DEFENDING THE AIRCRAFT CARRIER

PRADEEP CHAUHAN

It is axiomatic to state that India, as a sovereign independent nation, desires to use the seas for its own purposes while simultaneously preventing others from using them in ways that are to its disadvantage. The **'ability'** to attain these twin objectives is what is known as 'maritime power', which comprises political, economic and military components. The primary 'instrument-of-state' for the exercise of the **military** component of maritime power is the Indian Navy — and, to a limited degree, the Indian Coast Guard. Indeed, within the Maritime Zones of India (MZI), which extend to the outer limits of our Exclusive Economic Zone (EEZ), the Indian Navy functions in seamless coordination with the Indian Coast Guard. Beyond the EEZ, however, the Indian Navy is the sole maritime manifestation of the sovereign power of the Indian Republic. Thus, on the one hand, the Indian Navy (along with the Indian Coast Guard) is the enabling instrument of maritime power, ensuring India's own use of the seas. On the other hand, the navy is also the **preventive** instrument of India's maritime power against the use of the seas by 'state', 'non-state' and state-sponsored-non-state' actors in ways that are inimical to India.

As a direct result of India's political decision to have a foreign policy that abjures any and all military alliances, the Indian Navy cannot afford to ape any of the 'niche-navies' of the world such as several European/NATO (North Atlantic Treaty Organisation) Navies. In other words, it cannot afford to 'specialise' in

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one or another strategic or operational facet while leaving other facets to be dealt with by some other navy. By corollary, it has no option but to pursue a 'balanced' set of operational and logistic capabilities that will enable it to remain relevant and significant across the entire spectrum of conflict.

In order to maximise its options for strategic or operational 'manoeuvre' (at the regional-theatre level) in responding to an attack by an adversarial nation-state, India is inevitably driven to acquire, possess and master 'blue water' naval capability. In times of peace and tension, this involves 'dissuasion', 'deterrence', the 'shaping of the probable battle-space' through 'perception management' and 'presence' missions, the maintenance of 'Maritime Domain Awareness' (MDA) through direct as well as cooperative surveillance, the gathering and collation of intelligence on a regional basis, and, the efficient discharge of the 'diplomatic', 'constabulary' and 'benign' roles of the navy. In times of active conflict, however, this implies the ability to routinely and efficiently mount and sustain naval operations-of-war at significant distances — of the order of several hundred nautical miles (nm) — from the Indian coast. Not only is 'air power' — or, given the contemporary technological context, 'aerospace power' — critical to sustain both 'offensive' and 'defensive' operations at these distances, but this air power must be available both 'here' and 'now'. For the most part, modern, technology-derived, shore-based airborne platforms such as air-to-air refuellers (tanker aircraft) have overcome the 'here' component of this twin requirement for the sustenance of blue water combat operations. However, the 'now' component requires aerospace power that is an 'embedded' or 'integral' component of fleet capabilities at sea. This is why integral air power, as embodied by the combat component known as a 'Carrier Battle Group' (CBG) has long been (and remains) a central operational concept of the Indian Navy. Although the US Navy, reflecting its doctrinal emphasis on air strikes launched 'from the

sea' against targets on the land, has changed the nomenclature to 'Carrier Strike Group' (CSG), the former seems more relevant to the Indian context. Whatever be the preferred terminology, the group consists of a synergistic and mutually supporting conglomerate of warships centred upon an aircraft carrier. The adjective 'synergistic' is particularly apt because the combat-capability of the group as a whole is almost always greater than the sum of its parts. Thus, while critically analysing the strengths and vulnerabilities of a CBG (or CSG), it is very important to bear in mind that it is the 'group' and not the aircraft carrier alone that must remain the central point of reference. In combat terms, the CBG is like a mathematical integer that cannot be fractionalised. Yet, aircraft carriers — even by themselves — are so highly visible, so hugely symbolic, and, tend to attract so much attention, that many analysts end up developing sophisticated but nevertheless fallacious arguments relating to the real and perceived vulnerabilities of this single platform alone, without applying their very considerable analytical skills to the CBG/CSG as a unitary whole.

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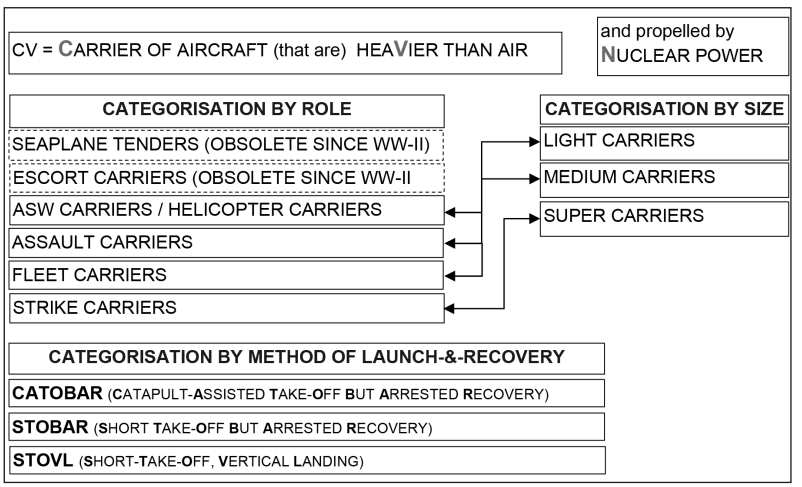
With the commissioning and recent active deployment of the *Vikramaditya* along with its air-group, and against the backdrop of the ongoing construction of the new *Vikrant*, there is a revival of the debate on the combat vulnerability of the aircraft carrier. Several Indian analysts worriedly point to the acquisition by potential adversaries of reconnaissance satellites, anti-ship ballistic-missiles, supersonic (and now 'hypersonic') long-range cruise missiles, nuclear-propelled attack-submarines (SSNs), very quiet diesel-electric submarines, and so on. These are serious apprehensions that neither can, nor should, evoke glib responses that are driven by empty bravado. The *Vikramaditya* is run by a highly trained crew whose number exceeds 1,500 — that is, the approximate strength of one-and-a-half infantry battalions of the Indian Army! Other than in a nuclear war, it would be inconceivable

for the Indian Army to lose one-and-a-half battalions to enemy combat power in just a few minutes. However, this magnitude of human loss in so compressed a timeframe is exactly what could happen were one of the Indian Navy's contemporary aircraft carriers to be sunk as a result of enemy action. The effect upon residual fighting capability, as also upon resultant morale at the naval, armed forces, and national levels would be no less catastrophic. Hence, issues involving a careful 'vulnerability assessment' and an equally careful 'vulnerability mitigation' are serious matters that merit serious and informed discussion and debate.

Terminological exactitude is a critical feature of any such analysis. In other words, it is essential to understand that the term 'aircraft carrier' is itself a generic one. There are several types of aircraft carriers, which vary widely from one another in terms of their displacement tonnage, their physical dimensions, their purpose or roles, their means of propulsion, the number of aircraft they carry in peace-time as opposed to the number that can be carried in combat, the manner in which these aircraft are launched and recovered, the extent and depth of on-board logistics, and repair capacity and capability, and so on. An example of this variety may be seen from the following schematic, familiarity with which might reduce the usage of loose or *ad hoc* terminology.

Fig 1



It is a historical fact that the last aircraft carrier to be been sunk in war-time was the Japanese aircraft carrier *Amagi*, in Kure harbour, in July 1945. Indeed, many proponents of the aircraft carrier — especially the Americans — make much of the fact that no US aircraft carrier has been sunk in combat since 1942. Yet, it is also true that during the sustained maritime combat of World War II, of the 66 fleet carriers and light fleet carriers that were used by the various protagonists, as many as 24 were sunk in combat against a variety of adversarial platforms — ships, submarines and naval aircraft.[1] If one were to include the smaller escort aircraft carriers (these were used for direct and indirect support operations in support of merchant convoys), the number of aircraft carriers sunk in enemy action would increase to 39. Since this article deals with defending the *Vikramaditya* in combat, these would appear to be sobering figures. That said, it is critical to remember that the vulnerability of an aircraft carrier that is part of a well-knit CBG / CSG is lower (by several orders of magnitude) than the vulnerability of an aircraft carrier operating pretty much by itself. Hence, the vulnerability or otherwise of aircraft carriers in World War II is certainly an indicative point of reference but hardly a definitive one.

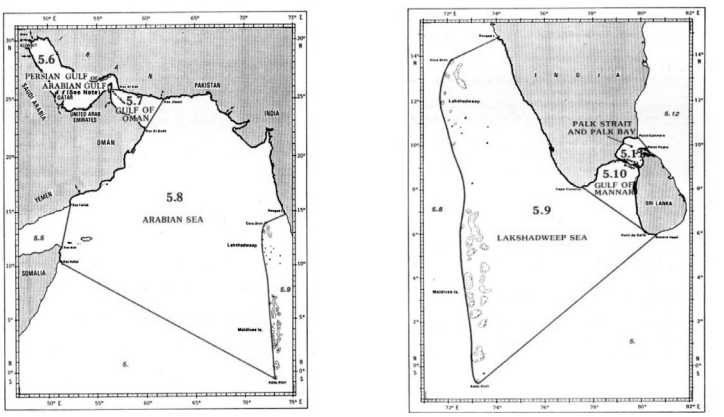
A typical combat-engagement cycle may be summarised as **"surveillance, detection, classification, identification, localisation, tracking, attack-criteria (i.e. evasion/engagement), and damage assessment"**. The vulnerability of the *Vikramaditya*-centred CBG in times of conflict needs to be analysed against this cycle. However, it is also important to avoid the simplistic trap of considering naval warfare as a game of 'hide and seek', where the 'hiders' and 'seekers' are mutually exclusive entities with pre-defined roles. In truth, the hunter is also simultaneously the hunted and vice versa. This, along with the attendant fact that the hunter and the hunted may be operating in completely different mediums, each oblivious of the other, imposes limitations upon both protagonists.

Surveillance and Detection: Thus, the first problem for an enemy that seeks the destruction of an aircraft carrier of the size and type under discussion is one of combat-surveillance and resultant detection. The

1. http://www.militaryphotos,net/forums/showthread.php?11486-fleet-carriers-sunk-in-world-war 2.

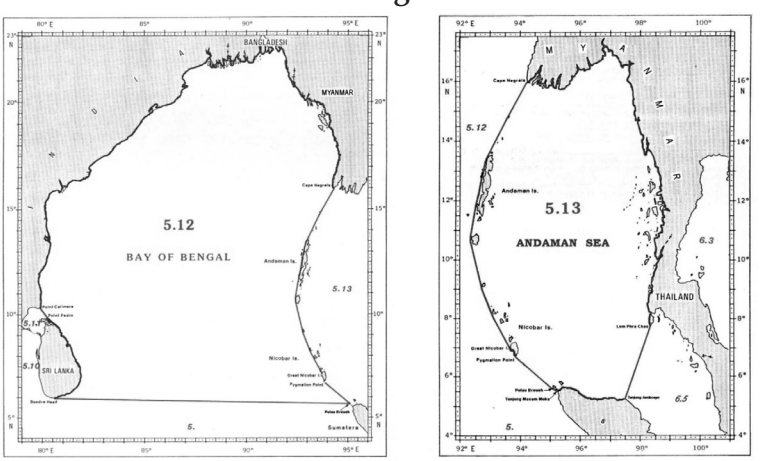
magnitude of this problem needs to be appreciated. Even if one were to consider solely what ***we*** call the 'Arabian Sea' (i.e., the sea area comprising the 'Arabian Sea' and the 'Laccadive Sea' as described in the Third Edition of IHO's Special Publication 23 *Limits of Oceans and Seas*, the area to be kept under surveillance is some 46,48,000 km². Similarly, the Bay of Bengal (inclusive of the Andaman Sea) covers an area of 27,72,000 km².

Fig 2



Source: IHO Special Publication 23, 3rd Edition. See at http://www.iho.int/iho_pubs/standard/S-23/S-23_Ed3_1953_EN.pdf

Fig 3



Source: IHO Special Publication 23, 3rd Edition. See at http://www.iho.int/iho_pubs/standard/S-23/S-23_Ed3_1953_EN.pdf

Persistent surveillance of these water bodies is well outside current capabilities of any form of shore-based radars, including 'over-the-horizon' ones. Surveillance by sea-based radars (aboard ships and submarines) is a formidable challenge. The average range of detection of a large surface ship or a group of surface ships by a shipborne radar is of the order of 30 nm (56 km), thereby yielding detection within an area (πr^2) of 9,852 km^2, which is 0.2 percent of the Arabian Sea alone (and 0.45 percent of the Bay of Bengal). In short, for the entire Arabian Sea to be kept under surveillance at any moment in time ('*t*'), against a CBG, would call for some 471 ships, each with optimally operating surface detection radar! Detection ranges achieved by submarines are significantly lower due to the low height of the radar antenna — apart from being an operationally unviable option. That leaves satellite-based oceanic surveillance and oceanic surveillance by airborne radars. Indeed, these are the options of choice.

However, since a CBG (such as the *Vikramaditya*-centred one) is quite comfortably able to cover a distance of some 900 km in a 24-hour period, real-time detection is needed. Insofar as satellite-based detection is concerned, this calls for ground stations whose 'footprint' would enable real-time downloads of imagery (electro-optical, radar, infra-red, or whatever) of medium/large objects detected at sea. An adversary seeking to make the Indian Ocean 'transparent', must, therefore, possess an adequate number of adequately located ground stations. As the name implies, 'ground stations' require ground. Such an adversary must, therefore, possess adequate 'territory' upon which 'ground stations' can be positioned — even if such 'ground stations' are contemporary, small, and portable ones, such as the US/NATO 'RAPIDS' (Resource and Programme Information Development System). All this is well beyond the current or near-term capabilities of any of India's likely adversaries. Turning finally to air-borne detection, this is typically achieved through shore-based 'Long Range Maritime Patrol' (LRMP) aircraft such as the P3C Orion, the Boeing P8I, etc. Pakistan has some capability within the Arabian Sea, and China has some marginal capability at the eastern fringes of the Bay of Bengal. These capabilities are further degraded by the deployment pattern likely to be adopted by the carrier-operating navy. Thus,

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the CBG, like any major weapon system, is likely to be deployed in accordance with the principles of 'manoeuvre warfare' and not those of 'attrition warfare'. In other words, the CBG would not normally be deployed where the enemy's tri-Service strength is the greatest — in this case, within the unrefuelled combat radius of an intact enemy's shore-based Fighter Ground Attack (FGA) aircraft. Indeed, the 'deployment-pattern' of the CBG is an overarching factor that is germane right across the aforementioned 'combat-engagement cycle' [surveillance, detection, classification, identification, localisation, tracking, attack-criteria (i.e. evasion/engagement), and damage assessment].

CBGs routinely put to sea well and are judiciously positioned firmly within 'blue waters' well before a crisis deteriorates into a conflict. It is instructive to note that in the six years of World War II, only one aircraft carrier (the Imperial Japanese ship *Amagi*) was ever sunk while in port. Thus, *"…the most basic protection the carrier has against being detected… is distance. The areas in which carriers typically operate are so vast that adversaries would be hard-pressed to find them even in the absence of active countermeasures by the battle group."*[2]

Classification: Assuming that detection has, indeed, been achieved, the problem of classification must now be wrestled with. In terms of traffic density, the Indian Ocean is the busiest of all the world's oceans, with over 120,000 ships transiting the International Shipping Lanes (ISLs) of this ocean every year. On our western seaboard, the Strait of Bab-el-Mandeb (connecting the Gulf of Aden and the Red Sea) accounts for some 22,000 ships annually, while the Strait of Malacca on the country's eastern seaboard accounts for a staggering 70,000 ships every year. Amongst these numbers are some large, fast ships — several of which, but not all, are comparable in size and

2. Dr Loren Thompson, *Aircraft Carrier (In)Vulnerability* (Naval Strike Forum, Lexington Institute, August 2001).

speed to an aircraft carrier. Examples include Ultra Large Crude Carriers (ULCCs) such as those operated by the shipping company 'TI' (Tankers International), Very Large Crude Carriers (VLCCs), Maersk E class container carriers, a number of cruise-ferries and cruise-liners, several 'car-and-truck' carriers, and, a large variety of 'Roll-on-Roll-off' [Ro-Ro] ships. Moreover, heavy-lift warships as also those designed for amphibious operations (such as the French Navy's Mistral class) and a number of classes of LPDs (Landing Platform Docks) can also be quite easily mistaken for aircraft carriers. In short, the process of correct classification is by no means as simple as it might initially appear. The situation is exacerbated by the fact that in a modern CBG such as that centred upon the *Vikramaditya*, the constituent ships of the group could be fairly dispersed. Yet another problem is that, as an air-borne hunter, the LRMP aircraft is acutely aware of its own vulnerability to carrier-based attrition. As such, every time the LRMP aircraft makes a detection — of what might eventually turn out to be one of these carrier-like merchantmen or a 'non-carrier' warship — it has no choice but to assume that every such contact is, indeed, the enemy aircraft carrier. Consequently, it is forced to **immediately** adopt a series of gambit tactics designed to promote its own survival against interception by carrier-based aircraft, which, however, seriously degrade the 'probability-of-detection' as a mathematical function of the 'scouting operation' being undertaken by it. This, as any experienced LRMP pilot crew would testify, is a very serious limitation and plays havoc with the entire process of executing a planned 'search'.

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Identification: Even after a contact that has been detected is classified as an aircraft carrier, problems of 'identification' persist. This is because extra-regional aircraft carriers (especially those of the US and French Navies) are deployed in both the Arabian Sea and the Bay of Bengal. It would be catastrophic if one of these were to be engaged by a trigger-happy LRMP aircraft searching

for the Indian Navy's *Vikramaditya* CBG. Although it is possible for an LRMP aircraft to effect a 'search mission' while using only passive means such as ESM (Electronic Support Measures), acoustic devices (sonobuoys, for example) and electro-optics, such a 'search' would yield a low 'probability-of-detection'. As such, more often than not, a 'search' mission seeking to confirm the presence or absence of a CBG in the area being searched, would be undertaken at least partially by active means (radar). The constituent ships of the CBG, being far more capacious than an LRMP aircraft, carry a far greater range and variety of Electronic Warfare (EW) suites than an aircraft. As such, an LRMP aircraft transmitting on its radar is very vulnerable — first, to detection by any or all of the excellently data-linked constituents of the CBG and, thereafter, to interception by carrier-based aircraft data linked to highly-qualified aircraft-direction teams, equipped with state-of-the-art Beyond Visual Range (BVR) missiles, well before it can reach its own 'Weapon-Release-Line' (WRL). Although intercept-geometry and calculations lie outside the scope of a generic article such as this, it is worth mentioning that even the venerable *Viraat*, with its severely limited number of 'Sea Harrier FRS-51' interceptors, has invariably succeeded in intercepting LRMP aircraft (colloquially known as 'snoopers') in advanced, freewheeling tactical and operational exercises such as the various editions of TROPEX (Theatre-level Operational-Readiness Exercise), involving both fleets of the Indian Navy as well as aircraft from the Fleet Air Arm and the Indian Air Force. The *Vikramaditya*, with its vastly superior numbers and capability of aircraft (the MiG 29-K), will certainly have a very much easier time of it.

Tracking and Attack Criteria: As Dr Lauren Thompson of the Lexington Institute puts it,

> Simply finding an aircraft carrier at a particular moment in time won't satisfy an attacker's targeting requirements. Once the carrier is spotted, the attacker must make a series of command decisions leading to the launch of weapons, and then the weapons must transit the space between their point of origin and the carrier. While all this is occurring, the carrier is moving. During a 30-minute

> period, it may have manoeuvred anywhere within a circle measuring 700 square miles. Over 90 minutes, the area grows to 6,000 square miles…."[3]

Thus, the probability of destruction of even a missile-equipped LRMP aircraft by carrier-based interception is increased manifold once the process of 'tracking', as a precursor to an attack on the CBG, gets underway. It must never be forgotten that LRMP aircraft holdings in the inventories of our potential adversaries are severely limited. Consequently, every loss of an LRMP aircraft imposes a very severe penalty on war-fighting capability. This is because it is this very LRMP aircraft that is required to 'trigger' the launch of shore-based aircraft of the enemy air force that have been earmarked for 'Maritime Air Operations' (MAO). Without this trigger, the MAO commander does not know when exactly he should launch his Fighter Ground Attack (FGA) aircraft to attack the carrier. This is a critical input to him because in attacking the CBG at long distances from the coast, his aircraft will need to operate with a number of limitations. They will consume a significant amount of fuel in the transit to and from their weapon-release line. As a result, their time-on-target will be limited. If a tanker aircraft is deployed near the seaward limit of the autonomous radius-of-action of the FGA, the refueller itself will become a strategically important (and, hence, hugely attractive) target for the carrier-borne aircraft and, as a further consequence, additional resources will have to be committed by way of air defence fighter aircraft so as to ensure its safety. The enemy's shore-based strike aircraft would, perforce, be operating well outside the cover of their land-based radars and, hence, bereft of direction by their fighter controllers. On the other hand, the *Vikramaditya*'s Combat Air Patrol (CAP) comprising MiG-29K aircraft in the interceptor role would be operating in the air defence mode, would have relatively more fuel and, hence, greater combat time (time-on-task). They would be operating within the radar cover of the CBG as a whole and, with their contemporary armament of BVR air-to-air missiles, would have the advantage of being directed by ship-borne fighter-controllers (known in the Indian Navy as 'direction officers'). It is clear that the MAO commander ashore cannot afford to fritter away

3. Ibid.

the fuel-endurance of his aircraft by launching them too early and, yet, he certainly cannot afford to launch them too late. Consequently, the timeliness and accuracy of the 'launch-trigger' provided to him by his LRMP aircraft is a *sine qua non* for his operations. Similarly, where conventionally powered submarines are concerned, they need to be redeployed in order to intercept the highly mobile and comparatively speedy CBG. This redeployment is achieved through what is known as 'MR-Sub Cooperation' ('MR' = Maritime Reconnaissance aircraft, which is just another term for an LRMP aircraft). The aircraft typically remotely triggers a shore-based Very Low Frequency (VLF) station and provides the information required for one or more submerged diesel-electric submarines to undertake 'Contact-Motion Analysis' (CMA) and accordingly redeploy for an interception. Without the LRMP aircraft, the dreadfully slow speed of conventionally powered submarines makes this whole business of redeployment a non-starter. Hence, as the *Vikramaditya*-centred CBG attains sequential or simultaneous destruction of the enemy's LRMP aircraft, it incrementally cripples the ability of the enemy to sensibly deploy either shore-based FGA or submarines against it. This will allow the CBG to close the enemy coast, should that be its operational intent.

This brings us to an important question of whether the requirement to close the enemy coast to attack targets ashore (military power projection) is truly what the *Vikramaditya*-centred CBG is meant to do. The answer lies in once again taking a look at the schematic categorisation of aircraft carriers shown in **Fig 1**. With a displacement of 45,400 tonnes, the *Vikramaditya*, which is conventionally (steam) propelled and carries some 36 aircraft (primarily the MiG 29-K), is certainly a 'fleet aircraft carrier'. However, she is not a 'strike carrier' (or 'super carrier') such as the nuclear-propelled aircraft carriers of the US Navy's Nimitz class, each of which displaces approximately 100,000 tonnes and carries about 90 fixed and rotary-wing aircraft, many of which have been designed primarily for air strikes on targets ashore. While the *Vikramaditya* does have reasonable shore strike capability, the number of aircraft she carries does not permit this to be her primary role. Instead, her principal purpose is that of a 'fleet carrier' — to form an integral part of a mutually-supportive and synergistic CBG

that can deliver telling punishment to enemy shipping (men o' war and merchantmen alike), submarines and aircraft, at ranges well beyond the launch-ranges of enemy weapons, including missiles. This is an important distinction because it implies that the deployment pattern of the *Vikramaditya* would be predicated towards maximising her blue water mobility and attendant manoeuvrability. By corollary, it sharply reduces and limits the vulnerability of the CBG to shore-based air attacks by an opposing air force. In support of such a pattern of deployment , the well-respected Dean of Naval Warfare Studies of the US Naval War College, Professor Robert C. Rubel, cautions war-planners, *"Do not become decisively engaged with land forces unless decisively superior"*. He goes on to emphasise that *"….the requirement to feed aircraft continuously into a land fight essentially robs the aircraft carrier of its maneuverability…"* and reminds them that a fundamental principle governing fleet deployment is, *"Do not tie a mobile fleet to a piece of ground."* [4.]

Defending the *Vikramaditya*-centred CBG against sub-surface threats is a more complex matter than defending it against aircraft threats. The ubiquitous 'negative-gradient' acoustic profile of the Arabian Sea makes early detection of submarines difficult, particularly if the CBG were to rely solely upon the hull-mounted sonars fitted aboard its constituent surface combatants. On the other hand, the ensuing vulnerability is mitigated by the fact that a conventionally-propelled submarine can be effectively redeployed for a mid-ocean interception of the CBG only through some form of MR-sub cooperation (which has been already been dealt with in this article). Quite apart from its 'blue water' positioning, the high speed-of-advance of the CBG is, in itself, an effective submarine-evasion measure, especially when it is overlaid by tactical manoeuvring involving course variations. Traditional deployments of conventional submarines concentrate upon 'choke-points' — whether created 'geographically' or 'operationally'. To be even marginally effective, mid-ocean deployments by conventionally propelled submarines need very accurate and timely tactical intelligence (via MR-sub cooperation) with regard to the 'Mean Line of Advance' (MLA) of the CBG. The difficulties

4. Professor Robert C Rubel, "The Future of Aircraft Carriers", *Naval War College Review*, vol. 64, no. 4, Autumn 2011.

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involved have already been touched upon earlier in this article.

However, once a nuclear-propelled attack submarine (what NATO refers to as an 'SSN') is introduced, the threat-equation changes sharply. On the one hand, SSNs are significantly noisier than contemporary diesel-electric submarines. On the other, their endurance limits are dictated by crew fatigue and not by battery life. As such, they have no 'indiscreet' periods dictated by the need to recharge batteries. Of course, this is also true (albeit to a limited extent) of diesel-electric submarines that are equipped with one or another form of 'Air-Independent Propulsion' (AIP). For all that, where the SSN really scores over the AIP-equipped diesel-electric boat (submarines are traditionally referred to as 'boats') is in its high underwater speed. This, coupled with the fact that SSNs routinely carry a combination of torpedoes (both 'anti-ship' and 'anti-submarine') and anti-surface missiles, means that there are no 'Limiting Lines of Approach' (LLAs) for an SSN and the CBG faces an all-round threat, rather than solely one from the van as is the case with the threat posed by conventionally-propelled boats. Thus, on the one hand, the ability of the CBG to use high transit speeds as an effective submarine-evasion tactic is nullified. Unable to 'evade' the threat, the CBG is forced to address it through the adoption of anti-submarine attack methods. On the other hand, the threat has metamorphosed into an all-round one, involving both torpedoes and sub-surface-launched missiles. Of course, the submarine must still be able to obtain an accurate fire-control solution through Contact Motion Analysis (CMA) and reach its launch position without being detected and, hence, prosecuted. As in all forms of Anti-Submarine Warfare (ASW), earliest detection is vital. There certainly are technical means available to the CBG to achieve long-range detection. These include Variable-Depth Sonars (VDS) aboard the surface combatants constituting the CBG, as also 'towed sonar arrays' streamed by ships equipped with them. In both cases, however, there is a penalty to be paid in terms of speed and manoeuvrability, thereby increasing vulnerability. Consequently, tactical

means have to be superimposed upon the technical ones. Indeed, developing, testing, and validating optimal tactical deployments of VDS-fitted and towed-array-fitted ships all form the 'bread-and-butter' of specialised naval organisations such as the Indian Naval Tactical Evaluation Group (INTEG) and the tactical war-gaming simulators in the navy's various tactical trainers. These tactical-technical combinations are obviously highly classified and can receive only the most perfunctory mention here. Yet, there is no gainsaying the fact that howsoever efficient, ASW measures taken by surface-ships against an SSN threat are seldom going to be adequate. Airborne ASW, on the other hand, is much more promising. In the case of the *Vikramaditya*-centred CBG, this involves an extensive and intensive deployment of rotary-wing ASW aircraft such as the refurbished Sea King Mk 42B and the Kamov-28, as also 'coordinated ASW operations' by shore-based long range ASW-capable aircraft such as the refurbished IL-38SD, the TU-142M, and, most important of all, the P8I. This is where the limited size of the *Vikramaditya* poses the most constraints, since it imposes limits upon the number of ASW-capable helicopters that can be embarked. This is also where the inadequacy in numbers of contemporary 'Medium-Range Multi-Role' (MRMR) helicopters is most acutely felt, since almost every frontline surface combatant of the *Vikramaditya*-centred CBG is capable of embarking and deploying two specialised medium/heavy ASW helicopters. Of course, this is also precisely where our bureaucratic inefficiencies — and the yawning knowledge-gaps that are ubiquitous within the Ministry of Defence — have their most severe operational impact. Logistic efficiencies (or lack of them) directly impact aircraft 'serviceability rates' and the logistic train at sea to support CBG-based naval combat operations takes well over two decades

Logistic efficiencies (or lack of them) directly impact aircraft 'serviceability rates' and the logistic train at sea to support CBG-based naval combat operations takes well over two decades to master. The experience of the US Navy, the British Royal Navy, the French Navy and the Indian Navy is all uniform in this regard and those analysing Chinese capabilities would do well to bear this in mind.

to master. The experience of the US Navy, the British Royal Navy, the French Navy and the Indian Navy is all uniform in this regard and those analysing Chinese capabilities would do well to bear this in mind. The deployment of an SSN (the *Chakra*, for the immediate present) as an intrinsic element within the *Vikramaditya*-centred CBG is an option that has been extensively validated by the US Navy and, amongst several other advantages, holds out much promise in dealing with the enemy SSN threat. This deployment of one's own SSN in an anti-submarine (hunter-killer) role against another SSN (or an SSBN) has long been common in both the US and the erstwhile Soviet Navy. It would be reasonable to expect the *Vikramaditya*-centred CBG to be similarly integrated with the Akula-class *Chakra* and follow-on indigenous SSNs, thereby minimising its vulnerability to an SSN attack.

Irrespective of the launch platform, the threat of the anti-ship cruise missile has been greatly diminished by current fleet capability. Indeed, there is little doubt that the uniformly excellent performance of the Barak anti-missile defence system has contributed enormously to the Indian Navy's renewed confidence in the capability and survivability of the *Vikramaditya*-centred CBG. This robust sense of self-belief has changed the fundamental pattern of deployment of the CBG from one where the principal aim was to avoid detection by missile-equipped LRMP aircraft of potential enemies. Today, there is a palpable sense of confidence that every ship of the CBG (including the aircraft carrier itself) has the proven ability to 'take on' a first-launch of an incoming anti-ship sea-skimming missile by the enemy and to thereafter 'take out' the launch-platform (whether surface, sub-surface or air-borne). This sense of self-assurance and the resultant rise in fleet morale is no small thing and has contributed significantly to a resurgence of bold and imaginative operational planning. As the new and greatly improved 'Barak ER' is inducted into the navy and retrofitted aboard its major surface combatants, this buoyancy is all set to increase.

That said, there is an increasingly shrill debate over the issue of what has come to be known as the 'anti-ship ballistic missile'. The Chinese-made 'Dong Feng 21-D' (DF-21D [CSS-5 Mod-4]) is widely touted by some as being a 'carrier-killer'. However, the actual state of development of this capability is far less clear than these Cassandran prophecies of doom might have us

believe. Some analysts, like the defence journalist J Michael Cole are on record in the respected current affairs magazine *The Diplomat* to say that the entire issue may just be part of strategic deception![5] Cole emphasises that "… ever since the People's Liberation Army's then chief of general staff General Chen Bingde gave the first official confirmation in July 2011 that the PLA was developing the DF-21D ASBM, specifics about the missile have been few and far between, with officials refraining from discussing the program in detail. For the most part, the hype has been the result of reports in Chinese media, which were subsequently picked up by Western outlets and analysts ….". Likewise, on April 10, 2014, the International Relations and Security Network (ISN) — the respected "open access information services for both professionals and students who focus on international relations (IR) and security studies" — published an interesting piece by the veteran Washington correspondent and analyst Cdr Otto Kreisher, USNR (Retd), in which he points out,

> …For a ballistic missile to hit a target at 1,000 miles or more, it has to know where that target is located, with a high degree of accuracy. That's complicated when the target — such as a carrier strike group — is moving at up to 34 miles per hour. For the weapon to be effective, such a geographic fix must be updated constantly. To locate a carrier initially, China could use its over-the-horizon (OTH) radars, which can search out more than a thousand miles. But the geographic accuracy of OTH radars at long range can be off by scores of miles. China is known to have at least three reconnaissance satellites in orbit over the Pacific — with SAR or optical sensors — that could be used to more accurately fix a carrier's position. Long-range Chinese reconnaissance aircraft or attack submarines could also pinpoint a carrier, if they were operating in the right area. But in a time of conflict, a patrol airplane or submarine attempting to get close to a carrier — shielded by its E-2C early warning airplanes, F/A-18 interceptors, and an anti-submarine screen of subs and destroyers — might not succeed. If the Chinese could get an accurate fix on the carrier, the data would have to be processed, and the

5. Michael J Cole, "The Diplomat", April 22, 2013: http://thediplomat.com/2013/04/the-df-21d-or-carrier-killer-an-instrument-of-deception/

> missile prepared, programmed, and launched — a complicated command and control procedure that has to be routinely tested and practised to ensure it works. The missile, its homing sensors, and guidance system would also have to function properly to reach and hit the moving carrier.
> Those integrated steps — to find, fix, target, and hit — are crucial links in what the military calls the "kill chain" of a successful weapon system. The complexity of that kill chain led Jan van Tol, a retired Navy captain and senior fellow on strategic planning at the Center for Strategic and Budgetary Assessment, to wonder…. in an interview, "I have seen no stories of any kind that China has successfully tested the system, first, against any mobile targets; … secondly, mobile targets at sea; and thirdly, mobile targets at sea amid clutter," meaning the various support ships in a carrier battle group. Such a demonstration "is what's really important to show that the weapon had actually reached operational capability," and these are "very difficult things."[6]

It is certainly true that if the Chinese really do have the capability they have claimed, the threat is one that needs to be prepared for assiduously in terms of anti-ballistic missile systems — whether the Aegis system or some indigenous one. Since this article leans towards the immediate present, however, and since China certainly has no ability to target a carrier operating within the Indian Ocean, this threat is not an immediate one. Nor is there any immediate answer to such a threat. There is, however, a 'window of time' available and we would do well to utilise it optimally.

The vulnerability of aircraft carriers has been, and will continue to be, debated for a long time yet. As always, the gallop of technology will favour first one side and then the other. At the present juncture, however, within the contemporary context of maritime conflict involving India and given the strengths and capabilities of the *Vikramaditya*-centred CBG, the foregoing arguments show that although defending the *Vikramaditya*-centred CBG in times of conflict is a complex exercise involving technical and tactical acumen of a high order, it is, nevertheless, very much 'doable'.

6. Otto Kreisher, "China's Carrier Killer: Threat and Theatrics", April 10, 2014, http://www.isn.ethz.ch/Digital-Library/Articles/Detail/?lng=en&id=177869