POLICY BRIEF

The Tactical Reach and Requirement of the Indian Navy

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Executive Summary

The Indian Navy has embarked on an ambitious effort to modernise its forces in order to respond to the increasing activities of various naval forces in the Indian Ocean region. In particular, a lot of attention has been rendered to the capabilities of the Chinese naval forces. The debate is still young on how India should respond to growing Chinese naval power. How will India fare in a naval engagement with China? Should and will it be able to match Chinese force modernisation? Is a force-on-force modernisation pace the only option? Should India be concerned about strategic outcomes of engaging in an arms race with China? These are policy questions that need to be debated and analysed before any policy decisions are made. This policy brief is an initial attempt at examining these questions.

Policy Recommendations

(1) The most probable naval standoff between India and China in the near future would be an extension of a border dispute that extends over to the maritime domain in some form of a blockade. The Indian Navy should focus on preparing for such a contingency.

(2) For the Indian Navy, a massed force-on-force attack against an alerted Chinese force would be highly disadvantageous. Approximately 10 per cent of Chinese assets can completely destroy the entire massed fleet of Indian destroyers and frigates when they are in a simultaneous engagement, i.e. a naval melee. Since the Chinese possess naval force superiority (in terms of number of ships) in ample measure, it would be very disadvantageous for India to engage in a force-on-force massed engagement with China without either capability to execute a surprise attack or to execute a first-strike before the Chinese can launch a retaliation strike. The Indian Navy should aim to execute better tactics rather than brute force against the Chinese Navy.

(3) Without surprise or first-strike as an option, the Indian naval forces must fight as a dispersed force and win by out scouting the enemy so as to avoid a debilitating attack. By fighting as a dispersed force, the Indian forces will be able to demonstrate to the Chinese that they cannot have assured victory, which might be enough diplomatic leverage.

(4) The ability of the Indian forces to fight as a dispersed force in order to effectively prevent Chinese naval success is just enough. Its fleet of destroyers and frigates seem to have just about the right number of vessels to dissuade Chinese actions. It would be prudent for Indian policymakers to aim to increase this relative balance of assets.

(5) Maintaining the relative acquisition pace with China is very critical for the Indian Navy.

(6) The challenge for Indian naval planners lies in acquiring naval assets without stoking an undesirable action by the Pakistani navy. Conceivably, the Pakistani navy is a more probable near term threat than the Chinese navy for India. Given that, it would be prudent to be aware of any policy distortions Indian naval acquisition vis-à-vis China might create with Pakistan.

(7) If India is able to acquire longer-range missiles or longer-range sensors, significant advantages will accrue to it. Investing in better missiles and sensors might in fact turn out to be the best alternative for the Indian Navy rather than to engage in costly arms race with China.

Introduction

The changing dynamics of its geo-political neighbourhood has caused the Indian Navy to re-evaluate its operational capabilities in recent years. In particular, the growing reach and power projection capabilities of the Chinese Navy are seen broadly as a potential challenge to which the Indian Navy has to adapt and respond. The debate within India, for the most part, has focused on the "Strings of Pearls"[1] argument which describes China's efforts to increase access to ports and airfields and develop special diplomatic relationships that extend from the South China Sea through the Strait of Malacca, across the Indian Ocean, and on to the Arabian Gulf, to facilitate the stationing and berthing of vessels by providing technical support, maintenance, refueling, and associated materiel supplies.[2] The argument is made that these "pearls" could be used in a naval engagement to India's disadvantage.

Most Indian analysts espousing the idea of a Chinese naval threat point to the Chinese presence in and near the Indian Ocean as part of its "far sea defense" concept. China has introduced the concept of ''far sea defense" as the driver for developing its long-range naval capabilities. The PLA Navy (PLAN) defines the "far seas" as stretching from the northwest Pacific Ocean to the eastern Indian Ocean and, more recently, the east coast of Africa.[3] This evolving manifestation of China's military and diplomatic strength outside its traditional maritime region is seen as threatening.

Given this threat,[4] the pertinent policy questions for the Indian Navy are: What are the capabilities of the Chinese force vis-à-vis India? Are current Indian capabilities sufficient? What are its future capability requirements? What can India do to respond without initiating a costly arms race? This paper will attempt to explore and answer these questions.

The Primary Mission of the Indian Navy: Naval Blockade

The first step in analysing the relative strengths between Chinese and Indian naval forces, is to determine the most probable naval engagement scenario between them in the near future. Without this context, it will not be possible to examine if their relative capabilities favour one side or the other. It seems that the most probable naval standoff between India and China in the near future would be an extension of a border dispute that extends over to the maritime domain in the form of a blockade. India's new Maritime Doctrine has openly stated that, "The only measure of combat effectiveness at sea is the successful use of ocean areas or the denial of the same to an adversary, all aimed at furthering national interests, in war and peace. In other words, the capability of a navy to affect sea control or sea denial in the ocean areas of its interest would be a major determinant in the outcome of war."

The Indian Navy has in the past successfully engaged in blockade missions. In the 1999 Kargil War with Pakistan, the Indian Navy, in a determined anticipatory move to help deter Pakistan from escalating the fighting into a larger war, went on full alert and readied itself to blockade Pakistan's ports, principally Karachi. In the ensuing Operation Talwar, India's eastern and western fleets joined assets and blocked the Arabian Sea routes to

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[1] Port and airfield construction projects, diplomatic ties, and force modernization form the essence of China's "String of Pearls." The "pearls" extend from the coast of mainland China through the littorals of the South China Sea, the Strait of Malacca, across of Indian Ocean, and on to the littorals of the Arabian Sea and Persian Gulf. Each "pearl" in the "String of Pearls" is a nexus of Chinese geopolitical influence or military presence. Hainan Island, with recently upgraded military facilities, is a "pearl." An upgraded airstrip on Woody Island, located in the Paracel archipelago 300 nautical miles east of Vietnam, is a "pearl." A container shipping facility in Chittagong, Bangladesh, is a "pearl." Construction of a deep water port in Sittwe, Myanmar, is a "pearl." The construction of a navy base in Gwadar, Pakistan, is a "Pearl."

[2] Christopher J. Pehrson, "String of Pearls: Meeting the Challenge of China's Rising Power Across the Asian Littoral," Strategic Studies Institute (2006); David Brewster, "Looking Beyond the String of Pearls: Indian Ocean is Where India Holds a Clear Advantage over China," *India Today* (2013); Alex Vines, "Mesmerized by Chinese String of Pearls Theory," *The World Today* (2012); Cmde Ranjit B Rai, "China's String of Pearls vs. India's Iron Curtain," IndianDefenceReview.com, Vol. 24-4 (2009); Arun Sahgal, "China's Military Modernization: Responses from India". In Ashley J. Tellis and Travis Tanner (Eds.), *Strategic Asia 2012-13: China's Military Challenge*. The National Bureau of Asian Research, Washington D.C., 2012.

[3] Philip C. Saunders, Christopher D. Yung, Michael Swaine, and Andrew Nien-Dzu Yang, (Eds.), *The Chinese Navy: Expanding Capabilities, Evolving Roles*. National Defense University Press, Washington D.C., 2011; and Joseph Y. Lin, "China Focuses on 'Far Sea Defence," *Asia Times Online*, 9 July 2010.

[4] This paper does not examine the validity of the claim that the Chinese actions are threatening. That is assumed to be valid and further analysis is conducted. That should not be taken to imply that the author agrees with those claiming that Chinese actions are directed towards India or that it is inherently threatening.

Pakistan. The presence of Indian naval ships played on the Pakistan navy's apprehension of oil supplies from the Gulf being disrupted. Sensitive about the vulnerability of these oil supplies, and aware that a naval engagement might expose its fuel storages in Karachi and its sea lanes to naval attack, the Pakistan Navy escorted its oil tankers along the Makran Coast. Later, Pakistan's then Prime Minister Nawaz Sharif disclosed that Pakistan had been left with just six days of fuel to sustain combat operations had a full-scale war broken out.[5] By manoeuvring and positioning its fleet, the Indian Navy was able to bring pressure on its adversary without escalating tensions into a full-fledged naval engagement.[6]

In the near term, it seems reasonable for the Indian Navy to want to possess the capability to perform a similar form of blockade against China. The Chinese certainly seem to think that is the capability that India would bring to effect on them. Beijing has since the mid-2000s expressed concern over its so-called "Malacca Dilemma", whereby a vast majority of its imported energy resources passes through the narrow straits of Southeast Asia, primarily the Malacca Straits, increasing the country's vulnerability to disruption. A Chinese naval analyst, Zhang Ming, has recently proclaimed that the Islands of India's Andaman and Nicobar Archipelago could be used as a "metal chain" to block Chinese access to the Straits of Malacca.[7] That India has established its Far Eastern Command centre in the Andaman, and Nicobar Islands is seen by some Chinese observers as evidence of a potential Indian desire to be able to contest the passage of Chinese vessels into the Indian Ocean. For its part, the Indian Navy has rounded the Malacca Straits into the South China Sea and the Pacific, secured good relations with Vietnam and has examined the option of participating in a "Quadrilateral Initiative" alongside Australia, Japan and the United States, which is widely interpreted as a means of hedging against rising Chinese naval power.

Given the predominant concern about naval blockades, further analysis of Chinese and Indian naval capability in this paper will be evaluated on the basis of that particular mission.

Force-On-Force Comparisons

In order to determine the relative capability of China and India to engage in and break a naval blockade a simple mathematical analysis is performed. The model, called the "fractional exchange ratio," is a robust way to compare equal-cost configurations of naval forces without any knowledge of how exactly and where warships will fight or the competence of the tacticians who will employ them in combat. The model aspires to the simplest mathematical equation that captures the essential dynamics of force against force fighting in sea, thereby enabling an exploratory analysis of modern naval warfare possible.[8]

Force-on-force comparison of naval combat is given by the two basic fractional exchange ratio equations shown below. These equations will be employed in this paper in order to compare current Chinese and Indian naval capabilities. Let $\Delta\mathbf{B} = \frac{\alpha A - b_3 B}{b_1}$ be the effect of a single Chinese salvo attack on Indian ships in terms of ships put out of action. Similarly, let $\Delta\mathbf{A} = \frac{\beta B - a_3 A}{a_1}$ be the effect of a single Indian salvo attack on Chinese ships.

For the kind of naval blockade missions discussed above, it is the destroyers and frigates that will be pressed into action. The model is, therefore, exercised with these aggregate task fleet elements and the results are expressed as aggregate losses to these particular fleet elements. Therefore, the two sides, China and India, will have (*A=76*) and (*B=23*) total ships respectively before an engagement. See Table 1 below for details on the current total number of Chinese and Indian naval assets.

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[5] Benjamin S. Lambeth, *Airpower at 18000': The Indian Air Force in the Kargil War.* Carnegie Endowment for International Peace, Washington D.C., 2012.
[6] Vice Admiral GM Hiranandani (Retd.), "Chapter 9: Operation Talwar during the Kargil War in 1999." In *Transitions to Guardianship: The Indian Navy 1991-2000*. Ministry of Defense (Navy), Naval Headquarters, New Delhi (2009).
[7] Cmde Ranjit B Rai, "China's String of Pearls vs. India's Iron Curtain," IndianDefenceReview.com, Vol. 24-4 (2009); and David Brewster, "Looking Beyond the String of Pearls: Indian Ocean is Where India Holds a Clear Advantage over China," *India Today*, (2013).
[8] Wayne P. Hughes, Jr., "A Salvo Model of Warships in Missile Combat Used to Evaluate Their Staying Power." In Jerome Bracken, Moshe Kress, and Richard E. Rosenthal (Eds.), "Warfare Modeling," Military Operations Research Society, USA, 1995.

Table 1: Comparing Chinese and Indian Naval Assets[9]

Chines Platforms	Total
Nuclear-powered attack submarine (SSN)[10]	5
Diesel-powered attack submarine (SSK)[12]	55
Aircraft Carriers[14]	1
Destroyers[15]	14
Frigates[17]	62
Amphibious ships	85
Patrol and Coastal Combatants[19]	211+
Mine warfare ships	47
Logistics and Support	205

India Platforms	Total
Nuclear-powered attack submarine (SSN)[11]	1 (trials)
Diesel-powered attack submarine (SSK)[13]	14
Aircraft Carriers	—
Destroyers[16]	11
Frigates[18]	12
Amphibious ships	10
Corvettes[20] (Patrol and Coastal Combatants)	24
Mine warfare ships	8
Logistics and Support	50

The fractional exchange ratio equation is calculated on the basis of the following characteristics of naval ships:

- *Staying Power* of a naval ship is the number of nominal Anti-Ship Missile (AShM) hits needed to put the ship out of actions, denoted by a_1 and b_1 for China and India respectively.[21] The Indian destroyers/frigates/cruisers seem to possess more

[9] International Institute for Strategic Studies, *Chapter Six: Asia, The Military Balance 2013*. International Institute for Strategic Studies 113:1, 2013; U.S. Department of Defense, "Military and Security Developments Involving the People's Republic of China 2012, *Annual report prepared for Congress* (2012); Ronald O'Rourke, "China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress," *Congressional Research Service, CRS Report RL33153* (2012); and Andrew S. Erickson, "Naval and Air Forces: China's Modernization of its Naval and Air Power Capabilities." In (Eds.), Ashley J. Tellis and Travis Tanner, "*Strategic Asia 2012-13: China's Military Challenge.*" The National Bureau of Asian Research, Washington D.C., 2012.

[10] 3 *Han* (Type-091) with YJ-82 AShM, 6 single 533mm TT; and 2 *Shang* (Type-093) with 6 single 533mm TT. Only Tactical submarines included.

[11] *Chakra* (RUS *Nerpa*) with 4 single 533mm TT with 3M54 *Klub* (SS-N-27 *Sizzler*) SLCM, 4 single 650mm TT with T-65 HWT; (RUS lease agreement – under trials; not at full OC).

[12] 12 *Kilo* (2 Project 877, 2 Project 636, 8 Project 636N) with 3M54 *Klub* (SS-N-27B *Sizzler)* ASCM, 6 single 533mm TT with up to 18 Test-71/96 HWT; 20 *Ming* (4 Type-035, 12 Type-035G, 4 Type-035B) with 8 single 533mm TT; 16 *Song* (Type-039/039G) with YJ-82 (CSS-N-8) *Saccade* ASCM, 6 single 533mm TT; 4 *Yuan* (Type-039A) with 6 533mm TT; and 3 *Yuan* II (Type-039B) with 6 533mm TT.

[13] 4 *Shishumar* (GER T-209/1500) with 8 single 533mm TT; 4 *Sindhughosh* (FSU *Kilo*) with 6 single 533mm TT (2 of which are undergoing phased refit of 3M54 *Klub* (SSN-27 *Sizzler*) SLCM); and 6 *Sindhughosh* (FSU *Kilo*) with 6 single 533mm TT with 3M54 *Klub* (SS-N-27 Sizzler) SLCM.

[14] 1 *Liaoning* (capacity 18-24 J-15 ac; 17 Ka-28/Ka-31/Z-8S/Z-8JH/Z-8AEW hel).

[15] **DDGHM 12:** 4 *Hangzhou* (RUS *Sovremenny*) with 2 quad lnchr with 3M80/3M82 *Moskit* (SS-N-22 *Sunburn*) AShM; 2 *Luyang* (Type-052B) with 4 quad lnchr with YJ-82/83 AShM; 3 *Luyang II* (Type-052C) with 2 quad lnchr with YJ-62 AShM; 1 *Luhai* (Type-051B) with 4 quad lnchr with YJ-83 AShM; 2 *Luhu* (Type-052) with 4 quad lnchr with YJ-82/83
AShM. **DDGM 2:** 2 *Luzhou* (Type-051C) with 2 quad lnchr with YJ-82/83 AShM.

[16] **DDGHM** 6: 3 *Delhi* with 4 quad lnchr with 3M-24 *Uran* (SS-N-25 *Switchblade*) AShM; 3 *Shivalik* with 1 octuple VLS with 3M54 *Klub* (SS-N-27 *Sizzler*) ASCM. **DDGM** 5: 2 *Rajput* (FSU *Kashin*) with 2 twin lnchr with R-15M *Termit M* (SS-N-2C *Styx*) AShM; 1 *Rajput* (FSU *Kashin*) with 2 twin lnchr with PJ-10 *Brahmos* ASCM, 2 single lnchr with R-15M *Termit M* (SS-N-2C *Styx*) AShM; 2 *Rajput* (FSU *Kashin*) with 1 octuple VLS with PJ-10 *Brahmos* ASCM, 2 twin lnchr with R-15M *Termit M* (SS-N-2C *Styx*) AShM.

[17] **FFGHM 29:** 2 *Jiangkai* (Type-054) with 2 quad lnchr with YJ-82/83 AShM; 13 *Jiangkai* II (Type-054A) with 2 quad lnchr with YJ-82/83 AShM; 4 *Jiangwei* I (Type-053H2G) with 2 triple lnchr with YJ-82/83 AShM; 10 *Jiangwei* II (Type-053H3) with 2 quad lnchr with YJ-82/83 AShM. **FFGH** 1: 1 *Jianghu* IV (Type-053H1Q - trg role) with 1 triple
lnchr with HY-2 (CSS-N-2) AShM; **FFGM** 4: 2 *Luda* III (Type-051DT) with 4 quad lnchr with YJ-82/83 AShM; 2 *Luda* III (Type-051G) with 4 quad lnchr with YJ-82/83 AShM. **FFG** 28: 8 *Jianghu* I (Type-053H) with 2 triple lnchr with SY-1
(CSS-N-2) AShM; 5 *Jianghu* II (Type-053H1) with 2 triple lnchr with HY-2 (CSS-N-2) AShM; 3 *Jianghu* III (Type-053H2) with 4 twin lnchr with YJ-82/83 AShM; and 6 *Jianghu* V (Type-053H1G) with 2 quad lnchr with YJ-82/83 AShM; and 6 *Luda* II (Type-051) with 2 triple lnchr with HY-2 (CSS-N-2) *Seersucker* AShM.

[18] **FFGHM 11:** 3 *Brahmaputra* with 4 quad lnchr with SS-N-25 *Switchblade* AShM; 3 *Godavari* with 4 single lnchr with R-15 *Termit* M (SS-N-2D *Styx*) AShM; 3 *Talwar* I with 1 octuple VLS with 3M54 *Klub* (SS-N-27 *Sizzler*) AShM; and 2 *Talwar* II with 1 octuple VLS with 3M54 Klub (SS-N-27 *Sizzler*) AShM . **FFH 1:** 1 *Nilgiri* with 2 triple 324mm ASTT, 2 twin 114mm gun (capacity 1 SA316B *Alouette III* (*Chetak*) hel/*Sea King* Mk42 ASW hel).

[19] **PCFG 76+:** 65+ *Houbei* (Type-022) with 2 quad lanchr with YJ-82/83 AShM; and 11 *Huangfen* (Type-021) with 2 twin lnchr with HY-2 (CSS-N-3) AShM **PCG 26:** 6 *Houjian* (Type-037/II) with 2 triple lnchr with YJ-8 (CSS-N-4) AShM; 20 *Houxin* (Type-037/IG) with 2 twin lnchr with YJ-8 (CSS-N-4) AShM. **PCC 75:** 3 *Haijui* (Type-037/I); 50 *Hainan* (Type-037); and 22 *Haiqing* (Type-037/IS). **PB 34+**: *Haizui*/*Shanghai III* (Type-062/I).

[20] **FSGM 20:** 4 *Khukri* with 2 twin lnchr with R-15M *Termit M* (SS-N-2C *Styx*) AShM; 4 *Kora* with 4 quad lnchr with 3M24 *Uran* (SS-N-25 *Switchblade*) AShM; 10 *Veer* (FSU *Tarantul*) with 4 single lnchr with R-15 *Termit M* (SS-N-2D *Styx*) AShM; 2 *Prabal* (mod *Veer*). **FSM 4:** 4 *Abhay* (FSU *Pauk* II).

[21] a_1 = number of hits by India's missiles needed to put one Chinese ship out of action; b_1 = number of hits by China's missiles needed to put one Chinese ship out of action. Implicit in the equations is the assumption that staying power is linear, i.e. if two hits put a ship out of action, one hit reduces its striking power and defensive power by half.

staying power than the Chinese counterparts. For example, in 2012, China had 75 vessels with a total tonnage of 266,000 whereas India had 22 vessels with a total tonnage of 110,200. In other words, Chinese vessels seem to have a per ship tonnage of approximately 3547 whereas Indian vessels seem to have a per ship tonnage of approximately 5009. This translates into 1.5 times more tonnage and consequently more staying power for Indian vessels.[22]

- *Striking power* of each attacker is the number of accurate AShM launched, denoted by α and β.[23] It is the number of missiles that will hit if there is no ship defense. For our analysis both α and β will be taken to be 16. This number is derived from the observation that for the case of Chinese destroyers and frigates, they seem to be equipped with either 2 quad or 4 quad AShM launchers. This translates to 8 or 16 AShM per vessel (see Table 1 related footnote for details on this calculation). Unlike China, Indian destroyers and frigates are either equipped with 2/4 quad launchers or an octuple Vertical Lunch System (VLS) AShM (see Table 1 related footnote for details on this calculation). For the case of India, this again translates into 8 to 16 AShM per naval vessel.

- *Defensive Power* is the number of good shots that each defender will destroy or deflect when alert and ready to do so, denoted by a_3 and b_3.[24] In this paper, defensive power is assumed to be 20 per cent of striking power i.e. 0.2*16=3.2. Therefore, every Chinese and Indian naval ship is capable of defending 3.2 AShM when it is alerted to an attack.

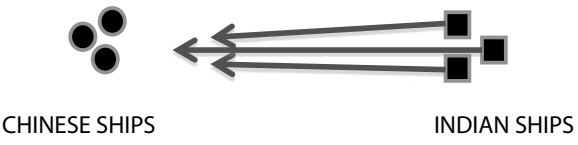
Force-On-Force Comparisons: Case Studies

All the following four case studies will examine a scenario where the Chinese Navy is trying to respond to and break an Indian naval blockade. The aim is to determine the capability of the Indian Navy to maintain the blockade without losing its fleet assets or escalating the engagement.

Case I: India has complete surprise over China

In this case scenario, India has complete tactical surprise over Chinese naval ships. Therefore, the Chinese ships are not able to exercise their defensive capability, i.e. a_3=0 (see Figure 1 for an illustration). As described above, the total Chinese seafaring ships, A=73 is subject to attack from a total of (B=23) Indian ships each firing up to 16 AShM. In this scenario, using the fractional exchange ratio equation, we can calculate and see that the entire Chinese fleet will be destroyed by Indian ships. The details are of the calculation are shown in Table 2.

Figure 1: Illustration of scenario where India has complete surprise over China



Case I shows that a massed force even of lesser number like India can mount an effective attack against a larger force like China when it is able to mount a stealthy undetected surprise attack. This is because when one ship is tracked and subjected to attack in a massed force, all the rest is too. It is however, not very easy to obtain complete surprise over an adversary. It is also not possible to hope for such an element of surprise in a naval blockade.

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[22] Geoffrey Till, *Asia's Naval Expansion: An Arms Race in the Making?* The International Institute for Strategic Studies, Artech House, London, UK, 2012; Andrew S. Erickson, "Naval and Air Forces: China's Modernization of its Naval and Air Power Capabilities." in (Eds.), Ashley J. Tellis and Travis Tanner, "Strategic Asia 2012-13: China's Military Challenge," The National Bureau of Asian Research, Washington D.C., 2012.

[23] α = number of well-aimed missiles fired by each Chinese ship; β = number of well-aimed missiles fired by each Indian ship. Again, implicit in the equations is the assumption that the missiles in the salvo are spread uniformly over the defender's ship. A uniform distribution is not necessarily best, because if each defender extracts an equal number of good shots, the whole strike may be defeated, whereas an uneven distribution concentrated against only some targets would put at least those targets out of action. However, knowledge required for optimal distribution of a salvo is almost impossible to get in foresight. Given that, the assumption of a uniform distribution is as good as any for exploratory analysis. Also, there is no allowance for two ships shooting at the same target or other waste and inefficiency in the fog of war. It is, however, possible for an interested analyst to build in such variances.

[24] a_3 = number of well-aimed Indian missiles destroyed by a Chinese ship; b_1 = number of well-aimed Chinese missiles destroyed by an Indian ship. Again, implicit in the equations is the assumption that defensive power ignores the existence of leakers; the aggregate defense is perfect until it is saturated with more missiles than it can defend against. Also, the coordination of defensive fire power and passive soft-kill measures is taken to be complete.

Case II: India does not have surprise but is able to deliver an undetected first strike

In Case II, India does not have tactical surprise over Chinese naval ships. Therefore, each individual Chinese ship is able to exercise their defensive capability, i.e. a_3= 3.2 (20 per cent of all incoming AShM can be defended and stopped). However, the Indian naval ships are able to still exercise a first strike before any Chinese offensive retaliation. Figure 2 shows an illustration of this concept. In the figure, the red lines indicate Indian AShM attacking Chinese ships and blue lines indicate defensive measures of each Chinese ship.

Figure 2: Illustration of scenario where India does not have surprise but is able to deliver an undetected first strike

Table 2: Fractional Exchange Ratio Calculations

	Total Chinese Ships **(A)**	Total Indian Ships **(B)**	Total number of AShM launched by per Chinese ship against Indian ships **(α)**	Total number of AShM launched by per India ship against Chinese ships **(β)**	The number of nominal AShM hits needed to put the one Chinese ship out of actions **(a_1)**	The number of nominal AShM hits needed to put the one Indian ship out of actions **(b_1)**	The number of good shots that each Chinese ship will destroy or deflect when alert and ready to do so **(a_3)**	The number of good shots that each Chinese ship will destroy or deflect when alert and ready to do so **(b_3)**	Total number of Chinese ships put out of action **(ΔA)**	Total number of Indian ships put out of action **(ΔB)**
Case I: India has complete surprise over China	76	23	16	16	1	1.5	0	--	368	--
Case II: India does not have surprise but is able to deliver an undetected first strike	76	23	16	16	1	1.5	3.2	--	~125	--
Case III: Both India and China simultaneously engage with no surprise or first strike advantage over the other	76	23	16	16	1	1.5	3.2	3.2	~125	~1142
Case IV: Simultaneous engagement – Massed Chinese naval forces against dispersed Indian naval forces	76	23 (dispersed as 3, 10, 10)	16	16	1	1.5	3.2	3.2	~77	--

In this scenario, using the fractional exchange ratio equation, we can see from Table 2 that the total number of possible Chinese ships that can be put out of action by Indian ships is reduced. However, it is still sufficiently high to destroy the entire Chinese fleet. This scenario might be possible in a case where the Indian Navy possesses superior scouting and targeting capability than the Chinese forces. For example, a networked and satellite-enabled Indian Navy might conceivably be able to achieve the outcome of Case II. Estimating if such a capability exists is left for further iterations of this paper.

Case III: Both India and China simultaneously engage with no surprise or first strike advantage over the other

In Case III, neither India nor China has tactical surprise over the other force. In this case, both forces simultaneously discharge their AShM with each exercising their defensive capability. Figure 3 shows an illustration of this concept. In

this scenario, using the fractional exchange ratio equation, we can see from Table 2 that the large number of ships in the Chinese fleet has a very large destruction potential vis-à-vis Indian forces.

Figure 3: Illustration of scenario where both India and China simultaneously engage with no surprise or first strike advantage over the other

CHINESE SHIPS INDIAN SHIPS

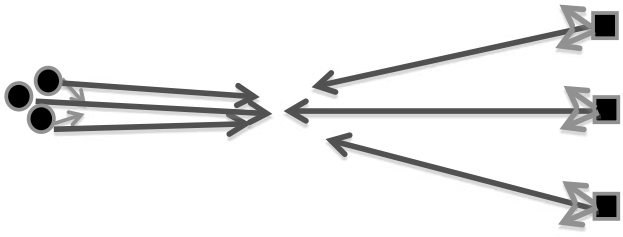
In fact, knowing that each individual Indian ship has b_3= 3.2[25] and b_1=1.5, the Chinese needs to commit approximately only 7 naval ships (i.e. less than 10 per cent of its naval ships) to completely eliminate Indian ships in a force-on-force head-on engagement.

This case illustrates that given its comparatively lower number of naval assets, India, in an engagement with no surprise or first strike to its advantage, would be completely defeated. Without superior scouting, targeting or attack capability vis-à-vis China, this would be the most likely outcome unless the Indian Navy develops innovative tactics. Case study IV is an attempt to explore such tactics.

Case IV: Simultaneous engagement – Massed Chinese naval forces against dispersed Indian naval forces

Case IV is a variant of Case III developed to provide an advantage for India. In this case, similar to Case III, both forces simultaneously discharge their AShM with each exercising their defensive capability. However, the Indian naval ships are dispersed into 3 fleets (composed of 3, 10 and 10 naval ships). Figure 4 shows an illustration of this concept.

Figure 4: Illustration of scenario with massed Chinese naval forces against dispersed Indian naval forces



CHINESE SHIPS INDIAN SHIPS

The tactic in play here by India is an attempt to mitigate its disadvantage of small number of its naval assets. The tactic is to spread the ships in the hope that not all would be detected and attacked simultaneously. In Case IV, Indian ships have an equal chance of detecting Chinese ships first, since all of them are massed together. However, China is confronted with the more difficult scouting problem of having to detect all of India's ships in the three different separated formations in order not to suffer the loss of its ships. If one of India's ships can track Chinese ships while staying outside of Chinese missile ranges, India's tracking ship may be able to guide another ship quietly into range with a fire-control solution for an undetected attack. While it is likely that some Indian ships will be detected and lost, if only one Indian ship detects first, it will devastate all of China's massed naval assets.

Table 2 shows the calculation and outcome of this tactic. The relative number of naval ships in Indian inventory seems just about right to engage in this tactic. It is important that India maintain its balance of forces with China at least at the present level in order to be able to execute a blockade mission. It is worth pointing out that the Chinese can respond to this tactic by dispersing their forces. In that case, the calculations go into details of relative losses of ships and sequential salvo attacks. For the aims of this paper, those details are not pertinent. It is unimportant to obtain the mathematically optimum solution, because there are too many unknowns that will mess up the distribution of fire, damage effects, etc. These and other uncertainties are assumed away in mean value computations.

Conclusion and Recommendations

The case studies I and II above demonstrate that the ideal desired course of action for an Indian naval engagement with China, given its smaller force, would be to have complete surprise over Chinese forces; or possess a first-strike advantage where the Indian naval ships are able to shoot at Chinese vessels before they have a chance to fire back. It would however, be very difficult for Indian naval vessels to obtain either of these advantages in a tense scenario involving a naval blockade.

[25] b_3 is the defensive capability of Indian ships against AShMs. It is assumed that 20 per cent of all incoming AShM can be defended against or in words, 0.2*16=3.2, is the number of AShM that are stopped.

In that case, a massed attack against an alerted Chinese force would be highly disadvantageous for India. As discussed in case III, approximately 10 per cent of Chinese assets can completely destroy the entire massed fleet of Indian destroyers and frigates when they are in a simultaneous engagement, i.e. a naval melee. Case study III demonstrates that naval superiority is the most advantageous force attribute to have. Since the Chinese possesses it in ample measure, it would be very disadvantageous for India to engage in a force-on-force massed engagement with China without either a capability to execute a surprise attack or to execute a first-strike before the Chinese can launch a retaliation strike.

Case IV examines what options exists for the Indian naval tactician against the Chinese force. Without surprise or first-strike as an option, the Indian naval forces must fight dispersed as shown in Case IV and win by out scouting the enemy so as to avoid debilitating attacks. By fighting as a dispersed force, the Indian forces will be able to demonstrate to the Chinese that they cannot have assured victory, which might be enough diplomatic leverage.

The ability of the Indian forces to fight as a dispersed force in order to effectively prevent Chinese naval success is just enough. Its fleet of destroyers and frigates seem to be just about the right number of 23 vessels to dissuade Chinese actions. It would be prudent for Indian policy makers to aim to increase this relative balance of assets. It does seem there are efforts to do this. In October 2008, the then Indian navy chief, Admiral Suresh Mehta, announced force-structure plans amounting to a 160-strong fleet including three aircraft carriers, 60 major combatants and 400 aircraft by 2022.[26] India has accordingly engaged in an extraordinarily ambitious fleet modernisation programme with some 40 new ships/submarines plus ten fast-attack craft currently under construction. Future iterations of this work would benefit from examining the relative acquisition pace between the Chinese and Indian navy and its effect on force-on-force naval engagement.

The challenge for Indian naval planners lies in acquiring naval assets without stoking an undesirable action by the Pakistani navy. Conceivably, the Pakistani navy is a more probable near term threat than the Chinese navy for India. Given that, it would be prudent to be aware of any policy distortions Indian naval acquisition vis-à-vis China might create with Pakistan. For example, India's launch of its first SSN in July 2009 was criticised by Pakistani Foreign Minister as "detrimental to regional peace" and promised "appropriate steps" to maintain a strategic balance. The following month saw then Admiral Mehta of the India Navy complaining about the alleged response with modifications to the Pakistani Navy's *Harpoon* missiles that brought them within range of land targets in India.[28] There are a number of assumptions in the analysis that will considerably change the calculus if they become invalid. For example, if nuclear weapons were involved, the forces, missions, and tactical plans would be very different. All four case studies assumed a networked force. Insofar as the equations are concerned, the linkages may be rudimentary and largely achieved by sound doctrine as a primary means of coordination, or they may be highly integrated and automated. To a very great extent, the equations represent a system that is performing as if it were networked completely. However, when that is not the case, there is a penalty. Future iterations of this paper will examine the relative networked coordination of Chinese and Indian naval ships and its effect on force-on-force engagement.

Finally, in the case studies, neither side has a weapon range and scouting advantage such that it can detect, track and target the other while standing safely outside the range of the enemy's weapons. If however, one of the sides possesses longer-range missiles or longer-range sensors, significant advantages will accrue to that side. Investing in better missiles and sensors might in fact turn out to be the best alternative for the Indian Navy rather than to engage in costly arms race with China.

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[26] Walter C. Ladwig III, "Delhi's Pacific Ambitions: Naval Power, "Look East," and India's Emerging Influence in the Asia-Pacific," *Asian Security*, Vol. 5, No.2 (2009).

[28] Geoffrey Till, *Asia's Naval Expansion: An Arms Race in the Making?* International Institute for Strategic Studies, Artech House, London, UK, 2012.

Author's Biography

Jaganath Sankaran is presently a Post-Doctoral Fellow at Harvard University's Belfer Center for Science and International Affairs. He was a 2012–2013 post-doctoral Stanton Nuclear Security Fellow at the RAND Corporation and is a Research Scholar at CISSM, Maryland School of Public Policy. Sankaran received his PhD from the Maryland School of Public Policy in 2012, where his work on space security resulted in a dissertation on Debating Space Security: Capabilities and Vulnerabilities. Before coming to the University of Maryland for his Master's in Engineering and Public Policy, Sankaran worked for three years with the Indian Missile R&D establishment in the areas of missile astrodynamics and modelling. He was also involved in the development of a ballistic missile defense system architecture. It is during this time that his interest in space weapons and arms control developed.

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The views expressed in this publication are entirely those of the author(s), and do not represent the official position of RSIS.

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Since June 2012, this project by the Institute of Defence and Strategic Studies (IDSS is a constituent unit of RSIS) has been engaged in identifying and analysing the key sources of strategic stability and instability in contemporary Asia. We sought to augment the prevailing understanding of how forces that stabilise Asia can be strengthened, and how forces that destabilise Asia (or have the potential for doing so) can be managed, and their adverse effects mitigated or contained.

The project addresses three key research concerns: First, examine major power relations in Asia. Second, analyse interstate dynamics within the maritime domain. And finally evaluate the impact of new and emerging military technologies in Asia. To that end, we organised three workshops during January-February 2013. We also commissioned a number of policy briefs, research papers, monographs, and edited volumes on critical security issues that have the potential to affect the security order in Asia over this decade.

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