Holding Co Ltd.

China Eastern Airlines is now one of the world’s largest, with some 700 airliners in service or order.

Dubai Airshow 2019: “a big success”



Static lineup close to the chalets (photo: Premjit Singh)

Sales of \$54.5 billion and record attendance

Dubai Airshow 2019, held from 17-21 November, has been hailed as a success by exhibitors, delegates and sponsors alike, as a lively week of trading came to a close. With more than 1,288 exhibitors (up 10% from the previous edition) in attendance, 161 aircraft on the event’s static display and a packed schedule of conferences and keynotes, the programme was the show’s busiest to date – as evidenced by the footfall of 84,043 trade attendees. Sales were also booming, with the order book on site reaching \$54.5 billion by close of business with the United Arab Emirates announcing a contract for the purchase of two additional GlobalEye’s from Saab.

Dubai Airshow 2019 was officially opened on 17 November, by Sheikh Mohammed bin Rashid Al Maktoum, Vice-President and Prime Minister of UAE and Ruler of Dubai, with Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of UAE Armed Forces. Also in attendance was Crown Prince of Dubai Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum, who joined his father for an inaugural tour of the site.

The static display included many new civil, business and military aircraft plus a selection of helicopters from industry leaders

and new players, including an A330neo displayed by Airbus, a Viking Twin Otter Series 400 from Viking Aircraft and Cessna Caravan C208B alongside a G120TP from Grob Aircraft. Emirates Airline showcased its ultra long range Boeing 777-300, A380-800 and Airbus Corporate Jet 319 while the AURA 100 UAV was on display from Aura Group of Companies (AGC).

Gulfstream showed its G500, G600 and G650 aircraft and other inclusions were from the Japanese Ministry of Defence, the French Air Force and of course the UAE Air Force. Soaring above the Dubai Airshow in the flying display were the UAE’s *Al Fursan* aerobatic display team, in addition to the French Air Force *Patrouille de France*, returning to the Dubai Airshow for the first time since 2011. Also flying was a Dassault Rafale and a Boeing B787-9 as well as several helicopters and the UK-based display team, the *Blades*.

Among 100 new exhibitors, were Saudi Arabia’s The Helicopter Company, which was also a key event sponsor. CEO Yahya Homoud Alghoraibi said the firm’s first show had been very successful. “We have done more than we expected, we have met and had discussions with a lot of companies and have seen a lot of customers and shown our aircraft to many people as well, so we are very happy with what has taken place. We are a

new company, so relationships matter a lot. Communication matters as well, and Dubai Airshow is one of the best communicators.”

Making its debut this year was EDGE, a group comprising 25 local entities working in five aerospace capability clusters, which

EDGE at Dubai airshow

EDGE, the advanced technology group inaugurated by Sheikh Mohamed bin Zayed Al Nahyan on 5 November, had the largest individual presence at this year’s Dubai Airshow. EDGE is the first-ever Advanced Technology Partner of the Dubai Airshow in its 30-year history. With the largest pavilion at the Airshow, EDGE showcased the capabilities of 11 entities: ADASI, AMMROC, Al Tariq, Beacon Red, EARTH, EPI, ETS, GAL, Halcon, Horizon and Jaheziya – covering industries focusing on autonomous systems, precision-guided aerial weapons - all the way to guided systems and MRO services for military aircraft, to name a few.



Super Mushshak from Pakistan made its familiar appearance (photo: Premjit Singh)

For the first time in 2019 there was a growing focus on space exploration regionally, recognised with its own conference programme, opening with *Women in Space*, hosted by the UAE Space Agency and featuring speakers from the UN and Boeing, among others. Aimed at examining the key role that female scientists, researchers, engineers and astronauts will play in the future of the global space industry, the conference proved a huge draw and former astronaut, the European Space Agency's Claudie Haigneré, said she found the level of engagement very encouraging. "I



Wing Loong I and II UAVs from China were displayed along with their weapons (photo: Premjit Singh)

was launched shortly before the show. (*see article*) Among the firms under the EDGE umbrella was Al-Tariq, and its CEO Theunis Botha said that the Dubai Airshow had been a great way to establish the brand's presence in the region. "EDGE has been very well received. We have been very busy and have been inundated with requests and interest from several friendly nations around us. I think we've had an excellent show, with lively interest in the product range that we're offering and this is exciting stuff."

Elsewhere, a host of speciality conferences, offering industry-specific keynotes, Q&A sessions and networking opportunities, attracted large crowds of professionals. Set across two days, the Global Air Traffic Management (GATM) conference took a close look into the future of traffic control, with virtual towers proving to be a particularly hot topic. *Cargo Connect*, a show within the show focused on the air freight industry, with data sharing across both geographical and business boundaries being a key focus.



Brahmos from India put on an impressive display (photo: Premjit Singh)



The India Pavilion (photo: Premjit Singh)

felt that really something is going on here, and I've been really impressed because this shows a real possibility for change. The new generation coming up here is so refreshing.”

Meanwhile, the Space Tech Talks schedule looked in-depth at the technological advancements needed for the next generation of space exploration, and the impact they are expected to have on the wider world. Indeed, the impact of both technology and space research on all aspects of industry was evidenced across the show floor, where exhibits ranging from Dubai Police’s new flying bike for hard to reach emergencies to new products in the medivac field, through to the first commercial space flight suits from Virgin Galactic, were all on show.

On the show’s culmination, Michele van Akelijen, Managing Director of show organisers Tarsus F&E LLC Middle East, stated, “We always want to outperform our last show, and 2019 has gone above and beyond expectation, with so much great business being done alongside an engaging and innovative programme of conferences, exhibits and flying displays. We have already seen exhibitors rebooking for the next edition, and we look forward greatly to seeing what the next two years of aerospace development will bring to our 2021 edition.”

Dubai Airshow 2019 proved to be a bumper year for armed forces procurement and maintenance deals, with the UAE’s Ministry of Defence among those unveiling major contracts at the show.



(photo: Premjit Singh)

UAE to Procure Additional GlobalEyes from Saab



The United Arab Emirates have announced that they intend to conclude a contract amendment for the purchase of two additional GlobalEye Airborne Early Warning & Control aircraft from Saab. The potential order value related to this contract amendment would be US\$ 1.018 billion. GlobalEye provides air, maritime and ground surveillance in a single solution, combining a new extended range radar with the ultra-long range Global 6000 jet aircraft from Bombardier.

Qatar Airways places \$4 billion LEAP-1A order

Qatar Airways has ordered CFM International LEAP-1A engines to power its new fleet of 50 Airbus A321neo family aircraft, placing the largest A321neo order ever in the Middle East; total value of \$4 billion US at list prices. Qatar Airways has been a CFM customer since 2015 and currently operates a fleet of eight CFM56-5B-powered A320ceo family aircraft. The first LEAP-1A-powered A321neo is scheduled to be delivered in 2020.

Indeed, it was Halcon, which is now operating under the EDGE umbrella, which scored the UAE MoD's first big contract, securing a purchase deal for various ammunitions worth US\$980 million. Elsewhere, Lockheed Martin received a UAE MoD contract to provide F-16 equipment, worth US\$20.6 million. "The Dubai Airshow provided an opportunity to reaffirm our enduring commitment to this dynamic region and offered Lockheed Martin a valuable opportunity to connect and engage with our local partners, as well as to showcase our wide range of advanced technological capabilities", stated Robert S. Harward, the firm's chief executive for the Middle East. "We actively support the UAE's goal of becoming a leader in cutting-edge defence solutions and look forward to expanding our role in helping it innovative ideas while attracting local talent to the defence sector."

The new C-390 Millennium by Brazil's Embraer was announced at a press conference at Dubai Airshow 2019. The aircraft will be manufactured in collaboration with Boeing under a new partnership, also announced at the show, known as Boeing Embraer – Defense. Marc Allen, President of Embraer Partnership & Group Operations, Boeing, stated, "The unique relationship of the air force and Embraer over 50 years is an important part of the reason of its capability development, and we especially appreciate [Embraer's] continued engagement as we build now this partnership between and across our companies."

Emirates signs for 50 Airbus A350 XWBs



Emirates signed an order for 50 Airbus A350 XWB worth \$16 billion. The deal, announced by Sheikh Ahmed Bin Saeed Al Maktoum, Emirates' Chairman and Chief Executive, was signed with Guillaume Faury, Airbus' Chief Executive Officer, will have the first aircraft delivered in May 2023. The order replaces a previous agreement of intent to purchase 30 A350s and 40 A330 Neos, and reflects Emirates' desire to move towards a new configuration featuring Premium Economy cabins.

Air Arabia orders 120 Airbus A320neos



Air Arabia, the Middle East and North Africa's first and largest low cost carrier, has signed a firm order for 120 Airbus aircraft comprising 73 A320neos, 27 A321neos and 20 A321XLRs.

Embraer Unveils its C-390 Millennium



Embraer has announced the name and designation of its multi-mission medium aircraft, being the Embraer C-390 Millennium. The

new designation reflects increased flexibility and value for operators that look for a transport/cargo aircraft to perform airlift and air mobility missions, among others. In 2009, the Brazilian Air Force (FAB) contracted Embraer to design, develop and manufacture the aircraft as a replacement for its aging C-130 fleet.

EDGE inaugurated

“An Advanced Technology Conglomerate, Poised to Transform Defence Industrial Capabilities”



Sheikh Mohamed Bin Zayed Al Nahyan with CEOs of the newly announced UAE Advanced Technology Company, EDGE

On 5 November 2019, Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces inaugurated EDGE, a company set to reposition the UAE as a notable global player in advanced technology. “With the digital era creating unprecedented challenges and opportunities, EDGE is positioned to disrupt capabilities across a wide breadth of industries.”

Starting with break-through innovations in the high investment defence sector, and with a priority on national security, EDGE is consolidating more than 25 entities, including subsidiaries from the Emirates



The spectacular inauguration of EDGE at Abu Dhabi

Defence Industries Company (EDIC), Emirates Advanced Investments Group (EAIG), Tawazun Holding, and other independent organisations.

As Faisal Al Bannai, CEO and Managing Director, EDGE stated, “EDGE will invest extensively across R&D, working closely with front-line operators to design and deploy practical solutions that address real world challenges. The solution to address hybrid warfare, lies at the convergence of innovations from the commercial world and the military industry. Established with a core mandate to disrupt an antiquated military industry generally stifled by red tape, EDGE is set to bring products to market faster and at more cost-effective price points.”

experts and talent from around the globe, to help on a wide spectrum of modern product development, ranging from ideation to building cross domain capabilities over its five core business clusters: Platforms & Systems, Missiles & Weapons, Cyber Defence, Electronic Warfare & Intelligence and Mission Support.

Vayu was informed that the company is set to implement advanced technologies such as autonomous capabilities, cyber-physical systems, the Internet of Things, advanced propulsion systems, robotics and smart materials, with a focus on artificial intelligence across all its products and services. Commenting on EDGE, Tareq Abdul Raheem Al Hosani, Chief Executive

EDGE as ‘first ever advanced technology partner’ at Dubai Air Show

EDGE, the advanced technology conglomerate, had the largest individual presence at Dubai Airshow 2019. Integrating over 25 entities from Emirates Defence Industries Company, Emirates Advanced Investments Group, Tawazun Holding, and other independent organisations, EDGE was the first ever Advanced Technology Partner of the Dubai Airshow in its 30-year history.

Technology has always been a national priority for the UAE and EDGE has been established to build on this effort to significantly develop the country’s technology leadership, globally. Starting with breakthrough innovations in the high investment sector of defence, and a priority on national security needs, EDGE has longer-term plans to transform a wide breadth of industries through technology spinoffs.

Having the biggest pavilion at the Dubai Airshow, EDGE showcased capabilities of 11 subsidiary companies: ADASI, AMMROC, Al Tariq, Beacon Red, EARTH, EPI, ETS, GAL, Halcon, Horizon and Jaheziya. EDGE will be investing extensively across R&D to develop technologies with transformational impact, and a state-of-the-art ‘Future Lab’ projected some of these advanced solutions and research areas of focus through a series of holographic displays.

The company also plans to leverage its partnership with the Dubai Airshow to raise its profile in the global aerospace arena and meet with partners to forge and strengthen strategic relationships for the future.

“Technology is drastically changing the aerospace industry, and EDGE is taking significant strides to respond with agile, bold and disruptive solutions - bringing products to market faster and more efficiently,” stated Faisal Al Bannai, CEO and Managing Director of EDGE.



Mr. Al Bannai has been appointed to lead EDGE, based on his start-up background and proven track record in leveraging emerging technologies to expand business opportunities at home and abroad.

In contributing to innovation and advanced technology growth, EDGE is to develop deeper partnerships with world-leading industry OEMs and defence contractors, the SME sector and academia alike. Accelerating the rate of innovation, EDGE will also be attracting elite industry

Officer of Tawazun Economic Council (the UAE’s Defence Enabler) stated, “We are invested in managing the uncertainty that technology brings by adapting our focus and capabilities towards a sustainable defence and security industry. EDGE will help us transform our domestic capabilities, while growing our engagements on defence and security exports.”

In 2018, the UAE topped the Global Innovation Index for the Arab world and EDGE aims to help the UAE to retain and expand that foremost position.



Faisal Al Bannai,
CEO and Managing Director, EDGE



- ✦ Leveraging advanced technologies, EDGE will evolve national security solutions and industries, beyond defence
- ✦ Phase 1 integrates 25+ entities from Emirates Defence Industries Company, Emirates Advanced Investments Group and Tawazun Holding
- ✦ Leveraging advanced technologies, EDGE will evolve national security solutions and industries, beyond defence



EDGE إيدج

EDGE is an advanced technology group established to develop disruptive solutions for defence and beyond. Solving real world challenges, it is dedicated to bringing innovative technologies and services to market with greater speed and efficiency. Starting with breakthrough innovations in the high investment sector of defence, EDGE places priority on national security. Consolidating over 25 entities and employing more than 12,000 minds, it offers expertise in five core clusters: Platforms & Systems, Missiles & Weapons, Cyber Defence, Electronic Warfare & Intelligence and Mission Support.

With adoption of advanced technologies such as autonomous capabilities, cyber-physical systems, advanced propulsion systems, robotics and smart materials, and a focus on artificial intelligence across all products and services, EDGE is creating interoperability and developing cross domain expertise – responding to an era where adaptability is everything.

Headquartered in the United Arab Emirates, EDGE is a catalyst for change, creating technologies that transform and transcend an array of industries.

“With Air Force and Air Defence being key areas of focus for militaries, we are invested in reimagining aviation capabilities and supporting its unprecedented growth and development, through technology exploration in areas such as autonomous vehicles, cyber-physical systems, advanced propulsion systems and robotics, with a focus on artificial intelligence across our products and services. The Dubai Airshow gives us an opportunity to deepen our strategic relationships within the aerospace industry”.

More F-35s for Israel



A further two Israeli Air Force F-35I Air fighters arrived at Nevatim Air Base on 15 September, departing from the LM factory in Fort Worth, Texas two days earlier and initially landing at Lajes in the Azores before continuing to Israel. A further two are due to arrive before the year's end with 50 scheduled to enter service. All aircraft delivered to date have joined Israel's first F-35I unit, 140 'Golden Eagle' Squadron and a second unit, 116 Squadron 'Defenders of the South', was established at Nevatim last April and will begin to receive its Adirs in 2020.

Rafale F3Rs deploy to UAE



Armée de l'Air Rafale B fighters have deployed to Base Aérienne 104 Al Dhafra in the United Arab Emirates, for hot weather trials of the latest F3R capability standard. The team from Centre d'Expertise Aérienne Militaire (CEAM, the French Air Force test and evaluation centre) conducted a series of trials using Rafale Bs from Escadron de Chasse 3/30 'Lorraine' and Escadron de Chasse et d'Expérimentation 1/30 (ECE 1/30) 'Cote d'Argent'. Trials involved 30 sorties including use of the Talios laser designation pod, the effectiveness of the terrain monitoring radar in a desert environment and thermal protection of the Rafale cockpit.

Final Typhoon for RAF



The last of 157 Eurofighter Typhoons for the Royal Air Force has been delivered to the Service at RAF Coningsby, Lincolnshire, being the FGR Mk. 4 of Tranche 3. The Typhoon Capability Director for BAE Systems – Air, said: "Typhoon was designed to continuously evolve and its untapped potential continues to be realised with new investments in radar, communications, data management, weapons and connectivity further strengthening its role in the frontline of securing the skies over the UK." Meanwhile, at BAE Systems production facility in Warton, Lancashire, assembly of Typhoons for the Qatari Emiri Air Force has begun, with the first delivery in 2022.

UAE F-16s in large force exercise



A coalition of US and French aircraft joined the United Arab Emirates Air Force and Air Defence (UAEAF&AD) for a two-day large-force exercise in the UAE. Staged by the UAE Air Warfare Centre in August 2019, the exercise involved UAEAF&AD F-16E/Fs, French Rafales and US Navy EA-18Gs. The USAF also provided F-35As (from the 4th Expeditionary Fighter Squadron), F-15Es (336th EFS), F-15Cs (159th EFS), plus an E-3 (968th Expeditionary Airborne Air Control Squadron) and a KC-10 (908th Expeditionary Air Refueling Squadron).

Objectives included a strike mission in an area heavily defended by enemy aircraft and surface-to-air missile systems.

Upgraded Il-78-2 tanker



The first Ilyushin Il-78-2 standard aircraft completed post-conversion test sorties at Zhukovsky on 26 September. After 18 months of modernisation, including new flight and navigation suite, plus self-defence and communications equipment, the aircraft is now being cleared for service. The equipment fit is similar to that of the Il-76MD-90A and Il-78M-90A, but retains the old D-30KP engines. The Il-78-2 programme will modernise the existing VKS fleet of Il-78 and Il-78M tankers.

Royal Canadian Air Force (RCAF) C295 in final livery



The first Airbus C295 for the Royal Canadian Air Force's (RCAF) Fixed Wing Search and Rescue Aircraft Replacement (FWSAR) programme, has been displayed in its final livery at Airbus facility in Seville, Spain.

NH90 Sea Lion for Germany

Airbus Helicopters has delivered the first NH90 Sea Lion naval multi-role helicopter to the German Armed Forces (BAAINBw), with a further two to be delivered by the end of



2019. 18 Sea Lions have been ordered for the Germany Navy, with deliveries expected to be completed in 2022.

Second RAF Poseidon



Maiden flight of the second P-8A Poseidon MRA1 for the RAF took place on 15 September, which was a short trip to Boeing Field for outfitting with mission equipment. The mission systems integration phase will follow prior to delivery to Naval Air Station Jacksonville, Florida.

KC-130J delivered to French Air Force

The first KC-130J for the *Armée de l'Air* was delivered to Base Aérienne 123 Orléans-Bricy in September 2019. The variant was awarded military type certification by the Direction Générale de l'Armement (DGA) on 5 September, the third Super Hercules to arrive at Orléans-Bricy. A second KC-130J will be delivered in 2020, this refueling version of the C-130J allowing the air force to refuel Caracal helicopters in flight.

F-35s for Poland

The US State Department had approved a possible Foreign Military Sale to Poland of 32 F-35A 5th generation fighters. The acquisition would cost an estimated US\$6.5bn, including support.



Meanwhile, six Italian Air Force F-35As were deployed to Iceland in September to perform the type's first NATO air surveillance and air policing mission. The Lightning IIs initially conducted familiarisation flights from Keflavik air base before being certified to fly air policing missions in Icelandic airspace.

New fighters sought by Croatia

Croatia has received five unofficial offers to replace its Air Force's MiG-21s with new fighters, as also another eight offering second-hand aircraft. The expressions of interest include those from Denmark (used F-16s), France (used Mirage 2000s or new Rafales), Israel (F-16 Baraks), Italy (used Typhoons), Norway (used F-16s), Sweden (Gripen C/Ds) and the US (new F-35As or F-16 Block 70/72s).

Meanwhile, Poland's defence minister Mariusz Blaszczak has signed a letter of request with the US Defense Security Cooperation Agency for the government-to-government purchase of up to five C-130H transports. Poland already operates five older C-130Es.

First Norwegian P-8A aircrew



Royal Norwegian Air Force (RNoAF) aircrew have graduated from USN Patrol Squadron 30's (VP-30's) Category 2 school at NAS Jacksonville, Florida, becoming the country's first to transition from the P-3C to the P-8A. VP-30's Foreign Military Sales Division facilitated the course with the RNoAF's 333 Skvadron, which began in early March. Ten more RNoAF aircrew are slated to arrive at VP-30 for training in the near future.

UAVs for Turkish Jandarma



Turkey's *Savunma Sanayii Baskanligi* (SSB, Presidency of Defence Industries) have delivered six additional Bayraktar TB2 armed unmanned aerial vehicles to the *Jandarma Havacilik Komutanligi* (Gendarmerie Aviation Command) to join six previously delivered, which first entered service in March 2017 and included two of the armed TB2 variants. The Turkish Aerospace Anka-S armed UAVs have been specifically delivered to meet requirements of the Turkish Armed Forces, the type being in service with the Turkish Air Force, with plans for a total of 40. Three Anka Block Bs are also being operated on long-term lease from SSB by Turkish Naval Forces Command.

Wing Loong 1 drones for Serbia



Serbia will reportedly take delivery of nine Chengdu Pterodactyl I (Wing Loong I) unmanned aerial vehicles with a possible follow-on order for 15 more. The Serbian deputy defence minister has confirmed that Serbia will buy armed UAVs from China with plans to assemble them locally, using Chinese-supplied technology.

Iran's new helicopters

Four locally produced helicopters have been delivered to Iran's Islamic Revolutionary Guard Corps (IRGC) Ground Forces, being three *Shahed 278s* and one *Shahed 285*, at the central province



of Isfahan. The *Shahed 278* is a four-seat, armed, light utility and reconnaissance helicopter using components from several other types and is externally similar to the Bell 206. Further development of the *Shahed 278*, the *Shahed 285* (or AH-85A) will be a single-seat light attack/reconnaissance helicopter.

MA60s for Angola



Xian MA60s have been delivered to the *Força Aérea Nacional de Angola* (FANA, Angolan Air Force), arriving at *Base Aérea No.1 Luanda-Belas/Quatro de Fevereiro International Airport* from China. The aircraft wore FANA titles but only carried Chinese ferry registrations rather than military serials. They are to be operated by the *Esquadra de Transportes* based at Luanda.

Chinese Z-10s and Mi-171s in Russian exercises



Eight Chinese People's Liberation Army Aviation Corps helicopters were recently deployed to Russia to take part in joint exercises. The four Z-10 attack helicopters and four medium-lift Mi-171s reportedly arrived at the civilian airport at Chelyabinsk for a fuel stop and continued the following day to the Russian air base at Orenburg en route to the Donguz training ground in the Orenburg region where they took part in the *Tsentr 2019* exercise.

Philippine Air Force orders Gulfstream G280



The Philippine Air Force has ordered a new Gulfstream G280 business jet for use as a command and control (C2) asset. Phil. Air Force Lt Gen Rozzano D Briguez had earlier said that the G280 was one of two fixed-wing C2 aircraft being purchased under the Philippines AFP modernisation programme. The other is a C295M which is similar to the three C295Ms serving with the 220th Airlift Wing and can also be used for VVIP transportation.

P-8s for RAAF

Another P-8 for the Royal Australian Air Force arrived in-country during October 2019, the 11th RAAF Poseidon being handed over for acceptance testing in the US on 27 September. In February 2014, the Australian government had approved the acquisition of eight P-8As and an order for the first four was placed in August 2015, followed by a second contract the following January. The Defence White Paper published had confirmed plans for a further seven P-8s aircraft.

AH-6i Helicopters for Thailand

The US State Department has approved a possible Foreign Military Sale to Thailand of eight AH-6i light attack reconnaissance helicopters and related equipment for an estimated cost of \$400 million.



Italy joins 'Team Tempest'



As noted earlier, Italy has become the second nation to join the UK's Tempest sixth-generation fighter project, the two governments signing a Statement of Intent (SOI) at the Defence & Security Equipment International (DSEI) defence exhibition in London. The SOI outlines several bilateral commitments including closer government alignment on future Typhoon enhancements; deepening discussions on Tempest military requirements; developing a combat air roadmap and identifying opportunities to integrate advanced technologies from the Typhoon into the Tempest, developing an innovative agile and co-operative industrial framework to deliver the Tempest; and launching pilot studies to demonstrate new and collaborative ways of working. This SOI involves several Italian firms including Leonardo Italy, Eletronica, Avio Aero and MBDA Italy, to define requirements of the aircraft.

Meanwhile Sweden has formally made its intention on involvement with the Tempest project, the MoU signed between the UK and Sweden in July covering joint development of future technologies associated with the platform.

UK F-35B in operational testing



Royal Air Force F-35B Lightnings have returned to the US for Operational testing on the Royal Navy aircraft carrier HMS *Queen Elizabeth* (R08). These aircraft from the *Lightning Force* are the first British fighters to join the carrier at sea when they began

the WESTLANT 19 trials off the US eastern coast. The F-35B had earlier completed an eight-week programme of fixed-wing *First of Class Flight Trials* on board HMS *Queen Elizabeth* in 2018. The UK *Lightning's* maiden cruise encompasses first phase of Operational Testing (OT-1) that examines service-optimised employment of the fifth-generation fighter in the maritime environment. The ultimate aim is to ensure that the capability already declared for land-based Initial Operating Capability (IOC) can be just as effectively employed from the deck of HMS *Queen Elizabeth*.

Taiwan's new Advanced Jet Trainer



The new Taiwan Advanced Jet Trainer (AJT) has been unveiled in an event presided over by Taiwanese President Tsai Ing-Wen and receiving the name *Yong Ying* ('Brave Eagle'). Powered by a pair of non-afterburning Honeywell/ITEC F-124-200TW engines, the AJT is expected to make its first flight in June 2020. As a subcontractor, AIDC has developed and constructed the airframe which will be based on the dual-seat F-CK-1 fighter. Sixty-six AJTs will be built for the ROCAF, with deliveries of final production aircraft scheduled for 2026. Compared with the F-CK-1, the AJT features an improved fuel system and new avionics.

Airbus and partners reveal Eurofighter ECR concept

At the International Fighter Conference in Berlin, Airbus and partners revealed concrete details of the new Eurofighter electronic combat role (ECR) concept. This role will enlarge



Eurofighter's multi-role capabilities and further increase the survivability of coalition forces in hostile environment. Eurofighter ECR will provide passive emitter location as well as active jamming of threats, and offer a variety of modular configurations for electronic attack (EA) and suppression/destruction of enemy air defence (SEAD/DEAD). Latest national escort jammer technology will ensure national control over features such as mission data and data analysis. The concept also features a new twin-seat cockpit configuration with a multi-function panoramic touch display and a dedicated mission cockpit for the rear-seat.

Korea's KF-X fighter programme



South Korea's Defence Acquisition Programme Administration (DAPA) have announced that prototype of the KF-X future fighter will be unveiled in the first half of 2021, with plans to begin flight tests a year later. Critical design phase of the aircraft is now complete, and prototype construction began in June 2018.

Sikorsky introduces RAIDER X



Sikorsky has introduced the RAIDER concept for an agile, lethal and survivable compound coaxial helicopter, specifically designed for securing vertical lift dominance against evolving peer and near-peer threats on the future battlefield. Through the U.S. Army's Future Attack Reconnaissance Aircraft (FARA) programme, RAIDER X is a revolutionary approach for rapid development and delivery of game changing technology and warfighter capabilities, equipped for the most demanding and contested environments.

Airbus A400M in helicopter air-to-air refuelling



An Airbus A400M successfully achieved first helicopter air-to-air refuelling contacts with an H225M, over the course of 4 flights, operated in day conditions over the south of France. This marks a decisive milestone towards its full capability as a tanker, these tests performed under the coordination of the French *DGA Essais en vol* flight test centre.

Meanwhile, another A400M completed certification flight tests for simultaneous paradropping of 80 troops from both side doors on a single pass, which concludes certification test phase of the paratroop dispatch capability of the A400M

Bell announces 360 Invictus



Bell Textron Inc. has revealed that the Bell 360 Invictus is the company's entrant for the US Army's *Future Attack Reconnaissance Aircraft* (FARA) Competitive Prototype programme. The Bell 360 Invictus' design incorporates the Invictus' rotor system, based on Bell's 525 Relentless rotor system which has been tested and proven at speeds in excess of 200 kts.

Bell Boeing V-22 Osprey fleet 500,000 FH



The V-22 fleet of tiltrotor aircraft built by Bell Textron Inc., and Boeing has surpassed the 500,000 flight hour milestone, with than 375 Ospreys flying, including the US Air Force CV-22 and the US Marine Corps MV-22. Since 2007, the V-22 has continuously served the Marines and Navy, as well as Air Force Special Operations. A third variant, the CMV-22, is scheduled to join the US Navy fleet in 2020.

Russia's National Helicopter Centre



Russian Helicopters Holding Company (part of Rostec State Corporation) is to unite with JSC Mil Moscow Helicopter plant and JSC Kamov to establish JSC *National Helicopter Centre* "named after Mikhail Mil and Nikolay Kamov" (NHC). These will combine the two helicopter design bureaus "for more efficient and higher-quality rotorcraft design and upgrades".

Global C-130J fleet surpasses 2 million FH

The global fleet of C-130J Super Hercules recently surpassed 2 million flight hours logged beginning with the C-130J's first flight on 5 April 1996, through the end of July 2019. Twenty-two



operators from 18 nations presently operate the type and contributed to this achievement. Countries with military variant C-130Js include the United Kingdom, United States (the U.S. Air Force, Marine Corps and Coast Guard), Australia, Italy, Denmark, Norway, Canada, India, Qatar, Iraq, Oman, Tunisia, Israel, Kuwait, South Korea, Saudi Arabia, France, and Bahrain.

2,600th C-130 Hercules

On 21 October, Lockheed Martin delivered the 2,600th C-130 Hercules tactical airlifter to U.S. Air Force Special Operations Command, being an MC-130J Commando II Special Operations airlifter assigned to 9th Special Operations Squadron at Cannon Air Force Base, New Mexico.

LM's modernised turret for AH-64E Apaches



The US Army recently awarded Lockheed Martin a \$40.6 million contract to produce Modernised Turrets (M-TUR) for the AH-64E Apache helicopter, an upgrade to the Modernised Target Acquisition Designation Sight and Pilot Night Vision Sensor (M-TADS/PNVIS) system with enhanced operational and performance capabilities.

GA-ASI's Predator Series exceed 6 million flight hours



General Atomics Aeronautical Systems Predator-series of Remotely Piloted Aircraft (RPA), which includes the Predator, Predator B, Gray Eagle, Avenger and MQ-9B SkyGuardian lines, have surpassed six million flight hours. The milestone was achieved on 31 October 2019 with GA-ASI aircraft having completed 430,495 total missions with some 90 percent of those missions flown in combat. "Every second of every day, 69 Predator-class Medium-Altitude, Long-Endurance (MALE) RPA are airborne throughout the world".

NGC EW Suite for F-16s



Northrop Grumman will demonstrate an internally mounted electronic warfare suite and digital radar warning receiver for F-16 fighters, the agreement issued under SOSSEC Consortium's Air Force Open System Acquisition Initiative (OSAI). The objective is to provide spherical radar warning, threat identification and countermeasure capabilities to protect aircrew from modern electromagnetic spectrum threats.

Raytheon's Peregrine Advanced AAM



Raytheon is developing the Peregrine medium-range, air-launched weapon that is "half the size and cost of today's air-to-air missiles, yet delivers greater range and effect". The new, smaller Peregrine missile is faster and more maneuverable than legacy medium-range, air-to-air missiles, and doubles the weapons load on a variety of fighter platforms.

1,000th Super Puma helicopter



Airbus Helicopters has delivered its 1,000th Super Puma helicopter, being a twin-engine multi-role H215 assembled in Marignane, France, which was handed over to the German Federal Police (*Bundespolizei*). This delivery completes the German Federal Police's order for four H215s, the first three of which were delivered in December 2018, and increases the German Federal Police's Super Puma fleet to 23, including 19 AS332 L1s, making the police force one of the largest operators of Super Pumas in the world today.

USAF RFP for Light Attack Aircraft



The USAF has released final requests for proposal for a limited number of Textron Aviation AT-6 and Sierra Nevada Corporation/Embraer Defense & Security A-29 aircraft. This is to “help support the National Defense Strategy’s focus on building allies and partner capacity, capability and interoperability via training and experimentation.”

Sikorsky HM-60W Combat Rescue Helicopter



Lockheed Martin has announced that the Sikorsky HH-60W Combat Rescue Helicopter (CRH) programme achieved Milestone C decision from the U.S. Air Force, which moves the programme into low rate initial production. The USAF requires 113 helicopters to replace its predecessor, the Sikorsky HH-60G Pave Hawks, the CRH being significantly more capable and reliable.

X-37B records 780 days in Orbit

The US Air Force’s X-37B Orbital Test Vehicle Mission 5 landed at NASA’s Kennedy Space Centre Shuttle Landing Facility on 27 October 2019. The spaceplane conducted on-orbit experiments



for 780 days during its mission, breaking its own record by being in orbit for more than two years. The total number of days spent on-orbit for the entire test vehicle programme is 2,865 days.

This is the USAF’s premier reusable and unmanned spacecraft, providing the performance and flexibility to improve technologies that allows scientists and engineers to recover experiments tested in a long-duration space environment. Managed by the Air Force Rapid Capabilities Office, the X-37B programme performs risk reduction, experimentation and concept of operations development for reusable space vehicle technologies.

Bangladesh orders Leonardo KRONOSLAND

The Bangladesh Air Force has ordered Leonardo’s KRONOSLAND radar to provide enhanced air surveillance, allowing operators to detect and track targets in tactical environments. Leonardo will also supply communications equipment, twelve months of technical support services, spare parts and a comprehensive training programme for Bangladesh Air Force personnel with modules both in Italy and Bangladesh.



German Army Eurospike contract

Eurospike, a joint venture between Rafael Advanced Defense Systems Ltd., Diehl Defence GmbH & Rheinmetall Electronics GmbH has signed a multi-year framework contract for the supply of SPIKE (known as MELLIS in Germany) missiles and launchers to the German Army. The missiles and launchers will be manufactured in Germany by local German companies, in keeping with RAFAEL’s global policy of teaming with domestic industry, “resulting in



knowledge transfer and local job creation”. As part of the framework contract, the first order is for the supply of 1500 Spike rounds, as well as hundreds of Rafael’s new ICLU (Integrated Control Launch Unit) dismounted missile launchers.

Biman Bangladesh Airlines order 787-9s



Biman Bangladesh Airlines (Biman) will be expanding their 787 Dreamliner fleet with two additional airliners valued at \$585 million. The purchase complements Biman’s fleet of 787-8s with the larger and longer-range 787-9 variant, which will help modernise the fleet and expand its international network.

Drukair gets ATR 42-600

Bhutanese national flag-carrier Drukair has taken delivery of a new ATR 42-600 aircraft, which will serve small airports and link Bhutan with Kathmandu, Kolkata and Dhaka. Through the



introduction of the -600 series’ latest generation Standard 3 avionics suite, Drukair will benefit from RNP AR 0.3/0.3 “which further enhances airfield accessibility and operational performance”.

First A350 XWB for Air France



Air France has taken delivery of its first A350-900, adding to an Airbus fleet of 143 aircraft, including 114 single-aisle and 29 wide-bodies. The airline recently conformed to purchase of Airbus’ A220, which will join the fleet over the next years.

Spirit Airlines MoU for 100 A320neos



Airbus and Spirit Airlines have signed a Memorandum of Understanding to acquire up to 100 A320neo Family aircraft, being a mix of A319neo, A320neo, and A321neo to meet its future fleet requirements.

Four European airlines into liquidation

Within some months, four European airlines have gone into liquidation. The Thomas Cook Group and its associated UK companies collapsed leading to grounding of Thomas Cook Airlines,



which had operated an all Airbus fleet of 29 A320 family airliners and seven A330s. The other airlines which have recently gone out of business are French carriers XL Airways and Aigle Azur, which operated A320s and A330s from Paris and Aigle Azur mainly to points in Europe, Brazil and China. They were followed in early October by Slovenian national carrier Adria Airways which operated eight Bombardier CRJ900s. All these collapses add to an extensive list of airline failures in Europe in recent years, which also includes Germania. WOW Air and Flybmi in 2019 itself, following Monarch Airlines and Air Berlin. Common factors include “overcapacity, intense competition and rising fuel prices”.

More A350-900s for Delta



Delta Air Lines fleet of Airbus A350-900 airliners will expand after the carrier acquired 20% of LATAM Airlines Group with a joint venture (JV). Delta will acquire the four A350-900s currently in LATAM’s fleet and assume LATAM’s purchase commitment for a further ten A350-900s, these to be delivered from 2020 to 2025. The 14 extra aircraft are additions to Delta’s own order for 25, of which 13 had been delivered.

Azul E195-E2s

Six E195-E2s will be delivered to Azul, the launch operator of the largest E-Jets E2 variant, by the end of 2019. Azul plans to put the type into service in the fourth quarter, the carrier being one of six E195-E2 customers so far, ordering 51 of these.

Thousandth A320neo



Airbus have delivered the 1,000th A320neo Family aircraft in October, this being an A321neo handed over in Hamburg to IndiGo of India, the biggest customer for the family, with its orders now totaling 430 aircraft. Airbus delivered the first A320neo Family aircraft in 2016 and its latest orders and deliveries data indicates a backlog of 6660 examples.

BelugaXL EASA Type Certification



The BelugaXL has received its Type Certification from EASA, paving the way for entry-into-service by early 2020. The aircraft is an integral part of Airbus’ industrial system and a key enabler for production ramp-up requirements beyond 2019, allowing for 30% extra transport capacity, being 7 metres longer and 1 metre wider than its BelugaST predecessor. The BelugaXL is based on an A330-200 Freighter, with a large re-use of existing components and equipment, and powered by Rolls Royce Trent 700 engines.

IAI launches 777-300ER Cargo Conversion Plan

Israel Aerospace Industries (IAI) has an agreement with GE Capital Aviation Services (GECAS) on the conversion of Boeing 777-300ER to cargo configuration, the first aircraft due for delivery to



GECAS in 2022. IAI has committed to providing GEAS with 15 such conversions with an option for 15 are in the future.

Ten VRT500s for Scandinavia



Rostec State Corporation will supply ten light VRT500 helicopters to Scandinavian countries, in an agreement with Rotorcraft Nordic AB. The optional equipment will be determined after the VRT 500 receives type certificate and certificate of airworthiness from (EASA).

French Navy receives 'standard 6' ATL2s

The first two ATL2 maritime patrol aircraft upgraded by Dassault Aviation were delivered to Lann-Bihoué French naval air station. The contract for the upgraded (standard 6) ATL2 combat system



was awarded by the defence procurement agency DGA on 4 October 2013, the programme involving 18 aircraft. Dassault Aviation will deliver a further five upgraded ATL2s during 2020-2023.

HMS Prince of Wales



A Royal Navy Merlin HM2 helicopter from 820 Naval Air Squadron became the first aircraft to touch down on the deck of the new aircraft carrier HMS *Prince of Wales* (R09). The Merlin had arrived at RAF Lossiemouth, Scotland, on 12 September to begin trials with HMS *Prince of Wales*, less than 24 hours after the warship left Rosyth dockyard in Fife for the first time. HMS *Prince of Wales* will spend the next few months completing an initial period of sea trials – with helicopters embarked – before arriving in her home base of Portsmouth, where she will be commissioned before Christmas.

China builds Type 054 frigates for Pakistan

Steel-cutting ceremony of two Type 054 A/P Frigates being built for the Pakistan Navy was held at Hudong Zhonghua (HZ) Shipyard in China. Type-054 A/P ships are state-of-the-art frigates equipped with modern surface, subsurface and anti-air weapons and sensors. These ships “will be the most technologically advanced platforms of Pakistan Navy that will strengthen its capability to meet future challenge in the Indian Ocean region”.



MBDA : Excellence by the Indian Navy's side!



Exocet MM40 Block 3

As Indian Navy warships patrol the seas, they have excellence by their side, with high-performing missile systems from MBDA such as Exocet on board their new *Kalveri*-class submarines. MBDA is proud of its long history supporting the Indian Navy, and celebrating Navy Day 2019.

MBDA has supported India's armed forces for over 50 years, providing over 40,000 missiles, many built in India during this time, and is working through its Indian joint venture – L&T MBDA Missile Systems Ltd – as part of *Make in India* programmes to provide new enhancements for the Indian Navy's fighting potency. L&T MBDA Missile Systems Ltd is offering Exocet MM40 Block 3 for the Indian Navy's Medium Range Anti-Ship Missile (MRASHM) requirement, the latest version of the venerable Exocet missile already in service with the Indian Armed Forces, and having improved electronics and an extended range.

For the Indian Navy's Short-Range Surface to Air Missile (SRSAM) requirement, L&T MBDA Missile Systems Ltd is proposing its next-generation Sea Ceptor



Marte ER

system, which utilises the CAMM missile that features a next generation all-weather RF-seeker, two-way datalink and soft-vertical launch system to provide a step-change in performance compared with previous generation systems. These are designed to protect Indian vessels from attacks from fast sea-skimming missiles attacking from multiple directions simultaneously. Sea Ceptor is the most high-performance and modern air defence system on the market, while also providing easy platform integration and many space, weight and safety benefits compared with older systems.

MBDA also has a full spectrum of missile systems to meet requirements of naval helicopters. For long-range requirements, MBDA's combat proven Exocet AM 39 missile is available, Marte ER provides excellent extended medium range capability, while Sea Venom/ANL provides unrivalled fire-and-forget or operator-above-the-loop ability to engage multiple targets at short to medium ranges in open waters or even challenging littoral environments.

The Indian Navy's Special Forces are offered the ATGM5, L&T MBDA Missile Systems Ltd being the world's only true 5th Generation Anti-Tank Missile as an Indian Designed Developed and Manufactured (IDDM) product under the *Make in India* approach. ATGM5 offers many unique capabilities, being truly network enabled, having a multipurpose warhead with selectable effects, and high-performance seeker technologies, proven for use in the maritime environment from small Special Forces vessels. 🇮🇳



Sea Ceptor/ CAMM

Loïc Piedevache,
Country Head India, MBDA



Sting like a Hornet !

Boeing's F/A-18 Block III Super Hornet is arguably the most lethal, advanced, combat-proven, multirole, frontline fighter-jet currently operated by the US Navy. Introduced in 2007, the aircraft is the next-generation evolution of F/A-18 Hornet and was envisaged as a naval platform from day one.

The F/A-18 Super Hornet was designed to bring together the power of the air and the might of the sea. Beyond the advanced technology that went into F/A-18, the creators had to keep in consideration complex requirements related to carrier-based operations including high loading which results in higher stresses on the airframe among other issues that come with integrating an aircraft on a carrier.

The history of Super Hornet is as interesting as is the history of naval aviation itself. Within a decade of the Wright brothers successfully demonstrating the first controlled flight in 1903, Washington Chambers and Eugene Ely successfully flew their Curtis biplane off-and on -American naval cruisers using wooden planks, sandbags and ropes, in 1910. In 1983, F/A-18 Hornet replaced another iconic US fighter, the F-14 Tomcat because the Hornets offered multi-role capability, were technologically superior to meet advanced threats and was much more economical to operate. The Super Hornet introduced

in 2007 provided further enhancement in the form of long range and greater payload carrying capability.

The Block III version of Super Hornet that is currently being built for the US Navy incorporates several key enhancements including advanced mission computer, data fusion capability and improved stealth characteristics to name few. Typically every decade, the US Navy has inducted a new fighter or a significantly advanced version of an existing frontline fighter to match evolving threats. With every new induction of fighters, carrier integration technologies, training, and tactics were revised. The US

Naval Aviation ecosystem of today has come a long way.

Boeing's F/A-18 Block III Super Hornet offers unmatched opportunity for the Indian Navy to get access to the US naval ecosystem, collaborate on carrier integration know how, equipment, weapon systems, training and cooperation initiatives

Currently, more than 700 Hornets and Super Hornets operate with the US Navy and serve with several navies or air forces of other countries. With orders of 116 additional Block III orders, Super Hornet will be in service for decades to come. The long life and growth potential of Super



Hornet will help Indian Navy incorporate new technologies in the platform. A great example of how the platform has evolved can be seen in the F/A-18 Growler, which is a carrier and land-based advanced electronic warfare aircraft that is currently operating with the US Navy and with the Royal Australian Air Force (RAAF).

The Hornet's Capabilities

The Block III version on offer to the Indian Navy is a state-of-the-art, advanced aircraft that is currently being built for the US Navy and will provide unique and differentiated capability to the Indian Navy.



The Block III F/A-18 Super Hornet's multi-mission capabilities include battle-space situational awareness, counter- stealth targeting, greater range, increased acceleration and improved survivability. The aircraft can carry variety of munitions for multi-role engagements. The Super Hornet has advanced network architecture in the form of a new computer that works with high throughput data link and offers advanced network-centric warfare capability through immense data-crunching power. A new 10x19 inch touchscreen display provides the pilot with the capability to see, track and target multiple targets generated by the common tactical picture.

Superior Economics

The F/A-18 Super Hornet not only has a low acquisition cost but also costs less to operate and offers high mission readiness. The sheer scale of Super Hornet fleet in the world and the associated favorable economies of scale

can help in lowering the cost of sustaining of the platform throughout its lifecycle. Along with an extended growth potential as evident from the airframe life of 10,000 hours, the Super Hornet has the lowest operation and support cost of any tactical aircraft in the United States military, even lower than single-engine aircraft, single crew member aircraft and fifth-generation aircraft in in the U.S. tactical aircraft inventory. This has been achieved by a constant focus on supportability of both the design and upgrades philosophy of the US Navy and Boeing along with its industry partners. And

then there are the high mission readiness rates.

By India – For India Sustainment

Boeing's 'For India – By India' sustainment programme builds on Boeing's almost eight decades of history in the country towards creating the next level of collaboration. Building on existing programmes and on India's growing supply chain network, the Super Hornets will be serviced and upgraded in partnership with the Indian Navy as well as India and US based partners, throughout the lifecycle of the aircraft. This will further enable its growth and develop advanced expertise in maintenance, resulting in higher availability of the aircraft, at competitive pricing and reduced risk for the Indian Navy.

Fully Compatible

The Super Hornet is fully compliant with the Indian Navy's carrier deck and hangars.

The F/A-18 Super Hornet can take off from Indian aircraft carriers via the ski ramp and is compatible with air refueling tankers operated around the world. The F/A-18 is offered in a single and two-seat variant, both of which are capable of performing all missions from a carrier. Additionally, the two-seat variant is able to provide training capabilities which match the Indian Navy's concept of operations for the carrier qualification of a fighter pilot.

A True Force Multiplier

Indian Navy today has eight P-8I long range maritime reconnaissance aircraft and more are shortly to be delivered. The F/A-18 Super Hornets can optimally interface with the P-8I and other US platforms soon to be inducted in the Indian Navy, which is sure to augment the lethality of these platforms, enhancing India's force projection capabilities.

In summary, with the F/A-18 Super Hornet Block III offer, the Indian Navy gets unique and differentiated capabilities enabling it to take on the challenges of tomorrow. Further, the Indian Navy will get to access the largest naval aviation ecosystem with the US Navy for co-development, training, technology upgrades and carrier integration.

Just like how a Curtis biplane ushered in the era of naval aviation 119 years back, the Super Hornet can help boost the US-India maritime and security relationship!



Article authored by Ankur Kanaglekar, Vice President, India Fighters Lead, Strike, Surveillance & Mobility, Boeing Defense, Space & Security

Navantia and the Indian Navy



Spanish Navy LHD Juan Carlos I multi-purpose amphibious assault ship and aircraft carrier

One hundred present owned by the Spanish Government, Navantia is a shipbuilder and leader in the design, construction and integration of state-of-the-art warships and submarines, as well as ship repairs and modernisation. They are also engaged in the design and manufacture of Integrated Platform Management Systems, Fire Control Systems, Combat Systems, Command and Control systems, Propulsion Plants and through life support for all its products.

Navantia's presence in India has been established with the *Scorpene* programme, being involved in co-fabrication and giving Navantia the opportunity for close interaction with the country and to understand the requirements. Navantia have established an office in New Delhi with the "strongest commitment to collaborate with the Indian Navy and the 'Make in India' programme".

Currently, Navantia is concentrating on participation in several Indian Navy programmes, offering advantages of a proven product and experience gained through similar programmes with the Spanish Navy. Navantia is presenting their product based on the Spanish Navy S-80, which will shortly be ready for sea.

The S80 has been designed by Navantia and is a new concept for a 3000-tonne,



The S-80 submarine from Navantia

non-nuclear submarine, designed from its concept with leading edge Air Independent Propulsion (AIP) system based on use of bio-ethanol and the highly efficient fuel cell developed by Collins Aerospace. The submarine can launch a wide variety of weapons and integrates a state-of-the-art system for combat and operations of Special Forces. Such improvements give the submarine its distinctive shape, clearly different from other conventional submarines extant.

The S80 is considered as "the most advanced conventional submarine", with

its high level of discretion and mobility in reaching distant theatres.

Navantia has also offered India a design based on the internationally successful Spanish Navy LHD *Juan Carlos I*, that had visited Mumbai in 2018, giving the Indian Navy an opportunity to assess the ship (see *Vayu IV/2018*). This type has been exported to Australia and Turkey thus far, is well proven and of low risk. The partnership with India's industrial group, Larsen & Toubro, makes this robust team capable of delivering the product tailored to Indian requirements. 🇮🇳

Courtesy: Navantia

Naval Group launches the ‘Suffren’



Latest generation of nuclear submarines (SSN)

On 12 July 2019, during a ceremony presided over by President of the French Republic Emmanuel Macron, Naval Group launched the *Suffren* in Cherbourg, the first of six nuclear submarines of this latest generation. This event is a key step for the *Barracuda* programme of the French Navy.

As Hervé Guillou, Chairman and Chief Executive Officer of Naval Group, stated, “We are proud to have presented to the President of the French Republic the first submarine of the *Barracuda*-class, a symbol of our exceptional know-how and our ability to master the most advanced technologies and the most complex products. The construction of the *Suffren* is a collective success, the result of a strong cooperation with our long-standing partners: the French Navy and the French Defence Procurement Agency (DGA), but also the Atomic Energy and Alternative Energies Commission (CEA), TechnicAtome and all the manufacturers of the sector. Now, we are all focused on finalising the *Suffren* tests at the shipyard, with the start-up of the nuclear boiler room in the coming weeks, but also on

producing the complete series. Maintaining our knowledge and adapting to new technologies are among our main priorities.”

Vincent Martinot-Lagarde, Director of the *Barracuda* programme at Naval Group, also commented: “To successfully complete this extraordinary project, several thousand women and men worked together, driven by the same values of team spirit and technical excellence. Today, on the occasion of this exceptional ceremony, we are very proud to present our work, which is the result of the extraordinary diversity of our skills.”

Result of Naval Group’s know-how and technological expertise, the *Suffren* is first of the *Barracuda*-class series, designed to replace the *Rubis*-class generation. Naval Group is in charge of the construction of this submarines series, including the design and construction of the ship and information systems as well as the manufacturing of the main components of nuclear boiler rooms.

Naval Group is the overall prime contractor of the ship’s architecture and TechnicAtome is the prime contractor for the nuclear reactor. The French Defence

Procurement Agency (DGA) is in charge of the overall programme, with the Atomic Energy and Alternative Energies Commission (CEA) for the nuclear reactor.

With this programme, Naval Group provides employment for more than 10,000 people involving some 800 companies. All the skills within the group are called upon to design and produce the *Suffren* and follow-ons of the *Barracuda* series. All Naval Group sites are simultaneously mobilised including Nantes-Indret, Angoulême-Ruelle, Brest and Lorient design and produce different systems and modules.

The Ollioules site is responsible for the design and production of the combat system. The entire programme is managed from Cherbourg, where the submarines are assembled and tested. The Toulon site will be in charge of the maintenance of the *Suffren* and gradually that of the entire series. The in-service support was taken into account from the submarine’s design stage to limit the number and duration of interventions, thus optimising the availability of the *Barracuda*-class at sea. 🦋

Pakistan's Navy and its Sea Eagle MPA



RAS, Rheinland Air Service of Germany, has delivered a second aircraft to the Pakistan Navy. The aircraft, known as RAS 72-Sea Eagle, is part of a multi-year contract signed in 2015 for equipping the Pakistan Navy with a contemporary fleet of maritime patrol aircraft. The first aircraft was formally handed over in June 2018 and the second aircraft delivered after its display at the Paris International Airshow in June 2019.

During the handover ceremony at RAS headquarters in Mönchengladbach, Germany, Nikolaos Mavrikis, Director Special Mission Division, stated: "The Pakistan Navy has taken delivery of its second RAS 72 MPA, becoming the newest operator of RAS' latest generation airborne platform and Aerodata's Mission Management system for anti-submarine warfare, based on the twin-engine turboprop ATR 72 platform. The two RAS 72 in operation provide our customer with strategic maritime dominance and enhance the defence and maritime security domain

of Pakistan. Working closely with the Pakistan Navy, and based on the feedback received from the operators as well as from the naval aviators, we can clearly claim that this programme has significantly extended the organisation's capabilities, modernised their fleet and endorsed the surveillance along the country's coastal as well as in international waters".

The state-of-the-art on-board sensors enable operators and decision makers to detect and identify sensitive targets above or below the surface of the ocean, while transmitting all information captured on-board in real-time to the dedicated command centre.

The RAS 72 multirole aircraft offers 'unrivalled efficiency' as well as operational flexibility not only for anti-submarine warfare and maritime patrol missions, but also for search and rescue and other humanitarian operations. In addition to the MPA configuration, RAS can configure the ATR 72 with a complete range of



interior arrangements, from pure passenger cabin and troop transport to complex customisation required for VIP guests as well as a variety of cargo options.

Rheinland Air Service (RAS), established in 1972, is a German MRO providing comprehensive FAA and EASA Part 145-approved aircraft maintenance, part-out services, and special mission modifications for commercial and business aircraft. In addition, RAS provides spare parts, aircraft sales, special mission aircraft design, integrations and modifications as well as ground handling and fueling services. The company, headquartered in Mönchengladbach, employs 270 staff at four German locations and its special mission division provides tailored turnkey solutions for various fixed and rotary wing airborne platforms and mission systems (see also *Vayu IV/2019*). 



80th Anniversary of Mikoyan Design Bureau



Mikoyan's aircraft design department was established on 8 December, 1939 as the Pilot Design Department of the Aviation Plant #1 and headed by Artem Mikoyan and Mikhail Gurevich. It was later renamed as Experimental Design Bureau named after A.I. Mikoyan otherwise known as the Mikoyan Design Bureau or Mikoyan OKB. In 1964 Gurevich retired, and Mikoyan passed away in 1970, was succeeded by Rostislav A Belyakov and in 1978 the enterprise was named after Mikoyan.

In 1995, Mikoyan OKB was merged with two production facilities to form the Moscow Aviation Production Association "MiG" (MAPO-MiG). There were several changes of the General Director and General Designer, even as the organisation concentrated on its last fighter design, the MiG-29 which was later upgraded to the MiG-29UPG standard alongside development of the navalised variant, the MiG-29K. Presently, the Company is concentrating on the MiG-35, itself based on the MiG-29 which serves in considerable numbers with the Indian Air Force and the Indian Navy.

India's relationship with the iconic 'MiG' goes back to 1963 when



Images: Angad Singh

the first variant of that classic, the MiG-21 f-13, appeared in IAF colours, to be followed over the next several decades with the follow on MiG-21FL, MiG-21MF, MiG-21bis and finally the MiG-21bison several squadrons of which are still in frontline service with the IAF.

The MiG-21 was followed by the MiG-23, MiG-25, MiG-27 and MiG-29 in IAF service, with well over a thousand of these fighters adorning IAF colours for over half a century. On 8 December 2019, even as RAC-MiG are celebrating their 80th anniversary in Moscow, there are three locations in India which will mark the occasion in suitable manner : Nasik in Maharashtra where HAL built the MiG-21s and MiG-27s, Air Force Station Adampur in the Punjab which has hosted MiGs for over half a century and Dabolim in Goa where the Navy's MiG-29Ks are shore based. 🦋

Na Zdorovie !

“Functioning seamlessly together”



The RAF and RN onboard HMS Queen Elizabeth

Flown by Royal Navy and Royal Air Force pilots, F-35 Lightnings have recently embarked on the 65,000-tonne aircraft carrier HMS *Queen Elizabeth* conducting operational trials off the east coast of the USA. This follows the successful developmental trials last year with US Lightnings, where the combined forces conducted 500 take offs and landings over a 11-week period at sea. These trials were aimed at ‘end-to-end’ testing of the aircraft and personnel to ensure the aircraft are compatible with the carrier, the tests involving mission planning, arming the aircraft using the ship’s Highly Automated Weapon Handling System, flying missions and debriefings on completion.

The landings on HMS *Queen Elizabeth* were part of the ‘WESTLANT 19’ Carrier Strike Group deployment and when fully operational, UK Carrier Strike Group will be a formidable force around the world, using a number of platforms to work alongside allies. During this period, the aircraft carrier was escorted by the Type 45 destroyer HMS *Dragon*, submarine hunter HMS *Northumberland*, tanker RFA *Tideforce* and Merlins from 814, 820 and

845 Naval Air Squadrons, Wildcats from 815 Squadron and Royal Marines from *Lima Company*, 42 Commando.

As Defence Secretary Ben Wallace stated, “This is another step towards the UK’s carrier strike capability becoming fully operational... bringing together of UK Lightnings on the first in class HMS *Queen Elizabeth* paves the way for the world’s most up to date, fully integrated carrier force.”

The F-35 Lightning is the first new generation fighter to combine radar evading stealth technology with supersonic speed, as well as the ability to land vertically. Given its ability to conduct missions both from land and sea, the Lightnings act as a formidable spine to the ‘carrier strike’ capability. The UK currently has 18 such aircraft, with orders placed for an additional 30 Lightnings.

First to land onboard was Wing Commander Adam Curd, Royal Air Force, who stated that “This is the first time I have landed onboard an aircraft carrier and for it to be HMS *Queen Elizabeth*, and in an aircraft as amazing as a UK Lightning, is quite something. This is a proud moment not only for me, but the wider team that has

brought us to this milestone for maritime aviation and UK Defence.”

The trials were conducted by the joint Royal Navy-Royal Air Force 17 Test and Evaluation Squadron from the Air Warfare Centre, the Squadron operating alongside personnel and aircraft from the UK Lightning Force, based out of RAF Marham. Assistant Chief of the Naval Staff for Aviation and Carrier Strike, Rear Admiral Martin Connell of the Royal Navy, said, “Embarking UK Lightning jets on HMS *Queen Elizabeth* for the very first time is a major milestone for Royal Navy and Royal Air Force aviation and for our development of the 5th generation Carrier Strike Group capability. Once again, the support from the US Navy and US Marine Corps has been incredible and undoubtedly helped bring us to this moment: making maritime aviation history.”

In turn, Air Officer Commanding Number 1 Group, Air Vice-Marshal Harvey Smyth of the Royal Air Force, said, “WESTLANT19 marks an extremely significant milestone on our 10-year journey in establishing our renewed Carrier Strike capability. Bringing our own Lightnings onboard HMS *Queen Elizabeth* for the first time gives us the opportunity to conduct critical operational testing. With the Royal Navy and Royal Air Force operating so closely together, these are incredibly exciting times for embarked Combat Air.”

The UK MoD plans to declare Initial Operating Capability for Carrier Strike by end 2020 while first operational deployment for 617 Squadron (the famous ‘Dam Busters’) on HMS *Queen Elizabeth* and a squadron of US Marine Corps Lightnings is due to take place in 2021.

As Commander of the Strike Group, Commodore Mike Utley, Royal Navy said, “Getting to this point of embarking UK Lightnings into our British-built carrier has been a significant joint undertaking by industry and military – both ours, and those from the United States. We will take the aircraft from the successful developmental phase we achieved last year through to a more operational footing, so we are confident that the Lightnings, the carrier and our destroyers and frigates will function seamlessly together.” 

Certification imminent for Irkut's MC-21



Irkut Corporation (part of UAC) is the established OEM for MC-21 airliners and have been carrying out certification tests of this new aircraft. Three MC-21-300s are involved in the tests and by end of 2019, another aircraft will join the certification campaign. The Irkut Corporation envisages initially receiving the Russian type certificate with further validation by the EASA. Within framework of the validation process EASA specialists have already carried out a number of test flights with the MC-21-300, including those at various altitudes and speeds as are required for commercial operations. During these tests, altitude of 12,500 metres, maximum speed of $M=0.89$, true speed of 949 km/h and flight duration of 6.2 hours were achieved, validating major design parameters and technological aspects of the airliner.

First public presentation of the MC-21-300 aircraft was at Paris Air Show 2019, with representatives of various airlines then having a chance to also experience enhanced comfort of the passenger cabin. The MC-21-300's economy cabin offers comfortable seats 18" wide with an aisle of 22,5" which makes it easy to bypass a trolley during cabin service, thanks to the wide fuselage (4,06 m) of the aircraft. Another cabin option is to have a high density configuration to seat up to 211 passengers on 18,5" wide seats and aisle width of 19.6". The seat pitch in high density layout will be 28" in the



forward section and 29" in the aft section of the cabin.

Such increased 'living space' not only enhances passenger comfort but the cabin pressure during cruise flight corresponds to an altitude of 6000 feet, which is currently only available in wide-bodied long range airliners while competing narrow bodies have that equivalent to 8000 feet altitude.

Series production of the MC-21-300 has already started, and amongst first operators will be Russian airlines and leasing companies. Ravil Khakimov, General Director of Irkut Corporation, has stated that list price of the MC-21-300 is some

20% lower than that of similar competing aircraft. Denis Manturov, Minister of Industry and Trade of the Russian Federation, said that active promotion of the MC-21-300 in the world market will be after commercial services commence in Russia by when also "a reliable after sales support system will have been established". Such work is currently being implemented with government investments.

The Russian Government is optimistic on the MC-21's future and according to Manturov, "MC -21-300 will become the leading Russian civil airliner in the near future".

MBDA: “ready to meet challenges of Europe’s missile defence”



The Council of the European Union has given “go ahead” to the TWISTER (Timely Warning and Interception with Space-based TheatER surveillance) capability project for implementation within the Permanent Structured Cooperation (PESCO) framework. This international missile defence project which already includes five European countries, seeks to develop, with support from the European Defence Fund, a European multi-role interceptor to address emerging threats and be brought into service by 2030.

This new endo-atmospheric interceptor will address a wide range of threats including manoeuvring ballistic missiles with intermediate ranges, hypersonic or high-supersonic cruise missiles, hypersonic gliders, and more conventional targets such as next-generation fighter aircraft. This Interceptor will integrate existing and future land and naval systems.

“MBDA is committed to meeting this need through next generation technologies and architectures building on national and company funded studies which have been conducted over the past five years. We will also draw on experience of industrial cooperation at European level, its long heritage of leading complex air defence programmes and its solid industrial relationships across the wider European landscape to establish a skills and capability led team”, stated company officials.

The TWISTER project is the second missile systems project to be supported under the new European defence agenda following the Beyond Line Of Sight (BLOS) capability programme which became part of PESCO in November 2018 and for which MBDA has put forward its 5th generation ground combat system, the only solution under European design authority that gives front-line combat units the ability to fire beyond the direct line of sight while maintaining man-in-the-loop decision-making. 🦋

Serbia orders MBDA Mistral 3s



Serbia has signed a contract for the acquisition of Mistral 3 short-range air defence systems. With this order, Serbia becomes the 32nd customer country for the Mistral missile and the 10th country invited to join the Mistral user club. The contract is for the acquisition of missiles, launchers for dismounted soldiers, related equipment and logistics, and the provision of technical and material assistance for integration of Mistral missile on the PASARS vehicles of the Serbian Armed Forces. As the latest generation of Mistral family in service today, Mistral 3 features a very high resistance to infrared countermeasures and a capability to engage air targets presenting a low thermal signature, including missiles and UAVs.

75th Anniversary of



Operation Market Garden

There were a number of important World-War II anniversaries in 2019, being 75 years after the Allies began to liberate north-west Europe and ending German occupation. One of these was in The Netherlands, commemorating 'Operation Market Garden'.

After the D-Day landings in France in June 1944, allied troops moved inland, increasingly liberating more French areas. In September that year, allied troops entered Belgium and a plan was made to speed up the advance before the onset of winter, to move further north in The Netherlands and cross some rivers to the east, so as to bypass the major German defences (the 'Siegfriedline') and so into the heart of Germany.

To secure vital bridges over the rivers, about 35,000 allied paratroopers were air dropped in Holland on 17 September 1944, of which some 11,000 were in the Arnhem region (mostly from the 6th British Airborne Division). On the first day, some hundreds of Dakotas and Horsa gliders airdropped the paratroopers and landed light equipment including jeeps plus other supplies. The allied forces were mainly British but also



Resplendent with its D-Day stripes, Douglas C-47 Dakota awaits paratroopers to embark

included American and Polish troops, the airborne troops tasked to take control of the bridges rapidly and secure their positions until bulk of the ground forces, moving from Belgium and south of The Netherlands, linked up with them.

However, the airborne troops faced immense resistance from German troops, who were in much larger in numbers than expected. The paratroopers, with their light equipment, could not carry out their original tasks against the heavily armed German forces and finally, just a small number were able to reach the bridge at Arnhem, but could not hold on to their positions and in less than a day, had to withdraw, giving back the Germans control over the bridge. Allied airborne troops were separated from each other and isolated by the German forces. By 24 September, the Operation was terminated but about 2000 trapped troops were evacuated to safety.

Operation Market Garden had failed and was thereafter to be referred to as “a bridge too far”. Of the some 11,000 paratroopers involved, only 2300 returned to the UK, 1500 were killed in action and others wounded or taken prisoner of war by the Germans. The Netherlands itself had to wait for final liberation until the next year in early May 1945.



After dropping their loads, Hercules of three Air Forces return to Eindhoven

Falcon Leap metamorphoses into Market Garden

75th anniversary of *Operation Market Garden* was commemorated in September 2019 in the Arnhem region, including a mass paratrooper force of about 1100 men from international forces, including several veterans as also Prince Charles and Princess Beatrix of the Netherlands being in attendance. Build up of this impressive demonstration had begun two weeks earlier, with preparations for the Dutch autumn exercise *Falcon Leap*. This annual exercise concerns various aspects of airborne operations including offensive air assault. Headquarters of operations was the Royal Netherlands Air Force base Eindhoven also location of the military transport and tanker aircraft including the C-130 Hercules and KDC-10. Participants included C-130s



Paratroopers and their Hercules



Paratroopers boarding a number of C-130 Hercules, all engines running

from the Royal Air Force, USAF, US Marine Corps, Royal Netherlands Air Force, the Italian Air Force, a Casa C-295 from Poland while Germany provided a C-160 Transall and 2 smaller special duty C-145s. The last two were used for para jumping of several WW II veterans as well as some special guests.

On the main day 21 September 2019, the aircraft flew in three waves, airdropping some 1100 paratroopers in front of an estimated 100,000 spectators gathered for the event. The aircraft flew in two formations, the first at 1100 feet and the second at 1300 feet flight levels.

The Exercise was a massive logistic operational challenge, with hosting of the aircraft, their crew and some 1100 paratroopers, for which the large Eindhoven

air base maintenance (KDC-10) hangar was used. Majority of the paradrops were with static line –automatic opening - parachutes at 1100 and 1300 feet. The other para droppings were free fall from 9500 feet, executed for the special guests with VIPs using smaller C-145 aircraft, even as Polish paratroopers performed free fall para drops from a C-295 aircraft.

The British Army’s “*Red Devil*” parachute team participated but certainly the most poignant was the tandem jump by a 98 year-old veteran of the *Operation Market Garden*. 🦋

Text and photos by Peter ten Berg



Recent deployment of the 1st Combat Aviation Brigade (1CAB) of the 1st Infantry Division was the fourth such in Europe under *Operation Atlantic Resolve*. As part of this, the 1st Combat Aviation Brigade of the United States Army was active in Europe during 2019, the helicopters and ground equipment arriving in the port of Zeebrugge in February 2019, the Brigade leaving Europe in October 2019 via the port of Rotterdam, to be relieved by the 3CAB.

Operation Atlantic Resolve is the military deployment in Europe, with an US Army division touring through Europe, every nine months.



Helicopters of the 1st Infantry Division had arrived in February 2019 at the Belgian port of Zeebrugge, a special compound having been set up on the quay for the helicopters. The helicopters then flew via Chievres to Germany where Ansbach became their new temporary home, from where they moved to the Baltic States, Poland and Romania. The 1CAB also participated during the 'Normandy Memorial' functions in June 2019.

During withdrawal of the troops and supporting material of the 1st Infantry Division, the Netherlands was host nation, the helicopters consisting of some 55 UH-60 Blackhawks, AH-64 Apaches and CH-47 Chinooks. The helicopters flew from Germany via Eindhoven to the Rotterdam port area, the helicopters then transported by ship to their home base in Fort Riley in Kansas. 🦋

*All photos and text by:
Joris van Boven and Alex van Noye*

Aerial Spectacle over Leopoldsburg



The Sanicole Airshow in Belgium

41st edition of the International Sanicole Airshow took place during 13-15 September 2019, the air show being traditionally held at Leopoldsburg in the north of Belgium.

The Sanicole Airshow has literally scaled new heights, from initially being merely a small event to a true aerial spectacle. The name *Sanicole* was coined by Lucien Plees who is founder of the flying club at Leopoldsburg airport in the municipality of Hechtel-Eksel in northern Belgium. Plees being owner of a sanitary facility in Korpsel at the time of its foundation, has created the word *Sanicole* as a combination of *sanitary* with name of his daughter, *Nicole*.

When the Sanicole Airshow was held for the first time, this event didn't attract much attention but as soon as Gilbert Buekenberghs took charge, the air show started spreading its wings, the Sanicole



Airshow expanding in the 1980s into becoming a large air show which earned its place in the sun, a special achievement because almost all successful air shows in Europe were not really commercial at that time. The first international participants in the Sanicole Airshow were from the Netherlands, France and England and this soon became branded as an international air event, the name changed to *International Sanicole Airshow* (abbreviated: ISA), and now is one of the most important air shows held annually in Belgium.

However, it took some time till the 1990s for the air show to become internationally known: it was named as the best European air show in 2010 and rewarded with the *Paul Bowen Award* by the European Airshow Council. Since 2011, the *Sanicole Sunset Show* is also unique, being held before the main event, when spectators can photograph and film flying display of aircraft during sunset and over the years, the *Sunset Show* has also developed into a full-fledged event. During this air show, many flares and fireworks were used that glint the dark skies, giving a fantastic opportunity for capturing mesmerising air shots.

The 2019 edition

The 41st edition of the Sanicole Air Show had the theme '75 years of Liberation'. The show started with the traditional flight of an American strategic bomber and this year, a Boeing B-52 Stratofortress took the mantle coming from the same stable as had the Boeing B-17 of World War II fame, an example flying a little later in the show.

During World War II the area around Sanicole airfield had been liberated by the Allies in early September 1944, then becoming launch pad for Operation *Market Garden* in the Netherlands, targeting the



Arnhem bridge ("too far"). During the air show, this was commemorated by the formation flight of a Supermarine Spitfire and a North American P-51 Mustang.

As the sun set, luminous aircraft appeared : the 'Patrol de Suisse'; 'Otto' the helicopter with fireworks; the 'Fireflies' a demo team with two propeller aircraft with fireworks on their wings; an NH-90 from the Belgian Air Force with flares; 'Vador' the Belgian F-16 demo pilot with flares, with its afterburner mostly on. The evening show ended into a Danish C-130J, firing flares, effects lasting a longer period of time.



In addition, there were also individual demonstrations by the Belgian NH90 and A109 helicopters 'Vador' the Belgian demo F-16; 'Zeus' the Greek demo F-16, a French AlphaJet, the Swedish Saab Viggen. The loudest demonstration was that by a Sukhoi Su-27 from the Ukraine. 🇺🇦

Text and photos: Joris van Boven and Alex van Noije

The daytime show had many classic aircraft of World War II : the Boeing B-17 came again, as did the Spitfire and Mustang. Then followed a special D-Day formation of the Belgian Air Force: a C-130 Hercules with black and white D-Day stripes and two F-16s with D-Day stripes, all three aircraft representing the three squadrons that flew with Belgian air crew during World War II under British Royal Air Force colours.

Various demo teams followed : 'Patrouille de Suisse', the 'Jordanian Falcons', 'Team Raven', the Belgian 'Red Devils'; the Belgian 'Victors', the Croatian 'Wings of Storm' and one of the very last performances of the French / Swiss 'Team Breitling'.



Sparrowhawk



Dynamic and in sync departure of two Mirage 2000s during Épervier-Photo by Loic Roulin

Joint exercise by the Swiss and French Air Forces

Being neighbouring nations, France and Switzerland have various bilateral collaborations including those in the defence sector. In the recent past the Swiss Air operated French-origin Dassault Mirage IIIs and recently, France has acquired Swiss-origin Pilatus PC-21s. Mutual training is one the core elements of both nations and its importance could be clearly seen in recently conducted Épervier exercise, which translates as *Sparrowhawk*, conducted annually and alternately in France or Switzerland at air bases of the *Schweizer Luftwaffe* (SL, Swiss Air Force) and *Armée de l'Air* (AdlA, French Air Force).



*A Hornet lands while four Mirage 2000s are overhead.
Photo by Loic Roulin*

Its origins are traced back to 1996 when two Swiss F/A-18s flew to the former home of *Group de Chasse* 01.002 (GC01.002, Fighter Group 01.002) *Cigognes* at Base Aérienne Dijon for four days to conduct joint air defence missions alongside resident Mirage 2000-5Fs. This year, Épervier was conducted at the Swiss base of Payerne, home to Aviation Wing 11 supporting two F/A-18 squadrons, one F-5 and a single air transport squadron. Their French counterparts deployed six Mirage 2000-5Fs of GC01.002, home based at Base Aérienne Luxeuil for which the timing was convenient, as explained by French Director of the Exercise (DIREX) Lt Col Aurélien, a veteran Mirage 2000 pilot with over 2500 flying hours of which 1100 are on the Mirage 2000 : “Initially, we operated for few days

aircraft (two Hornets and two Mirages) employing 1-v-1 till 2-v-2 scenarios as a maximum. The second and third waves were far bigger and more complex, with up to fourteen aircraft involved to carry out various operations. For example, this morning, I flew a 6-v-6 mission where four French Mirages and two Hornets from Meiringen operated as *Blue Air* performing Defensive Counter Air (DCA) missions against six *Red Air* Hornets from Payerne. *Red Air* needed to challenge the tactics of *Blue Air* whose goal is to validate their own game plan. Because *Red Air* knew the game plan of *Blue Air*, both sides needed to adapt their tactics constantly depending on actual developments in the air.”

A variety of missions were practiced during the week-long exercise and one

among them was High Value Air Asset (HVAA) protection training for which a Pilatus PC-6 or PC-7 was used.

Épervier provides value in more than one way for both nations, as it offers an opportunity to train jointly with a foreign nation and to test the procedures of its air force in an international environment. Crew interoperability is a keyword nowadays and this applies to both the pilots as well as ground crews. “Everybody benefits from this exercise. For the younger guys in the squadron, it is a good way to experience the aspects of a deployment to a friendly nation before they take over to the real ‘deal’. For them and also for the more experienced guys, it is good to see a different view on air defence and learn from each other both in the air as well as on the ground.” said Lt Col Aurélien. His Swiss colleague added, “During the exercise, we can compare NATO and non-NATO procedures and exchange experiences such the French have from their Baltic Air Policing missions in Eastern Europe.”

The French and Swiss have a long history of training together. Throughout the year, the F/A-18s of Payerne and the Mirage 2000s of Luxeuil fly with (and against) each other while operating from their respective home bases. Exchanges of pilots between combat squadrons as well as instructors with each other’s PC-21 training squadrons exist between both air forces. Swiss and French pilots also meet each other during the year-round exercises in Europe such as the *Tactical Leadership Programme*, *Tiger Meet* and *Frisian Flag*. 🦋

Text and some photos: Remco Stalenhoef



Mirage 2000 returns from first mission of the day with an inert MICA missile under its port wing- Photo by Remco Stalenhoef

from Nancy Air Base in France but soon after, flew to Switzerland to join Épervier.”

Main aim of this exercise was to upgrade levels in air defence by flying Mixed Fighter Force Operations (MFFO) while being confronted by air-to-air threats in increasingly complex missions. “If you have the chance to duel against each other regularly and your aircraft are similar in capabilities, you have to come up with something new every time – but that is not as easy as it sounds” stated Lt Col Aurélien. Explaining various scenarios of the exercise, Lt Col Mauron stated “Each day, four waves were flown with alternative scenarios created by Swiss and French pilots. During the first and fourth wave of the day, normally smaller Air Combat Manoeuvres (ACM) were flown by four



Flagship of the 18th Fighter Squadron sports a full colour tail- Photo by Remco Stalenhoef

Requiem for Phil Camp



Photo of Phil Camp and IAF Jaguar by fellow enthusiast Simon Watson

Aviation enthusiast, photographer – and fan of the Indian Air Force

Phillip Camp first visited India during the Aero India Show in 1996 along with his fellow enthusiast from England, Simon Watson and then over the next two decades, their was an ubiquitous presence not only at such events that took place every two years at Air Force Station Yelahanka but at many operational bases in many parts of the country. They covered *Vayu Shakti* at Pokhran in 2018 and Phil was also at Aero India 2019. He suddenly passed away in England in September 2019, leaving behind a trail of fans, most of them from the Indian Air Force, who have collectively, if silently mourned his departure.

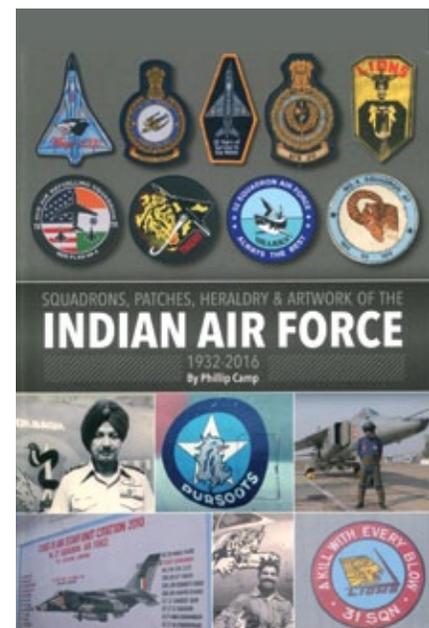
The images of aircraft and personnel taken by him have adorned pages of the *Vayu Aerospace Review* for over two decades and this article is dedicated to a fine gentleman and air enthusiast, especially that of the Indian Air Force.

Vayu's Angad Singh was his close companion in many 'adventures' in India and England and writes about his friend :

Aero India, Vayu Shakti, Iron Fist, Duxford, RIAT, Farnborough – so many deliriously happy, plane-crazy hours spent with the inimitable Phillip Camp. We have lost Phil after a short battle with jaundice and cancer. Those of us who were his friends lost a wingman – who'd shot with us in the Thar desert, atop the FDD at Yelahanka, by the fence line at Fairford, and just about anywhere that had planes flying !

He loved India and Indian aviation, and I dare say had seen more of this country than have many desis ! He was something of an expert on the IAF, and was respected and admired by every Air Force officer and airman whom he met. I've seen firsthand the joyful reception Phil has gotten from officers he last met a decade earlier! He treasured his India connection and everyone who crossed paths with him most certainly reciprocated.

Phil had co-authored a book on Indian Su-30s, and most recently wrote the definitive work on IAF patches, published in 2016. Both were smash hits among aviation enthusiasts. He was working on a Jaguar book and planned to write a lot more in retirement. His passing is a tremendous loss to the aviation community. Goodbye Phil, and blue skies my friend.



From the camera lens of Phil Camp



Top left, clockwise: pair of LCHs; Hawk of the 'Surya Kirans'; HAL Dornier 228; NAL Saras; HAL Light Combat Helicopter; HAL HTT-40



Top left, clockwise: IAF officers with Mi-35; HTT-36; Tejas LCA; IAF aircrew with MiG-29; French Rafale; Indian Army Pushpak AOP

Enthusiasm begets Enthusiasm

Perhaps the most precious legacy of Phillip Camp is his extraordinary book ‘*Squadrons, Patches, Heraldry & Artwork of the Indian Air Force 1932-2016*’ which he wrote, compiled, designed and published in 2016. In his dedication to the *Vayu Aerospace Review*, he penned that “this is accumulation of information. When I first came to India in 1996, your journal and the *Battleaxes* book (on No.7 Squadron) inspired me to seek further information on the Indian Air Force. As you know that time, there was nothing out there and no internet. Since then your journal has really impressed me. Such aviation history classics such as ‘*Sprits of the Wind*’, ‘*First to Last*’ and the iconic ‘*History of the IAF*’ in three Volumes adorn on my top book shelf with pride”.

Of course, over the two decades of his love affair with the Indian Air Force, Phillip Camp met with many other enthusiasts including Air Vice Marshal Vikram (Polly) Singh, Admiral Arun Prakash, Sqn Ldr RTS Chhina, Major General Atma Singh as also Henny Putkar, Vijay Seth, Atamvir Singh Multani, Sebastian Hoja and Air Cdr Rajesh Isser and so many others, unnamed.

He interacted with virtually all Indian Air Force squadrons and establishments

whom he included in the acknowledgements as being Squadron Nos. 1, 2, 3, 4, 6, 7, 8, 9, 10, 16, 20, 23, 24, 25, 27, 28, 29, 30, 31, 32, 35, 37, 47, 48, 52, 101, 108, 109, 112, 116, 125, 128, 129, 141, 151, 221, 223, 224, AFA, FTW, FWTF, HTS, MOFTU, OCU, ASTE, ADA, CABS, HAL.

In parallel with his photography, Phil’s ‘obsession’ with collecting unit patches



began in 1996 when he was presented the unique (and sadly final) patch which was on the flying suit of the late Sqn Ldr S Bhatnagar tragically killed along with other IAF and DRDO personnel when the experimental HS 748 AWACS aircraft went down near Arrakonam in January 1999. Phil had collected over 1000 Indian military aviation patches, visiting small shops in Malerkotla, Ambala and Delhi Cantonment and a large number of these are included in his book.

Every squadron, helicopter unit and most institutions are included but Phil’s particular fondness was for the *Surya Kiran* formation aerobatic team which he first visited at Bidar in 1996 and finally at Yelahanka during Aero India 2019, some images of which were included in *Vayu’s* Issue II/2019 (‘*Through the lens of Phil Camp*’).

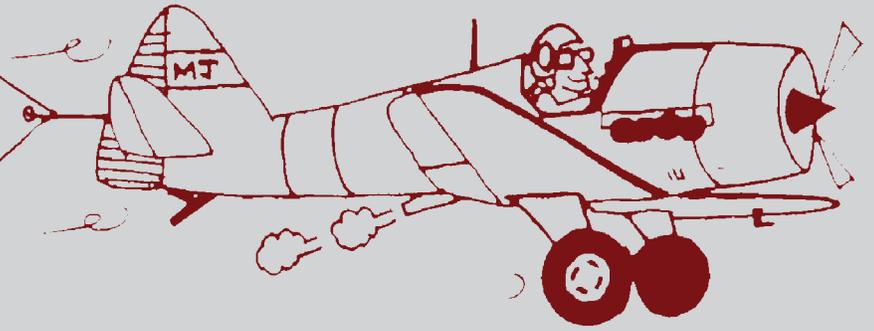
One could go on and on : Phil Camp’s book is not only an Indian air enthusiast’s bible, but will serve as vital reference for posterity. It is humbling that Phil was so enthused by the *Vayu Aerospace Review* and *The Society for Aerospace Studies* that he dedicated the last decades of life to following his passion. RIP. 🦋

Pushpindar Singh



Phil’s finale : (top) Neutra AEW&C aircraft escorted by pair of Su-30MKIs; Su-30MKI’s break off; Series Production Tejas of No.45 Squadron at Aero India 2019.

Ancient Aviator Anecdotes



Air Vice Marshal Cecil Parker recollects....

No Sense of an Ending

It was the summer of 1953 and the three of us coursemates (Veekay, Granny and self) had completed our Vampire conversion, commenced our operational training, but were still the juniormost sprogs in No. 7 Squadron at Palam. The good news was that a signal had been received posting in a new set of juniors and we three keenly looked forward to handing over our onerous secondary duties (O i/c Tea Club / Pay Parade / Crew Room etc) to the incoming new pilot officers!

The better news was that we had just received some arrears of Flying Bounty and were feeling rich! Veekay, who hailed from UP, suggested that we make a trip to Naini Tal where an uncle of his would do our hotel bookings. We asked for and were granted a few days of casual leave and were given Form Ds to a railhead called Kathgodam. We hired a taxi for our very first visit to Naini Tal where we checked into what would be called today, a 'starred' hotel full of Indian and foreign guests escaping the heat of the plains.

Life centred around the lake and we enjoyed ourselves in the scenic surroundings. On return from one of our excursions we passed through a room in the hotel equipped for table tennis where two young foreign girls were attempting to play. The older one (no more than 10-12 years of age) in a very English accent asked us if we knew how to play 'ping pong' and if so, would we please play with her as her young companion was of no use. We were happy to oblige till some time later a balding, elderly foreign gentleman, came and escorted them away.

Later at lunch we saw the two children as part of a somewhat large family party



*Air Marshal GE Gibbs in Vampire FB.52
of No. 8 Squadron*

at another table. At the end of lunch, the same gentleman, along with the two girls approached our table and we stood up. He introduced himself as Gibbs and came to thank us for looking after and entertaining the two young ladies. He then casually enquired if we were on holiday, to which Veekay (the seniormost of us) announced with some pride that we were "fighter pilots on leave". The gentleman paused awhile and then with a smile shook hands with each of us and wished us happy landings before returning to his table. Two days later, while checking out we read that an Air Marshal

Gibbs with his family had checked out ahead of us.

On return to our squadron we related this encounter to our seniors and were mortified to learn that he was none other than the C-in-C of the IAF! We had been taught that on 15 August 1947, the RIAF had become an independent organisation whose first three Chiefs were Air Marshals of the RAF on secondment. Air Marshal GE Gibbs was the third C-in-C of the IAF from 1951 (when we had joined the air force) till 31 March 1954 when he handed over to the very first Indian CAS, Air Marshal Subroto Mukherjee who had commissioned us 18 months earlier. Though we did not know names, we did feel proud that we three had shaken hands with 'our' first air chief, even if it was done unwittingly!

Of the first ten Indian air chiefs that covered my years in the IAF, I had personally interacted with eight as I did my growing up in the air force. The tenth Indian CAS was from No. 51-52 Pilots Course and we had known each other near 30 years but had never worked together. In fact the only professional interaction we had was in late 1977 when I took over the command of our base in Adampur from him. It was during his tenure as the CAS that he opened up an option for me to take premature retirement in 1986. It had been a wonderful three and a half decades that had enabled a very ordinary young man to experience some extraordinary and unforgettable moments in the air and on the ground in peace and war. For personal reasons I was more than happy to separate from the air force with no sense of an ending – or even a handshake.

A MEDICAL TRIBUTE



Four years ago, now in our early 80s, my wife and I experienced some cloudiness in our eye-vision and reported to the eye specialist at our MH (Military Hospital). He was most helpful, had our eyes tested fully and informed us that it was quite normal at our age to require cataract removal and lens replacement. Sensing the unspoken apprehension in this elderly couple, he

assured us that no hospitalisation was necessary, the operation itself was no more than 30 minutes and was a perfectly routine one. He however advised us not to delay much longer and encouraged us to seek a second opinion.

As we knew no eye specialist, we sought help from our doctor friend and next door neighbour, herself a retired army surgeon. She suggested that we see her brother-in-law, also ex-army, who was an eye specialist residing in the neighbouring colony and offered to seek an appointment for us. We were received most warmly by the eye surgeon and his wife who put us at ease while he carried out his own tests and examination. His independent diagnosis was entirely supportive of the MH eye specialist. Whilst the ladies were organising coffee, I took him aside to pay his fee. He laughed it off and said I had already paid him.

I was adamant and reminded him that I had no recollection of money changing hands. He put his hand on my shoulder and said, "Sir, to have a Maha Vir Chakra awardee in my home and under my treatment is an honour and privilege for me". This sentiment, expressed so sincerely by a (then) near-stranger, touched me greatly. I expressed my thanks, we shook hands and rejoined the ladies without any further reference to our private conversation. On our return drive, my wife casually asked me as to what fee I had paid. I merely told

her that he would accept no money from a brother officer.

We returned to the eye specialist at the MH who, learning that we lived alone, thoughtfully programmed four separate dates for our operations so that we could help each other post surgery. Both our children abroad offered to come and 'baby-sit' us but we felt quite capable of managing. Both my operations went off very well and my experience gave great confidence to my wife. When she went in for her first surgery, it was my turn to sit in the waiting room of the OT (Operation Theatre). She came out accompanied by the eye surgeon himself who assured me that the operation had gone off very well and she would be fine. He then took me aside and, with a twinkle in his eye, told me, "Sir your wife is the only patient I've had who, on the operating table, advised me on how to perform the surgery!". We both burst out laughing and I informed him not to worry as for years she had advised me on how to fly ("low and slow") and I had survived! We had both not only regained our normal eye sight, but made new friends from the medical fraternity.

Alas, life is uncertain and last month we had the sad experience of joining the large number of friends and family at the Memorial Meeting for the late medical officer who had so forthrightly expressed his personal admiration for gallantry awardees - a tribute I shall always remember. 🇮🇳



Vampire NF Mk.54s of No.10 Squadron, then based in Palam, in formation flight over a very new New Delhi. (Do readers recognize some iconic landmarks?)

25 Years Back

From Vayu Aerospace Review Issue VI/1994

IAF and PAF in race for Su-27s

A race for the Russian “super fighter”, the Sukhoi Su-27 has broken out between the Indian and Pakistan Air Forces. Even as IAF teams have visited Russia on a number of occasions during 1994, test flying the export variant (Su-30MK) and reportedly carrying out detailed evaluation, the PAF has had similar occasion to do so. The Pakistan Air Force had earlier given favourable recommendations for the procurement of Su-27s since the Lockheed F-16s were “on hold” in the USA since 1990 while the Indian Air Force Chief in a very recent interview, categorically stated that he “preferred the Su-30” citing its superlative performance, particularly range, endurance and the fact that the unit price was “substantially” lower than that of the French Mirage 2000-5, also being considered.

Disquiet in India

In a significant move, the Foreign Secretary of India called a special press conference in New Delhi on 30 November 1994, at a time that a Russian defence delegation was visiting Pakistan. It was stated that India was aware of the Pakistani bid to buy high performance Su-27 fighters from Russia, but “hoped that Moscow would do nothing that would alter the regional security balance”.

More MiG-29s for IAF

India and Russia have finalised terms for supply of another 10 MiG-29s, basically to make up for attrition. Considerable spade work had already been done during the Defence Secretary’s recent visit to Russia regarding MiG-29 spare parts, which has been a major irritant in resumption of Indo-Russian defence linkages after the disruptions during 1990-92.

HAL Chetaks for Namibia

HAL-built helicopters (two each Chetaks and Cheetahs) were formally handed over to the fledgling Namibian Air Force during a brief ceremony at Bangalore. “This was not a mere completion of a business transaction but was politically important as India had stood by Namibia for the last 30 years when they were fighting for independence”. Namibia has also expressed interest in the HAL ALH.

“Asian Air Express”

HAL Chairman RN Sharma has stated that framework for the prestigious 100-seater Asian Air Express project was expected to be formalised in early 1995. Another round of meetings between the consortium countries-China, South Korea and India-is to be held shortly. Apart from the three Asian partners, there are a number of aerospace companies in Europe and the United States which have expressed interest in joining the consortium and discussions with additional political partners have reportedly taken place.

Russi Mody is Chairman AI and IA

The newly-appointed part time Chairman of Indian Airlines (IA) and Air India (AI) Russi Mody has said that he would accord top priority to making both the airlines “competitive” to face the stiff challenges in the new liberalised system. Mr Mody said he had impressed upon IA top management the need to raise the load factor and morale of the staff to ensure the turnaround of the airlines - which has been in the “red” for the past two years and that the new motto of the airlines should be “major attention to minor details”.

Russia to develop Su-37 for UAE

The UAE and Russia have signed a Defence Agreement that includes co-development of a “Gulf” version of the Su-35 multi-role fighter, designated as the Su-37, along with purchasing its predecessor, the Su-35, plus T-80 main battle tanks, Tunguska and Tor

surface-to-air missiles. The Russians are also hoping that the cost of the deal will be deducted from their \$550 million debt to the UAE.

Pakistani production of K-8s

Even though the Pakistan Air Force has an interest in acquiring a total of 60 K-8 *Karakoram* jet trainers to replace the present Cessna T-37Bs and Shenyang FT-5s, in-country production (at Kamra) is being ruled out owing to financial reasons. Instead, Pakistan will concentrate on expanded component manufacture and production of a large variety of spares to support the K-8 in PAF service. The first six of an initial batch of 15 K-8s were delivered to Pakistan in September 1994, manufactured by China’s Nanchang Aircraft Manufacturing Company (NAMC) and are being tested by flying instructors of the Academy at Risalpur.

IA to train Ariana

India and Afghanistan reached an agreement on letting Ariana operate additional flights between Delhi and Kabul to fill the slot vacated by IA five years ago. IA pilots had then refused to fly services to Kabul airport because of the missile threat to incoming civilian airlines by battling factions in the civil war there. Indian Airlines does not overfly Afghanistan either, going by an old International Civil Aviation Organisation (ICAO) directive warning of threats to civil aviation from shoulder-fired missiles and artillery.

China’s role in South Asia

The US Defence Secretary William J Perry has sought to clarify his reported statement on China’s nuclear programme by denying that he visualised a dominant role for Beijing in South Asia in a geo-political sense. Former external affairs minister IK Gujral, took exception to Perry’s observation and said the defence secretary appeared to be asking China “to act as a Viceroy of South Asia.”

La La La



The Ministry of Road Transport and Highways has notified a new vehicle registration tag for the Union Territory of Ladakh : 'LA', superseding the earlier 'JK'. Interesting. The Tejas LCA series production aircraft have their tail numbers beginning with 'LA', superseding the earlier 'KH' which were the initials of Dr Kota Harinarayana, regarded as 'father' of the Tejas LCA programme.

Obviously inspired, the Indian Railway Catering & Tourism Corporation has named its Lucknow-Delhi Express as the 'Tejas', this state-of-the-art train being the Railways first "privately" run enterprise.

Make sure its not sooo late !

Toe Jam

Even as an Airbus A330neo was delivered to Air Caledonie International, the French Pacific Island territory's international airline, the inspectors on board refused to take acceptance owing to the smell of 'wet socks' in the cabin. Despite every effort,



the smell was persistent and crew members balked from operating the airliner till such time as source of the 'smelly sock' was found and the offending odour removed.

Try a football club's changing room !

Red, Hot and Scary



Amidst continuing tension between New Delhi and Islamabad, passengers in a recent SpiceJet ('Red, Hot and Spicy') flight from Delhi to Kabul actually got it 'scary' when their Boeing 737 was intercepted by PAF F-16s. Directed to lower altitude and report flight details, the cool Commander simply gave details of the scheduled Delhi-Kabul flight even as the F-16s continued to escort the airliner till it crossed into Afghan air space.

Thank heavens for the livery !

Castle in the Skies



According to recent reports, Thailand's King Maha Vajiralongkorn has now stripped his 34-year-old consort of all titles for "disloyalty" and apparent "ambition" to match the senior Queen's position (see *Talespin* in *Vayu* Issue V/2019).

Learn to land before you take off!

OMG !

Dramatic videograb is shared of an Emirates A380 virtually struck by lightning at Christchurch Airport in New Zealand as the South Island was battered by wild weather. More than 1,500 lightning strikes have hit the territory over a six hour period in November 2019.

Never, ever take nature for granted !



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