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INDIA AND AUSTRALIA: THE NEED FOR STRATEGIC COOPERATION IN UNDERWATER DOMAIN AWARENESS

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Introduction

India and Australia have established a strong strategic partnership aimed at enhancing maritime security in the Indo-Pacific region. This paper argues that it's time to extend that cooperation into the underwater domain, including strengthening underwater domain awareness (UDA).

In recent years there has been considerable progress under the India-Australia Comprehensive Strategic Partnership, especially in defence and security cooperation, as well as the the Mutual Logistics Support Arrangement,[1] which enables greater cross-service military activity and deployment of aircraft from each other's territories. The AUSINDEX maritime exercise, with its focus on anti-submarine warfare, has significantly bolstered the capabilities of both navies. Furthermore, the 2023 Malabar Exercise off the coast of Sydney showcased the increased collaboration and interoperability among Quad nations.

Ongoing efforts to enhance maritime domain awareness primarily focus on tackling surface-level threats and do not adequately address the emerging challenges in the underwater domain in the Indo-Pacific. Underwater security presents a substantial challenge, and it's imperative that it needs to be incorporated into the India – Australia maritime security framework, including through collaboration in UDA.

Underwater Strategic Environment of the Indo-Pacific

Growing strategic competition between China and the United States in the Indo-Pacific has raised concerns about the safety and security of critical maritime routes. About half of the world's containerised cargo, one-third of its bulk cargo and two-thirds of its oil shipment pass through it yearly. The vast stretched SLOCs and crucial choke points in the region make the region geostrategically important for major maritime powers. Over the past few years, there has been a significant increase in the number of submarines operating in the Southeast/Far East Asian region.

In 2019, Admiral Philip S Davidson, Commander of the US Navy, told the US Congress that the US is losing its advantage in the region due to the growing number of submarines operated by its adversaries.[2] According to Admiral Philip, there are four hundred foreign submarines in the world, of which roughly 75% reside in the Indo-Pacific.[3] One hundred and sixty of these submarines belong to China, Russia, and North Korea. In addition, eight navies operate 65 diesel-electric submarines, the majority of which have been commissioned within the last 15 years. Of these Soryu (Japan), Invisible (Type 218 with Singapore) and Type 214 class & Dosan Ahn Changh (Republic of Korea) can be counted as the most advanced conventional submarines. The proliferation of submarines poses a serious safety risk in the region.

But, the major security concern related to underwater security arises from the growing number of Chinese submarines and uncrewed underwater vessels in the region. Chinese nuclear and conventional submarines pose a long-term strategic threat to the free and open Indo-Pacific as well as to India and Australia. Due to its geographical vulnerability, China is focused on building anti-access/area-denial capability based on nuclear and conventional submarines.

The People Liberation of Army – Navy (PLAN) has six SSBNs of Jin Class (Type 094) with another six of Tang Class (Type 096) under construction, which will enter the service soon.

1: "1st India-Australia Annual Summit: Joint Statement," High Commission of India, Canberra, Australia, 2023, https://www.hcicanberra.gov.in/news_letter_detail/?id=100#:~:text=1st%20India%2DAustralia%20Annual%20Summit,Statement%20(March%2010%2C%202023)&text=At%20the%20invitation%20of%20Hon,8%20to%-2011%20March%202023.

2: Philip S. Davidson, "Statement of Admiral Philip S. Davidson, U.S. Navy Commander, U.S. Indo-Pacific Command Before the House Armed Services Committee on U.S. Indo-Pacific Command Posture," US Congress, 2019, https://www.congress.gov/116/meeting/house/109234/witnesses/HHRG-116-AS00-Wstate-DavidsonP-20190327.pdf.

3: Ibid.

These submarines will be armed with JL-2/JL-3 submarine launch ballistic missile ranges upwards of 5000 – 7000 nautical miles (NM) and are likely to operate in the South China Sea or Western Pacific, which provides a credible deterrence against the US. The PLAN also operates six Shang Class (Type 093) and plans to induct new SSNs (Type 095), which are said to be as capable as the US's Los Angeles and Virginia Classes.[4] In addition, there are 40 conventional submarines, of which eighteen AIP-fitted Yuan Class (Type 039). PLAN deployment of the conventional submarines in the Indian Ocean clearly demonstrates their long endurance capabilities.

There are concerns that in the future, PLAN may have ship and submarine access at Gwadar (Pakistan) and Hambantota (Sri Lanka) as a result of commercial arrangements with these countries. China, under the Belt and Road Initiative (BRI), is investing substantially in Iran, Bangladesh and Myanmar, particularly in building ports to expand its sphere of influence in the region, which many in Delhi believe endangers India's stake in the region. China is also deploying ocean research vessels to systematically map the Indian Ocean. India is closely monitoring Chinese fishing vessels in the Bay of Bengal and the Arabian Sea as they may be collecting marine data from India's economic exclusive zone. PLAN's pattern of deployment suggests an aspiration for a sustained presence in areas of overlapping interest with India.

Similarly, the Pacific Ocean holds significant importance for China for submarine operations. China's strategic objective is to establish a credible form of deterrence against the US by effectively operating SSBNs in the Pacific Ocean. Experts argue it is important to keep SSBNs close to the Chinese Coast for protection.[5] But, it is all the more important for China to deploy SSBNs and SSNs in the open seas, mainly in the Pacific to achieve credible deterrence against the US.

As China plans to induct newer class submarines, PLAN may soon deploy SSBNs and SSNs to conduct deterrence patrols in the Pacific Ocean.

Since the Western Pacific is sprawling with the US and Japanese ASW ships and aircraft, it may be important to consider China's growing interest in the South Pacific, which may also involve a plan to expand its submarine operations in the region. In fact, China's diplomatic engagement with the Pacific Island Countries (PICs) has improved tremendously in the last few years, which would provide much-needed support for China in protecting its maritime interest in the region. Of the fourteen countries in the region, China has established diplomatic relations with ten. Chinese investment in infrastructure and development projects in PICs has brought those countries closer to Beijing. This growing investment from China is causing concern for Australia and New Zealand, which have been major contributors to these nations and key players in the region. Australia is also apprehensive about the growing Chinese clout in the region that may lead to greater deployment of PLAN forces.[6] Therefore, it is plausible PLAN may deploy submarines and uncrewed underwater vessels in the region.

Second, the Pacific Ocean is rich in polymetallic nodules, Cobalt crust and sulphides, and most of the mineral deposits are present close to Australia's coast. China's Ocean Mineral Resources Research and Development Association (COMRA) has already obtained contracts from the International Seabed Authority (ISA) for seabed mining in the Pacific Oceans.[7] China has been conducting feasibility and preliminary research in mining sites in the South Pacific. At present, ISA is not issuing any extraction permits for deep-sea mining until it finalises its mining regulations.[8] Once the regulations are in place, China may begin mining the seabed in the area and may also work together with PICs to tap into the minerals on their EEZ.

Another major challenge in the underwater domain is the emergence of new unmanned/autonomous underwater vehicles. The Russia-Ukraine conflict has demonstrated that naval vessels are no longer immune from unmanned maritime systems. The growing demand for such systems shows that it will have a significant impact on naval warfare.

4: Manish Kumar Jha, "Is China's Nuclear Submarine Superior to Russia, India and US Subs?" Financial Express, March 22, 2023, https://www.financialexpress.com/business/defence-is-chinas-nuclear-submarine-superior-to-russia-india-and-us-subs-3018805/.

5: Greg Torode & Eduardo Baptista, "Analysis: China's Intensifying Nuclear-Armed Submarine Patrols Add Complexity for U.S., Allies," Reuters, April 4, 2023, https://www.reuters.com/world/chinas-intensifying-nuclear-armed-submarine-patrols-add-complexity-us-allies-2023-04-04/.

6: Malcolm David, "Australia Must Prepare for the Possibility of a Chinese Base in Solomon Islands," The Strategist, March 31, 2022, https://www.aspistrategist.org.au/australia-must-prepare-for-the-possibility-of-a-chinese-base-in-solomon-islands/.

7: Wang Yan, "China's Deep-Sea Mining, a View from the Top," China Dialogue Ocean, October 18, 2019, https://chinadialogueocean.net/en/conservation/10891-china-deep-sea-exploration-comra/.

8: Olive Heffernan, "Deep-Sea Mining Could Begin Soon, Regulated or Not," Scientific American, September 1, 2023, https://www.scientificamerican.com/article/deep-sea-mining-could-begin-soon-regulated-or-not/.

China already deployed UUVs to gather intelligence on the South China Sea's littoral countries. China placed great importance on its UUV program, as evidenced by its inclusion of the HSU-001 Large Displacement UUV in the 70th-anniversary military parade, along with a range of ICBMs and SLBMs.[9] The Qianlong III UUV, which is already in use, weighs 1.5 tons, can reach a maximum depth of 4500 meters, and has an endurance of 100 NM at three knots.

China oceanographic survey ships also use underwater gliders and Argo Floats to collect marine data in the Indo-Pacific waterway. In 2020, Indonesian fishermen caught a Chinese UUV near Selayar Island in a crucial maritime route linking the South China Sea to Australia's northernmost city of Darwin.[10] China's ongoing exploration and exploitation of seabed resources, coupled with its increasing maritime activities in the Indo-Pacific, has raised concerns about potential threats to regional security. In recent times, the region has encountered a series of submarine accidents. According to a report by the UK-based Daily Mail, China's Shang Class type-093 submarines experienced "catastrophic failure" of oxygen systems in the Yellow Sea, resulting in the tragic loss of all crew members.[11] Similarly, in 2021, a US nuclear attack submarine collided with an underwater object in the South China Sea and was forced to surface. While the crew escaped unharmed, the submarine hull suffered severe damage. These incidents serve as reminders of the inherent dangers and risks associated with operating submarines in the region. As the region is racing to the bottom of the sea, the need for understanding the underwater domain is imperative. Given that no single country has the necessary resources to achieve this understanding alone, cooperation seems to be the only way forward.

India and Australia's Anti-Submarine Warfare Capabilities

In the wake of the rapidly changing underwater security environment in the Indo-Pacific region, India and Australia are focused on optimising respective force structures to operate in the Indo-Pacific underwater domain. The detection, tracking, and identification of Chinese submarines within the tropical waters of the Indo-Pacific poses a significant challenge for both the Indian Navy and the Royal Australian Navy.

In order to defend the underwater domain, the Indian Navy's frontline vessels have been equipped with highly advanced hull-mounted sonar and towed-array sonar systems. These systems were indigenously developed taking into consideration the impact of the Indian Ocean environment on acoustic propagation. India is also continuously studying sonar performance, acoustic methods, and mapping of underwater landmass using acoustic methods to improve the Indian Navy's ability to detect, track, and identify underwater threats within the area of interest.

India also operates a fleet of Poseidon-8I long-range maritime reconnaissance aircraft and ASW helicopters. The induction of new MH-60R helicopters will further augment India's ASW capabilities. India's nuclear and diesel-electric submarines play a crucial role in India's overall ASW strategy and serve as a key component in the country's efforts to maintain a strong and secure underwater presence in the Indo-Pacific. The Indian Navy has also recently inducted the first three of sixteen domestically built Anti-Submarine Warfare Shallow Water Craft (ASW-SWC) manufactured by Garden Reach Shipbuilders & Engineers (GRSE) in Kolkata.[12] This will enhance India's capability to conduct anti-submarine warfare in shallow waters.

9: H I Sutton, "China Navy Reveals New Large Underwater Robot Which Could Be A Game Changer," Forbes, October 1, 2019, https://www.forbes.com/sites/hisutton/2019/10/01/china-reveals-new-robot-underwater-vehicle-hsu-001/?sh=255aa64d1991.

10: Andrew Greene, "Suspected Chinese Submarine Drone Found by Indonesian Fishermen in Crucial Maritime Passage to Australia," ABC News, December 31, 2020, https://www.abc.net.au/news/2020-12-31/suspected-chinese-submarine-drone-found-by-indonesian-fishermen/13022488.

11: Mark Nicol, "55 Chinese Sailors are Feared Dead After Nuclear Submarine 'Gets Caught in a Trap Intended to Snare British and US Vessels in the Yellow Sea'," Daily Mail, October 4, 2023, https://www.dailymail.co.uk/news/article-12589429/chinese-sailors-trap-yellow-sea.html.

12: "Anjadip, the 3rd of Eight Ships of ASW Shallow Water Craft SWC Project," Indian Navy, 2023, https://www.indiannavy.nic.in/content/anjadip-3rd-eight-ships-asw-shallow-water-craft-swc-project#:-:text=Craft%20SWC%20Project-,Anjadip%2C%20the%203rd%20of%20eight%20ships%20of%20ASW%20Shallow%20Water,VAdm%20R%20B%20Pandit%2C%20CINC%20SFC.

The ocean space separates Australia from other theatres of war and confers natural advantages.[13] Due to its "imperial commitments and obligations," Australia has developed a core anti-submarine capability.[14] This capability played a vital role in the Pacific War and contributed significantly to the US Navy's war efforts. Australia has maintained its commitment to this capability throughout the Cold War and beyond, as it played an active role alongside the US allies in ASW operations against Soviet submarines in the Pacific. During Operation Gateway, the Australian Royal Air Force took the lead in tracking Soviet ships and submarines from the South China Sea through the Straits of Malacca to the Indian Ocean.[15]

As the regional security environment is changing, Australia is building better ASW technology to detect, track and identify the Chinese submarines and close the gap between RAN and the US Navy, says defence expert Malcolm Davis. Australia presently operates six Collins-class diesel-electric submarines (SSKs) and plans to acquire and build SSNs over the next several decades as part of the AUKUS arrangement. The Hobart Class Destroyer, fitted with Aegis Combat systems, is equipped with modern sonar systems to conduct undersea warfare. The RAN is also planning to replace eight Anzac class frigates by 2030 with Hunter Class Frigates, which will have the most advanced anti-submarine warfare capabilities and improve the Australian Navy's ASW capabilities.[16]

Australia has been placing a lot of emphasis on enhancing the security of its underwater environment, with a particular focus on autonomous vehicles. Australian Navy Aviation Group currently operates three squadrons of MH-60R helicopters, and the Royal Australian Air Force operates twelve P-8A Poseidon Aircraft for ASW missions. Recently, Australia also approved purchasing the US Navy's Surveillance Towed Array Sensor System - Expeditionary (SURTASS-E), a containerised system that can also operate from commercial vessels.[17]

Australia is also developing an Extra-Large UUV (XLUUV) called "Ghost Shark" for military purposes and to provide the RAN with a vital advantage in undersea warfare.[18] Through AUKUS, Australia is also seeking to broaden its collaboration in AI and underwater systems, which will significantly enhance its technological capacity to develop autonomous underwater systems.[19]

India and Australia are investing in building advanced ASW capabilities, primarily to offset the rising threat posed by China in the region. Nonetheless, it is essential to recognise that their attention on the underwater domain extends beyond ASW, with significant consideration given to commercial and environmental interests that have taken on a more prominent role. The Russia-Ukraine war further highlights the vulnerability of underwater infrastructure. Particularly, the disruption of Nord Stream 1 and 2 gas pipelines in 2022 shows how the energy pipeline and submarine cable are easily susceptible to military action. The many pipelines and communication cables that now cross international waters increase the complexity of protecting the vital infrastructure beyond once national jurisdiction.
In the Indian Ocean Region, subsea pipelines and submarine cable has become more crucial for both India and Australia. Indian oil companies like ONGC, BORL, and HMEL manage pipelines off the western coast of India, connecting oil fields including Mumbai High, Neelam, Heera, and Bassein.[20] The South Asian Gas Enterprise Pvt. Ltd has been developing the deep sea offshore gas pipeline project from the Middle East to India. The pipeline will stretch 2,500 km across the Arabian Sea from the Middle East to India, reaching a maximum depth of 3,400 metres. This proposed undersea gas pipeline promises to deliver 31 MMSCMD gas to India for 20 years.[21]

13: Allan Behm, Peter Briggs and Paul Greenfield, "Australia's Future Submarines: An Explainer," The Australia Institute, 2022, https://australiainstitute.org.au/wp-content/uploads/2022/11/Submarine-Explainer-WEB.pdf.

14: David Stevens, A Critical Vulnerability: The Impact of the Submarine Threat on Australia's Maritime Defence 1915 –1954. (Canberra: Sea Power Centre – Australia, 2005).

15: "Operation Gateway," Royal Australian Air Force, 1982, https://www.airforce.gov.au/about-us/history/our-journey/operation-gateway.

16: "Hunter Class FFG," Royal Australian Navy, 2023, https://www.navy.gov.au/fleet/ships-boats-craft/future/ffg.

17: Ben Felton, "Australia Cleared For $207 Million Modular SURTASS Buy," Naval News, May 10, 2023, https://www.navalnews.com/naval-news/2023/05/australia-cleared-for-207-million-modular-surtass-buy/#:-:text=Australia%20received%20in%20principle%20approval,deal%20is%20approximately%20%24207%20million.

18: "Ghost Shark a Stealthy 'Game-Changer'," Australian Department of Defence, 2022, https://www.defence.gov.au/news-events/news/2022-12-14/ghost-shark-stealthy-game-changer.

19: Malcolm Davis, "AUKUS Requires Rapid Expansion of Autonomous Undersea Warfare Systems," The Strategist, October 30, 2021, https://www.aspi.org.au/opinion/aukus-requires-rapid-expansion-autonomous-undersea-warfare-systems.

20: Engineers India Limited, 2019, https://engineersindia.com/storage/2019/01/151_Download_Pipeline.pdf.

21: "$5-billion Undersea UAE-Gujarat Gas Pipeline Proposed," Financial Express, May 16, 2023, https://www.financialexpress.com/business/industry-5-billion-undersea-uae-gujarat-gas-pipeline-proposed-3089046/.

Moreover, India's "Deep Ocean Mission" has identified eleven potential sites for exploration in the Indo-Pacific and also domestically designed and developed a manned submersible – Samudrayaan – to carry three humans to the depths of the ocean as part of the mission.[22] Similarly, India and Australia were also exploring collaboration to lay down undersea cables to improve connectivity in less developed nations in South Asia and the wider Indo-Pacific.[23]

As an island country, Australia prioritises protecting submarine cables from natural and man-made disasters. There are more than twelve submarine cables that connect mainland Australia to the world. Australia, aware of the vital importance of submarine cables to its economy, implemented a tough cable protection legal regime.[24] The country has been a major player in the international energy market for a long period of time, exporting coal and gas around the world. However, in recent times, the country's capacity to produce low-cost solar and wind energy has caught the attention of many Asian countries, particularly South Korea, Singapore and Japan, who have a significant need for energy.[25] As a result, there has been a growing interest in Australia in exporting renewable energy to these countries through underwater power cables. Sun Cable is developing the Australia-Asia PowerLink, which would supply 15% of Singapore's electricity.[26]

India and Australia have shown a keen interest in delving deeper into the underwater domain. Their focus is not solely on military purposes but also on discovering commercial and economic prospects. As a result, it is imperative that both countries have a comprehensive understanding of the undersea environment. This makes collaboration in the UDA all the more crucial.

Significance of India – Australia cooperation in UDA

UDA involves achieving total situational awareness of the undersea environment, which includes monitoring and profiling water columns and seabed for the security, commercial, scientific exploration and marine environment interests of state and non-state actors. UDA should not merely be seen as a spatial extension of the broader concept of maritime domain awareness. UDA functions in different spectrums where the principal sensing mode is acoustic, which is the only means to generate a clear picture of the undersea region. Particularly in the tropical water of the Indo-Pacific, prevailing background noise caused by geophonic, biophonic and anthropogenic sources requires continuous monitoring of the ocean ambient noises for better performance of underwater sensors.[27] Currently, the detection capabilities of underwater sensors are limited by their range, and it is not practical to map vast areas using conventional sensors alone. Similarly, deploying and maintaining sensors across the Indian Ocean or at crucial maritime choke points to monitor underwater activity for security purposes can be a costly endeavour.

However, there is a need for continuous intelligence, surveillance, and reconnaissance (ISR) over the Indo-Pacific. To do that requires a system of satellite constellations, seabed sensors, towed arrays, maritime patrol aircraft, ASW helicopters, unmanned systems in both air and maritime, and submarines and information-sharing with strategic partners etc. This will help provide early warnings, indications, and situational awareness. No single country has the capacity and capability to carry out this enormous task, so India and Australia, who share common interests in the region, should collaborate in acoustic capacity and capability building to fill the gap in the underwater domain. By pooling resources, the two countries can achieve a greater level of understanding of the region.

22: "11 Sites Identified for Survey Under Deep Ocean Mission Project: Jitendra Singh," The Hindu, May 11, 2023, https://www.thehindu.com/sci-tech/energy-and-environment/11-sites-identified-for-survey-under-deep-ocean-mission-project-jitendra-singh/article66838829.ece.

23: Shashank Mattoo, "India, Australia to Discuss Connectivity Boost with Undersea Cables," Mint, September 24, 2023, https://www.livemint.com/news/india/india-australia-to-discuss-connectivity-boost-with-undersea-cables-11695577052568.html#:~:text=Summary&text=India%20and%20Australia%20will%20discuss,persons%20aware%20of%20the%20matter.

24: Samuel Bashfield & Anthony Bergin, "Options for Safeguarding Undersea Critical Infrastructure: Australia and Indo-Pacific Submarine Cables," Policy Options Paper No. 25, ANU National Security College, 2022, https://nsc.crawford.anu.edu.au/sites/default/files/publication/nsc_crawford_anu_edu_au/2022-06/nsc_pop_undersea_critical_infrastructure_no.25_web-1.pdf.

25: Peter Ker, Angela Macdonald-Smith and Ingrid Fuary-Wagner, "Australia's Export Dilemma: Solar Via Cable or Hydrogen by Ship?" Financial Review, January 23, 2023, https://www.afr.com/companies/energy/how-should-we-export-australia-s-renewable-energy-if-at-all-20230116-p5ccr1.

26: Ibid.

27: G. Latha, "An Autonomous Real Time Passive Acoustic Monitoring system to investigate the Ocean Environment," Indian Navy, https://indiannavy.nic.in/insshivaji/sites/default/files/autonomousrealtimepassiveacousticmonitorinsystem.pdf.

India and Australia's collaboration in underwater domain awareness has great potential for enhancing maritime security in the Indo-Pacific. Both countries have come to acknowledge the importance of UDA as a crucial element of their force structure. In 2021, Indian Navy Chief Admiral Karambir Singh listed "underwater domain awareness as one of the most critical areas for the navy."[28] Similarly, during Exercise Malabar 2023, Rear Admiral Christopher Smith from RAN said, "The underwater battle space is seen to be the front line in terms of competition and potential future conflicts." These comments highlight their commitment to effectively monitor and secure the maritime space in the Indo-Pacific, particularly the underwater domain, which is increasingly an important area in which India and Australia can work together.

Collaboration between India and Australia in the underwater domain is significant for multiple reasons: First, it allows for the sharing of resources, information, and expertise between two major maritime powers. The collaboration will let them pool their resources and capabilities in underwater surveillance technology and intelligence gathering. By working together, India and Australia can establish a robust network of sensors and surveillance systems in key strategic locations, enhancing their ability to detect and track submarines and other underwater threats. Similar to the US Sound Surveillance System (SOSUS), both countries can also plan a network of underwater sensors to monitor the chokepoints.

Second, collaboration in the underwater domain enables India and Australia to strengthen maritime interoperability. Joint exercises focused on UDA can enhance India and Australia's ability to operate in a coordinated manner and respond effectively if there is a submarine emergency in the region. Both countries operate deep submergence rescue vehicles (DSRV) that can quickly respond to any underwater crisis in the region.

Third, joint cooperation in the design and development of UUVs and associated technologies is one of the essential aspects of the growing relationship. Both countries possess some capability in developing unmanned underwater vehicle technology, and by joining forces, they can accelerate the advancement of UUV capabilities and maximise their potential in underwater operations. The Indian Navy has published a document outlining its plans for unmanned systems and listed some critical technologies that need to be developed. The Indian Navy also invited domestic and foreign players to participate in the programme.

Australia is also developing autonomous underwater vehicles and could potentially partner with Indian industries to manufacture underwater vehicles that meet the Navy's requirements. An Indian-Australian consortium could be formed for this purpose. Furthermore, this collaboration also opens up opportunities for joint research and development in the field of underwater technology, fostering innovation and technological advancements.

Fourth, India and Australia should collaborate to safeguard submarine cables and other underwater infrastructure. It is essential for both countries to collaborate on protecting critical underwater infrastructure, such as submarine cables, that are vital for communication and economic activities. Australia's submarine cable legal regime is considered to be the "gold standard" in international regulation of cables. India can consider adopting similar laws by working together with Australia. Additionally, India and Australia can jointly organise a regional summit to raise awareness about the significance of the "Submarine Cable Protection Zone" among the neighbouring countries.

Finally, it is imperative for both India and Australia to come up with comprehensive solutions to tackle the significant environmental hurdles that arise due to deep-sea mining activities in the region. The adverse impacts of such mining practices on the marine ecosystem and biodiversity cannot be ignored and must be addressed with utmost seriousness. Therefore, it is crucial for both nations to collaborate and devise sustainable measures to mitigate the harmful effects of deep-sea mining in the region.

In conclusion, China's rise as an Indo-Pacific naval power is influencing the security and intelligence planning of many nations. India and Australia's cooperation in the underwater domain is crucial to enhancing regional security as well as the maritime capabilities of both nations. This collaboration could also expand into other fields, including marine technology, scientific study on the underwater marine environment, and maritime governance, leading to a more comprehensive understanding of the underwater environment. By pooling capabilities, India and Australia can establish a robust network of sensors and surveillance systems, enhancing maritime interoperability. Collaboration in UDA would not only improve India and Australia's strategic partnerships but would also contribute to overall security architecture in the Indo-Pacific.

28: Huma Siddiqui, "Underwater Domain Awareness Main Focus of the Indian Navy: Chief," Financial Express, December 3, 2020, https://www.financialexpress.com/business/defence-underwater-domain-awareness-main-focus-of-the-indian-navy-chief-2142665/.

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