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# UNDERWATER COMPETITION IN THE INDO-PACIFIC

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## Introduction

The Prussian military philosopher Carl von Clausewitz introduced the term "The Fog of War" to describe the uncertainty that exists in military operations with respect to one's own capability, adversary's intent, and the precise understanding of the battlefield. The informational asymmetry gives a strategic advantage by blinding one's enemy. The competition for this advantage is more intense in the underwater domain than most of the others such as land, air, space, and the sea above water.

During the Cold War, the United States enjoyed an overwhelming advantage after it succeeded in building nuclear-powered attack submarine (SSN) and submarine-launched ballistic missiles (SLBM) and laying undersea cables (Sound Surveillance System, or SOSUS) in the Atlantic Ocean and the Pacific Ocean to detect and contain the erstwhile Soviet Union's submarines. These networks played a significant role in ending the Cold War and entrenching the United States' supremacy in the underwater domain, which continues to date.

Currently, the underwater competition in the Indo-Pacific region is being played out between three great powers, namely the United States, China, and Russia, but with increasing involvement by regional powers such as Japan, Vietnam, and India. The strength of submarines is that they are invisible and thus can be deployed anywhere in the open sea. However, they are always at risk of detection. For example, nuclear submarines emit noise through nuclear reactors and steam turbines, and similarly conventional submarines emit noise through snorkeling.

At a conference in November 2019, U.S. Secretary of Defense Mark Esper said, "Advances in AI [artificial intelligence] have the potential to change the character of warfare for generations to come. Whichever nation harnesses AI first will have a decisive advantage on the battlefield for many, many years. We have to get there first."[1] A "cat and mouse game" in the underwater domain—often focused on deploying stealthier submarines and developing detection and tracking technologies in anti-submarine warfare (ASW)—is about to change with AI, which will facilitate the execution of more dynamic operations with a minimized risk of losing human lives. In this chapter, I will focus on how the underwater domain changes over time in the context of strategy and security in the Indo-Pacific and forecast future scenarios with emerging technologies.

## Game Changers in the Underwater Domain: Lessons from the History of Submarine Technologies

### Nuclear-Powered Submarine

The world's first nuclear submarine, *USS Nautilus* (SSN-571), was launched in 1954, and it was successfully commissioned in 1955.[2] Only four years after the U.S. started operating a nuclear submarine, it aborted plans for building further conventional submarines and decided to focus its resources and budget on nuclear-powered submarines. Compared to the conventional type, the nuclear submarine has certain disadvantages in that it is noisier, its development and maintenance are expensive, it generates enormous amounts of harmful radiation, which, if leaked, can cause harm to both human and marine life, and after retirement the time taken to process nuclear reactors and fuel is lengthy. However, nuclear propulsion offers inexhaustible power and frees the submarine from the need to surface frequently as it does not require air. The risk of being found by the enemy is lower, thereby making it suitable for long-term dives in the vast ocean.

Meanwhile, the Soviet Union continued to develop and maintain conventionally-powered submarines. As submarines are very expensive and require advanced technology for construction and operation, the Soviets chose the relatively inexpensive and technically stable conventionally-powered submarines to supplement nuclear-powered submarines, partly because of the lack of economic power.

**The Manhattan Project**

In 1939, the United States confirmed the findings of the occurrence of fission in uranium resulted in the immediate release of enormous amounts of energy. The United States then carried out the Manhattan Project, in which hundreds of scientists and engineers were involved in developing and manufacturing an atomic bomb. For the first time in human history, the United States dropped atomic bombs on Hiroshima and Nagasaki in 1945, demonstrating the destructive power of nuclear weapons to the world.

However, even before the army-led Manhattan Project was executed, the U.S. Navy was studying how power could be derived from nuclear fission and utilized as a source of power supply for submarines. The research was led by U.S. Naval Research Laboratory physicist Dr. Ross Gunn with the goal of overcoming the disadvantages that submarines faced from having to regularly emerge to the surface for fresh air. The Atomic Energy Commission (AEC) proposed that research and development be conducted on using nuclear power to propel naval vessels.

In 1949, Admiral Hyman G. Rickover, who later came to be known as the "Father of the Nuclear Navy," became the Director of the Naval Reactors Branch of the Bureau of Ships and was also assigned to the Division of Reactor Development of the AEC. Congress authorized the construction of the nuclear-powered submarine, called the *Nautilus*, in 1951.

## Submarine-Launched Ballistic Missile and New Missions

During World War II, Germany had developed V1 and V2 rockets to attack Britain. After its defeat, German rocket technology was transferred, along with German engineers, when they were moved to the United States and the Soviet Union.

The U.S. Navy succeeded in launching a missile from underwater, but amid these circumstances, the launch of the R7 (8,800 kilometer range), the world's first intercontinental ballistic missile, by the Soviet Union in 1957, had a major impact on U.S. research and development. That same year, the Soviets successfully launched the Sputnik rocket and put it into orbit.

As a result of the "Sputnik Shock," the development of Polaris, a U.S. Navy-driven SLBM, was pushed ahead of schedule. With solidified fuel, which increased safety, the Polaris A-1 (ranging 1,852 kilometers) was developed. Two missiles were successfully launched underwater during the dive by the first nuclear-powered ballistic missile submarine, the *USS George Washington* (SSBN 598) in 1960. The missile was able to carry only

one nuclear warhead, but later the Poseidon C-3, which had a greater range and increased accuracy, was able to carry multiple nuclear warheads in a single missile.

With these developing technologies, U.S. nuclear submarines were operated for two different purposes: (1) submarines that were equipped with torpedoes and mines to attack enemy submarines or surface ships, and (2) strategic submarines that were assigned for strategic nuclear deterrence as part of the U.S. nuclear triad. The emergence of nuclear-powered ballistic missile submarines (SSBN), the platform for SLBM, allowed submarines submerged underwater to survive semi-permanently and retaliate with nuclear weapons if their country was preemptively attacked. Given its "second strike ability," it plays a decisive role in deterrence even today.

**Sound Surveillance System (SOSUS)**

It is generally acknowledged that the United States had overwhelming military power over the Soviet Union during the Cold War and that the Soviet Union collapsed due to internal factors such as economic failures under the communist system, the burden of increasing military budgets, and the independence of member states from the Soviet Union. However, it is worth mentioning that a game-changer technology was neither nuclear-powered submarines nor ballistic missile submarines, both of which were acquired by the United States and the Soviet Union almost simultaneously, but it was submarine-detecting technologies that created the disparity in underwater operations and eventually led to the end of the Cold War. The theory behind this technology was not new or innovative, but merely an extension of the basic technical premise behind the development of submarines.

The combat capabilities of a submarine were not enough to maintain supremacy in anti-submarine warfare, but the ability of sonar to keep track of Soviet submarines had a greater role to play. Radar cannot detect underwater targets. The propagation of sound waves in the sea depends not only on factors such as water depth, salinity, and water temperature, but also on the season and weather. Therefore, a technology for determining the enemy's character, position, and distance was required.

The U.S. Navy installed hydrophones on fixed cables laid on the seafloor and focused on improving the performance of its SOSUS that analyzed submarine sounds received on the ground. As many Soviet submarines were set up at strategic locations around the North Pacific Ocean

and North Atlantic Ocean, SOSUS helped keep track of submarines leaving the submarine base. SOSUS became an important system of the U.S. Navy. During the 1962 Cuban Crisis, SOSUS demonstrated its effectiveness by detecting a Soviet diesel submarine.[3] By 1970, the area covered by SOSUS stretched from the east to the west of the Atlantic Ocean and the vast waters of the Norwegian Sea.

However, aided by the spy activities of former U.S. Navy warrant officer John Walker in the mid-1970s, the Soviets became aware of the acoustic weakness of its own submarines and rushed to improve quietness. In the following years, Soviet Accra-class submarines and Sierra-class submarines succeeded in significantly reducing noise levels.

The U.S. Navy subsequently developed the Surveillance Towed-Array Sensor System (SURTASS) as a complement to SOSUS, which was used for collecting submarines' acoustic fingerprint information, detection and tracking of submarine contacts at long range, and worked by towing sonar from a surface ship. In 1985, the combination of SOSUS and SURTASS was recognized as a part of the Integrated Undersea Surveillance System.[4] The system reached its Cold War peak with 11 NAVFACs (Naval Facilities)/NOPFs (Naval Ocean Processing Facilities), 14 SURTASS ships, two Ocean Systems commands, and manned by approximately 4,000 personnel in the late 1980s.[5]

This was a "cat and mouse" game. The improved detection capabilities of the U.S. Navy led the Soviet Union to reduce its submarine noise levels, which in turn forced the U.S. Navy to make major changes in its strategy. Rather than primarily destroying Soviet submarines, deploying attack submarines to the bastion of the Soviet Union—the Barents Sea and the Sea of Okhotsk—became a more effective approach.

The presence of SOSUS made it possible to contain the Soviets in NATO's so-called "GIUK" gap (a strip of ocean between Greenland, Iceland, and the United Kingdom). It was hard for them to pass through the GIUK gap to reach open waters without being detected by the SOSUS network. The U.S. Navy was able to maximize the effectiveness of the strategy by deploying some offensive submarines on the front. This shift in the U.S. strategy forced the Soviet to deploy nuclear-powered attack submarines (SSNs) in the Soviet naval bastions to protect its own strategic nuclear submarines, thereby making it more difficult for the Soviets to navigate in the Atlantic and Pacific Oceans.[6]

**Sonar**

The first attempt to detect underwater targets using underwater acoustic waves was made after the Titanic collided with an iceberg and sank in 1912. This event led to the advancement of iceberg detection research. During World War I, the British developed first underwater acoustic sensor (ASDIC: Anti-Submarine Division-ics) in a battle with U-boats. There are two types of sonar: active sonar, which transmits sound waves and measures the position of the enemy vessel, based on the time taken for the sound to bounce back from the target, and the intensity of the sound: and passive sonar, which detects the sound emitted by the opponent.

Commenting on the SOSUS, Edward Whitman, a former senior editor of *Undersea Warfare*, writes, "the Navy's pioneering Sound Surveillance System—SOSUS—became a key, long-range early-warning asset for protecting the United States against the threat of Soviet ballistic missile submarines and in providing vital cueing information for tactical, deep-ocean, anti-submarine warfare. And although subsequent events—most notably the end of the Cold War—robbed SOSUS of much of its mission, its history remains an object lesson in how inspired, science-based engineering development can lead to extraordinary operational effectiveness."[7]

Success in a battle is often measured by metrics such as territory gained, or enemies killed. However, John Stillion and Bryan Clark of the Center for Strategic and Budgetary Assessments points out that "[i]n many cases, disrupting, delaying, or harassing the enemy may be sufficient to achieve one's most important military objectives. In the short-term, the side using these approaches may be able to gain a temporary advantage toward a larger goal; in the long-term, these approaches may impose significant costs on an enemy in exchange for a relatively small investment."[8]

## Developments in the Indo-Pacific: The Submarine Arms Race

### China's Pivot to the Seas

At present, there are over 120 nations worldwide that have their own navies, of which 41 operate submarines. In total, there are about 460 submarines operating worldwide.[9] Among them, countries such as the United

States, Japan, China, Russia, Germany, France, Spain, the United Kingdom, the Netherlands, Italy, and Sweden have the technology to build submarines on their own. There are six countries that possess nuclear submarines: the United States, Russia, China, France, India, and the United Kingdom. It is believed that Pakistan is aiming for nuclear submarines. In addition, it is reported that South Korea aims at building a 5,000-ton nuclear-powered submarine to boost its deterrence capability against a potential North Korea sub-based nuclear attack.[10] U.S. Navy submarines are all nuclear-powered, and none of the other nations have the same level of attack and operational capabilities as the United States; thus, the United States continues to maintain its supremacy in the underwater domain.

However, U.S. supremacy in the underwater domain is being challenged by China in the last few decades, and this has also triggered China's neighbors in the Western Pacific to build up their naval forces. Russia's increased presence in the region is also a matter of concern. According to Admiral Philip Davidson, Commander of the U.S. Indo-Pacific Command (USINDOPACOM), roughly 75% of the non-U.S. submarines in the world reside in the Indo-Pacific region. About 160 of these 300 submarines belong to China, Russia, and North Korea. While these three countries increase their capacity, the United States retires attack submarines (SSNs) faster than they are replaced. He suggests "potential adversary submarine activity has tripled from 2008 levels, which requires at least a corresponding increase on the part of the United States to maintain superiority."[11]

The U.S. Department of Defense's 2019 Annual Report to Congress pointed out that China was accelerating the development of innovative technologies such as AI and unmanned systems and that the modernization of the People's Liberation Army (PLA) would be completed by 2035. China aims to be a prominent nation with a "world-class" military by 2049. According to the report, modernization of China's submarine force remains a high priority for the People's Liberation Army Navy (PLAN). PLAN currently operates four nuclear-powered ballistic missile submarines (SSBN), six nuclear-powered attack submarines (SSN), and 50 conventionally-powered attack submarines. The number is expected to be between 65 and 70 submarines by 2020.[12]

China has built artificial islands in the South China Sea, turning them into military bases. It is reported that China's nuclear submarine base at Yulin, which is located on the southern coast of Hainan Island, is protected by surface ships and fighters, and an underground tunnel has also

been constructed to prevent the submarines from being visible from the sea, sky, and space.

China is also interested in building undersea cable infrastructure. In 2018, Chinese smartphone maker Huawei Technologies completed a cable project, which bridge Brazil and Cameroon.[13] Huawei is estimated to be involved in around 30 undersea cable projects. Reportedly, the company has a hand in about 60 projects to enhance cable landing stations, for boosting transmission capacity.[14] In February 2020, Huawei Marine Networks has been awarded the contract to build a new subsea cable to connect the Maldives with Sri Lanka.[15]

In 2009, *USNS Impeccable* (T-AGOS-23) was harassed by Chinese ships in the South China Sea. This incident was an example of the dangerous "cat and mouse" game underway. One of the six ocean surveillance ships of the same kind (T-AGOS), the *Impeccable* uses SURTASS equipment to gather undersea acoustic data. The ships also carry electronic equipment to process and transmit that data via satellite to shore stations for evaluation.[16] According to the statement on the incident by the U.S. Department of Defense, five Chinese vessels shadowed and aggressively maneuvered close to the *Impeccable* in the South China Sea. She was 70 miles south of Hainan Island, conducting routine operations in international waters.[17] She was monitoring China's new and functioning SSBN and SSN and collecting data on the submarines and seafloor to improve her ability to detect the submarines, in peacetime, and efficiently hunt them during war. There was another incident just several days before this incident in which U.S. surveillance vessels were "subjected to aggressive behavior, including dozens of fly-bys by Chinese Y-12 maritime surveillance aircraft."[18]

**Regional Responses to China's Naval Rise**

In response to China's expanding maritime interest in the Indo-Pacific, particularly China's aggressiveness in the disputed South China Sea, a number of countries in the region have been making significant moves to modernize their naval forces. There are three ways to acquire a submarine: (1) purchase a retired used submarine from a foreign country; (2) import the finished product as it is; and (3) acquire a production license and build it in your own country with support from abroad.

In this region, Vietnam is a state that has a clear vision of strategic submarine deployment to respond to the threat posed by China. Vietnam has purchased six Kilo-class vessels from Russia.[19] Due to Vietnam's mari-

time claim in the South China Sea, which overlaps with China's, and also its proximity to China's Yulin naval base along the southern coast of Hainan Island, Vietnam is building its capability at an accelerated pace to defend from a potential threat. If Vietnamese submarines have the capability to detect Chinese submarines when entering or leaving a port, it could be a threat to China, which implies that it would be exposing itself to its adversaries. In other words, it would disrupt China's naval operations to block the South China Sea and the Western Pacific. James Holmes, a professor of strategy at the U.S. Naval War College, suggests that "Vietnamese access denial could take on an offensive as well as a defensive character."[20] However, according to Alexander Vuving, a professor at the Daniel K. Inouye Asia-Pacific Center for Security Studies, "Vietnam's effort is far from affecting the balance of forces in the South China Sea."[21]

Another country that is actively trying to utilize submarine force in their national security strategy is Indonesia. The Indonesian fleet has made a deal to procure three submarines from South Korea. Regarding Indonesia's objective, Shang-su Wu, a research fellow at Nanyang Technological University in Singapore, wrote that "[w]ith several strategically important straits connecting the Indian and Pacific Oceans within its borders, Indonesia is unlikely to avoid competition among maritime powers—primarily between China and the US" and "the possession of certain naval capabilities is essential for Jakarta to protect its sovereignty and to serve as a bargaining chip in realpolitik."[22]

Taiwan, which is under pressure from China to accept the "one China" policy, has aging submarines (two made in the Netherlands and two made in the United States), but the U.S. government's promise in the 1990s to provide eight conventionally-powered submarines did not materialize. In addition, there are only 15 countries that have diplomatic relations with Taiwan,[23] which makes it difficult for Taiwan to procure and license technology from other countries. Currently, there are plans to build eight vessels indigenously.[24] However, the U.S. State Department's Bureau of Political-Military Affairs announced in May 2020 that the State Department had approved a possible sale of 18 MK-48 Mod6 Advanced Technology Heavyweight Torpedoes and related equipment at a cost of US$180 million.[25]

India, which started operating submarines as early as 1967 after acquiring them from the Soviet Union, currently operates 16 submarines, including 14 diesel-electric submarines.[26] In 2012, India acquired a nuclear-powered submarine, the Akula-class *INS Chakra*, on lease from Russia.

Its first indigenous ballistic missile and nuclear submarine *INS Arihant*, built with support from Russia, was reported to be in service in 2016. India is also building Scorpene-class submarines in cooperation with a French shipbuilder. Furthermore, in 2019, India announced its collaborative project with a foreign company to domestically build six conventional submarines.[27] In November 2018, India's Prime Minister Narendra Modi announced that *INS Arihant* successfully completed its first deterrence patrol.[28]

In Malaysia, two submarines that were purchased from France in 2009 and 2010 have been commissioned. Singapore will procure four submarines from Germany.

Although these facts seem to be proof of an arms race in the region, three major Southeast Asian claimants in the South China Sea, namely, Malaysia, the Philippines, and Vietnam, are not attempting to equal or surpass China. They are not engaging in an arms race with China, but, as Vuving put it, their long-term ambition is "minimal deterrence."[29]

Some countries purchase submarines from China. Bangladesh commissioned two used submarines, which were imported from China in 2017. The Bay of Bengal is geopolitically crucial for China's attempt to encircle India. Bangladesh has reinforced its maritime power locally in the Indo-Pacific. Thailand decided to own a submarine for the first time after purchasing one from China and plans to purchase two more. It is reported that Pakistan plans to purchase eight submarines, of which four will be built in China and the other four will be built indigenously.[30]

These developments demonstrate how China's military power is influencing the political decisions and naval strategies of neighboring countries. As of 1990, the Philippines, Vietnam, Thailand, Malaysia, Bangladesh, and Singapore had no submarines (at that time, there were two in Indonesia, six in Australia, 19 in India, and six in Pakistan).[31] The seascape is changing quickly.

**Russia**

Russia has also been focusing on rebuilding its military strength. According to Admiral Mark Ferguson, then-Commander of the U.S. Naval Forces Europe and the Allied Joint Force Command of the North Atlantic Treaty Organization, citing public remarks by Russian Navy Commander-in-Chief Admiral Viktor Chirkov, the intensity of Russian submarine

patrols had risen in 2015 by almost 50 percent over the previous year.[32] The patrols are visible signs of increasing interest in submarine warfare by President Vladimir Putin, whose government has pursued new classes of quieter and stealthier diesel and nuclear-powered attack submarines.

Furthermore, U.S. and other Western officials have long warned that Russian vessels have been active near major undersea fiber-optic cables that keep the world's internet running. In July 2019, a Russian submarine caught fire during a mission, killing 14 sailors on board in Russian territorial waters in the Barents Sea. BBC Monitoring quoted U.S. officials as saying that the vessel was the nuclear submarine AS-12, nicknamed Losharik, which was designed to tamper with undersea cables.[33] Even if the military undersea network SOSUS was not compromised, severing the global Internet cables would have caused immediate and catastrophic damage to many nations.

The Russian Navy also poses a threat by developing a nuclear-powered, nuclear-tipped torpedo named Poseidon (Status-6) that can traverse thousands of miles across oceans autonomously after launching from a submarine. In March 2018, Putin publicly unveiled a 3D-animated video showing Poseidon attacking a city and a carrier task force. Later, real-life footage of a Poseidon launch was released as well. It is reported that U.S. intelligence estimates that the Poseidon will complete testing by 2025 and commence operational service in 2027.[34] Although there is skepticism about developing nuclear-powered systems with unmanned capabilities for Poseidon before 2027, the "U.S. Nuclear Posture Review," published in 2018, states that Russia is developing at least two new intercontinental range systems, one of which is "a new intercontinental, nuclear-armed, nuclear-powered, undersea autonomous torpedo," recognizing such a weapon system could become a threat to U.S. national security.

The Pentagon acknowledged in February 2020 that the United States has deployed at least one low-yield nuclear warhead on a U.S. Navy nuclear ballistic missile submarine.[35] John Rood, then-Under Secretary of Defense for Policy, stated that this supplemental capability strengthens deterrence and provides the United States a prompt, more survivable low-yield strategic weapon.[36]

## What Should Japan Do?

Japan made it clear in its "National Defense Program Guidelines for 2019 and Beyond" that Maritime Self-Defense Force will retain 22 diesel-type manned submarines.

As the underwater domain becomes more crowded than ever with naval operations in recent years, operations using unmanned undersea vehicles (UUVs) to monitor submarines of other nations as well as to ensure the security of submarine cables will be more common in the next few decades due to fewer possibilities of risking human lives. Detecting technologies such as SOSUS may not be effective since UUVs are much smaller compared with manned submarines, which makes it difficult to determine their positions with accuracy.

Unlike the United States, which must dive through the vast Atlantic Ocean, Indian Ocean, and Pacific Ocean, Japan is likely to invest in the development of UUVs that could concentrate enough on several choke points around the islands for patrol and complement the missions of conventionally powered submarines.

Japan should seek to enhance the system of collecting and monitoring information underwater by operating UUVs to patrol efficiently and defend effectively. The research and development of UUVs depend upon the private sector, even though it is still less attractive for Japan's defense industry in comparison with building conventional submarines.

It is recommended that the Japanese government encourage the private sector by procuring UUVs at a certain level of volumes to ensure their benefit and at the same time support exporting UUVs to Japan's allies. UUVs will be able to replace the shrinking applicant pool for Japan's Self-Defense Force to overcome the diminishing population.

It is desirable that Japan develop UUVs equipped with defense and attack capabilities, such as setting and sweeping of mines and firing torpedoes to deter China in the disputed waters, such as East China Sea, other than monitoring submarines.

These operations require advanced communication networks that enable contact with their motherships on surface or other UUVs, high level of communication system to integrate into the existing kill chain. The keys to future ASW will be innovative technologies for small and lightweight high-performance power supply and ultra-low power consumption system for AI and communication to survive independently underwater.

### Japan

Japan has a long history of operating submarines. The Imperial Japanese Navy acquired five Holland-class vessels from the U.S. company Electric Boat in 1905. By building its own submarines, Japan came to possess one of the world's most powerful submarine fleets by the beginning of World War II. As an ally of the United States during the Cold War, Japan made significant contributions in detecting Soviet submarines using various equipment, including a fleet of 100 P-3C anti-submarine patrol aircraft. For decades, Japan improved its submarine capability and developed what later came to be known as the Soryu-class.

Responding to China's assertiveness, Japan is not an exception in improving its capabilities in the underwater domain. Mitsubishi Heavy Industries and Kawasaki Shipbuilding Corporation are alternately building one submarine per year for Japan. The Japan Maritime Self-Defense Force (JMSDF) currently maintains 20 diesel-electric attack submarines (nine Oyashio-class and 11 Soryu-class) and plans to increase the number to 22 by 2021. JMSDF currently operates two flotillas divided into six divisions. The first and second submarine flotillas are based in Kure and Yokosuka, respectively.

In 2018, Japanese submarines, along with ASW destroyers, conducted anti-submarine training in the South China Sea. JMSDF took extraordinary measures to announce this fact, which appears to have been aimed at demonstrating the high operational capability of Japanese submarines. Japanese submarines have some unique features. *JS Oryu*, SS-511, the latest Soryu-class diesel-electric attack submarine that has been commissioned in March 2020, is Japan's first submarine with lithium-ion batteries, which store about double the power of standard batteries.[37] It is the world's largest conventionally-powered boat and can remain fully submerged for longer periods of time.

## Conclusion:
## Future Scenarios in the Underwater Domain

History shows that countries which actively incorporated science and technology into their military have enjoyed supremacy. The United States and the erstwhile Soviet Union developed similar technologies through World War II and the Cold War era in the form of nuclear-powered submarines and submarine-launched ballistic missiles, but it was detection technology,

SOSUS, that eventually helped the United States maintain its supremacy in ASW.

Recent technological developments with more complex networks connecting conventional and emerging domains indicate that the state of the underwater from the Indian Ocean to the Pacific Ocean has been changing dramatically. In the last 10 years, U.S. superiority has gradually diminished with the rise of China, Russia, and Asian countries, which have entered the submarine arms race. During his nomination hearing before the Senate Committee on Armed Forces in 2018, Admiral Philip Davidson, Commander of USINDOPACOM, described the United States' undersea dominance as "a perishable advantage." He said, "[t]he U.S. maintains a significant asymmetric advantage in undersea warfare, but the PLA is making progress. China has identified undersea warfare as a priority, both for increasing their own capabilities as well as challenging ours."[38]

One possible scenario that might involve U.S. forces in the Indo-Pacific region is where one country disturbs others by physically cutting off submarine cables, including SOSUS, by deploying UUVs. This operation leads to disconnection of communication and is likely to isolate a nation, or several nations, from receiving necessary information via the Internet. Considering that more than 90% of international communications rely upon submarine cables, this will have a tremendous impact and confuse military operations, including the chain of command.

Such a scenario could be a particularly huge threat to Taiwan, a small island under continuous pressure from China's military presence. The U.S. Department of Defense report titled "Military and Security Developments Involving the People's Republic of China 2019" suggests that China continues to prepare for contingencies in the Taiwan Strait to deter and, if necessary, compel Taiwan to abandon its moves toward independence. It also suggests that China is "likely preparing for a contingency to unify Taiwan with the mainland by force, while simultaneously deterring, delaying, or denying any third-party intervention on Taiwan's behalf."[39] In case of such hostilities, it is unlikely that the United States will not intervene militarily.

Research and development on UUVs are one of the key areas of competition between the United States and China. The U.S. Defense Advanced Research Projects Agency (DARPA) has succeeded in completing a test cruise of the anti-submarine warfare continuous trail unmanned vessel known as *Sea Hunter*, which covered over thousands of kilometers

for months under remote monitoring.[40] Boeing's autonomous extra-large unmanned undersea vehicle (XLUUV), the 51-foot-long *Echo Voyager*,[41] succeeded sea trials off the coast of Southern California in 2017.[42] Based on this experience, Boeing is now developing four *Orca* XLUUVs,[43] which could include capabilities for gathering intelligence, placing or clearing naval mines, attacking other ships or submarines, conducting stand-off strikes, and more.[44] DARPA has also launched the *Manta Ray* program to advance key technologies that will enable the next-generation UUVs to operate for extended durations without the need for human-driven logistics support or maintenance. The program aims to overcome the limitations of current UUV designs to allow large payload capacity and long-duration missions.[45]

Another possible scenario might be a cyberattack in combination with an underwater strike. In 2018, U.S. media reported that cyberattacks sponsored by the Chinese government targeted a U.S. Navy contractor who worked for the Naval Undersea Warfare Center. The information hacked included sensitive data about a project called Sea Dragon, which aims to develop a supersonic anti-ship missile for use on U.S. submarines.[46]

From the history of underwater competition between the United States and the erstwhile Soviet Union during the Cold War wherein detecting system SOSUS was an important factor for determining victory, one can draw the lesson that new detecting or tracking systems for UUVs could serve as a breakthrough or game-changing technology in future ASW, establishing supremacy in the underwater domain.

Amid the coronavirus pandemic, which engulfs the entire world on a historic scale, China continued to exhibit an aggressive stance in the flashpoint South and East China Seas. In April 2020, a China Coast Guard vessel collided with and sank a Vietnam fishing vessel in the vicinity of the Paracel Islands in the South China Sea. Beijing established two districts in the South China Sea to administer islands and reefs to cement its claim to sovereignty over the area. In May, China sent Coast Guard vessels into Japanese territorial waters near the Senkaku Islands in the East China Sea for two consecutive days. These are a few examples that indicate China's ambitions for assertive roles in the maritime domain in the post-coronavirus world order. It is essential that the United States and regional powers cooperate continuously to build peace and stability looking beyond the corona crisis.

## Notes

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