Continuous at Sea Deterrence: Evaluating India's Strategic Posture

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Abstract

India's evolving strategic posture in the Indian Ocean region (IOR) is reflected by its pursuit of Continuous at Sea Deterrence (CASD). CASD represents a critical element in the strategic posture of a nuclear weapons state, involving permanent deployment of at least one ballistic missile submarine (SSBN) at sea to maintain a constant and invulnerable second-strike capability. The article discusses the challenges and opportunities with respect to implementing CASD like improved submarine technology interoperability, and strengthening safety protocols. In addition, it deliberates on how India's CASD posturing affects regional stability as well as deterrence credibility. It critically examines the readiness, deployment, posture, and operations associated with CASD in relation to Indian military forces thereby offering insights on the prospects and challenges of CASD as the pillar of India's maritime strategy. A qualitative research methodology is used by utilizing a combination of strategic analysis and expert interviews to assess the effectiveness and prospects of India's CASD. By offering a detailed evaluation, the article contributes to the broader understanding of maritime strategy and nuclear deterrence in the IOR.

Keywords: Nuclear submarines, Nuclear-weapons, Deterrence, Indian Ocean, India

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Introduction

India's pursuit of a robust sea-based nuclear deterrent posture is epitomized by the development and deployment of nuclear-powered ballistic missile submarines (SSBNs). As the most significant pillar of India's nuclear triad, SSBNs form a critical component of its national security architecture, providing continuous at-sea deterrence (CASD) capability that enhances the survivability of its nuclear arsenal and reinforces its strategic posture. India's induction of first indigenously built SSBN, INS Arihant and subsequent efforts to expand the submarine fleet, however, are not without controversy.[2] Critics contend that the SSBN program aggravates regional arms race, and raises concerns about weaknesses in command and control structure and diverts valuable resources from tenacious domestic needs. India's SSBN forces have also drawn scrutiny for aiming to upset the delicate strategic balance and trigger a naval arms race in the region.[3]

In early 2018, it was reported that INS Arihant had been inoperative for several months due to an incident in which the submarine's propulsion compartment was flooded, following the inadvertent opening of a hatch when the vessel was docked. The incident underscored the technical complexities and operational risks inherent in maintaining the nuclear-powered submarine fleet. The event raised concerns over the safety protocols and maintenance procedures, highlighting the challenges India faces in achieving operational readiness and reliability in its SSBN program and nuclear deterrence.[4]

The literature on India's nuclear deterrence policy reveals a complex interplay of strategic considerations and regional dynamics. O'Donnell and Ghoshal discuss the pressures on India's credible minimum deterrence, highlighting the balance required to deter adversaries without triggering an arms race.[5] J. Lo critiques the stability of nuclear deterrence in South Asia, suggesting that the presence of nuclear weapons might exacerbate insecurity rather than enhance

[2] Iftikhar Ali and Jatswan S. Sidhu, "India's Doctrinal Modifications: Counterforce Temptations in South Asia," *Journal of Asian and African Studies* 57, no. 3 (2022): 424-445.
[3] Diana Wueger, "India's Nuclear-Armed Submarines: Deterrence or Danger?" *The Washington Quarterly* 39, no. 3 (2016): 77-90.
[4] G. Lakshmi, "INS Arihant: The Political and Environmental Dimensions," *Indian Journal of Political Science* 75, no. 3 (2014): 571-578.
[5] Frank O'Donnell and Debalina Ghoshal, "Managing Indian Deterrence: Pressures on Credible Minimum Deterrence and Nuclear Policy Options," *The Nonproliferation Review* 25, no. 5–6 (September 2, 2018): 419–36.

it.[6] A. Kumar analyzes the applicability of traditional deterrence theories in Pakistan-India context, underscoring unique regional challenges.[7] C. Bluth examines the asymmetric nuclear capabilities and doctrines between Pakistan and India, pointing to the difficulties in maintaining stable deterrence.[8] In addition, PM Kamath provides a forward-looking perspective on India's nuclear strategy, emphasizing the nuanced approach needed to maintain regional stability.[9] These works collectively offer a comprehensive overview of the strategic issues and theoretical debates surrounding India's nuclear deterrence policy.

However, a gap exists in the literature regarding India's application of CASD approach in its nuclear deterrence strategy. Specifically, there is a lack of comprehensive analysis on the challenges associated with implementing this approach and its potential impact on regional dynamics. This gap highlights the need for further research to explore the implications of CASD on South Asian security and stability.

To fill this gap, the article analyzes how technological advancements, changing operational doctrines[10] and geopolitical considerations shape India's maritime deterrence capabilities.[11] By examining these developments, the article provides an understanding of India's SSBN deployment and posture, highlighting the potential risks and challenges associated with CASD. It also examines the broader implications of India's SSBN program, questioning the strategic merits and long-term viability of its modernization efforts in regards to regional security dynamics and global non-proliferation efforts.

The article employs a qualitative research methodology and utilizes secondary sources such as books, journal articles, reports and newspaper articles. The strategic analysis focuses on assessing India's SSBN capabilities within the broader context of its nuclear deterrence strategy. Moreover, the article reviews key policy documents, statements of senior Indian naval personnel,

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[6] James Lo, "Nuclear Deterrence in South Asia: Theory and Practice," *International Journal* 58, no. 3 (September 1, 2003): 395–414, https://doi.org/10.1177/002070200305800308.
[7] Arvind Kumar, "Theories of Deterrence and Nuclear Deterrence in the Subcontinent," in *The India-Pakistan Nuclear Relationship* (Routledge India, 2007).
[8] Christoph Bluth, "India and Pakistan: A Case of Asymmetric Nuclear Deterrence," *Korean Journal of Defense Analysis* 22, no. 3 (September 1, 2010): 387–406.
[9] P. M. Kamath, "Indian Nuclear Strategy: A Perspective for 2020," *Strategic Analysis*, March 1, 1999, https://doi.org/10.1080/09700169908458932.
[10] Ali Ahmed, "Indian Army's Flagship Doctrines: Need for Strategic Guidance," In *the Routledge Handbook of Indian Defence Policy* (Routledge India, 2020), 171-184.
[11] Saima A and T. Ghaffar, "India's Undersea Nuclear Deterrence: Impact on Indian Ocean Region's Strategic Stability," *CISS Insight Journal* 9, no. 1 (2021): 1-32.

and academic literature to provide a comprehensive understanding of the factors shaping India's SSBN program.

The article is organized as follows: First, the study explains the concept of CASD. It then describes the various Indian submarine programs, followed by an analysis of the associated risks and challenges. Subsequently, the article discusses the regional dynamics and challenges arising from the implementation of CASD. Finally, it concludes with a summary of the findings and their implications.

Concept of Continuous at Sea Deterrence (CASD)

Continuous at Sea Deterrence (CASD) is a strategic doctrine practiced by nuclear-weapon states to maintain credible and effective nuclear deterrence at sea. At its core, CASD is based on the notion that at least one SSBN armed with nuclear missiles is patrolling the oceans to give an assured second-strike capability in the wake of a nuclear attack.[12] The theory of nuclear deterrence underpins this strategy, suggesting that the threat of devastating retaliation prevents adversaries from launching a first strike.

The effective functioning of CASD depends on the nation's ability to keep SSBNs dispersed in different maritime theaters allowing them to survive a first attack or attempt to neutralize their nuclear weapons. In contrast to other land and air-based delivery means which are relatively susceptible to detection or preemption, SSBNs offer unmatched stealth, mobility and survivability, creating redundancies in a country's nuclear deterrent posture.[13] However, CASD operations involve complex interplay of factors such as submarine acquisition and modernization, specialized training of personnel and readiness, strategic and intelligence planning, robust command and control systems.[14]

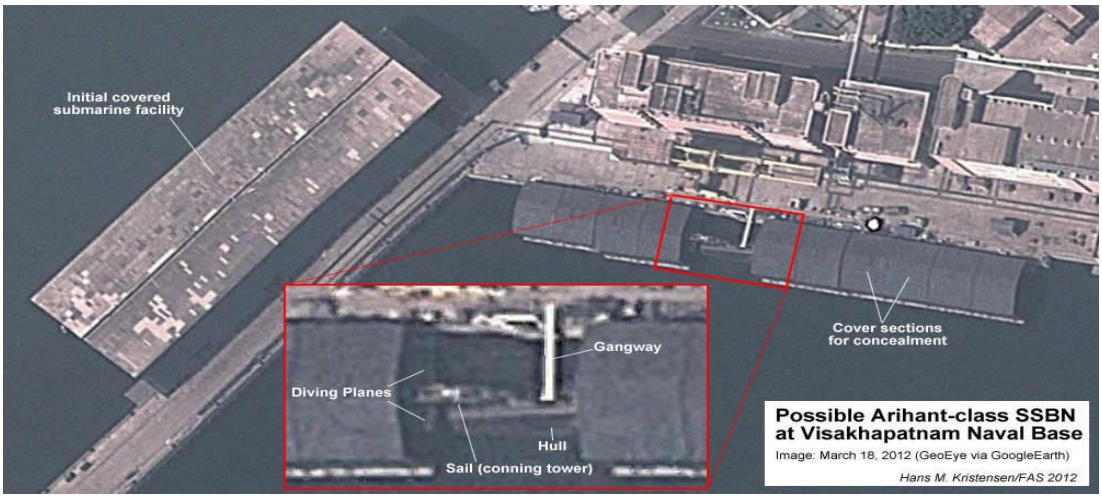
Furthermore, SSBN's patrolling for CASD would firstly require designating areas that are safe and secure, as usually these patrols are for extended periods of time where communications silence is maintained to minimize risk of detection. CASD is based on the principle of strategic ambiguity, where the location and position of SSBNs remains deliberately

[12] R. Medcalf, K. Mansted, S. Fruhling and J. Goldrick, *The Future of the Undersea Deterrent: A Global Survey* (National Security College: ANU, 2020), 11.
[13] V. Sakhuja, "Sea Based Deterrence and Indian Security," *Strategic Analysis* 25, no. 1 (2001): 21-32.
[14] Frank O' Donnell and Yogesh Joshu, "Lost at Sea: The Arihant in India's Quest for a Grand Strategy," *Comparative Strategy* 33, no. 5 (2014): 466-481.

vague to potential adversaries, creating uncertainty about the country's retaliatory measures.[15] This also serves to deter adversaries from contemplating a first nuclear strike, knowing that in the event of a preemptive strike, SSBNs would remain a major retaliatory threat, capable of inflicting unacceptable damage on the attacker.[16]

India's Nuclear Submarine Program

India's nuclear submarine program began some four decades back with the development of a prototype 90 MW in 1985. In 1988, India leased a nuclear attack submarine[17] (SSN) of the Charlie class from the former Soviet Union, laying the groundwork for the establishment of an Advanced Technology Vessel (ATV) Program.[18] By November 2018, through the ATV and under collaborative oversight of the Indian Navy, Defence, Research and Development Organization (DRDO) and Bhabha Atomic Research Centre (BARC), India's first SSBN, INS Arihant concluded its deterrent patrol in November 2018.



The satellite imagery showing extended nuclear submarine of Arihant class at Visakhapatnam.[19]

[15] Alexey Arbatov, "Nuclear Deterrence: A Guarantee For Or Threat to Strategic Stability?" *Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century – Insights from Theory and Practice* (2021): 65-86.
[16] James Holmes, "Sea Changes: The Future of Nuclear Deterrence," *Bulletin of Atomic Scientists* 72, no. 4 (2016): 228-233.
[17] Nuclear-Powered Attack Submarine (SSN) is nuclear powered submarine with conventional weapons designed for anti-submarine warfare and surface-ship attack roles. The SSN also provides crucial protection for SSBN by detecting and neutralizing any potential threats thereby ensuring the safety and effectiveness of its nuclear deterrent mission; Thomas Roby, "Nuclear Attack Submarines," *Journal of Defence Studies* 14, no. 4 (2020): 59-76.
[18] Yogesh Joshi, "Samudra: India's Convoluted Path To Undersea Nuclear Weapons," *The Nonproliferation Review* 26, no. 5-6 (2019): 481-497.
[19] Hans M. Kristensen, "India's SSBN Shows Itself," *Federation of American Scientists* (2012). https://fas.org/publication/arihant/

INS Arighat, second submarine of the class, was secretly launched for sea trials in 2017.[20] It is an upgraded variant and has the codename S-3. Little has been publicly announced about its capabilities and current status in the public domain. The development and deployment of these submarines are conducted with a high degree of confidentiality, reflecting a deliberate strategy to limit public knowledge and media coverage. According to *Jane's,* an open-source intelligence company specializing in defence intelligence, the *SSBN* will be commissioned in later part of 2024. It also states that in 2021, India quietly launched its third indigenous SSBN, codenamed S-4.[21] Satellite imagery has shown that S-4 may carry twice the Submarine Launched Ballistic Missiles (SLBMs) of INS Arihant and INS Arighat, could have up to 24 K-15 SLBMs or 8 K-4 SLBMS with a range of 3,500 kilometers.[22]

In addition to having a robust fleet of five to six SSBNs, India plans to have a sizable fleet of SSNs,[23] until 2021 it was formally operating the Russian-leased INS Chakra.[24] The arsenal of sea-based missiles in New Delhi is equipped with a variety of nuclear-capable delivery systems. Along with surface-launched ballistic missiles and cruise missiles, the missile inventory also includes submarine-launched ballistic missiles.[25] With a 750 km range, INS Arihant is equipped with 12 K-15 Sagarika SLBMs or 4 K-4 SLMBS of 3500 km.[26] However, with this range of missiles India cannot target the full extent of Pakistani Territory. In order to attack China with K15 Sagarika SLBMs, INS Arihant must place itself within the striking distance, which raises severe concerns about the submarine's deterrent capability.

In order to achieve geographical proximity with China, the submarine would need to navigate the Yellow Sea, which lies between the Korean Peninsula and mainland China. This would be a suicidal move for Arihant due to presence of Chinese military bases in the region.

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[20] Christopher Clary, "Twenty-Five Years of Overt Nuclear India," *Arms Control Today* 53, no. 8 (2023): 6-11.
[21] Jane's Defense, "India to Commission Second Nuclear Submarine By End of 2024," *Defense News*, https://www.janes.com/osint-insights/defence-news/sea/india-to-commission-second-nuclear-submarine-by-end-of-2024
[22] Zahir Kazmi, "Challenges of Strategic Stability Amongst Littoral Powers of the Indian Ocean Region," *CISS Insight Journal* 11, no. 2 (2023): 109-141.
[23] Hans M. Kristensen and Matt Korda, "Indian Nuclear Weapons, 2022," *Bulletin of the Atomic Scientists* 78, no. 4 (2022): 232-234
[24] Rajesh Basrur and Shang-Su Wu, "India's Conventional Strategy in a Nuclear Environment: A Neglected Link," *Defence Studies* 23, no. 3 (2023): 457-476.
[25] Ashley J. Tellis, *Striking Asymmetries: Nuclear Transitions in Southern Asia* (Washington: Carnegie Endowment for International Peace, 2022), 112.
[26] Vipin Narang, "Russian Influence on India's Military Doctrines," *Journal of Indo-Pacific Affairs* 4, no. 1 (2021): 65-73.

According to Geoffrey Till, a retired commodore of British Royal Navy and maritime strategist, India perceives Pakistan and not China, as its primary nuclear foe, which is the reason why it is prioritizing the development of short-range ballistic missiles to serve as a nuclear deterrent. This idea disproves any claims that these innovations are not specifically focused on Pakistan.[27] India intends to build long-range SLBMs K-5 that is projected to have a range of 6000 km and K-6, which is reported to be outfitted with multiple independently targetable reentry vehicles (MIRVs) technology.[28] It has previously built K-4 SLBMs with range of 3500 km. Other nuclear-capable delivery systems, such as cruise missiles Nirbhay and BrahMos, are part of India's inventory of sea-based weapons in addition to SLBMs. In March 2013, a test firing of the BrahMos submarine-launched variant was conducted.[29]

Project Varsha: India's Strategic SSBN Naval Base

Project Varsha is a strategic naval base under-construction in the Bay of Bengal that is designed to house a fleet of over 12 SSBNs.[30] It has multiple underground facilities, such as tunnels, which might be used as submarines pens. According to Indian Defense Research Wing (IDRW), the naval base stretches across 1,680-acres on the Eastern Coast at Rambilli. The analysis of satellite images indicates that there is a rapid expansion underway and the project is expected to be completed within the time limit.[31] The underground base serves two purposes. First, it provides protection against surveillance. Second, it offers the requisite infrastructure for nuclear engineering, which helps in managing the operational challenges.[32] The construction design indicates that it can house multiple types of submarines, increasing the operational flexibility of the facility.[33]

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[27] Geoffrey Till, "Naval Development and International Stability in the Indian Ocean Region" In *India-China Maritime Competition* (Routledge, 2019), 11-19.
[28] Aqeel Akthar and Sufian Ullah, "India's Sea-Based Nuclear Forces and Strategic Stability in South Asia," *Australian Journal of Maritime & Ocean Affairs* 15, no. 1 (2023): 54-68.
[29] Ashley J. Tellis, *Striking Asymmetries: Nuclear Transitions in Southern Asia* (Washington: Carnegie Endowment for International Peace, 2022), 112-113.
[30] Hans M. Kristensen and Matt Korda, "Indian Nuclear Weapons, 2022," *Bulletin of the Atomic Scientists* 78, no. 4 (2022): 224-236.
[31] Dev Patel, "India's Sea-based Deterrent: Evaluating the Effectiveness of India's Submarine Nuclear Deterrent," Edited by Simone Williams, *On the Horizon: A Collection of the Papers from the Next Generation* (Center for Strategic International Studies (CSIS), 2020), 74-84
[32] Gabriel Honrada, "India Making Bay of Bengal into a Nuclear Launchpad," Asia Times, June 2024, https://asiatimes.com/2024/06/india-making-bay-of-bengal-into-a-nuclear-launchpad/.
[33] Kerry R. Bolton, "INS Arihant and India's Geopolitical Role," *Foreign Policy Journal, Asia Pacific Essays 6,* no. 2 (2012): 1-9

This location is critical, and the Indian Navy can gain a strategic advantage due to its proximity to important trade routes. Due to this proximity, the Indian Navy's response time can be shortened, and it can collaborate with other regional partners, such as Bhabha Atomic Research Center (BARC), which played a significant role in the domesticating the production of nuclear submarines. In addition, another important Indian project in this regard is Project Varsha. It strengthens India's second-strike capability as it enables India to launch submarines from an underground base. Furthermore, these developments indicate India's ambition to maintain a strong position in the IOR.[34]

India's SSBN Operations and Deployment

India's strategic thinking on nuclear deterrence is influenced by historical precedents, including the strategies pursued by major nuclear powers such as the former Soviet Union.[35] The Soviet Union, which practiced a bastion strategy,[36] concentrated its SSBNs within heavily fortified maritime bastions to enhance their survivability and reduce vulnerability to enemy attacks. While India draws lessons from the Soviet approach, it also recognizes the limitations and risks associated with the bastion strategy,[37] particularly in the context of evolving maritime threats and technological advancements.[38]

Due to Project Varsha, India can use the Bay of Bengal as a safe zone for SSBNs, and its deep waters provide a safe zone for submarines due to their depths compared to the crowded waters of the Arabian Sea, noted Iskander Rehman.[39] This location gives India the ability to maneuver through the Bay of Bengal secretly, without being detected by surveillance networks.

[34] Hans M. Kristensen and Matt Korda, "Indian Nuclear Weapons, 2022," *Bulletin of the Atomic Scientists* 78, no. 4 (2022): 232-234

[35] Anindya J. Majumdar, "Security Narratives of China's Impingement in the Indian Ocean Theatre," *China in India's Neighbourhood* (Routledge India, 2024), 191-206.

[36] Jan S. Breemer, "Soviet Naval Capabilities," *International Journal of Intelligence and Counter Intelligence,* no. 4 (1986): 119-132.

[37] The Soviet bastion strategy, developed during the Cold War, aimed to protect its SSBN fleet from US sonar system sensors. It involved creating heavily fortified and heavily defended areas in the world's oceans, known as "bastions," where SSBNs could operate safely under the protection of surface ships, submarines, and maritime aircraft.

[38] Tony H. An, "India's Pursuit of Sea-Based Strategic Deterrence: Security Concerns on the Path to A Credible Minimum Deterrence," PhD diss., (Monterey, CA: Naval Postgraduate School, 2021), 10-12.

[39] Iskander Rehman, "India's Fitful Quest for Sea Power," *India Review* 16, no. 2 (2017): 226-265.

Furthermore, naval assets, including India's aircraft carrier, are expected to provide cover for its SSBN. This might provide Indian submarines necessary safe zone to launch ballistic missiles.[40]

According to A former Indian Navy Commodore Anil Jai Singh, "for nuclear deterrence, one submarine always needs to be on patrol. If Arihant is in and out of the harbor, it is not exactly a deterrent. We need 3-4 SSBNs so we can keep one on patrol when one may be in port, one going for patrol, and one coming back."[41] This operational model draws parallel with United Kingdom's CASD which has spanned for over fifty-two years. However, Yogesh Joshi raises concerns about India's sea-based nuclear deterrent, stating that unless India deploys SLBMs with an intercontinental range, its sea-credibility against Pakistan and China is likely to be compromised.[42]

In line with the assessment of India's sea-based nuclear capability, Hans Kristensen and Matt Korda observed in *Bulletin of the Atomic Scientists* that the range of K-15 SLBM's range restricts its capability to target locations primarily in southern parts of Pakistan. Furthermore, they noted that India's SSBNs would face limitations in targeting all of China unless it traverses through the Strait of Malacca.[43] India, to address these challenges, is advancing the development of the K-5 SLBM that would have a range of 5,000 kilometers.[44]

As such, India's pursuit of CASD is based on its own security imperatives drawing on past experiences while adapting to present challenges.[45] The operationalization of CASD will also require the development of robust communication infrastructure, including Extremely Low Frequency (ELF) and Very Low Frequency (VLF) systems, to enable reliable communication with submerged SSBNs.[46] India's current communication infrastructure is limited, and significant investment and technological advancements would be required to establish an

[40] Gulshan Bibi and Brice T. Lee, "Ramifications of India's Naval Build-Up in Nuclear Realms," *Margalla Papers* 27, no. 2 (2023): 1-13.
[41] Commodore Anil Jai Singh, "What is the Task of Indian Nuclear Submarine" *Defence Talks https://www.youtube.com/watch?v=KQCrViC_ES0&ab_channel=DEF-TALKSbyAadi*
[42] Yogesh Josh, "Samudra: India's Convoluted Path to Undersea Nuclear Weapons," *The Nonproliferation Review* 26, no. 5-6 (2019): 481-497; Evolving Submarine Arm of Indian Navy – An Interview with Cdre Anil Jai Singh (Retd IN) *Defence Research and Studies, https://www.youtube.com/watch?v=y2hw1csmb74&ab_channel=drastalks*
[43] Hans M. Kristensen and Matt Korda, "Indian Nuclear Weapons, 2022," *Bulletin of the Atomic Scientists* 78, no. 4 (2022): 232-234
[44] Tony H. An, "India's Pursuit of Sea-Based Strategic Deterrence: Security Concerns on the Path to A Credible Minimum Deterrence," PhD diss., (Monterey, CA: Naval Postgraduate School, 2021), 40.
[45] Yogesh Joshi, "Samudra: India's Convoluted Path to Undersea Nuclear Weapons," *The Nonproliferation Review* 26, no. 5-6 (2019): 481-497.
[46] James R. Holmes, "Sea Changes: The Future of Nuclear Deterrence," *Bulletin of Atomic Scientists* 72, no. 4 (2016): 228-233.

effective communication network capable of supporting CASD operations. While India has made some progress in this regard, particularly in developing satellite communication capabilities, significant challenges remain in achieving the level of communication reliability required for CASD.[47]

India's adoption of CASD for its SSBNs is likely to entail strategic positioning of submarines in key areas of the Indian Ocean, presenting a challenge for neighboring countries. Given India's decades-long preparation in the realm of nuclear naval platforms since the 1980s, it possesses a degree of expertise and experience in this domain. Neighboring countries will need to reassess their own security postures and invest in appropriate countermeasures from today, recognizing the lead time required to develop and deploy nuclear naval platforms.[48] This proactive approach is essential to effectively manage the implications for regional stability and security, fostering dialogue and cooperation among all stakeholders.

Risk and Challenges

Nuclear submarines are complex and technically advanced platforms that operate under challenging environments. As emphasized by scholars and naval practitioners, the systems associated with SSBNs inherently carry some danger of accidents due to their configurations designed for stealth missions.[49] Added to that, both nuclear reactors and submarine platforms are prone to many types of mishaps. These can be catastrophic, considering that SSBNs on deterrence patrol have mated nuclear weapons on board.[50]

Submarines operate deep underwater, with restricted supplies of air and water, and potentially exposed to enemy fire. Although modern day submarines are equipped with advanced technologies that allow them to operate independently for extended periods using efficient storage and planning to provide balanced meals to the crew, the problems for risks remains high for the Indian Navy that has a history of incidents questioning safety measures and a robust

[47] Steinar Hoibraten and Elin Enger, "India's Nuclear Infrastructure Status and Challenges," *India in Global Nuclear Governance* (2019): 1-21.
[48] Institute of Strategic Studies Islamabad, *India's Maritime Buildup – Implications for the Indian Ocean*, 23 May 2024. https://www.youtube.com/watch?v=bpBidyWloLA&ab_channel=InstituteofStrategicStudiesIslamabadISSI.
[49] Ibid.
[50] Z. Mian, M. Ramana and A. Nayyar, "Nuclear Submarines in South Asia: New Risks and Dangers," *Journal for Peace and Nuclear Disarmament* 2, no. 1 (2019): 184-202.

safety culture. For Diana Wueger, the primary concern is the several mishaps involving India's nuclear submarine fleet in a very short period of time.[51]

It was reported that INS Chakra, an Indian SSN under lease from Russia had an accident in December 2017. The cause was attributed to be either a "collision at sea" or "accidental scrapping while entering the narrow channel of Vishakhapatnam naval base." The repairing damage was described to be "substantial work," [52] an indication of the severity of the incident and bringing to light, potential shortcomings in safety protocols within Indian naval authorities. Visakhapatnam has previously encountered incidents where naval platforms encountered challenges navigating the confined waters.

The SSBN, INS Arihant, has already encountered an incident raising serious lapses and concerns about operational readiness. Since India considers the discussion on SSBN's and CASD operations as highly sensitive, the policymakers dealing with nuclear matters were almost silent on the issue except for few reports surfacing in the public domain and in the Indian media. According to these sources, "while it was at harbor, a hatch on the rear side was accidentally left open," and as a result, "water entered the propulsion compartment and damaged it."[53]

However, the accuracy of the assessment has been contested, and the Indian defense ministry declined to provide details to a query in the Indian Parliament concerning the "scope of the damage" and the "estimated cost of repairs."[54] These incidents underscore the critical importance of adherence to safety protocols in the construction, maintenance and operations of nuclear submarines. The lack of transparency regarding these accidents also raises questions about responsibility and accountability in India's defence establishment.[55]

INS Arighat, the upgraded variant of Arihant class SSBN, experienced a tragic incident when "hatch of a tank blew off" during routine test on March 2014.[56] An unnamed naval officer

[51] Diana Wueger, "India's Nuclear-Armed Submarines: Deterrence or Danger?" *The Washington Quarterly* 39, no. 3 (2016): 77-90.
[52] Yogesh Joshi, "Samudra: India's Convoluted Path to Undersea Nuclear Weapons," *The Nonproliferation Review* 26, no. 5-6 (2019): 481-497.
[53] G. Lakshmi, "INS 'Arihant' The Political and Environmental Dimensions," *The Indian Journal of Political Science* 75, no. 3 (2014): 571-578.
[54] Urvashi Sarkar, "What's Known – And Not Known About India's Nuclear Weapons Budget," *Bulletin of the Atomic Scientists,* November 2, 2021.
[55] Tony H. An, "India's Pursuit of Sea-Based Strategic Deterrence: Security Concerns on the Path to a Credible Deterrence," PhD diss., Monterey, CA: Naval Postgraduate School, 2021.
[56] Frank O' Donnell and Yogesh Joshi, "Lost at Sea: The Arihant in India's Quest for a Grand Strategy," *Comparative Strategy* 33, no. 5 (2014): 466-481.

expressed concerns to the media, stating that the accident happened inside the submarine, the consequences could have been catastrophic for the nuclear powered platform.[57] These incidents shed light on concerns regarding its civilian nuclear facilities and the BARC, the leading architect of nuclear reactors powering India's SSBNs.[58] There are concerns from within India regarding these institutions ability to "meet the rigorous organizational requirements necessary for safe operations of complex and high hazard technologies," like the SSBNs.[59] These incidents underscore shortcomings in the safety culture within the Indian armed services.

Challenges to Regional Stability and Way Forward

The deployment of Indian SSBNs for CASD will be detrimental to crisis stability in the context of South Asia. The strategic environment in the region is already fraught with the dangerous possibilities of crisis escalating from conventional to the nuclear domain. Indian decision to operationalize a sea-based deterrent further exacerbates the risks.

Furthermore, the complexities of naval operations and characteristics of the sea are different from those on land, making the oceans, the only domain where nuclear platforms can encounter each other at close distance. There is also the difficulty in determining the intentions as well as capabilities of dual-capable weapons systems significantly increasing the risk of escalation.[60] Therefore, during times of crisis, an Indian naval platform carrying cruise missiles with a dual-capability would likely be perceived as a nuclear threat, regardless the missiles carry conventional warheads or not.

During the Cold War, the launch authority was pre-delegated to submarine commanders as a necessary measure to reinforce deterrence by guaranteeing that nuclear weapons remained prepared for deployment. For safety measures, the former Soviet Union used electro-mechanical locks to prevent unintentional or accidental launch of the SLBMs, whereas the US opted for pre-delegation, allowing the commander to fire SLBMs on their own without external intervention. It is unclear at this time how the Indian government would handle this situation. There are two civil agencies, BARC and DRDO, entrusted with the "custody of the fissile material," whereas the

[57] K. G. Ramkumar and Prakash Panneerselvam, "Indian Navy's Submarine Development Programme: A Critical Assessment," *Journal of Asian Security and International Affairs* 10, no. 3 (203): 395-416.
[58] Richard B. White, "Command and Control of India's Nuclear Forces," *The Non Proliferation Review* 21, no. 3-4 (2014): 261-274.
[59] Ibid.,265.
[60] M. Ihsan Qadir and Saif ur Rehman, "Emerging Paradigm of the Indian Ocean: Arihant's Prowl and Regional Implications," *Strategic Studies* 37, no. 4 (2017): 65-80.

armed services have the delivery systems.[61] If India decides to deploy mated weapons on Indian SSBNs, it would require fundamental changes to nuclear command and control and strategic weapons at sea would weaken New Delhi's civilian oversight.

Joshi, based on interviews with former Indian naval leadership, is of the view that Indian policymakers with 'canisterized' SLBMs are prepared to delegate powers to naval commanders in advance, thereby giving ability to launch SLBMs within minutes if necessary.[62] However, in such a case, there are serious questions over legitimate safeguards and lack of political oversight, thereby significantly raising the risk of escalation in any future crises between Pakistan and India.[63]

The Indian projected requirement to develop 10 to 12 nuclear-powered submarines[64] in Indian Ocean on the pretext of China-Pakistan threat is an aggressive and escalatory use of sea-based nuclear deterrent that complicates the deterrence matrix for regional states. It spirals a naval arms race by forcing states to have additional submarines and ASW systems.[65]

The escalatory actions by India and responses to restore strategic stability by acquiring modern naval platforms is likely to raise the possibility of inadvertent encounters that could potentially lead to incidents at sea.[66] To mitigate such risks, US and Soviet Union signed the "Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War between US and Soviet Union" in 1971 and "Agreement on the Prevention of Incidents on and over the High Seas (INCSEA)" in 1972.[67] These significantly reduced the number of naval accidents between the two superpowers and implementing similar measures in the naval domain could help reduce the risk of incidents at sea in South Asia.[68]

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[61] R. White, "Command and Control of India's Nuclear Forces," *The Non-Proliferation Review* 21, no. 3-4 (2014): 261-274.
[62] Y. Joshi, "From Ambivalence to Resurgence: India's Journey as A Nuclear Power," *India Quarterly* 78, no. 2 (2022): 350-370.
[63] Muhammad Azam Khan, "S-2: Options for the Pakistan Navy," *Naval War College Review* 63, no. 3 (2010): 85-104.
[64] K. G. Ramkumar and Prakash Panneerselvam, "Indian Navy's Submarine Development Programme: A Critical Assessment," *Journal of Asian Security and International Affairs* 10, no. 3 (203): 395-416.
[65] Iskander Rehman, "India's Fitful Quest for Sea Power," *India Review* 16, no. 2 (2017): 226-265.
[66] Scott Sagan, "The Perils of Proliferation in South Asia," *Asian Survey* 41, no. 6 (2001): 1064-1086.
[67] David F. Winkler, "The Evolution and Significance of the 1972 Incidents at Sea Agreement," *Journal of Strategic Studies* 28, no. 2 (2005): 361-377.
[68] K. Ban, "Maritime CBMs as Soft Deterrence in Northeast Asia: A Sea of Paradox and Its Remedies," *Pacific Focus* 35, no. 3 (2020): 463-490.

Pakistan and India signed an "Agreement on Advanced Notice on Military Exercises" in 1991.[69] However, even with bilateral agreement, tensions have remained between the two nations; among the unsettling reminders are the incidents involving the downing of a Pakistan Navy Atlantique aircraft in 1999[70] and the INS Godavari's close encounter with PNS Babur in 2011.[71] Such incidents, considering the political climate between the two countries, could have led to a chain of events to a more serious crisis involving nuclear brinksmanship. Although the events that have occurred in recent times have seen no fatal incidents, the risks associated with nuclear platforms necessitate stringent safety measures and communication protocols.[72]

India remains dismissive to reaching a bilateral agreement on risk reduction at sea with Pakistan.[73] Consequently, there are no significant communication channels between the two navies during crises.[74] During the 1998 Lahore Declaration, the two nations committed to "conclude an agreement on the prevention of incidents at sea." However, no significant attempts were made to materialize the arrangement.[75] India's propensity to operationally deploy a nuclear submarine with a carrier battle group, INS Vikramaditya, in post-Pulwama standoff, demonstrates New Delhi's willingness to prioritize and rely on strategic naval platforms, including SSBNs, even at lower levels of escalation ladder. This shift underscores the increasing importance of naval elements in India's nuclear posture and its readiness to incorporate these assets into its broader Defence strategy.[76]

While other nuclear nations with SSBNs also maintain mated warheads, there is a greater risk of accidental or early deployment of nuclear weapons due to geographical proximity in

[69] Umbreen Javaid, "Confidence Building Measures in Nuclear South Asia: Limitations and Prospects," *South Asian Studies* 25, no. 2 (2020).
[70] Muhammad Ali, "Maritime Issues Between Pakistan and India: Seeking Cooperation and Regional Stability," PhD diss, (Monterey, California, Naval Postgraduate School, 2012), 53-57.
[71] Z. Mian, M. Ramana and A. Nayyar, "Nuclear Submarines in South Asia: New Risks and Dangers," *Journal for Peace and Nuclear Disarmament* 2, no. 1 (2019): 184-202.
[72] Salman Bashir, "The China-India-Pakistan Nuclear Triangle: Consequential Choices for Asian Security," *Journal for Peace and Nuclear Disarmament* 5, no. 2 (2022): 336-349.
[73] Feroz Hassan Khan, "Strategic Risk Management in Southern Asia," *Journal of Peace and Nuclear Disarmament* 5, no. 2 (2022): 369-393.
[74] Jose M. Gonzalez, "Bridges from the Sea: Maritime Confidence Building Measures Between India and Pakistan," PhD diss., (Monterey, CA: Naval Postgraduate School, 2023), 77.
[75] Rajesh Pendharkar, *The Lahore Declaration and Beyond: Maritime Confidence-Building Measures in South Asia*, Occasional Paper No. 51 (Washington, DC: Stimson Center, 2002), 2, https://www.jstor.org/ stable/resrep10845.
[76] David Scott, "India's Drive for A Blue Water Navy," *Journal of Military and Strategic Studies* 10, no. 2 (2008).

South Asia.[77] A CASD approach requiring an increased readiness levels and develop increasing numbers of warheads to maintain a sizable fleet of SSBN would render India's declared "nuclear minimalism" as "practically meaningless." These steps by India also undermine international attempts to stop vertical proliferation of nuclear weapons.

Indian move to maintain several nuclear reactors and its stock of weapons-grade plutonium outside the oversight of the International Atomic Energy Agency (IAEA) safeguards, raises apprehensions regarding transparency and potential proliferation of nuclear materials.[78] Reports also surfaced indicating that the Indian government confiscated "6.4 kg of uranium from Jharkhand in June 21" and "7 kg from Maharashtra in May 2021." Similarly, in "Kolkata on August 21, an incident occurred where 250 kg of highly radioactive Californium was discovered, leading to apprehension of two individuals."[79]

Finally, the challenges associated with Indian SSBN's operational readiness and maintenance is a significant concern for deterrence stability in South Asia. To enhance the safety and effectiveness, the USA and former Soviet Union during the shift from conventional diesel-electric submarines to nuclear-propelled submarines[80] had go through substantial cognitive and cultural changes. However, India's submarine force struggles with persistent serviceability issues.[81] India has experienced several incidents on its submerged platforms, such as the flooding of INS Arihant caused by human error and the accidental blowing off of a hatch during a hydro-pressure test on INS Arighat.[82] Moreover, the nuclear reactor and designs of Indian submarines contribute to their increased noise levels susceptibility to detection.[83] The vulnerability of SSBN as a result of factors discussed might place increasing pressure on commanders of submarines equipped with mated and readily deployable nuclear weapons, as a result straining South Asia's strategic stability.

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[77] D. Wueger, "India's Nuclear-Armed Submarines: Deterrence or Danger?" *The Washington Quarterly* 39, no. 3 (2016): 77-90.
[78] A. Akthar and S. Ullah, "India's Sea-Based Nuclear Forces and Strategic Stability in South Asia," *Australian Journal of Maritime & Ocean Affairs* 15, no. 1 (2023): 54-68.
[79] Sang Min Kim, "India Arrests Alleged Uranium Traders", Arms Control Association, July-August 2021.
[80] Institute of Strategic Studies Islamabad, *India's Maritime Buildup – Implications for the Indian Ocean*, 23 May 2024. https://www.youtube.com/watch?v=bpBidyWloLA&ab_channel=InstituteofStrategicStudiesIslamabadISSI
[81] A. Akthar and S. Ullah, "India's Sea-Based Nuclear Forces and Strategic Stability in South Asia," *Australian Journal of Maritime & Ocean Affairs* 15, no. 1 (2023): 54-68.
[82] Trevor Hollingsbee, "Indian Ballistic Missile-Armed Submarine Now Operational," *Ausmarine* 40, no. 8 (2019): 10.
[83] Ari Kattan, "Emerging Submarine Detection Technologies and Implications for Strategic Stability," *On the Horizon: A Collection of Papers for the Next Generation* (2019): 67.

Conclusion

India's pursuit of CASD and the deployment of SSBNs in the IOR present several significant challenges and concerns. The deployment of SSBNs armed with nuclear-tipped missiles exacerbates existing regional tensions heightening the risk of conflict and nuclear escalation. This strategic posture increases the security dilemma, as neighboring states and international observers perceive these actions as a direct threat, potentially leading to an arms race and increased regional instability. Moreover, India's approach to CASD and SSBN deployment undermines efforts towards confidence-building measures, transparency, and cooperation in the region. By projecting military power and asserting dominance, India risks exacerbating security dilemmas and undermining the prospects for stability in the Indian Ocean. India risks aggravating tensions with neighboring countries, particularly Pakistan, leading to a dangerous military buildup and strategic competition in the IOR. Furthermore, India's rapidly expanding SSBN program raises serious concerns about occupational safety and professional standards. The incident with INS Arihant highlights the dangers associated with maintaining nuclear-powered submarines and questions India's ability to effectively and efficiently manage SSBN's for CASD patrols without posing a threat to the environment and security of the region. The highly sensitive and classified nature of the CASD operations adds additional layers of complexity. As more details of India's CASD and SSBN operations become available, perceptions of instability and uncertainty are likely to further complicate the regional security architecture.