THE UNFOLDING CONTOURS OF 21ST CENTURY NAVAL AVIATION

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While a large Indian Army had been considered indispensible by the British for sustaining their far-flung empire, they did not brook the creation of a naval force which had the slightest chance of becoming a future rival to the Royal Navy. Pre-independence discussions about the proposed size and shape of free India's Navy had thrown up two viewpoints.

The departing British visualised the Indian Navy (IN) as a component of a Commonwealth task force meant to counter a possible Soviet advance into the Indian Ocean. The nationalist opinion, articulated by the visionary historian and diplomat KM Panikkar, demanded that India should break away from the Royal Navy and develop a strong, three-dimensional force to defend its maritime interests[1].

The recent experience of World War II having demonstrated the utility of aircraft carriers in multiple roles, a 15-year naval plan paper envisaged four aircraft carriers, four cruisers, 16 destroyers, 16 submarines and about 400 aircraft for the post-independence IN. Clearly unaffordable for an impecunious fledgling nation, with so many demands on its limited resources, a more pragmatic and spartan plan emerged, subsequently, with the support of Lord Mountbatten, which included a single light fleet aircraft

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1. K. M. Panikkar, *India and the Indian Ocean: An Essay on the Influence of Sea Power on Indian History* (London: George Allen & Unwin, 1945), p. 23.

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carrier with a balanced force of cruisers, destroyers and auxiliaries. The carrier (INS *Vikrant*) came 14 years after independence, but it formed the dream and the kernel around which the IN painstakingly built its now substantial air arm in seven decades.[2]

In this essay, I have attempted to trace the genesis and rise of naval aviation in other navies, before covering its logic, growth and future in the Indian context. For nearly a century, the component of naval aviation that has attracted both approval and controversy, not only within navies, but also in the sister Services and political circles, is the aircraft carrier. However, there are only 10 navies, worldwide, that operate such ships today. Naval aviation, thus, encompasses much more than carriers. Although it will be my endeavour to cover as many aspects as possible, the reader may well find the discourse being dominated by carriers.

THE RISE OF AIR POWER AT SEA

It was barely seven years after the Wright Brothers had ushered in the epoch of aviation, that an intrepid American named Eugene Ely pioneered ship-borne air operations. In November 1910, he undertook a breath-taking launch from a wooden platform fitted in the bows of a US Navy cruiser and, two months later, performed the equally difficult task of landing on the stern of another cruiser at anchor. Aviation was now ready to go to sea as an integral part of navies.

In April 1913, Britain constituted the Royal Flying Corps (RFC) with naval and military wings. A year later, naval aviation was recognised as a new branch of the Royal Navy and the Royal Naval Air Service (RNAS) came into being, with its own rank structure. With the onset of World War I, the RFC was despatched to France to provide support to the army, while the RNAS was deployed from ashore and afloat in maritime operations.[3]

2. RAdm Styindra Singh, *Blueprint to Bluewater* (New Delhi: Lancer International, 1992), pp. 35-45.
3. Adm AK Chatterji, *Naval Aviation: A World History* (New Delhi: Allied Publishers Pvt Ltd, 1985), pp. 11-20.

In that era, the fleet that spotted the enemy first had an advantage in the battle to follow. The ship-borne aircraft was, therefore, eagerly adopted as a "crow's nest in the sky" for scouting and obtaining early warning of enemy dispositions. Like all innovations, the aircraft too faced much opposition from the traditionalists. Conservative admirals were firmly convinced that battleships—45,000-ton behemoths, bristling with guns, ranging from 0.5-inch to 14-inch calibre and protected by 12-inch thick armour-plating—were immune to all threats. In the face of such scepticism, the aircraft made a hesitant debut on the maritime scene – first in the scouting role, then, for gunnery observation, and, finally, for strike and fleet air defence.

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Soon, cruisers and battleships began to be equipped with one or two seaplanes as a standard fit. They would be launched from a jury ramp on the gun turret and recovered from the water board by the ship's crane. Subsequently, warships began to be converted to the dedicated role of 'seaplane-tenders' and could support a number of such aircraft.

The end of World War I, however, saw a nasty blow struck at naval aviation. Preaching "unity of air power", Brig-Gen Hugh Trenchard prevailed upon the British government to merge the RFC with the RNAS to form an independent force for conduct of air operations. Thus, on April 1, 1918, the Royal Air Force (RAF) came into being, with Lord Trenchard as the Chief of the Air Staff. Having handed over 2,900 aircraft, 127 naval air stations and 67,000 personnel to the RAF, the Royal Navy abolished the post of Fifth Sea Lord and naval aviation became a concern of the new Air Ministry.[4]

The limitations of seaplanes in aerial combat had led to the development of the true aircraft carrier, capable of operating fighters. Many existing hulls were converted to this role, on both sides of the Atlantic, by installing a

4. Ibid., pp. 21-26.

full length flat deck, but the first ship to be designed and built, *ab-initio*, as an aircraft carrier was the Imperial Japanese Navy's *Hosho,* in 1922, to be followed by the British ship HMS *Hermes*, in 1924.[5]

Despite a great deal of protests and lobbying, the Royal Navy was not to regain control of its air arm till just before the outbreak of World War II, in 1939. Two decades of control by the Air Ministry had, however, led to neglect of naval aviation and the Royal Navy lagged well behind the RAF as well as the American and Japanese Navies as far as aircraft development was concerned – having to fly biplanes right upto 1941 even as the Spitfire, the Zero and the Wildcat took to the skies.

ROLES OF AIR POWER AT SEA

The first week of December 1941, saw the unfolding of two historic air actions against maritime forces. On December 7, in a surprise attack on Pearl Harbour, waves of Japanese carrier-borne aircraft sank or damaged eight battleships of the US Pacific Fleet. Three days later, on December 10, Japanese shore-based bombers and torpedo-aircraft attacked and sank the Royal Navy's battleships *Repulse* and *Prince of Wales,* along with four destroyer escorts, off the coast of Malaya. Not only had the 'battleship myth' been shattered, but also the superiority of air power, against warships, established decisively at sea.[6]

Carrier-borne air power was instrumental in deciding the course of the war in all theatres of World War II. Whether it was hunting surface raiders like the *Bismarck* and *Graf Spee*, convoy escort duty in the Atlantic, power projection ashore in the Mediterranean or over-the-horizon combat against other carriers in the Pacific, their role is too well known to be recounted here. It resulted in the aircraft carrier displacing battleships and armoured cruisers from the centre-stage of maritime power.

Such was the clamour for air support at sea that the war saw even merchant ships being equipped with fighters which could undertake a rocket

5. Ibid., p. 27.
6. https://en.wikipedia.org/wiki/Sinking_of_Prince_of_Wales_and_Repulse. Accessed on April 23, 2016.

assisted take-off from a small ramp in the bows.[7] Temporarily, this proved a useful measure against German U-boats and patrol aircraft, but when the casualty rate in convoys shot up, small merchant ship hulls were modified with a flight deck which could accommodate 15-20 aircraft. These became the famous escort carriers fondly dubbed "Jeep" carriers.[8]

The end of World War II saw the US Navy with a massive fleet of 99 carriers and the Royal Navy with 40 such ships of assorted types. Such inventories were, however, unaffordable and began to be rapidly reduced after the Japanese surrender. The newly formed US Air Force (USAF) claimed worldwide reach with its strategic bombers; posing a serious threat to naval aviation. A period of inter-Service tension led to the cancellation of the carrier USS *United States* and four sister ships. This was accompanied by the resignation of the navy chief and other admirals.[9]

Desperately seeking a strategic function to assign to its carriers, the US Navy eventually found a niche for naval aviation in the national strategy. Two ship-borne bombers, the A-3 Sky-warrior and A-5 Vigilante (two of the heaviest carrier-borne aircraft ever) were assigned a nuclear attack role against Soviet land targets.[10] This brought the carriers back on centre-stage, alongside the ballistic missile submarine force.

As the post-war polarisation threw up new East-West political tensions, it soon became obvious that there was going to be no diminution in either the importance of carriers or in the roles assigned to them. In the seven decades since the end of World War II, carriers have continued to play a vital role in projecting air power to exert a decisive influence on conflicts. The Korean War, the Suez crisis, the long Vietnam War, the 1971 Indo-Pakistan War and the Falklands Campaign are just some of the conflicts in which carriers made a significant contribution.

7. http://ahoy.tk-jk.net/macslog/TheDevelopmentoftheCatapu.html . Accessed on April 23, 2016.
8. https://en.wikipedia.org/wiki/Merchant_aircraft_carrier. Accessed on April 24, 2016.
9. M Hill Goodspeed, ed., *US Naval Aviation* (Pensacola, Florida: Naval Aviation Museum Foundation. 2001), p. 39.
10. http://www.tailsthroughtime.com/2016/01/the-bomber-career-of-douglas-3.html. Accessed April 26, 2016.

In a latter day context, the asymmetric conflicts in the Balkans, Kuwait, Iraq, Afghanistan, Libya and Syria have consistently shown that not just the US Navy, but also the British, French and Italians have used aircraft carriers as sovereign territory to project power and influence events far from home.

CONTINUING RELEVANCE OF THE CARRIER

It is said that when the US is faced with an international crisis, the first question the president asks the chairman, Joint Chiefs of Staff is: "Where are the carriers?" This story may be apocryphal, but the fact remains that the Pentagon and State Department consider aircraft carriers as "five acres of sovereign territory", to be used for leveraging state policy. They are potent mobile bases which can be positioned off any shore, worldwide, in a matter of hours or days, to project naval air power – for reassuring friends, coercing adversaries or rendering humanitarian assistance to the stricken.

Carrier air wings are just one component – albeit the most high profile – of naval aviation. The others are land-based Maritime Reconnaissance (MR), Anti-Submarine Warfare (ASW) and Electronic Warfare (EW) forces, organic ship-based helicopters and Unmanned Aerial Vehicles (UAV). The roles to be discharged by naval aviation are defined by the contours of a nation's maritime strategy; and may include providing air defence to the fleet, assisting in establishment of 'sea control', exercising 'sea-denial' and undertaking 'power projection' in the enemy littoral and across his shore.

The single most important factor that distinguishes naval aviation from air forces is the fact that naval aircraft form integral components of the maritime-matrix, and are, essentially, an extension of the fleet's weapons and sensors. The key utility of aircraft to the fleet commander arises from three attributes: the ability to see (visually or electronically) much further than a ship; the ability to deliver ordnance well beyond the ship's visual/ radar horizon ability to be immediately available to the fleet on a 24x7 basis.[11]

Only a handful of navies possess ships that meet the US definition of an 'aircraft-carrier'; i.e. a ship displacing over 65,000 tons and able to carry an

11. *Naval War College Review*, vol 67, no.3, Summer 2014; Robert C Rubel, *Theory of Air Power* (2014), pp. 64-65.

air-wing of 60-70 fighters, strike aircraft, ASW helicopters and fixed-wing Airborne Early Warning (AEW) machines. Other navies own smaller, 'aviation-capable' ships that can operate Short Take-Off and Vertical Landing (STOVL) jets and helicopters.[12]

QUESTION MARK OVER CARRIERS

Worldwide, a majority of naval aviation assets are, therefore, land-based and the aircraft and helicopters are often employed to fulfill the twin roles of reconnaissance (also termed as 'scouting') and maritime strike. Armed with anti-ship missiles, the scout can locate, identify and attack the enemy, thus, functioning as an extension of the fleet's sensors and weapons. Japan, for example, owns no carriers but has established a maritime cordon of 1,000 nautical miles (nm) radius and deploys a force of 150 P-3 Orion and S-2 Tracker patrol aircraft to sanitise it.

Against this background, the traditional justification for aircraft carriers, that they provide tactical air power independent of land bases, where and when required by navies, is being increasingly questioned; especially in an era of diminishing defence budgets. The emergence of China's 'anti-Access and Area-Denial' (A2AD) strategy seemed to further bolster the case against carriers.

There was active debate about the justification for building any more of these expensive behemoths, accompanied by the proposition that land-based air power – naval or air force – could take over their roles at sea. However, Britain's hugely expensive programme to revive its fixed-wing ship-borne aviation; China's new-found enthusiasm for aircraft carriers; and the US 'air-sea battle' concept seem to have provided a pause in this debate. India, too, has embarked on an ambitious carrier building programme, with one ship due to be delivered in 2019 and another on the drawing board.

While the affluent Western powers may have their own strategic logic for maintaining carriers in their order of battle, a rising economic and maritime power like India needs to reflect carefully on this issue, and evolve a sound

12. Ibid., p. 68.

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rationale, within the ambit of its maritime strategy, for creating an aircraft carrier force.

Let me now shift this discourse to a different plane and establish the geo-strategic rationale that underpins the Indian Navy's growth, from which will flow the logic that demands a robust naval air arm.

A MARITIME INDIA?

India has been, since centuries, a maritime nation, in every sense; although a national affliction of 'sea blindness' has prevented us from acknowledging it. A kind of 'maritime awakening', seems to have occurred over the past decade-and-a-half to make India's decision-makers acknowledge the criticality of the oceanic environment, and the dire need to focus on maritime security. The developments that have contributed to this realisation, perhaps, include the dramatic exposure of India's soft coastal underbelly in November 2008, the trauma of rampant piracy and the looming menace of the People's Liberation Army Navy (PLAN).

Above all, it was the powerful phenomenon of globalisation that, belatedly, brought home to Indian intelligentsia that this peninsular nation, isolated to landwards, is almost entirely dependent on the seas for its well-being and prosperity. International trade, the *sine qua non* of globalisation, is carried overwhelmingly by sea, as is energy, the lifeblood of growth and industry.[13]

A 7,500-km-long coastline, dotted with 200 major and minor ports, a huge Exclusive Economic Zone (EEZ), offshore islands, a merchant fleet, exceeding 10 million tons, and nearly 100,000 sea-farers, serving under many flags, place India amongst the world's major maritime nations.

13. Arun Prakash, *Varuna Vak* (New Delhi: National Maritime Foundation Policy Paper, 2011), p. 3.

EMERGING THREATS IN THE INDIAN OCEAN REGION (IOR)

India is, now, poised to be a significant player in world affairs, but its rise is coincident with that of neighbouring China, with the attendant hazards of such an occurrence. India would, therefore, need to shape its policies to forestall the domination of its neighbourhood by a hegemon and safeguard its core interests.

China's significant maritime build-up includes nuclear and diesel submarines, amphibious shipping, surface escorts and naval aviation. Of special concern to India is China's growing force of nuclear-powered attack submarines (or SSNs), which can interdict shipping at long ranges.

China's heavy dependence on the Indian Ocean sea lanes has led to its deep involvement in this region; virtually at India's doorstep. Its 'string of pearls' strategy was crafted for the acquisition of maritime footholds, along vulnerable Indian Ocean sea lanes; the first two being Gwadar and Djibouti. China has, now, gone a step further by evolving the 'one belt-one road' concept, to push an even more ambitious maritime agenda linking China's interests in the Indian and Pacific Oceans. India's anxiety over these developments was aggravated by the first-ever entry of Chinese submarines into the Indian Ocean in mid-2014.

China's significant maritime build-up includes nuclear and diesel submarines, amphibious shipping, surface escorts and naval aviation. Of special concern to India is China's growing force of nuclear-powered attack submarines (or SSNs), which can interdict shipping at long ranges. Once China's first aircraft-carrier, *Liaoning*, equipped with the J-15 Tiger Shark fighter attains operational status, the PLAN will be able to project maritime power right across the Pacific region. There is evidence that China's carrier construction programme may run into 3-4 ships. All this could herald a possible bid at domination of Indian Ocean Sea Lines of Communication (SLOCs).

Our western neighbour, Pakistan, has created a potent sea-denial capability with a few submarines equipped with Air-Independent Propulsion (AIP) that endows them with extended underwater endurance. It has also

created a substantial force of maritime reconnaissance aircraft and a mix of US and Chinese supplied warships; and all these platforms are armed with anti-ship missiles.

THE MARITIME CARD

Although India has an edge in conventional military strength over Pakistan, it is clear that in any bilateral conflict, China will come to the aid of its "all-weather ally" in more ways than one. While moral and material support will flow instantly from Beijing to Islamabad, it is the opening—threatened or actual—of a "second front" that troubles Indian military planners.

Prudence demands that for every Indo-Pakistan confrontational scenario, only a proportion of India's land and air forces should be deployed on the western border; the rest remaining on alert for containment of any Chinese adventurism or diversionary ploy in the north or northeast. Under these circumstances, the best that India can hope to achieve militarily is a stalemate. It is in this situation of serious asymmetry, with respect to the Sino-Pak axis, that India needs to play the "maritime card" to checkmate both adversaries.

In Pakistan's case, intense pressure can be brought to bear in support of Indian Army operations from the country's seaward flank. Moreover, given a few weeks, Pakistan's military machine as well as populace can also be starved of essential supplies and material. This would encompass the full spectrum of maritime warfare: from commodity denial and anti-submarine warfare to power projection across the littoral.

China, in its quest for securing strategic resources, has cast its net world-wide; from Australia to the Russian Far East and from West Africa to the heart of South America. These far flung economic interests make China dependent on extended SLOCs which criss-cross the Indian Ocean, and expose huge maritime vulnerabilities. India's central location in the Indian Ocean, about half way between the Persian Gulf and the Malacca Strait, places it in a dominant position astride vital SLOCs. Thus, China's exposed 'jugular vein' could be gainfully exploited by the IN to relieve pressure on land.[14]

14. Ibid., p. 19.

MARITIME GAME CHANGERS

In the foregoing context, a few aspects of IN force accretion plans, which will endow the nation with a number of powerful maritime options, bear mention here.

- The expected advent of the PLA Navy, especially its nuclear submarines, into the Indian Ocean has lent urgency to the Maritime Domain Awareness (MDA) task. The IN has evolved a multi-layered surveillance capability (more of this later) but the 'icing on the cake' is the recently launched GSAT-7 communication satellite, meant exclusively for IN use, which will facilitate the networking of sensor and weapon data across its vast footprint.
- The addition of the ex-Russian INS *Vikramaditya*, with its complement of MiG-29K fighters and Kamov-28/31 helicopters, will boost the navy's capability to exercise sea-control and to project power across the shore. Current plans envisage a second (and perhaps third) indigenously built carrier joining the fleet. Given the wealth of carrier operating experience available in the IN, these ships are capable of tilting the balance of power in our region.
- Operationalisation of India's first indigenously-built nuclear-powered ballistic missile submarine (SSBN) *Ariihant* will ensure that India has an invulnerable second strike capability, thus, enhancing the effectiveness and credibility of its nuclear deterrent *vis-a-vis* adversaries—China and Pakistan. As the Service responsible for safe and efficient conduct of SSBN operations, the IN will be the custodian of their nuclear-tipped ballistic missiles.
- The induction of the nuclear-powered attack submarine (SSN) INS *Chakra*, on a 10-year lease from Russia, has placed a powerful weapon of offence in the hands of the IN. Apart from the anti-shipping role, it can also undertake, with virtual impunity, tasks as varied as surveillance, special operations, intelligence gathering and land attack.

While the IN had always aspired for the status of a true blue water force at some future point of time, neither the politicians nor the bureaucracy shared

this vision. The phrase, 'blue water navy', incidentally, denotes a maritime force which has the capability of undertaking missions in waters distant from home, for extended period of time in pursuit of national interests. It implies the availability of large, well-armed warships, logistic support, and an integral aviation capability.

In accordance with its long-term perspective plan, the IN is in the process of steadily acquiring large, well-armed warships – mostly from Indian shipyards – and a logistic fleet that will provide support in distant waters is being created. In the next part of this essay, I will discuss the growth of India's naval air arm and briefly dwell on its different components.

FLEDGLING NAVAL AIR ARM

A Directorate of Naval Aviation, established in 1948, began preparations for the creation of an air arm by sending officers to the UK for training. While plans for acquiring an aircraft carrier were placed on the back-burner due to financial stringency, the formation of a Fleet Requirement Unit was approved and an order for ten Sealand twin-engined amphibians placed in 1951 to equip it. The first Sealand flew into Cochin on February 4, 1953, and this date marks the foundation of India's naval aviation arm. In May the same year, the navy's first air station, INS *Garuda*, was commissioned, also in Cochin.

To the squadron of ten Sealand amphibians, the IN soon added ten Fairey Firefly fighters, modified for target-towing, and three HT-2 trainers. In 1957, India purchased the unfinished hull of the light-fleet carrier HMS *Hercules* in the UK; to be renamed later as INS *Vikrant* after its commissioning in 1961. In order to prepare crew for flying the carrier-borne aircraft, the IN acquired three Vampire Mk 51 fighters and a Vampire Mk 55 trainer from Hindustan Aeronautics Limited (HAL), to form a Naval Jet Flight in Sulur.[15]

The choices of carrier-borne aircraft for a relatively small ship like the *Vikrant* were limited and required considerable deliberation. Eventually, the British built Armstrong-Whitworth Sea Hawk FGA Mk 6 was chosen for

15. Chatterji, n.3, pp. 103-110.

Vikrant's fighter squadron and the French Breguet Alize for its anti-submarine warfare squadron. The training of the air crew as well as maintenance personnel was undertaken in the UK and France. The carrier was initially allotted two Sikorsky S-55 helicopters on loan from the Indian Air Force (IAF) for search and rescue and these were later replaced by the French Alouettes III (later renamed Chetak).

Reliance on air power, integral to the fleet, and available round the clock, has been an article of faith with the IN, since the induction of the *Vikrant* 55 years ago, and the Indian Navy's tactics as well as strategy are built around the carrier task force concept. Similarly, all major warships, in service, or being built, carry one or more helicopters to enhance the ship's reach and capability. However, a significant proportion of naval aviation is shore-based; and I start with a description of its MR and ASW components.

MR AND AIR-BORNE ASW

India's extensive maritime interests and the emerging hazards of diverse nature in the vast Indian Ocean demand that a sharp vigil be maintained on activities on, and beneath, its waters.

During the 1971 War, the 5,000-km-long passage of the PNS *Ghazi* from Karachi to Vishakhapatnam and the sustained presence of the PNS *Hungor* off the west coast till she sank the frigate INS *Khukri* were both severe indictments of our maritime reconnaissance and air-borne ASW capabilities. This was one of the major factors underlying the government's decision to transfer control of the MR-ASW role from the IAF to the IN, after a prolonged debate, in 1975.

At this point, the navy was in the process of preparing to receive the Illyushin-38 ASW aircraft which was to be acquired from the USSR. In an already difficult situation, the new decision required that the IN take over the Super Constellation squadron from the IAF even before the arrival of the Il-38. Finding pilots, observers and maintainers for this aircraft became a challenge, but by squeezing resources from other streams, the navy managed to create a new MR unit.

The Boeing P-8 (I) patrol and anti-submarine warfare aircraft has been commissioned and eventually a force of 35-40 such aircraft will be required to meet the demands of MDA.

Intense maritime activity in the Indian Ocean and the huge area that has to be kept under surveillance requires substantial MR-ASW capabilities. With the anticipated advent of Chinese nuclear submarines into the Indian Ocean, these capabilities assume strategic overtones. They are, therefore, embedded in the navy's network-centric operations model and closely linked with its MDA capabilities.

The IN has evolved a multi-layered surveillance capability with deployment of task-optimised aircraft, as well as UAVs for each layer. Currently, these tasks are undertaken by a mix of Tupolev-142, Illyushin-38, Dornier-228 aircraft and Heron and Searcher UAVs. A new squadron of eight Boeing P-8 (I) patrol and anti-submarine warfare aircraft has been commissioned and eventually a force of 35-40 such aircraft will be required to meet the demands of MDA.

The IN has been one of the pioneers in UAV operations at sea, and experience has shown that these systems are extremely efficient and cost-effective. Ship-borne and long-endurance UAVs will be able to bring about a transformation in the MDA scenario.

INDIA'S CARRIER AVIATION

The Indian Navy's steadfast adherence to the aircraft carrier as the centre-piece of its doctrine and strategy has paid rich dividends over the past half-century. One striking manifestation of this was the contrast between the manner in which the IN and PLAN, almost simultaneously, inducted new aircraft carriers into their fleets.

The past four years have seen the PLAN hesitantly feeling its way towards operationalising the *Liaoning* and its complement of J-15 Tiger Shark fighters. It is reported that the ship is being designated a "training carrier"[16]. The IN, on the other hand, having commissioned the INS *Vikramaditya* in 2012, in Russia, sailed her 10,000 miles to Karwar and, by 2014, had worked

16. https://en.wikipedia.org/wiki/Chinese_aircraft_carrier_Liaoning. Accessed on April 27, 2016.

up the ship and its squadrons of MiG-29K fighters and Kamov-31 ASW helicopters to fully operational status.[17]

What is debatable, however, is the logic and operational effectiveness of the IN placing reliance on a one, small aircraft carrier in the past. No doubt, it has been a Hobson's choice, forced upon the Service by severe economic constraints as well as strategic tunnel-vision at the national level, but the following limitations have loomed in the background:

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- Both the INS *Vikrant* and INS *Viraat* were 'light fleet carriers'—the smallest in the carrier family. They have been restricted in speed and endurance, as well as the all-up weight and number of aircraft that could be launched and recovered from their decks.
- Due to these limitations, both ships could only carry sub-sonic aircraft of limited range and endurance during their operational life.
- The possible outcome of a Sea Hawk's encounter with an F-86 or a Sea Harrier's interception of an F-16 has always remained a source of concern for carrier captains and fleet commanders, over the years.

For these reasons, the deployment of its carrier, in the face of a superior shore-based hostile air force, has constituted a perpetual operational challenge for the Indian Navy.

With a larger carrier, capable of operating state-of-the-art fighters now in its inventory, the Indian Navy's operational options have become much broader. Our future task forces will be able to confidently undertake missions in the face of air opposition, especially if adequate fighters are available to provide round the clock tactical air support. However, one must bear in mind that new threats from land-based ballistic missiles may now confront the carrier task forces of the future, and suitable counter-measures will need to be evolved.

17. https://en.wikipedia.org/wiki/INS_Vikramaditya. Accessed on April 24, 2016.

FUTURE CARRIER OPTIONS

The choice of configuration, size and propulsion of a carrier has a direct linkage with the type of aircraft that will operate from it; and this constitutes a typical "chicken and egg" conundrum. Should one choose the aircraft first, or should the carrier design be frozen first? This was the problem that plagued the British Royal Navy's carrier programme for over a decade, and led to many flip-flops, controversies and huge cost-escalation.

In India's case, the configuration of the *Vikramaditya* was decided a decade ago and the first Indigenous Aircraft Carrier (or IAC-1) will follow suit. Both are STOBAR ships and will operate the MiG-29K and possibly the LCA-Navy during their lifetimes. STOBAR is an acronym for: Short Take-off (over a ski-jump) But Arrested Recovery into a set of wires. However, the design of the IAC-2 and follow-on ships remains open.

The IAC-2 will enter service, in the next decade, at a juncture where a balance-of-power struggle may be underway in this part of the world, with China and India as the main players. Should the PLA Navy decide to deploy the *Liaoning* or her successors in the Indian Ocean, the Indian Navy's tactical aviation assets would assume crucial importance. Therefore, a well-considered decision has to be taken about aircraft selection, before the concept-design for IAC-2 is frozen.

Essentially, the ship could be equipped with one of three types of aircraft available, and each type will profoundly affect its design and operating philosophy in different ways.

- Conventional take-off and landing types like the F/A-18 Super Hornet and Rafale-M will require a steam catapult for launch and arrester gear for recovery. This would mean a CATOBAR (Catapult Assisted Take-Off But Arrested Landing) carrier with a steam-driven catapult. An electro-magnetic version of the catapult, under development, has been offered by the USA.
- Types like the Su-33, MiG-29K and LCA-Navy will call for a ski-jump, instead of a catapult, in the forward part of the carrier, and arrester wires at the stern. This would mean a STOBAR configuration for the carrier.
- The F-35B version of the Joint Strike Fighter (JSF) would be an extension of the Harrier family. Capable of vectored thrust, it will require only a

ski-jump to enhance take-off performance. The choice of the F-35B would result in the most simple and cheapest ship—a STOVL carrier. But the aircraft itself is likely to be expensive.

An additional important consideration arises from the fact that Air-borne Early Warning (AEW) remains a vital requirement for a carrier at sea, and while helicopters may provide a partial answer, comprehensive warning and control can be delivered only by fixed-wing AEW aircraft of the E2-C Hawkeye variety. However, such machines can be operated only from CATOBAR carriers.

One way of simplifying complex choices would be to decide whether to use a catapult or not; bearing in mind that their sole source is the USA. The choice of a catapult equipped ship will reduce the aircraft contenders to just the F/A-18 and Rafale-M. If there is to be no catapult, then the STOBAR or STOVL ship will have the option of operating one of the Russian fighters or the American F-35B JSF[18].

SHIP-BORNE HELICOPTERS

The silent, modern diesel submarine, equipped with Air-Independent Propulsion (AIP) and armed with anti-ship missiles, can pose a potent threat to merchant shipping as well as naval surface forces. However, the really worrisome prospect for IN commanders is the impending advent of the PLAN's SSNs into our waters. Endowed with unlimited endurance, and speeds higher than most warships, these submarines can dominate vast ocean areas with their long-range torpedoes and even longer range anti-ship and land-attack missiles.

The modern warship, for all its stealth and weapon intensity, has become increasingly vulnerable to anti-ship missiles, launched by ships, submarines and aircraft, as also to torpedoes fired by submarines. Under these circumstances, the ship-borne helicopter provides not only a panacea against threats, but also extends the ship's detection capabilities in all dimensions. Equipped with 'dipping' sonars, expendable sonobuoys and an

18. Arun Prakash, "A Tale of Two Ships". *Vayu Aerospace International,* December 2012.

array of weapons, the ASW helicopter – either by itself or in combination with a ship or aircraft—is a formidable submarine hunter-killer.

With virtually every sizeable warship in our navy carrying one or more ASW helicopters, the IN rotary-wing fleet is set to grow substantially. Apart from ASW, the other roles that are traditionally assigned to helicopters include anti-ship strike, AEW, special operations, electronic intelligence, Search and Research (SAR) and casualty evacuation.

The IN rotary-wing fleet, apart from a large number of Chetaks, has over the years, comprised four different versions of the twin-engined Seaking, Kamov-25 and Kamov-28 ASW helicopters and the Kamov-31 AEW helicopter. Barring the last two, all the other helicopters are well past their prime and in urgent need of replacement. Given the customary, slow pace of acquisitions in the Ministry of Defence (MoD), this operational lacuna is likely to persist for some time.

Having undertaken a historical survey and provided a description of the current state of play in respect of India's naval air arm, I have still not discussed the vexed question that inevitably comes to mind in the context of aircraft carriers: their vulnerability to emerging threats—military, political and economic—and their future viability. In the concluding section of this essay, I will address some of these conundrums without attempting to provide definitive answers.

CARRIER CONUNDRUMS

For all its strengths and virtues, the carrier has never failed to evoke controversy and arouse passions—positive and negative. It continues to evoke strong criticism that it is an expensive anachronism and a relic of outdated World War II thinking, which offers little substantive advantage over lower-cost alternatives. Pointing to key threats like enhanced battlespace transparency, better anti-ship missiles, improved submarine capabilities, and the hazard from shore-based ballistic missiles, critics are again predicting that the carrier's days are numbered. Just as critics focus on the carrier's expense, size and vulnerability to run it down, loyalists cite size, reach and mobility as its strengths.

Many of the world's smaller navies, including the IN, which have remained loyal adherents of the carrier concept, although never owning more than a single (operational) carrier, face unique problems and have much to learn from each other's experiences. In an age of dwindling budgets, such navies face a sustained challenge, as much from internal critics as from politicians and the other Services, to continuously prove the operational utility of their sole carrier in a variety of scenarios.

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

Although the spectre of the anti-ship cruise missile has haunted the carrier for many decades now, it has not been possible to pass judgment because no head-on, evenly matched confrontation has taken place between the two so far. The Falklands War saw many ships being targeted by anti-ship missiles but none of them was a carrier. Whether this was due to the use of sound counter-measures or astute tactical positioning that kept the carriers out of out of Argentinian reach is not clear.

Proliferation of satellites and other sophisticated surveillance systems has rendered the maritime battlespace almost totally transparent, and critics claim that a carrier may now have few places to hide. China's A2AD strategy, which is reportedly centred on the DF-21D and DF-26 Anti-Ship Ballistic Missiles (ASBM), amongst many other weapons, has added a new dimension to the carrier vulnerability debate. With an estimated range exceeding 1,000 nm, these ASBMs may force aircraft carriers to remain beyond distances suitable for efficient air operations against the Chinese mainland.

The DF-21D/26 systems would, presumably, receive targeting data from Over-The-Horizon (OTH) radars, satellites and patrol aircraft/UAVs. The initial panic having subsided, it appears that a number of counter-measures may be available to degrade or defeat the effectiveness of this concept

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which has never been tried out against a live, moving target. The options available to a carrier group include: (a) degradation/ destruction of target data sources; (b) mid-course interception using anti-ballistic missile weapons (including high-energy lasers and micro-wave weapons); (c) use of course/speed alterations and smoke/ camouflage to deceive the missile seeker-head; (d) decoys to seduce the seeker-head; and, finally, (e) hard-kill measures to achieve terminal destruction of incoming missiles.[19]

A technological innovation which has the potential to radically change the calculus of carrier employment is the Unmanned Combat Aerial Vehicle (UCAV). For a given usage of carrier deck space, a UCAV offers double or triple the range and many times more endurance than a manned aircraft. Moreover, the elimination of a pilot in the loop not only makes it stealthier, but also eliminates the operational constraints imposed by risk to human life.

The Northrop-Grumman X-47B UAV recently completed an extensive trial programme, from the decks of US Navy (USN) carriers, culminating in a successful air-to-air refuelling exercise. The USN has, thereafter, announced the integration of the X-47B into carrier operations alongside manned aircraft and designated it the Unmanned Carrier-Launched Air-borne Surveillance and Strike System (UCLASS). This, once again, opens the prospect of a carrier remaining well outside the enemy "threat envelope" and discharging a majority of its roles with relative impunity.[20]

One must start with the premise that no platform is invulnerable, and that ships, if not deployed with operational acumen, will suffer in action at sea. However, regardless of its size, a fast-moving carrier is not easy to

19. Rubel, n. 11, p. 68.
20. http://www.northropgrumman.com/Capabilities/x47bucas/Pages/default.aspx. Accessed on April 26, 2016.

locate and identify at sea. Even if found, the carrier's air group and escort is capable of neutralising hostile ships, aircraft and submarines before they become a threat. In the worst case, even if it sustains missile hits, the carrier's chances of surviving serious damage are far greater than those of any other type of ship.

CONCLUSION

Today, there are less than 25 aircraft carriers in the world. The huge costs involved in constructing, operating and maintaining carriers have left this citadel of sea power in the hands of just a few select countries which include Brazil, France, India, Italy, Russia, Spain, Thailand, UK and the USA. It is noteworthy, however, that the number of carrier operating navies has risen from just four at the end of World War II to ten; with China being the latest entrant.

The latest Maritime Strategy emphasises that in order to exercise power projection and sea control in "blue waters", future IN fleets will be focussed, amongst other capabilities, on *"two carrier task forces, each comprising one or more carrier battle groups"***. In addition, it visualises enhancement of** *"naval aviation capability, covering integral and shore-based aviation assets, including UAVs.*

Only time will tell whether the carrier can prevail over the emerging technological and economic challenges, or become extinct. However, as I stated at the beginning, there is much more to naval aviation than just carriers.

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Air power has, unquestionably, become intrinsic to every form of military operations—on land, at sea or in the air. In the past, controversy and even acrimony had arisen over the proclivity of some to describe air power as

21. *Ensuring Secure Seas: Indian Maritime Security Strategy* [IHQ, MoD (Navy), October 2015], pp. 138-144.

"indivisible". While "indivisibility of air power" may have been a good hypothetical construct, in the early days, the ubiquity and indispensability of air power in today's battlespace has rendered this concept archaic. The British Air Power Doctrine attempts to resolve this conundrum by describing air power as: "*The ability to project power from the air and space to influence the behaviour of people or the course of events"*, and then adding that *…air power is inherently joint and drawn from all three Services"*.[22]

The navy's 15-year perspective plan, apart from 2-3 aircraft carriers, envisages an air fleet of 300-400 fighters, patrol aircraft, helicopters and UAVs; representing a substantive addition to India's air power. The IN has accepted maritime strategist Julian Corbett's dictum, *"Wars are rarely won by at sea, by navies; they only make it possible for armies to do so on land"*.[23] Perhaps there is need to adapt this aphorism to latter day circumstances, and accept that *"Wars cannot be won by a single component of military force. Jointness is the key to victory"*.

Given its growing reach and strategic capabilities that include long-range strike, aerial-refuelling and Air-borne Warning and Control System (AWACS), the IAF can be a powerful ally whose cooperation the Indian Navy must actively seek. This may be a good time for the two Services to get together and evolve an Air-Sea Battle Doctrine which will not only harness their synergy but also undergird India's 21st century regional aspirations.

22. British Air Power & Space Doctrine. AP 3000, 4th Edition. (Air Staff MoD UK), pp. 13-14.
23. Sir Julian Corbett, *Some Principles of Maritime Strategy* (London: Longmans Green & Co. 1911).