

# **TAMING SEA DRAGONS**

**Maintaining Undersea Superiority  
in the Indo-Asia-Pacific Region**

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## About the Author



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The views expressed in this report are mine alone. I am solely responsible for any errors or omissions of fact or analysis.

## About the DSA Program

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## Maintaining Undersea Superiority in the Indo-Asia-Pacific Region

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## Executive Summary

In his 2010 book, titled *Monsoon: The Indian Ocean and the Future of American Power*, Robert Kaplan asserted that the Indian Ocean “is at the heart of the world, just as it was in antique and medieval times.”<sup>1</sup> Kaplan’s definition of the Indian Ocean was expansive: “a geography that encompasses, going from west to east, the Red Sea, Arabian Sea, Bay of Bengal, and Java and South China seas.”<sup>2</sup> U.S. government officials have taken to calling the maritime region that extends from the East Coast of Africa to the West Coast of the United States the “Indo-Asia-Pacific Region.” In a 2016 statement to Congress, Admiral Harry B. Harris supported Kaplan’s assertion of its strategic importance by citing that the region currently contains seven of the 10 largest standing armies and five nuclear-capable nations, and will contain 70 percent of the world’s population by 2050.<sup>3</sup> The importance of the region’s maritime shipping routes cannot be overstated: 70 percent of all maritime petroleum and 50 percent of all maritime container shipments flow through the Indian Ocean.<sup>4</sup>

Within this strategic maritime setting, the United States and its regional allies face a grave challenge to their undersea superiority in the Indo-Asia-Pacific region during the next decade. Three potential adversaries – the People’s Republic of China, Russia, and the Democratic People’s Republic of Korea (North Korea) – have bolstered the capability and capacity of their undersea warfare (USW) forces, and all three nations possess proven submarine-launched ballistic-missile (SLBM) capabilities. Additionally, they are proliferating USW platforms and technologies to expand the capabilities of other American adversaries, like Iran, and to undermine relationships with traditional American security partners like Thailand and Pakistan.

The United States and its Asia-Pacific treaty allies (Japan, the Republic of Korea [South Korea], Republic of the Philippines, Australia, New Zealand, and Canada) are maritime nations and dependent upon the movement of economic and security goods via the sea. A loss of undersea superiority would threaten a loss of their freedom of movement on the sea, as illustrated by the crippling losses of commercial and military ships to German U-boats in the Atlantic during World War II.<sup>5</sup> Maintaining undersea superiority will be a strategic imperative during any major power conflict in the Indo-Asia-Pacific region, and the capital-intensive nature of naval forces – in terms of both equipment and highly trained personnel – underscores the mandate to maintain sufficient capability and capacity in peacetime so as to deter conflict, and, should deterrence fail, prevail in conflict.

The American and allied response to the burgeoning Soviet submarine threat in the Atlantic provides a historic analog; by the late 1950s, the Soviet Navy had amassed a force of more than 400 diesel submarines.<sup>6</sup> As the Cold War bloomed into an existential struggle with the Soviet Union, the United States and its NATO allies invested significant resources in anti-submarine warfare (ASW) forces, doctrine, and training to strive to maintain undersea superiority in peacetime – and prevail in the event of conflict. This effort spawned major technological leaps such as the first nuclear-powered submarine and a revolution in signal processing that enabled the U.S. and NATO navies to achieve dominance in passive sonar techniques.<sup>7</sup> Additionally, the United States built significant ASW capacity to find, track, and hold at risk Soviet submarines around the globe; this capacity peaked at a force of 184 ASW-capable destroyers and frigates, 102 attack submarines (SSNs), and 24 active and 14 reserve patrol squadrons operating nearly 450 P-3C maritime patrol aircraft by the mid-1980s.<sup>8</sup> Additionally, NATO members such as the United Kingdom, Canada, Norway, and the Netherlands also built significant ASW forces and routinely employed them under both national and NATO command during Cold War operations versus the Soviet submarine threat.

### The United States and its regional allies face a grave challenge to their undersea superiority in the Indo-Asia-Pacific region during the next decade.

Following the dissolution of the Soviet Union in 1991, America and its allies (NATO in the Atlantic, plus Japanese, South Korean, Australian, and New Zealand treaty allies in the Pacific) became the sole proprietors of undersea supremacy. In a nod to the prevailing strategic calculus that forecasted a theoretical “peace dividend,” the United States reduced its USW force structure by half, resulting in a force of 116 ASW-capable cruisers, destroyers, and frigates; 56 attack submarines; and 12 active and 7 reserve maritime patrol squadrons operating 225 P-3Cs.<sup>9</sup> Additionally, the opportunity cost of two prolonged counterinsurgency campaigns in Afghanistan and Iraq beginning in 2001 slashed the training and proficiency of American USW forces as their focus was diverted to other mission areas like strike warfare; maritime security operations; and intelligence, surveillance, and reconnaissance.

By 2010, U.S. Department of Defense leadership recognized the imperative to maintain undersea superiority in light of renewed Russian submarine threats as evidenced by *The New York Times*' reporting of two Russian *Akula*-class attack submarines operating near the east coast of the U.S. in August of 2009.<sup>10</sup> The U.S. ramped up investment in USW capital equipment through the acquisition of platforms like the *Virginia*-class SSN and the P-8A Poseidon maritime patrol aircraft and successfully recovered some tactical proficiency by re-emphasizing ASW training in fleet exercises. However, those restored American USW capabilities cannot mask a fundamental reality: The lack of American capacity generates an unacceptable level of risk of the loss of undersea superiority in the Indo-Asia-Pacific region during the next decade. Doubters of this thesis need only look at the U.S. Navy's program to install surface ship torpedo defense (essentially an anti-torpedo torpedo) systems on all major surface combatants by 2025 at an estimated per-unit cost of \$15 million.<sup>11</sup> The urgency and magnitude of investment in this program serves as evidence of the Navy's institutional lack of confidence in its ability to maintain undersea superiority.

**China's People's Liberation Army Navy (PLAN) currently operates a fleet made up of 330 surface ships and 66 submarines, and some naval observers have forecast that the PLAN is on a vector to operate a fleet of 430 surface ships and 100 submarines by 2030.**

Three factors contribute to this reality. First, the size of the potential Indo-Asia-Pacific battlespace is immense – approximately three times larger than the Atlantic theater during the Cold War.<sup>12</sup> Second, the potential adversaries listed above have attained sufficient submarine capacity to distribute throughout that large battlespace and execute a sea denial strategy. China's People's Liberation Army Navy (PLAN) currently operates a fleet made up of 330 surface ships and 66 submarines, and some naval observers have forecast that the PLAN is on a vector to operate a fleet of 430 surface ships and 100 submarines by 2030.<sup>13</sup> Third, the United States remains a global power with competing strategic interests in 18 maritime regions of historic national interest. While President Barack Obama's "rebalance to the Pacific" spurred the U.S. Navy to homeport 60 percent of its fleet in the Pacific, the fact of the matter is that 40 percent of new USW platform investments will likely be based in the Atlantic to meet other strategic imperatives. That is not the case for China or North Korea; 100

percent of their USW investment will affect the strategic calculus of the Indo-Asia-Pacific theater. Russia is a different case in that its USW forces are predominantly based in the North Sea Fleet and focused on operations in the Atlantic and Mediterranean regions; however, that fact will continue to divide the strategic focus of American force planning.

There are four broad ways to mitigate a military capacity shortfall: (1) buy/build more capacity, (2) contract for more capacity through alliances and coalitions, (3) develop revolutionary "leap ahead" technologies to alleviate conventional capacity shortfalls, and (4) counter the capacity shortfall in one domain by leveraging superiority in other domains. Even in light of President Donald Trump's campaign pledge to build a 350-ship navy and the U.S. Navy's release in December 2016 of a force structure assessment calling for a 355-ship navy, the U.S. will not be able to buy or build its way out of this USW capacity shortfall – at least not within the next decade.<sup>14</sup> *Virginia*-class SSNs and *Arleigh Burke*-class destroyers currently require five years to build. Those timelines could be reduced by bolstering shipyard capacity, but that will take time to expand the facilities

and recruit, hire, and train a workforce to perform that highly skilled labor. Additionally, any increased output of the shipbuilding industry will be offset in the near term by a waterfall of decommissionings of the Reagan-era "600-ship navy" buildup. The Navy commissioned as many as six attack submarines per year in the 1980s, and the curse of that buildup is that those ships are simultaneously reaching the end of their surface lives during this decade.

Simultaneously, NATO allies' investment in their national USW forces has not kept pace with the undersea threat. Of the 28 NATO allies, only five (the United States, the United Kingdom, Greece, Estonia, and Poland) met their commitment to spend 2 percent of gross domestic product on defense in 2016.<sup>15</sup> To illustrate the effect of this underinvestment in real terms, the United Kingdom's Royal Navy – formerly the vanguard of a global *Pax Britannica* – has allowed its USW force structure to dwindle to only 23 ASW-capable ships and seven attack submarines, while the Royal Air Force divested

of its maritime patrol aircraft capability in 2010.<sup>16</sup> It should be noted that the UK has increased its defense spending to meet the 2 percent threshold in 2016 and recently announced the purchase of nine P-8A maritime patrol aircraft; however, those aircraft will not become operational until 2019. This affects the Indo-Asia-Pacific security calculus in that it forces the United States to maintain significant USW capability and capacity in the Atlantic to protect American and allied interests against Russian undersea threats.

America's Asia-Pacific allies have increased their defense spending to record levels in light of aggressive Chinese behavior and North Korean nuclear saber-rattling. Japan's 2017 defense budget is its largest ever at more than ¥5 trillion (\$42.5 billion) and marks the fifth consecutive year of defense spending increases.<sup>17</sup> South Korea's 2017 defense budget is also its highest ever at 40.33 trillion Korean Wan (\$36.49 billion).<sup>18</sup> However, Chapter 3 highlights the lack of capacity of those nations' USW forces to maintain their undersea superiority against rising Chinese and North Korean threats, and there is currently no regional alliance or coalition structure to aggregate their USW capacity.

## **NATO allies' investment in their national USW forces has not kept pace with the undersea threat.**

As previously stated, any large-scale U.S. military operations in the Indo-Asia-Pacific region are wholly dependent upon the maritime movement of materiel in the form of food, fuel, and ammunition. Therefore, the United States cannot choose to substitute supremacy in the air domain for a loss of supremacy in the undersea domain as an example of an alternative, asymmetric strategy. These facts leave only two viable strategic ways to maintain the undersea superiority calculus from today to 2025. The first is to partner for more USW capacity by building a coalition of like-minded nations in the Indo-Asia-Pacific region. The second is to operationalize affordable leap-ahead USW technologies such as autonomous, unmanned undersea vehicles and expendable, distributed, networked undersea sensors to quickly remedy some of the current capacity shortfall.

Recommendations to achieve these two strategic imperatives follow:

### **1. Build a Standing Indo-Asia-Pacific USW Coalition**

The United States maintains strong bilateral treaty alliance relationships with Canada, Japan, South Korea, Australia, and New Zealand and accordingly has developed effective USW information-sharing mechanisms and habitual training and operating relationships with each of those nations. However, historical enmity, coupled with the lack of an overarching political alliance structure like the North Atlantic Council within NATO, has prevented the development of an effective, multilateral USW force that multiplies the effects generated by each national force.

The United States should lead the establishment of a USW coalition built around the following elements:

- A Coalition Undersea Warfare Center (CUSWC – pronounced “CUSS-wick”) that facilitates USW information sharing and coordination
- Common USW doctrine, analogous to the NATO Allied Tactical Publication series
- A USW information-sharing regime, with a classified information systems technology solution to enable it

A good starting point for the coalition would be the United States, Canada, Australia, New Zealand, South Korea, and Japan, which would double the USW force structure that the United States possesses. The existing AUSCANNZUKUS Command, Control, Communications, Computers, and Intelligence agreement offers a successful template on which to model the initial core coalition information sharing effort.<sup>19</sup>

Other Indo-Asia-Pacific nations should be considered for future coalition membership based on political orientation, geographic location, and USW capability. India, Singapore, Vietnam, the Philippines, Malaysia, and Indonesia represent a second tier, and the prospects for integrating each of those nations into the coalition is addressed in Chapter 4. The Republic of China (Taiwan) represents a third tier for consideration. While it is uncertain whether the first-tier coalition members would be willing to violate their “One China” policy and admit Taiwan into the USW coalition in peacetime, it is likely that in any conflict that threatens Taiwan's existence as a free-market, democratic polity, the United States and other regional allies will fight in concert with Taiwanese armed forces, including in the undersea domain.

## 2. Build Habitual Multilateral USW Training and Operating Relationships Beyond the Core Coalition

Coordinated USW (involving ships, submarines, aircraft, unmanned vehicles, and other distributed sensors) is a complex undertaking at both the operational and tactical levels of war. Coordinated USW must be rehearsed and practiced in peacetime to ensure success in the event of conflict. The United States has led the execution of multilateral exercises that include USW, such as the Rim of the Pacific (RIMPAC) biennial exercise off Hawaii, and in 2015 and 2016, Exercise Malabar was executed in the Indian Ocean as a trilateral exercise with American, Japanese, and Indian participation. However, the frequency and membership breadth of these multilateral exercises should be increased, and USW should be a core mission focus. This recommendation is not solely aimed at USW coalition members. As an example, while India is not proposed for initial coalition membership, both the coalition and India would benefit greatly through the conduct of regular multilateral USW exercises.

## 3. Foster Coalition Research, Development, and Acquisition of Affordable Technologies to Increase Coalition USW Capacity

The United States is investing in the research and development of numerous technologies such as unmanned surface vehicles (USVs), unmanned undersea vehicles (UUVs) and distributed, networked undersea surveillance sensors that may present affordable solutions for coalition partners to boost their distributed undersea surveillance capacity. Inviting coalition partners to participate in the development and acquisition strategies for these emerging technologies could increase the economies of scale of these programs and improve affordability for all partners. Traditional barriers to cooperative acquisition programs include the fear of compromise of national and/or proprietary technologies and a strong motivation to protect national industrial bases and domestic employment in an increasingly globalized economy. The “Buy American Act,” first passed in 1933 and amended frequently since, serves as an illustrative example of the second barrier. However, exemptions may be granted to qualifying nations, and this coalition research and development initiative should facilitate multilateral sales of USW technologies, including American purchases from coalition partners. None of the allied nations in the Indo-Asia-Pacific region can go it alone to maintain their undersea advantage in the region.

Critics of this coalition-building approach may point toward three significant barriers to achieving these recommendations:

1. The historic and cultural enmity that dominates the region, e.g. Japanese-Korean, Japanese-Filipino, American-Vietnamese, etc.
2. The inherently classified nature of undersea warfare, coupled with a strong desire to protect the security of coalition members’ undersea forces – national technology, tactics, techniques, and procedures, and USW operations that pursue national vice coalition objectives.
3. The fundamental flaw of coalition warfare in that it lacks political and strategic coherency that enables long-term planning to generate success in complex military operations like coordinated ASW.

While the United States and its allies and partners in the Indo-Asia-Pacific region currently lack the political coherency that underpins NATO, the regional strategic challenges they face are trending toward existential threats, at least when viewed through the eyes of the Japanese and South Koreans – and their American treaty allies. The recent trilateral cooperation among Japan, South Korea, and the United States on ballistic-missile defense (BMD) in the face of a rising North Korean threat dispels all three of those critiques. The historical enmity between the Japanese and Korean cultures is profound, BMD technologies and techniques are highly classified, and there is no overarching political agreement that underpins this effort; rather, they have formed a coalition due to their common national security interests.<sup>20</sup> The same case should be made for preserving superiority in the undersea domain, as Japan and South Korea are dependent upon maritime flows of energy and commerce for their national security, and a loss of superiority in the undersea domain could threaten their security.

International relations theorists might point out that this coalition-building effort seems to be directed at China, which could be counterproductive to securing Chinese cooperation on other regional and global policy goals of mutual interest. Frankly, it is. China’s increasingly assertive behavior in the Indo-Asia-Pacific region since 2009, coupled with recent efforts to undermine U.S. leadership of the post-World War II international rules-based order, makes it clear that China poses a challenge to regional security and stability and that it is building the military capability and capacity to make that threat credible. A 2016 RAND Corp. report titled “War with China – Thinking Through the Unthinkable” opened with this quote:

War between the United States and China could be so ruinous for both countries, for East Asia, and for the world that it might seem unthinkable. Yet it is not: China and the United States are at loggerheads over several regional disputes that could lead to military confrontation or even violence between them. Both countries have large concentrations of military forces operating in close proximity. If an incident occurred or a crisis overheated, both have an incentive to strike enemy forces before being struck by them. And if hostilities erupted, both have ample forces, technology, industrial might, and personnel to fight across vast expanses of land, sea, air, space, and cyberspace. Thus, Sino-U.S. war, perhaps a large and costly one, is not just thinkable; it needs more thought.<sup>21</sup>

The *South China Morning Post* newspaper (based in Hong Kong) recently reprinted an opinion-editorial titled “China Has All but Ended the Charade of a Peaceful Rise.”<sup>22</sup> The title speaks for itself. The Chinese have used naval, coast guard, and paramilitary vessels to harass regional neighbors over disputed maritime claims in the East and South China Seas; they have militarized seven newly reclaimed islands in the Spratly Island chain in the South China Sea despite President Xi Jinping’s pledge to avoid doing so; and they have continued to provide material support to North Korea while it flouts United Nations prohibitions on nuclear and ballistic-missile proliferation and threatens regional stability in the process. Meanwhile in the United States, despite a reported admonishment by the Obama administration’s National Security Council to stop using the term “competition” when speaking about China, Department of Defense leaders continued to use the phrase in their public statements in a clear-eyed assessment of Chinese capabilities and intent.<sup>23</sup>

Finally, in addition to the three recommendations listed above, the U.S. and its regional allies should execute more assertive deterrence in the undersea domain as described below.

#### **4. Demonstrate Conventional Deterrence in the Undersea Domain Through “Hold at Risk” USW Operations**

Any Chinese or Russian submarine that ventures beyond its territorial sea in the Western Pacific should be continuously tracked and signaled to be “held at risk” by the United States and its USW coalition partners. Political scientist Richard K. Betts called deterrence “the essential military strategy behind containing the Soviet Union and a crucial ingredient in winning the Cold War without fighting World War III.”<sup>24</sup> A key part of the United States and NATO’s deterrent strategy was demonstrating undersea superiority by holding at risk Soviet ballistic-missile submarines (SSBNs) and the SSNs that were deployed to protect them. In a similar fashion, the United States and its USW coalition partners should sow doubt in the minds of Russian and Chinese naval commanders that their submarine force would survive in the event of conflict.

Implementing this recommendation is not simply a matter of executing more effective ASW operations; rather, it is a policy decision by national leadership to permit ASW forces to be more overt and aggressive in the prosecution of Chinese submarine deployments, which is certain to induce friction in the broader American-Sino relationship and China’s relationships with regional coalition partners. However, friction in the undersea domain does not necessarily prohibit strategic security cooperation in other areas of mutual interest, such as maritime counterpiracy or sustaining the free flow of commerce, particularly the maritime shipment of hydrocarbons from the Middle East. At the operational level, some U.S. commanders have expressed concerns that aggressive, sustained ASW operations will expose our tactics, techniques and procedures to the Chinese and enable them to develop technological and doctrinal countermeasures that could erode American and allied advantages in the event of a conflict. This concern misses the broader point: Effective, aggressive ASW operations in peacetime would serve as a powerful deterrent that prevents conflict, just as it did versus the Soviet Union during the Cold War.

The United States, its Asia-Pacific allies, and their Indo-Asia-Pacific partners must acknowledge that their undersea security is in grave danger. The rational response to that acknowledgment is to devise an appropriate strategic response and then demonstrate its efficacy to potential adversaries. Failure to sustain the United States’ and allied undersea superiority could result in a strategic disaster for the Indo-Asia-Pacific region, and perhaps the entire global community.



*“Of the world’s 300 foreign submarines, roughly 200 are in the Indo-Asia-Pacific region; of which 150 belong to China, North Korea, and Russia.”*

—Admiral Harry Harris, February 2016<sup>25</sup>



In April 2017, North Korean leader Kim Jong-Un attends a military parade in Pyongyang marking the 105th anniversary of the birth of late North Korean leader Kim Il-Sung. Chinese, Russian, and North Korean submarine forces constitute the majority of the threat to allied undersea superiority throughout the Indo-Asia-Pacific region. (Getty)

## Introduction

This statement by the commander of U.S. Pacific Command illustrates the tectonic shift that has occurred in the Indo-Asia-Pacific strategic environment over the past 15 years. There are three dimensions to this shift. The first is the sheer submarine force capacity that China and North Korea have built – and the Russians have recovered since their submarine force was largely left to rust pier-side during the 1990s. Second, it implies that the Chinese and North Koreans have made significant qualitative improvements in their submarine forces to merit mention in the same sentence as Russia – although there remains a significant qualitative gap. The capabilities of the Soviet sub force were widely documented before the Soviet Union’s demise in the early 1990s, and the Russians have gone to great lengths to demonstrate not only the force’s renaissance but also the addition of transformational capabilities such as the launching of land-attack cruise missiles (LACMs) from a Project 636 *Kilo*-class hunter-killer diesel attack submarine (SSK) during combat operations in Syria in December 2015.<sup>26</sup> China and North Korea have taken a page from Russia’s strategic communications playbook regarding their submarine forces: The Chinese recently announced that they would begin strategic deterrent patrols with their new *Jin*-class ballistic-missile nuclear submarines, and the North Koreans released video footage of a successful submerged launch of a ballistic missile from a *Gorae*-class experimental ballistic-missile diesel submarine (SSBA).

Finally, it is noteworthy that Admiral Harris grouped China and Russia into the same category as North Korea. U.S. military strategy documents have consistently categorized North Korea as an adversary since North Korean forces invaded South Korea more than 65 years ago. However, within the span of the past 15 years, both China and Russia have been identified as putative “partners” in U.S. strategic planning documents. For example, the 2001 Quadrennial Defense Review (QDR) stated the following about Russia:

An opportunity for cooperation exists with Russia. It does not pose a large-scale conventional military threat to NATO. It shares some important security concerns with the United States, including the problem of vulnerability to attack by ballistic missiles from regional aggressors, the danger of accidental or unauthorized launches of strategic weapons, and the threat of international terrorism.<sup>27</sup>

China was not mentioned in the 2001 QDR, even though that report was published five months after a tense standoff triggered by the collision of a Chinese F-8 fighter aircraft with a U.S. Navy EP-3E maritime patrol and reconnaissance aircraft off Hainan Island on April 1, 2001. After the terrorist attack of September 11, American policy and strategy myopically focused on counterterrorism in the Middle East and South Asia, and what little effort was invested in the Indo-Asia-Pacific region focused on deepening economic cooperation. Even as recently as the 2006 QDR, official U.S. policy encouraged China to become a “partner” in addressing common security challenges:

U.S. policy remains focused on encouraging China to play a constructive, peaceful role in the Asia-Pacific region and to serve as a partner in addressing common security challenges, including terrorism, proliferation, narcotics and piracy.<sup>28</sup>

However, the emerging competition with China came sharply into focus in 2009 due to increasingly assertive Chinese behavior. The People’s Liberation Army Navy (PLAN) deployed a counterpiracy naval task force to the Gulf of Aden and Indian Ocean and has maintained a continuous counterpiracy presence ever since, demonstrating its yearning to project power beyond its traditional operating areas inside the first island chain in the western Pacific. Additionally, the Chinese attempted to enforce their policy of prior permission required for the entry of foreign military ships and aircraft into their exclusive economic zone (EEZ) beginning with the harassment of the USNS *Impeccable* in the South China Sea in March 2009 and continuing with a series of harassments of U.S. Navy vessels operating in international waters and aggressive intercepts of U.S. military aircraft operating in international airspace. The 2010 QDR marked a tone shift from cautious optimism to legitimate concern about China’s intent:

The United States welcomes a strong, prosperous, and successful China that plays a greater global role. The United States welcomes the positive benefits that can accrue from greater cooperation. However, lack of transparency and the nature of China’s military development and decision-making processes raise legitimate questions about its future conduct and intentions within Asia and beyond.<sup>29</sup>

The 2014 QDR acknowledged this emerging competition with China:

With China, the Department of Defense is building a sustained and substantive dialogue with the People’s Liberation Army designed to improve our ability to cooperate in concrete, practical areas such as counter-piracy, peace-keeping, and humanitarian assistance and disaster relief. At the same time, we will manage the competitive aspects of the relationship in ways that improve regional peace and stability consistent with international norms and principles.<sup>30</sup>

Chinese and Russian behaviors since the release of the 2014 QDR have served to accelerate the notion that both nations are competitors – and in fact, may be colluding to undermine the United States’ leadership of the post-World War II rules-based order.<sup>31</sup> Russia invaded Georgia in 2008 and the Crimea and Donbas region of eastern Ukraine in 2014, and it continues to occupy both regions in contravention of international law. In December 2013, China commenced an island reclamation campaign on seven disputed maritime features in the South China Sea. In July 2016, China undermined the international legal principle of the peaceful resolution of disputes in refusing to acknowledge the findings of the Permanent Court of Arbitration’s ruling that its maritime claims in the South China Sea were in contravention of the United Nations Convention on the Law of the Sea that its land reclamation actions had caused significant damage to the marine environment; and that it has unlawfully deprived the Philippines of its lawful rights within their 200-nautical-mile EEZ. China continues to utilize its maritime law enforcement forces such as the Chinese Coast Guard and a paramilitary national fishing fleet to stake out China’s excessive maritime claims while simultaneously encroaching on other regional nations’ lawful maritime claims. Each of these Chinese actions threatens the stability of the region and the national security and sovereign rights of U.S. treaty allies. Additionally, in 2016 North Korea conducted six ballistic-missile launches and an underground nuclear test in contravention of United Nations Security Council Resolutions – which were approved by both China and Russia.

All of this is presented as evidence that China and Russia – and their North Korean client – are bent on challenging the U.S.-led post-World War II international order in the Indo-Asia-Pacific region. Those challenges are presented in many ways, particularly by the Chinese



China's "String of Pearls" depicts the country's political influence and military presence astride oil routes.

with their economic clout in the region. The Chinese have invested heavily in developing maritime port infrastructure across the Indo-Asia-Pacific region, often referred to as a "string of pearls" (see map) that includes the newly reclaimed islands in the Spratlys, and infrastructure upgrades to existing ports in Sihanoukville, Cambodia; Maday Island, Myanmar; Chittagong, Bangladesh; Hambantota, Sri Lanka; Gwadar, Pakistan; and Djibouti.<sup>32</sup>

These ports were expanded under the guise of facilitating maritime trade, but they clearly have military utility in providing logistics support to Chinese naval operations in the Indian Ocean region, as evidenced by recent Chinese naval task group and submarine deployments to the Indian Ocean and Gulf of Aden.

**China and Russia - and their North Korean client - are bent on challenging the U.S.-led post-World War II international order in the Indo-Asia-Pacific region.**

NATO's Cold War strategy for maintaining undersea superiority versus the Soviet submarine threat is not linearly translatable into a strategic solution to the current undersea challenge in the Indo-Asia-Pacific region for three reasons. First, the physical geography, political geography, and oceanography of the Indo-Asia-Pacific region differ markedly from that of the Atlantic. Second, the United States no longer possesses the post-World War II industrial capacity that enabled the Cold War military buildup to counter the Soviet Union; most developed market economy democracies (with the exception of South Korea and Japan) have outsourced their commercial shipbuilding and therefore lack the organic capacity to match the cumulative effects of China's and Russia's naval buildup. Finally, the Asia-Pacific region lacks an overarching political alliance structure (like NATO in the Atlantic) around which to organize multilateral security strategy and military operations. These three factors necessitate an alternative strategic approach to maintain undersea superiority in the Indo-Asia-Pacific region.

## Visualizing the Indo-Asia-Pacific Undersea Environment

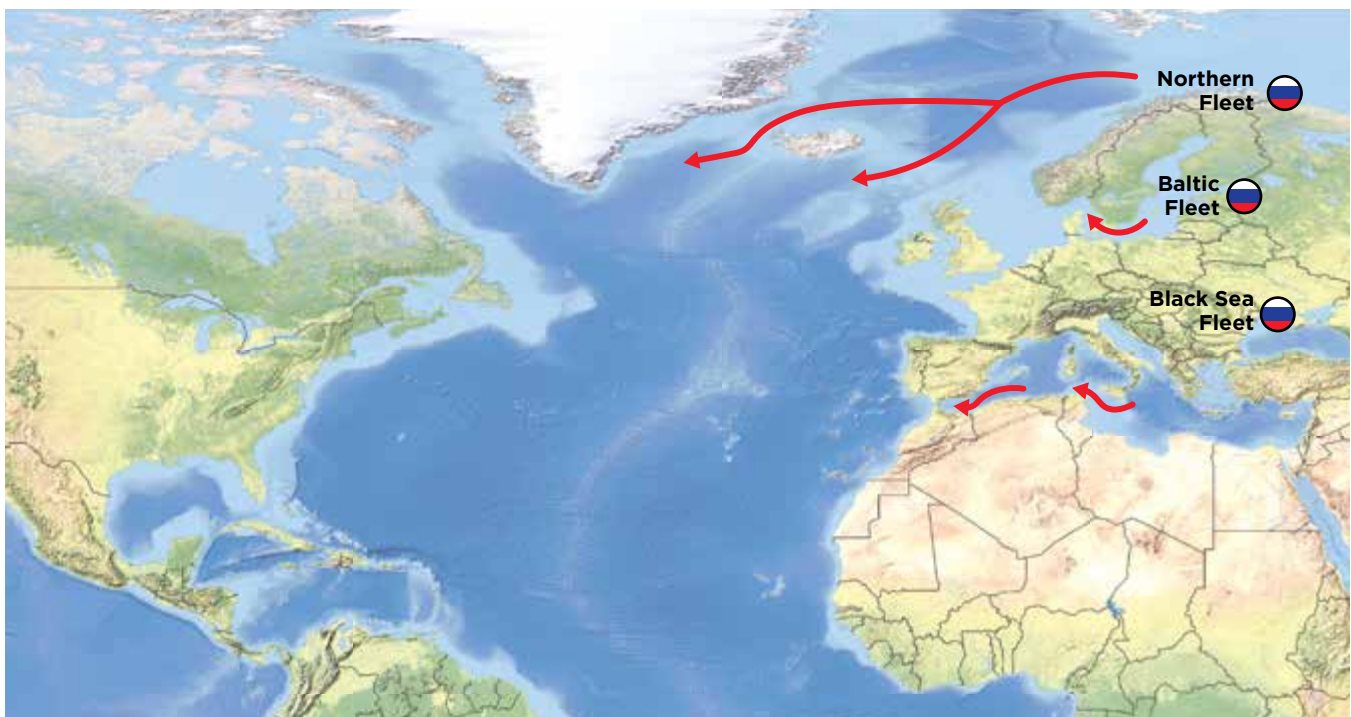
As discussed in the introduction, the U.S. and NATO strategy to neutralize the Soviet submarine threat during the Cold War serves as a reference model for a strategy to sustain U.S., allied, and partner undersea superiority in the Indo-Asia-Pacific region today. However, the Indo-Asia-Pacific environment differs from the Atlantic in three distinct dimensions: physical geography, political geography, and oceanography.

### Physical Geography

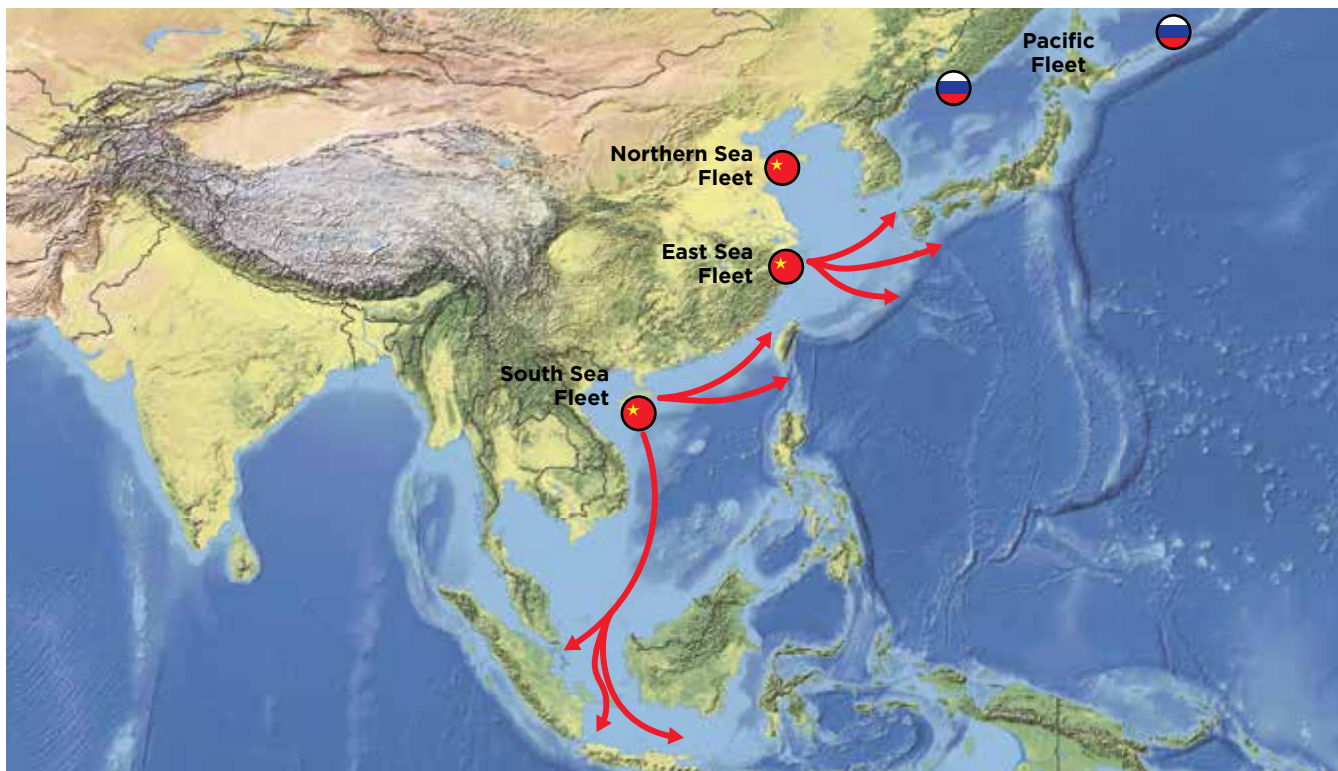
The physical geography of the Atlantic forced Soviet submarines to navigate narrow chokepoints. Soviet Northern Fleet submarines were forced to transit through the Greenland-Iceland-United Kingdom (GIUK) gap; Baltic Sea Fleet submarines had to negotiate the Danish Straits; and Black Sea Fleet submarines had to pass through the Bosphorus, Dardanelles, Sicilian, and Gibraltar Straits to reach their operating areas in the Atlantic. This physical geography led NATO to develop an “ASW chokepoint strategy,” whereby NATO ASW forces leveraged the increased probability of detection offered by the reduced volume of search space as Soviet submarines transited these chokepoints. After gaining contact in the vicinity of these chokepoints,

NATO forces attempted to maintain a constant track on those Soviet submarines and hold them at risk as a signal of deterrence.

The geography of the Indo-Asia-Pacific region also forces Chinese submarines to navigate through chokepoints to operate beyond the first island chain and into the Indo-Asia-Pacific region, but there is no single chokepoint for undersea warfare (USW) forces to concentrate their search effort. Chinese submarines based in the North or East Sea Fleets can exit the East China Sea to the North via the Straits of Tsushima; the east via the Tokara Strait in the Ryukyu Island chain or the Miyako Strait further to the south; or to the south via the Taiwan Strait. Additionally, Russian submarines based in Petropavlosk on the Kamchatka Peninsula are completely unconstrained by chokepoints, which greatly complicates efforts to search for them after they get underway. If an adversary submarine evades detection during the initial phase of getting underway from its homeport and transiting through constrained chokepoints, the large volume of water afforded by the open ocean provides a measure of sanctuary from ASW forces. While the hydroacoustic ASW search conditions may improve in the deep, open ocean, so does the volume of water that must be searched, resulting in a reduced probability of detection.



North Atlantic physical geography depicts key straits. Note the implications for the Russian Navy's access to the Atlantic Ocean. (Based on National Oceanic and Atmospheric Administration map, adapted by CNAS.)



Indo-Asia-Pacific region physical geography depicts key maritime straits. Note how the seas have multiple straits for entry/exit, unlike the single chokepoint character of the Mediterranean or Baltic Seas. (Based on National Oceanic and Atmospheric Administration map, adapted by CNAS.)

### Political Geography

The political geography of the Indo-Asia-Pacific region is also vastly different from that of the Atlantic. During the Cold War, NATO USW forces benefited from the fact that NATO nations sat astride every chokepoint that Soviet submarines were forced to navigate. This enabled NATO USW forces to utilize an interconnected web of naval bases, air bases, and hydroacoustic and electromagnetic surveillance facilities to maintain persistent surveillance of those chokepoints, detect any Soviet submarines attempting to navigate them, and maintain persistent tracking into the open waters of the Atlantic Ocean.

This stands in stark contrast with the Indo-Asia-Pacific region. While American USW forces benefit from access to naval and air bases in Japan, South Korea, the Philippines, and Australia, none of those nations permit routine access to one another's bases. That environment is beginning to change – for example, security cooperation is deepening between the Japanese and South Koreans, as well as the Japanese and the Filipinos – however, it is episodic rather than enduring.

In light of increasingly assertive Chinese behavior, nations in the region have granted new access to American USW forces. U.S. access to naval and air bases in the Philippines and Singapore was solidified under defense cooperation agreements signed in 2014 and 2015, respectively. Additionally, Indonesia is reportedly interested in obtaining U.S. assistance and foreign military



Cold War North Atlantic political geography (pre-NATO expansion) shows the natural chokepoints through which Soviet subs had to navigate. (Based on National Oceanic and Atmospheric Administration map, adapted by CNAS.)

funding (FMF) to build a base in the Natuna Islands at the southern entrance to the South China Sea, and it is likely that U.S. access would be a condition of that funding if approved.<sup>33</sup>

**Oceanography**

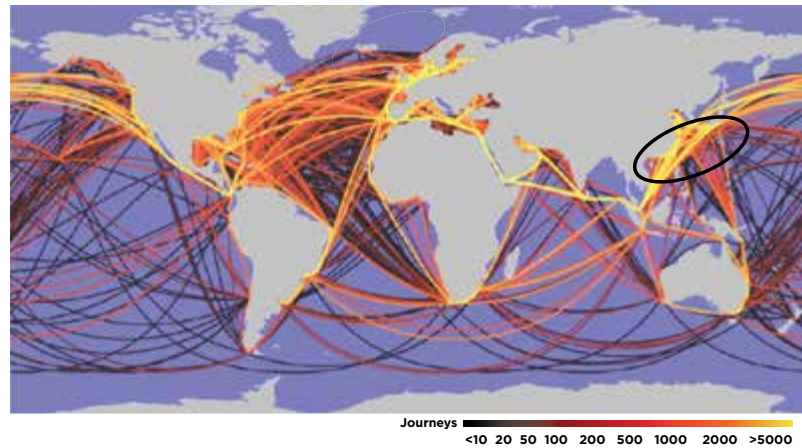
There are three oceanographic factors that combine to make the Indo-Asia-Pacific region a more challenging USW environment than the North Atlantic. The first factor is significantly higher densities of commercial fishing and shipping activity, which increase the ambient noise levels and mask the hydroacoustic signature of submarines. Global maritime shipping routes illustrate the density of commercial shipping in the East and South China Seas – key areas for locating Chinese submarines as they leave their homeports. By contrast, the waters of the Norwegian and Barents Seas have extremely low levels of commercial shipping and fishing activity, resulting in an optimum hydroacoustic environment for ASW forces.

The second factor is higher sea surface temperatures, which result in poor hydroacoustic conditions for ASW forces as the warm water near the surface refracts radiated sound downward within the water column.

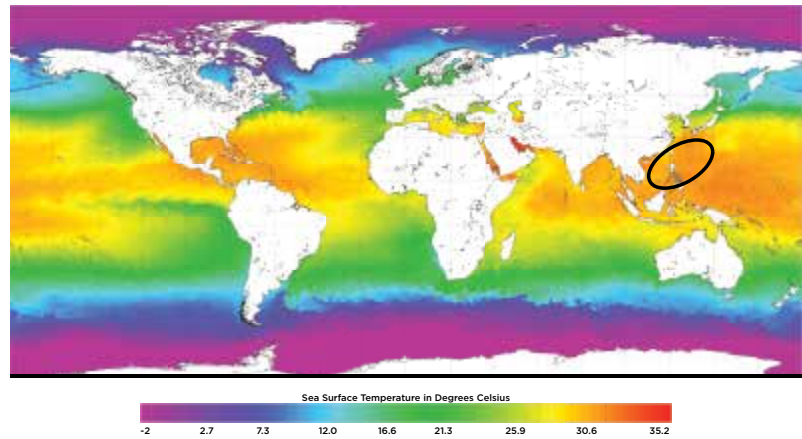
The third differential factor is the extent of shallow water within the first island chain.

The combination of high ambient shipping noise, warm sea surface temperatures, and shallow water creates poor hydroacoustic conditions for ASW forces inside the first island chain as radiated sound is refracted downward in the water column and then reflected off the ocean bottom, which creates hydroacoustic “bottom bounce” contact that is difficult to detect and localize. A bottom-bounce hydroacoustic environment also creates suboptimal conditions for long-range detections of submarines when compared with the surface ducting conditions that are found in the cool waters of the Norwegian and Barents Seas or the convergence zone conditions that are found in the deep waters of the Central Atlantic and Central Pacific Oceans.

The combination of these factors results in poor environmental conditions for conducting ASW operations in the East and South China Seas at a critical phase of the submarine’s journey – the phase where it first submerges after leaving port and attempts to evade detection by ASW forces. It is difficult to detect a submarine in the vast expanses of the Pacific after it has passed through one of the myriad chokepoints of the East and South China Seas due to the large volume of water that must be searched. This fact will inform recommendations regarding both shallow and deep water ASW search capacity later in this paper.



Global merchant shipping traffic densities illustrated by the high flow of shipping activity near the Asia-Pacific chokepoints.<sup>80</sup>



Warmer surface temperatures, measured in degrees Celsius, refract sound downward within the water column and create suboptimal hydroacoustic conditions for anti-submarine warfare forces. (NOAA)<sup>84</sup>



Shallow water, depicted in light blue, results in poor hydroacoustic conditions for ASW forces due to multipath propagation for passive sonar and high levels of bottom reverberation for active sonar. (Based on National Oceanic and Atmospheric Administration map, adapted by CNAS.)

## Regional Adversary Undersea Warfare Force Overviews

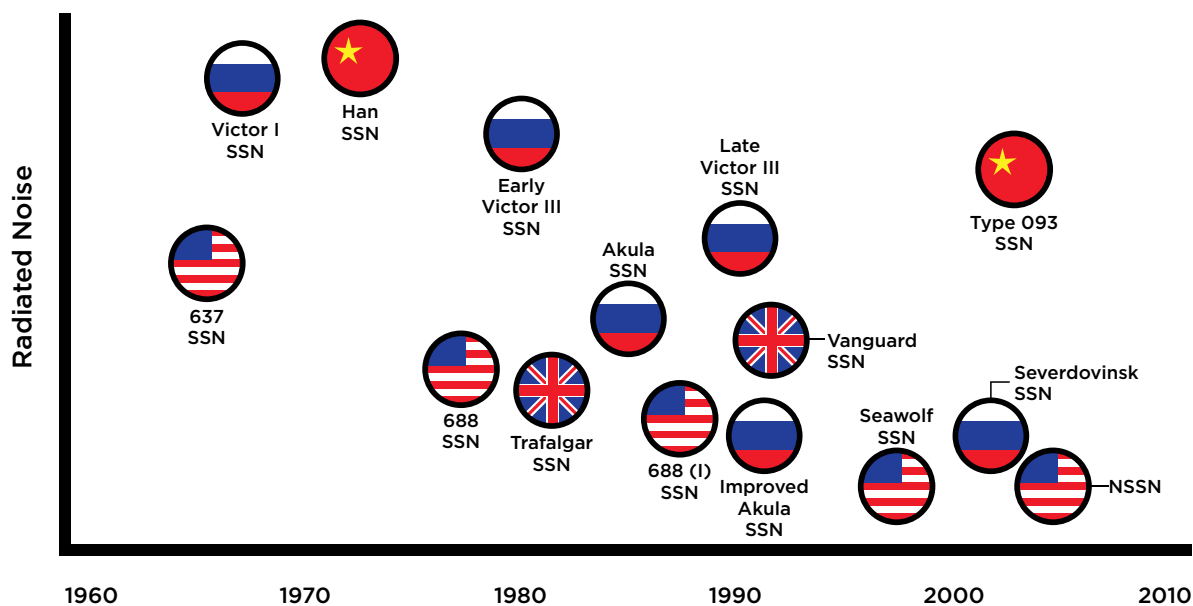
Chinese, Russian, and North Korean submarine forces constitute the majority of the threat to allied undersea superiority throughout the Indo-Asia-Pacific region. Iran also possesses a small but capable submarine force made up of three Russian-built *Kilo*-class and 13 North Korean-designed, indigenously built midget submarines.<sup>35</sup> Additionally, the Iranians are domestically producing two new classes of submarines that will reportedly be fitted with anti-ship cruise missiles (ASCMs).<sup>36</sup> Iran's submarine forces have not demonstrated a capability to operate beyond the northern reaches of the Arabian Sea, so its principal threat to allied interests is its potential to disrupt the flow of maritime transshipment of hydrocarbon resources through the Strait of Hormuz. Pakistan also factors into the undersea calculus of the Indo-Asia-Pacific region. While the United States has sustained Pakistan's designation as a major non-NATO ally since 2004, Pakistan has deepened its security relationship with China, including the purchase of eight Chinese *Yuan*-class diesel submarines (SSPs), four of which will reportedly be built in Pakistan.<sup>37</sup> Pakistan's security calculus revolves around its relationship with India, and further Indian drift toward the American side of the security equation in the region could spur the Pakistanis to drift toward the Chinese side of the equation as a counterbalance. However, the remainder of this chapter will focus on identifying the USW strengths and vulnerabilities of China, Russia, and North Korea.

### China

China constitutes the principal challenge to U.S. and allied undersea superiority throughout the Indo-Asia-Pacific region. The PLAN operates more than 60 submarines today, including two of the world's premier models of diesel submarines in the twelve *Kilo*-class SSKs purchased from Russia and twelve indigenously produced Type 039A *Yuan*-class SSPs.<sup>38</sup> The *Yuan* class has air-independent propulsion (AIP) capability, which extends the ships' submerged endurance before they are required to come to the surface and snorkel to recharge their batteries. The PLAN also possesses three older

**China constitutes the principal challenge to U.S. and allied undersea superiority throughout the Indo-Asia-Pacific region.**

Type 091 *Han*-class and two Type 093 *Shang*-class nuclear-powered attack submarines. These submarines have the range, speed, and endurance advantages of nuclear power, but lack the advanced quieting technologies of U.S. or Russian nuclear submarines and are vulnerable to passive acoustic detection by ASW forces. The remainder of China's submarine forces consist of older-generation Type 035 *Ming*-class and Type 039 *Song*-class diesel submarines. In 1997, the Office of Naval Intelligence (ONI) released a chart that estimated the acoustic signature of *Han*- and *Shang*-class SSNs relative to other nuclear submarines. (See graph of Radiated Noise on page 13.)

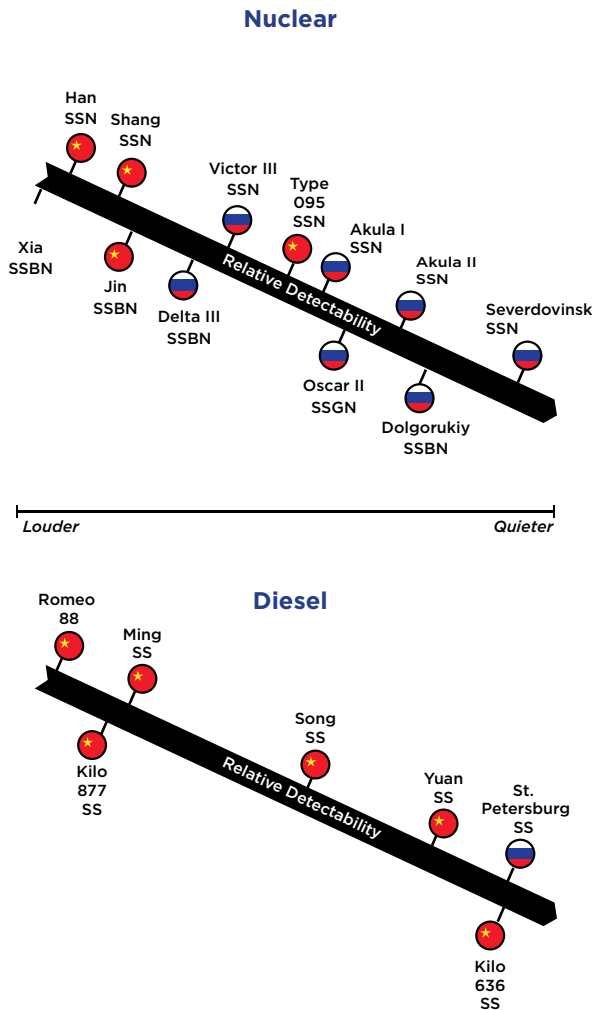


Relative radiated noise levels for nuclear submarines. "NSSN" refers to the U.S. Virginia-class submarine. Chinese nuclear submarines lack the quieting technologies of their U.S., British, and Russian counterparts.

Source: Office of Naval Intelligence, "Worldwide Submarine Challenges," (1996) 11, <https://babel.hathitrust.org/cgi/pt?id=mdp.39015037830505;view=1up;seq=15>.

ONI published an updated version of this graphic in 2009 that included an assessment of the acoustic signatures of Chinese diesel submarines. (See graph below comparing diesel and nuclear acoustic signals.)

China has showcased the expanding operational reach of its submarine forces through highly visible deployments to the Indian Ocean region. Multiple news outlets reported on the deployment of a *Shang*-class SSN to the Indian Ocean during the winter of 2014-2015.<sup>39</sup> Additionally, a *Song*-class SSK was photographed in the port of Colombo, Sri Lanka, in September 2014, while a *Yuan*-class SSP was photographed in the port of Karachi, Pakistan, in May 2015.<sup>40</sup> The commencement of nuclear deterrence patrols by its four Type 094 *Jin*-class



Relative radiated noise levels for Chinese nuclear and diesel submarines compared to Russian submarines.

Source: Office of Naval Intelligence, "The People's Liberation Army Navy: A Modern Navy with Chinese Characteristics," (August 2009), 22, <https://fas.org/irp/agency/oni/pla-navy.pdf>.



Chinese People's Liberation Army Navy (PLAN) Type 054A Jiangkai II-class frigate represents a significant ASW capability improvement for the PLAN through the integration of a variable depth sonar and a hangar to support the embarkation of an anti-submarine warfare helicopter such as the Z-9 helicopter on the stern in this photo. (Chinese Military Review)



Chinese People's Liberation Army Navy Air Force Y-8 maritime patrol aircraft carries maritime search radar under the nose, electro-optical/infrared turret aft of the nose landing gear, weapons bay forward of the main landing gear, and magnetic anomaly detector boom aft of the tail. (PLARealTalk.com)

ballistic-missile submarines (SSBNs), coupled with JL-2 submarine-launched ballistic missiles (SLBMs), represented another major development for the PLAN submarine force.<sup>41</sup>

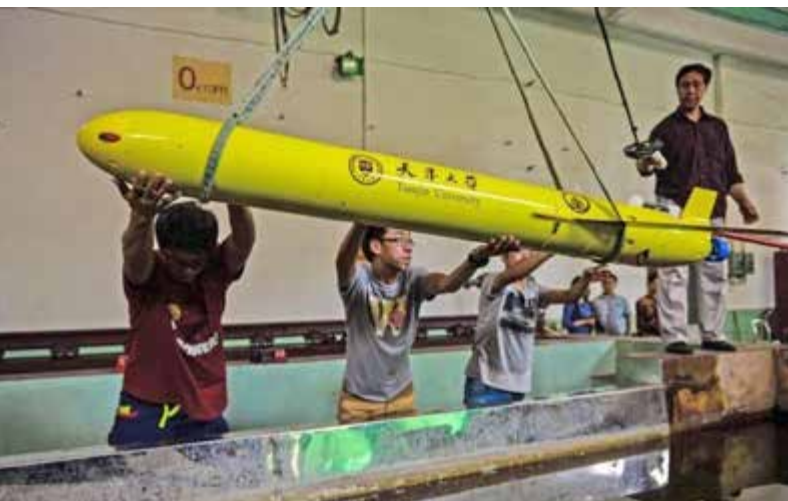
ONI estimates that the PLAN will possess more than 70 submarines by 2020, and 64 percent of them will be capable of launching ASCMs with ranges in excess of 100 nautical miles.<sup>42</sup> Other naval observers have calculated that the PLAN submarine force will approach 100 submarines by 2030.<sup>43</sup> It is important to note that PLAN submarines are principally sea control/sea denial platforms and do not possess significant ASW capabilities due to the lack of passive sonar equipment including towed arrays. In fact, a lack of ASW capability has been the Achilles' heel of PLAN fleet design, but the Chinese have recognized this fact and are investing heavily to



improve the ASW capabilities of their surface and airborne platforms. Newer PLAN warships like the Type 054A *Jiangkai II*-class destroyers incorporate variable depth sonar and a hangar to embark an indigenously built Z-9 or Z-18 ASW helicopter equipped with a pulse compression radar, dipping sonar, and ASW torpedoes. The PLAN is also developing an ASW-capable maritime patrol aircraft through the integration of ASW sensors such as a maritime search radar, an electro-optical/infrared turret, a magnetic anomaly detector (MAD), and sonobuoys, along with a weapons bay for carriage of air-launched torpedoes in the ubiquitous, multipurpose Y-8 four-engine turbo-prop airframe.<sup>44</sup>

Like the United States, China is also investing in the research and development of unmanned undersea vehicles (UUVs) and has released some information into the public domain, such as pictures of the Haiyan UUV glider shown below.<sup>45</sup>

Additionally, China is reportedly attempting to develop advanced ASW search systems based on detecting microgravity anomalies caused by the presence of a submarine and the detection of neutrinos emitted from the reactors of nuclear-powered submarines.<sup>46</sup> While it is difficult to predict if this Chinese technological endeavor will produce a breakthrough in detecting U.S. nuclear-powered submarines, it serves to illustrate China's commitment toward improving its ASW capability.



Unmanned undersea vehicle (UUV), like Chinese experimental "Haiyan" unmanned UUV glider, have the potential to be a disruptive technology in undersea warfare. The Chinese are investing in research and development in the same fashion as the United States. (People's Daily)

## Russia

The Russians possess qualitatively superior USW forces compared to the Chinese; however, the Russian Pacific Fleet lacks capacity. In 2015, ONI estimated that there were two *Dolgorukiy*-class and three *Delta III*-class SSBNs, four *Oscar II*-class guided cruise missile submarines (SSGNs), five *Akula II*-class SSNs, and eight *Kilo*-class SSKs active in the Pacific Fleet.<sup>47</sup> This total of five SSBNs and 17 attack submarines pales in comparison with the peak of Soviet Pacific Fleet USW capacity in the mid-1980s, which numbered 36 SSBNs and 88 attack submarines.<sup>48</sup>

The new *Severodvinsk*-class SSGN is nearly on par with the U.S. *Virginia* class in its acoustic quieting, passive sonar (using a spherical bow-mounted array, hull-mounted flank arrays, and a towed array), and strike warfare capability (32 vertically launched Kalibr land attack missiles). Two *Severodvinsk*-class ships have been launched out of a total planned build of eight hulls; both have been assigned to the Northern Fleet, and it is not clear when the first *Severodvinsk* will be assigned to the Pacific Fleet. However, Russia's Northern Fleet divides the focus of American USW strategic planning, making it unlikely that the United States will apportion more than 60 percent of its USW forces to the Indo-Asia-Pacific region. Additionally, in the event of conflict in the Indo-Asia-Pacific region, Russia's Northern Fleet could contribute by creating undersea mayhem in the Atlantic or by swinging Northern Fleet forces to the Pacific via the Northern Sea Route and the Bering Strait.

## The Russians possess qualitatively superior USW forces compared to the Chinese; however, the Russian Pacific Fleet lacks capacity.

Russia's surface and airborne ASW capability has atrophied greatly as submarines were prioritized for new construction and sustainment investment during the lean budget years of the 1990s and early 2000s. The Russian Pacific Fleet currently has only four *Udaloy*-class and two *Sovremenny*-class ASW-capable destroyers, and all of them are more than 20 years old and nearing the end of their service lives.<sup>49</sup> Additionally, there are only 15 IL-38 May and 24 TU-142 Bear F/J maritime patrol aircraft remaining in the Russian naval aviation inventory.<sup>50</sup> While these aircraft have benefited from incremental upgrades to their sensors and avionics, IL-38 and TU-142 production ceased in 1972 and 1994, respectively, so the material readiness of those aging aircraft is suspect.

### North Korea

The North Korean submarine force consists of approximately 70 diesel submarines made up mostly of Russian-designed *Romeo* diesel class and indigenously produced *Sango*-class coastal diesel submarines (SSCs). Historically, the Korean People's Navy (KPN) submarine force has been utilized for covert infiltration of special operations forces and mining; however, the sinking of the Republic of Korea Navy (ROKN) corvette ROKS *Cheonan* in March of 2010 by a wake-homing torpedo launched from a North Korean submarine demonstrated the sea control/sea denial capability of the KPN's submarine forces.<sup>51</sup> Given the opacity of North Korea's political and military leadership, it is difficult to predict North Korea's role in a broader conflict in the Indo-Asia-Pacific region; therefore, prudent USW planners must factor in the possibility that North Korean submarines could contribute to a broader sea denial strategy in support of Chinese strategic objectives.

## **Prudent USW planners must factor in the possibility that North Korean submarines could contribute to a broader sea denial strategy in support of Chinese strategic objectives.**

Additionally, another important North Korean USW development occurred in August 2016: the successful submerged launch of a KN-11 SLBM by a *Gorae*-class diesel submarine.<sup>52</sup> While the *Gorae* is an experimental submarine and contains only a single SLBM tube, the successful test demonstrates North Korea's commitment to develop and deploy ballistic-missile submarines (SSBs). This development could divert significant

American and allied ASW resources to maintain tracking of a North Korean SSB anytime it puts to sea and would also complicate U.S. and allied ballistic-missile defense (BMD) planning as its mobility expands the potential threat axes for BMD defensive systems.

Chinese, Russian, and North Korean cumulative submarine capacity has the potential to overwhelm American ASW capacity and generate at least temporal sea control in the Indo-Asia-Pacific region. While the degree of strategic cooperation among those three nations is uncertain and hotly debated amongst regional observers, the fact of the matter is that operational planners cannot assume away the potential for coordination, cooperation, or perhaps even an alliance in the event of conflict in the Western Pacific. For example, what role would Chinese and Russian submarines play in the event of a renewed conflict on the Korean Peninsula that threatened North Korea's existence? Or, what role would Russian and North Korean submarines

play in the event of a clash over the Senkaku/Diaoyu Islands that triggers Article 5 of the U.S./Japanese Treaty of Mutual Cooperation and Security? Planners are forced to account for the worst case, which would be a trilateral alliance or coalition among China, North Korea, and Russia – and in that case, the United States does not possess sufficient ASW capacity to maintain undersea superiority.

## U.S. and Allied Undersea Warfare Force Overviews

The United States has led the world in ASW technology and innovation since the end of World War II; the imperative to do so was driven home by the near-loss of maritime supply routes to Europe at the hands of German U-boats and the loss of numerous capital warships in the Pacific due to Imperial Japanese Navy submarines.

The strategic imperative to maintain effective ASW capability did not diminish with the end of World War II; as the Cold War bloomed into an existential struggle with the Soviet Union, the Soviet Navy amassed a force of more than 400 diesel submarines.<sup>53</sup> The U.S. and its allies invested significant resources in ASW forces, doctrine, and training to strive to maintain undersea superiority in peacetime – and prevail in the event of conflict. U.S. and allied USW force structure was abruptly slashed by 50 percent after the end of the Cold War and has continued to erode in capacity ever since. Fortunately, the United States has maintained a technological edge to sustain its qualitative superiority. A brief overview of the United States' and its Asia-Pacific treaty allies' USW forces follows to depict the allied strategic balance in the undersea domain, and the nations are listed in descending levels of USW capability and capacity.

### The United States

The United States possesses the most capable USW force in the world. Its *Los Angeles*- and *Virginia*-class submarines are unrivaled in their acoustic quieting and passive sonar capabilities, which give them a significant tactical advantage in detecting adversary submarines before they are counterdetected. U.S. P-3C Orion aircraft, and the P-8A Poseidon maritime patrol aircraft that are replacing them, give the United States an unparalleled broad-area, multi-sensor ASW search capability. The range, speed, and endurance of these aircraft enable them to pounce on fleeting submarine detection opportunities up to 1,200 nautical miles from their bases, and they are capable of rapidly searching broad swaths of ocean in the hydroacoustic, electromagnetic, infrared, and visual spectra over the course of a single 10-hour sortie. Early *Arleigh Burke* (DDG-51)-class destroyers possess significant ASW capability, with their SQS-53C bow-mounted and SQR-19 Tactical Towed Array Sonar Systems; ships of Flight IIA and later incorporate a hangar deck to enable the embarkation of two MH-60R Seahawk helicopters – the most capable ASW helicopters in the world and a key element of the U.S. Navy's defensive ASW



*USS Wasp (CV-7) sank on September 15, 1942, northwest of Espiritu Santo in the Solomon Islands, after being torpedoed by the Japanese submarine I-19. (U.S. Navy)*

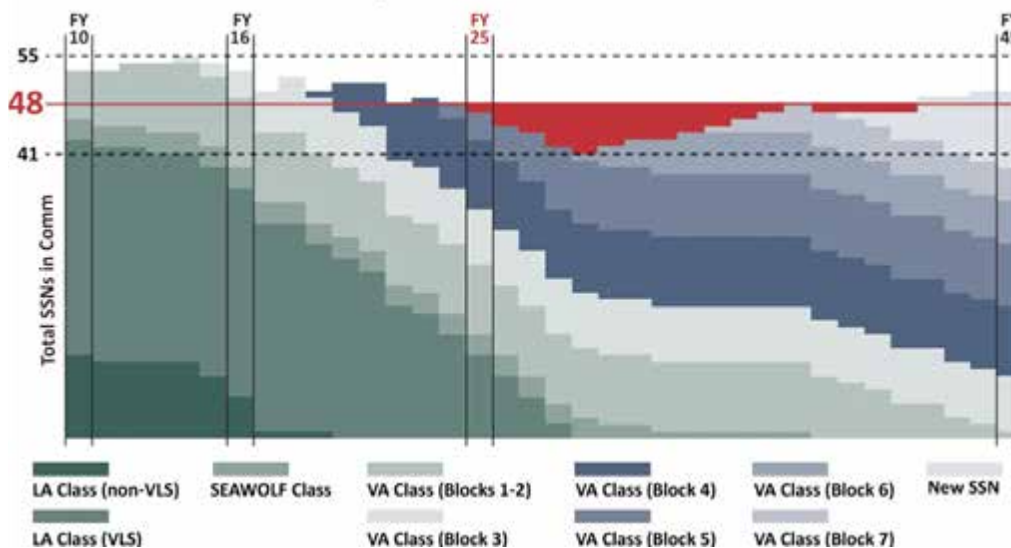
capability. Additionally, five Ocean Surveillance Ships employing the Surveillance Towed Array Sonar System provide high-endurance, long-range passive surveillance capabilities and a low-frequency active sonar that enables long-range detections of submarines with quiet passive signatures.

Considering these unmatched capabilities, an outside observer might ask, “So what’s the problem?” In a nutshell, the problem is a lack of capacity. The United States currently has 53 attack submarines in service, and despite increasing *Virginia*-class production rates to two hulls per year, the inventory will fall to just 41 submarines by 2029 under current ship-building forecasts. See Figure 1 for a detailed inventory of U.S. attack submarines.

Applying the 60/40 Pacific/Atlantic basing ratio results in approximately 32 submarines based in the Pacific Fleet today, and the naval rule of thumb is that a ship spends roughly one-third of its life on deployment (with the other two-thirds spent on maintenance and training). This results in a steady state (“phase 0 presence” in military parlance) of approximately 10 attack submarines deployed across the vast expanses of the Indo-Asia-Pacific region.

In the case of maritime patrol aircraft, the U.S. Navy (USN) is halfway through the process of buying 117 P-8s to equip a force of 12 squadrons with six aircraft each (the remainder of the aircraft will be used for training, testing, and pipeline maintenance and modification

FIGURE 1:  
**U.S. Attack Submarine Inventory Through 2045**



The red depicts a shortfall below the U.S. Navy’s requirement of 48 attack submarines under current shipbuilding plans. The Navy has raised the requirement to 66 attack submarines in its 2016 Force Structure Assessment and is determining how it will attain that inventory. (USNI News)

that displace 27,000 and 19,000 tons) that carry SH-60K ASW helicopters. The JMSDF also operates a force of more than 80 P-3C maritime patrol aircraft and is recapitalizing that force with the indigenously designed P-1. In light of increased Chinese incursions into disputed territorial claims around the Senkaku Islands and North Korean nuclear saber-rattling, the Japanese cabinet proposed a \$42.5 billion defense budget for 2017 – the largest in Japanese

periods). With one-third of that force on deployment at any given time, the United States will have 28 maritime patrol aircraft to apportion around the globe – which means that approximately 12-15 of them will be deployed in the Indo-Asia-Pacific region, depending upon the strategic setting in other regions. Those low steady-state force densities – 10 submarines and 12-15 maritime patrol aircraft deployed across the entire Indo-Asia-Pacific region – illustrate the USW capacity challenge that the United States faces.

**Those low steady-state force densities – 10 submarines and 12-15 maritime patrol aircraft deployed across the entire Indo-Asia-Pacific region – illustrate the USW capacity challenge that the United States faces.**

**Japan**

The Japanese Maritime Self Defense Force (JMSDF) is the most capable USW ally in the Indo-Asia-Pacific region. The JMSDF operates more than 40 ASW-capable destroyers and frigates; 17 diesel attack submarines that are among the most capable diesel submarines in the world; and four large “helicopter destroyers” (two classes

history, and the fifth consecutive annual increase in defense spending.<sup>54</sup> If ratified by the Japanese parliament, this budget will significantly boost the USW capability of the JMSDF, including increasing the number of diesel submarines to 22.

Japan’s geography is also a strength for the allied USW calculus in the region. JMSDF ships and submarines and the USN’s ships that are homeported in Japan are immediately “on-station” after leaving port, which significantly reduces the transit time that Pacific Coast- or Hawaii-based USN ships must expend to arrive on-station in the Indo-Asia-Pacific region. Additionally, Japan maintains a network of air bases covering a distance of 1,300 miles and ranging from Misawa Air Base on the northern tip of the island of Honshu to Kadena Air Base on the island of Okinawa in the south. Those bases significantly expand the operational reach of ASW operations by maritime patrol aircraft.

The JMSDF and USN have forged a habitual USW training and operating relationship that serves as the model for a USW coalition in the Indo-Asia-Pacific region. The United States and Japan have developed joint USW tactics, techniques, and procedures; have an information-sharing regime; execute frequent and recurring USW exercises and real-world operations; and exercise tactical control over each other’s USW forces. The JMSDF’s ASW proficiency remained relatively high compared to that of other American allies during the last decade, as the JMSDF’s defensive sea control focus was not distracted by power

projection and maritime security operations in the North Arabian Sea and Arabian Gulf in support of the wars in Afghanistan and Iraq.

### Australia

The Royal Australian Navy (RAN) and maritime patrol arm of the Royal Australian Air Force (RAAF) possess excellent USW capability, but lack capacity. The RAN operates 11 ASW-capable frigates that embark the MH-60R ASW helicopter. Australia announced in 2016 that it will recapitalize its six indigenously built *Collins*-class diesel submarines with 12 French-designed, Australian manufactured Shortfin *Barracuda*-class diesel submarines at a cost of \$50 billion Australian – the most expensive acquisition program in Australia’s history.<sup>55</sup> The RAAF also operates 15 AP-3C maritime patrol aircraft that are being recapitalized through the purchase of 15 P-8As. The professionalism of the Australian armed forces is widely respected, and they have proven to be highly proficient in ASW during multilateral exercises like the biennial Rim of the Pacific (RIMPAC) exercise off Hawaii.

### South Korea

The ROKN possesses credible USW capability and is building capacity. The ROKN operates 25 ASW-capable destroyers and frigates; 15 German-designed, Korean-built Type 209 and Type 214 diesel attack submarines; 16 P-3C maritime patrol aircraft; and 30 ASW-capable helicopters. The ROKN’s ASW capability is largely focused on littoral ASW versus diesel submarines in light of the threat posed by North Korean coastal submarines, but the ROKN is working to build broader ASW proficiency through bilateral and multilateral exercises with the USN.

### Canada

Canada possesses a small but capable Pacific-fleet-based USW force consisting of five frigates, seven P-3C maritime patrol aircraft, 14 ASW helicopters, and three former Royal Navy *Upholder*-class diesel submarines. Canada has announced plans to recapitalize its frigates and ASW helicopters, but not its aging diesel submarines or maritime patrol aircraft. Canada participates in a series of bilateral and allied ASW exercises with the United States and maintains a high level of ASW proficiency.

### New Zealand

New Zealand possesses a small but capable ASW force consisting of two ASW-capable frigates, eight SH-2G helicopters, and six P-3K2 maritime patrol aircraft. Due to the lack of an indigenous submarine force, New Zealand is solely reliant upon allied ASW exercises to maintain its ASW proficiency.

### Republic of the Philippines

The Republic of the Philippines is the final American treaty ally in the Indo-Asia-Pacific region.<sup>56</sup> Security cooperation between the United States and the Philippines deepened during the presidency of Benigno Aquino to include the signing of an Expanded Defense Cooperation Agreement (EDCA) in 2014 that offered access to five key Filipino bases for American forces.<sup>57</sup> However, following his election in May 2016, President Rodrigo Duterte threatened to terminate the EDCA.<sup>58</sup> Due to this uncertainty in the Filipino-American security relationship, this paper will exclude the Philippines from consideration for membership in the USW coalition in the near term. The Filipino Navy does not possess any USW capability; however, the Philippines’ strategic location could provide key basing access and logistics support for coalition forces dependent upon Filipino domestic politics. As of the writing of this paper, that possibility seems untenable under President Duterte but could change in the future.

The formation of an Indo-Asia-Pacific USW coalition consisting of these six bilateral treaty allies would more than double the USW capacity of the U.S. alone, as shown in Table 1.

**TABLE 1**  
**Current Allied Undersea Warfare Force Structure**

NATION	ASW CAPABLE SHIPS <sup>1</sup>	MARITIME PATROL AIRCRAFT	ASW HELICOPTERS	SUBMARINES <sup>2</sup>
United States <sup>3</sup>	50	42 <sup>4</sup>	100	32
Japan	46	80	94	17
Australia	11	15	22	6
South Korea	25	16	30	15
Canada <sup>5</sup>	5	7	14	3
New Zealand	2	6	8	-
Philippines	-	-	-	-
<b>Totals</b>	<b>139</b>	<b>166</b>	<b>268</b>	<b>73</b>

Notes:

1. Cruisers, destroyers and frigates; some corvettes are ASW-capable, but are limited in range/endurance for employment throughout the Indo-Asia-Pacific region.
2. Nuclear and diesel attack submarines; does not include nuclear deterrent submarines.
3. U.S. force structure is based on estimates of Pacific-based units.
4. The U.S. is planning to buy a total of 117 P-8A maritime patrol aircraft, but only 42 will be based in the Pacific Fleet. However, the remainder of those aircraft could rapidly deploy to the Indo-Asia-Pacific region in the event of a crisis.
5. Canadian force structure is based on estimates of units assigned to the Pacific Fleet.

All USW platforms of these nations enjoy a high degree of interoperability in their secure communication and information exchange systems – for example, the Link 11 Naval Tactical Datalink System. Additionally, all airborne ASW platforms utilize compatible sonobuoys to enable seamless turnovers during the prosecution of a submarine. The potential USW capacity of this coalition would completely transform the strategic undersea superiority calculus of the Indo-Asia-Pacific region. The principal barrier to its formation is the lack of a political commitment from each of the candidate states. However, resolute political leadership by the United States could succeed in convincing its bilateral treaty allies that it is in their national interest to form a multilateral coalition in the face of a rising Chinese undersea threat to their national security interests.

## Potential Partner Nation Undersea Warfare Force Overviews

The following nations are listed as second-tier “potential partners” for the USW coalition based on their political orientation, geographic location, and USW capability and capacity. Politically, each of these nations (except Taiwan) are members of the Non-Aligned Movement, which was founded in 1961 to give middle states a strategic alternative to joining either the Western or Soviet blocs during the Cold War. These nations’ association with the Non-Aligned Movement has traditionally precluded defense cooperation with the United States; however, that barrier is beginning to crumble as each of the nations is faced with a rising Chinese threat to its security interests. For India, the threat is in the form of increasing Chinese naval presence on and under the Indian Ocean. For Malaysia and Indonesia, it comes in the form of conflicting Chinese maritime claims over Swallow Reef and the Natuna Islands and fishing rights in the South China Sea. Barring a change in Chinese policy, these nations will likely continue to build closer relationships with the United States and should be considered as candidates to join the USW coalition. Each of the following nations’ calculus on the cost/benefits of joining the USW coalition will be shaped by perceptions of Chinese threats to its security rather than American and allied appeals.

At the operational and tactical level, it would be challenging to integrate Russian-built platforms into the USW coalition due to significant interoperability challenges in secure communications, tactical datalink systems, and disparate sensors like sonobuoys. However, common doctrine and training could partially overcome each of those barriers if a nation made a commitment to join the coalition.

### India

Since losing a ship (INS *Khukri*) to a submarine attack during the 1971 Indo-Pakistani naval war, the Indian Navy has prioritized investment in undersea warfare capabilities. The Indian Navy now operates 24 ASW-capable destroyers and frigates and 12 U.S.-built P-8I maritime patrol aircraft. The Indians also operate a mix of 14 attack submarines that include nine Russian-built *Kilo*-class diesel submarines, four German-built Type 1500 diesel submarines, and one Russian-built *Akula*-class nuclear submarine under lease from Russia. The Indians are also indigenously building six French-designed *Scorpen*-class diesel attack submarines as part of their plan to achieve a force of 24 attack submarines.<sup>59</sup> Additionally, the Indians joined the sea-based nuclear deterrent club with the launching of the indigenously built INS *Arihant* nuclear ballistic-missile submarine.

The Indians have publicly declared their concern over the increasing Chinese submarine presence in the Indian Ocean and Chinese submarine sales to India’s traditional rival in the region: Pakistan. Indian Defense Minister Manohar Parrikar publicly called for the Indian government to consider increasing its submarine force structure beyond the planned 24, which serves as a signal of India’s doubt in its own undersea security.<sup>60</sup>

**As with Japan, India’s strategic location would become a valuable asset for the coalition. The Indian subcontinent lies at the midpoint of the Indian Ocean as an opportunity for ship and aircraft logistics support.**

It would have been unthinkable for the Indians to join a coalition with the United States 20 years ago; India’s foreign policy was explicitly built upon the Non-Aligned Movement, and India obtained most of its armaments from the Soviet Union and then Russia. However, Indo-American relations have warmed significantly over the past decade as evidenced by the launching of a Defense Trade and Technology Initiative in 2012 and the 2016 signing of a Logistics Exchange Memorandum of Agreement that will deepen Indo-American cooperation on military arms sales and supplies. If India perceives that the Chinese and Pakistani submarine threat to its national security interests continues to increase, it is not inconceivable that India would join a USW coalition

to bolster its undersea security. As with Japan, India's strategic location would become a valuable asset for the coalition. The Indian subcontinent lies at the midpoint of the Indian Ocean as an opportunity for ship and aircraft logistics support. Additionally, India's Andaman and Nicobar Command sits astride the eastern entrance to the Indian Ocean and presents an ideal location for coalition undersea surveillance assets.

### Singapore

For a nation that is often categorized as a "city-state," Singapore punches above its weight. The Royal Singapore Navy operates six ASW-capable frigates, five Fokker F-50 maritime patrol aircraft, six U.S.-built S-70 ASW helicopters, and four diesel submarines. While this capacity is limited when compared to American or Chinese USW forces, Singapore could provide an outsized contribution to the USW coalition through its strategic location, which could serve as a key node for maritime intelligence collection and logistics support. The Royal Singapore Navy's 2009 establishment of a maritime security Information Fusion Center with linkages to 35 countries illustrates this potential. Singapore has deep economic ties with China, but its security relationships are oriented toward the United States and Europe. Singapore must manage the friction generated by those two competing orientations, but a perception of increased Chinese threat to its national security could drive it to join the USW coalition.

### Vietnam

The Vietnamese People's Navy has recently acquired credible USW capability in the form of five Russian-built ASW frigates, eight Russian-built KA-28 ASW helicopters, and six Russian-built *Kilo*-class diesel submarines. Vietnam's political orientation will be the principal factor in determining its accession to the USW coalition. Vietnam's relations with the United States have warmed significantly during the past 40 years, while relations with China have been on a declining vector stemming back to the 1974 Sino-Viet clash over the Paracel Islands, the 1979 Sino-Viet border war, and recent friction over excessive Chinese maritime claims in the South China Sea. Like other southeast Asian countries, Vietnam has economic linkages with China that are deep and shape its strategic calculus. Even if Vietnam does not formally join the USW coalition, it has an interest in sharing information with coalition members in order to operate its new *Kilo*-class submarines in the South China Sea without fear of ASW prosecution by coalition members who may misidentify it as a Chinese *Kilo*-class submarine.

### Indonesia

Indonesia has the largest navy in Southeast Asia in terms of numbers of personnel and vessels, but its USW forces are relatively underinvested, with only eight ASW-capable frigates, 16 ASW-capable corvettes, and three German-built Type 209 diesel submarines. Like India, Indonesia has traditionally been a leader of the Non-Aligned Movement. However, it has recently experienced friction with China over maritime sovereignty claims and fishing rights around its Natuna Island chain in the South China Sea. *IHS Janes' Defense* reported that Indonesia is building a submarine base at Ranai on the island of Natuna-Besar and is seeking U.S. FMF assistance to fund it.<sup>61</sup> The Natuna Islands sit astride the southern entrance to the South China Sea, and the coalition would benefit greatly from the logistics support it offers if Indonesia were to join the USW coalition.

### Malaysia

Malaysia is beginning to build USW capability through the purchase of two French-built *Scorpene*-class diesel submarines and the construction of six second-generation patrol vessel frigates that will embark British-built Super Lynx ASW helicopters. Malaysia's geography offers highly strategic basing opportunities as the Malay Peninsula borders the length of the Straits of Malacca and the island of Borneo forms the southeastern boundary of the South China Sea. Malaysia's political calculus in joining the USW coalition is a complicated mix of economic, security, and cultural concerns, as 24 percent of Malaysian citizens identify themselves as ethnic Chinese.<sup>62</sup>

### Taiwan

It seems unthinkable that Taiwan could join a peacetime USW coalition with the United States and its allies in the Indo-Asia-Pacific region; each of the six proposed core coalition members have officially recognized the People's Republic of China as the sovereign government of China and do not maintain official relations with the Republic of China on the island of Taiwan. On the other hand, assuming Taiwan does not commit a legitimate *casus belli*, it is also unthinkable that the concert of democracies in the Asia-Pacific region would stand idle and allow the People's Republic of China to forcefully destroy the *de facto* sovereignty of a fellow democratic nation. In a conflict with China that threatened Taiwan's national existence, it is inevitable that Taiwan would fight in a coalition with the United States and other regional allies. This high-intensity coalition warfare would be extremely difficult without prior coordination and rehearsal, which

is why Taiwan is offered for consideration. The six core coalition members have significant economic relationships with Taiwan, and the United States has a direct security relationship with Taiwan. Under the terms of the 1979 Taiwan Relations Act, the United States is committed to “provide Taiwan with arms of a defensive character” and “maintain the capacity of the United States to resist any resort to force or other forms of coercion that would jeopardize the security, or the social or economic system, of the people of Taiwan.”<sup>63</sup>

For a nation of its relative size and means, Taiwan possesses credible ASW capability in operating four ASW-capable destroyers and 20 ASW-capable frigates, each embarking a U.S.-built S-70 ASW helicopter. Additionally, Taiwan operates 12 P-3C maritime patrol aircraft. Taiwan operates only two Dutch-built *Zwaardvis*-class and two World War II-era U.S.-built *Guppy*-class diesel submarines, but it is seeking to purchase new submarines to bolster its sea denial capability.

**Assuming Taiwan does not commit a legitimate *casus belli*, it is also unthinkable that the concert of democracies in the Asia-Pacific region would stand idle and allow the People’s Republic of China to forcefully destroy the de facto sovereignty of a fellow democratic nation.**

The aggregate undersea warfare capacity of these potential partners is significant, but it pales in comparison to two other dimensions of a possible coalition. The first is the breadth of its geographic span, which would greatly expand the operational reach of each individual coalition partner. The second dimension is the political dimension: Low-level military cooperation in peacetime has the potential to build trust and goodwill that spurs cooperation in other sectors such as diplomacy and economic matters.

## Strategic Alternatives

Sections 2 and 3 offered evidence that Chinese, Russian, and North Korean undersea warfare capacity far exceeds the steady-state USW capability that the United States is able to sustain in the Indo-Asia-Pacific region. There are 60 Chinese, 70 North Korean, and more than 20 Russian submarines present (although not underway) every day in the Indo-Asia-Pacific region, while the United States is able to sustain approximately 10 submarines underway in the region. In light of that fact, there are four fundamental strategic approaches to overcome a military capacity shortfall: (1) buy/build more capacity, (2) enlist more capacity through alliances or coalitions, (3) seek a revolutionary technological breakthrough that changes the capacity equation, or (4) counter the capacity shortfall in one domain by leveraging superiority in other domains.

### Buy/Build USW Capacity

President Donald Trump pledged to build a 350-ship Navy during his presidential campaign, and in December 2016 the U.S. Navy released a Force Structure Assessment that outlined a design for a 355-ship Navy that increased the required number of attack submarines from 48 to 66 and the number of ASW-capable destroyers from 88 to 104 (see figure 2).<sup>64</sup>

**Figure 2: Type/Class Ship**

TYPE/CLASS	2014	2016
Aircraft Carriers	11	12
Large Surface Combatants	88	104
Small Surface Combatants	52	52
Amphibious Warfare Ships	34	38
Attack Submarines	48	66
Guided Missile Submarines	0	0
Ballistic Missile Submarines	12	12
Combat Logistics Force	29	32
Expeditionary Fast Transport/High Speed Transport	10	10
Expeditionary Support Base	3	6
Command and Support	21	23

**Total** **308** **355**  
*The Navy’s 2016 Force Structure Assessment outlines the ship type/class requirements. Increased numbers of ships with anti-submarine warfare (ASW) capabilities are highlighted in red by the author. Small surface combatants (frigates) are not highlighted due to uncertainty in the configuration of their mission packages and the transition from the Littoral Combat Ship to a frigate design. The author acknowledges that a number of these ships will have ASW capability.<sup>64</sup>*



This signal of political will and a force structure vision to build a “350-ship Navy” is welcome news for sea power proponents and American allies alike. However, readers must understand that this is not a “quick fix” that will eliminate the current USW capacity shortfall; rather, they should think in terms of a decade or 15 years before appreciable capacity increases are achieved. While the Navy has not released a new shipbuilding plan to depict how it could achieve this goal, the Congressional Research Service (CRS) released a report outlining a notional schedule and cost for building a 350-ship Navy.<sup>66</sup> CRS’ report planned for a notional force of 59 attack submarines within that 350-ship Navy and achieved it by adding an additional *Virginia*-class SSN into the same years (2021, 2024, and 2026-2035) where a *Columbia*-class SSBN (replacement for the *Ohio*-class SSBN) was planned for procurement.<sup>67</sup> Under this plan, the U.S. Navy would not achieve a force of 59 SSNs until 2041 – 25 years from now. While it is feasible to accelerate this plan by growing the shipbuilding industrial base, it will take years to expand the production facilities and recruit, hire, and train a highly skilled workforce. A *Virginia*-class submarine currently requires 61 months to build; an expansion in the industrial base could reduce that build time to 55 months hence the assertion that it will require at least a decade to achieve significant capacity increases.<sup>68</sup> Building this 350-ship Navy will also require sustained domestic political consensus to bear the cost. CRS estimates that it will require an additional \$8 billion per year in shipbuilding funding over the next 30 years to achieve a 350-ship Navy, which is a 50 percent increase over the current \$16 billion in annual shipbuilding funding. Additionally, this is only part of the cost of building a 350-ship Navy; it will also require significant increases in operations and maintenance funding and increased personnel funding to man the ships.

**Even if the factors of time and money are removed from the equation, a 350-ship Navy would not completely eliminate the steady-state USW capacity shortfall in the Indo-Asia-Pacific region.**

Even if the factors of time and money are removed from the equation, a 350-ship Navy would not completely eliminate the steady-state USW capacity

shortfall in the Indo-Asia-Pacific region. As depicted in the Navy’s 2016 Force Structure Assessment in Table 1 above, building a 355-ship Navy would result in the addition of 16 additional attack submarines and 16 additional ASW-capable large surface combatants. However, applying the 60/40 Pacific/Atlantic basing policy and the 1/3-1/3-1/3 rule of thumb of ship maintenance/training/deployment cycle produces an additional steady-state deployed capacity increase of four additional deployed attack submarines and four additional deployed ASW-capable surface ships to distribute throughout the vast expanse of the Indo-Asia-Pacific region. It is also important to keep in mind that a ship or submarine based on the West Coast of the United States spends roughly two of a notional six-month Indo-Asia-Pacific deployment in transit to and from the region, effectively generating only four months on-station.

The logic outlined above is not intended to advocate against building a 350-ship Navy; a 350-ship Navy generates strategic depth and surge capacity in the event of conflict. Rather, it highlights how even a 350-ship Navy generates only incremental capacity increases in steady-state deployed USW forces and requires a minimum of a decade to achieve those increases. Steady-state deployed capacity informs the daily deterrent calculus in the Indo-Asia-Pacific region, and the calculus is not favorable if the United States is forced to go it alone across the entire region.

There are other alternatives to increase USW capacity in the Indo-Asia-Pacific region, such as altering the 60/40 basing policy in favor of more Pacific basing; building a 350-ship Navy that focuses heavily on improving USW capacity at the expense of power projection capacity; and forward basing more USW-capable ships, submarines, and aircraft in the Indo-Asia-Pacific region to reduce deployment transit ratios. Each of these options is feasible but brings negative consequences that tilt the decision making back toward the status quo.

#### **Enlist Capacity Through Alliances/Coalitions**

Historical accounts of this military strategy date back as far as the Greco-Persian War in the fifth century BC, when the Greek city-states banded together in an alliance to defeat the threat posed by the Persians. The following definitions of alliances and coalitions will be used for this paper:

- An alliance is the relationship that results from a formal agreement between two or more nations for broad, long-term objectives that further the common interests of the members.

- A coalition is an arrangement between two or more nations for common action. Coalitions are typically ad hoc, formed by different nations, often with different objectives, usually for a single event or for a longer period while addressing a narrow sector of common interest. Operations conducted with units from two or more coalition members are referred to as coalition operations.<sup>69</sup>

While both forms of multilateralism require political agreement among the member states, alliances are more formal and require a higher level of political commitment.

In a nod to the differing political, cultural, and historical climates in each region, the U.S. approach to post-World War II security for the Pacific theater was radically different from that in the Atlantic theater. In the Atlantic, the United States led the formation of NATO, complete with an integrated political and military command structure. NATO is both a collective and mutual defense alliance, and it included two former wartime foes in West Germany and Italy. In the Pacific, there was general recognition that states would not enter a collective defense alliance with their former Japanese foe; accordingly, to maintain peace and stability in the western Pacific, the U.S. signed bilateral mutual defense treaties with Japan, the Philippines, Australia and New Zealand, and finally South Korea after the cessation of the Korean War.

Even in the face of a rising Chinese threat to United States regional treaty allies' national security, it is unlikely that regional political attitudes would accept the formation of a NATO-like alliance structure in the Indo-Asia-Pacific region. However, a less formal, less binding coalition structure is within the realm of the possible, particularly if charter membership is limited to those nations that have existing alliances with the United States – namely Japan, Canada, South Korea, Australia, and New Zealand. By default, the United States would be at the center of this coalition at its founding, but as the coalition charter matured over time, leadership could transfer to other nations on a rotational basis. Each of the proposed charter nations has participated in a similar and successful maritime coalition structure in the Arabian Gulf and Indian Ocean as part of a Maritime Security Task Force (CTF-150). That coalition is built upon the principles that participation is purely voluntary and no nation is asked to carry out any duty that it is unwilling to conduct. Additionally, command of CTF-150 is rotated among participatory nations on a four- to six-month basis, which could serve as a good model for this USW coalition.<sup>70</sup>

### Develop Revolutionary Technology

The history of undersea warfare is replete with examples of revolutionary technological leaps such as the installation of radar equipment on maritime patrol aircraft, the installation of snorkels on diesel submarines to reduce their visual and radar signature while they charge their batteries, the development of MAD equipment, or the development of the passive Sound Surveillance System (SOSUS) that enables long-range hydroacoustic surveillance and detection of submarines.

Experts like Bryan Clark at the Center for Strategic and Budgetary Analysis have postulated that “big data” high-fidelity oceanographic models coupled with advanced signal processing could enable revolutionary acoustic and non-acoustic submarine detection methods through exploitation of biologic, seismic, hydrodynamic, or radiation phenomena.<sup>71</sup> Given the current pace of innovation, many of these techniques will likely mature and become operational over the next two decades. However, until the technology can be miniaturized, the size, weight, and power requirements for these systems will necessitate their deployment on large USW platforms like destroyers, attack submarines, and maritime patrol aircraft, which means that these systems will enhance the capability of USW forces but not remedy the capacity shortfall due to the previously detailed “can’t buy/build it fast enough” calculus of large USW capital platforms.

The key to increasing capacity through revolutionary technology is to produce smaller, less expensive USW-capable platforms and networks of surveillance sensors. The United States is investing heavily in research and development of unmanned vehicles that will operate under, on, and above the sea. Unmanned vehicles currently suffer from three principal technology barriers to solving the USW capacity shortfall:

1. Power densities. Unmanned surface vessels (USVs) and unmanned aerial vehicles (UAVs) utilize oxygen in the air to burn inexpensive hydrocarbon-based fuels. However, the low energy densities of hydrocarbon fuels necessitate large hull forms and airframes to generate endurance, thereby driving up cost. UUVs currently rely on electrical battery power, which brings inherent endurance limitations. While power densities will continue to increase through innovative technologies such as hydrogen fuel cells and miniaturized nuclear reactors, unmanned vehicles are unlikely to disrupt the USW calculus in the Indo-Asia-Pacific region in the next decade.

2. Onboard artificial intelligence (AI). The process of hydroacoustically detecting and classifying a submarine is equal parts science and art. While classes of submarines tend to have common hydroacoustic and power generation characteristics that combine to produce a class-unique signature, each submarine's signature changes due to variances in speed, depth, water temperature, operating mode, and its maintenance status. In manned USW platforms, the science is resident in the acoustic processing systems while the art is resident in the judgment and experience of the acoustic operators. AI has the potential to imbue unmanned platforms with the judgment and experience of the art of undersea warfare, but until that technology matures, unmanned vehicles are reliant upon a command and control link to bring a human operator's artful judgment and experience into the equation.
3. Command and control (C2) links. As outlined above, unmanned vehicles remain reliant on C2 links back to a human operator for mission control. In the case of USVs and UAVs, this is executed using the radio frequency (RF) spectrum for transmission of data, including over-the-horizon operations using satellite communications. Maintaining long distance C2 links for UUVs is a daunting challenge due to the physical characteristics of the transmission of sound through water. UUVs can broach the surface of the ocean to transmit and receive RF spectrum communications, but this evolution increases their probability of counterdetection and detracts from their mission profile.

Technological innovation will inevitably eliminate these barriers, but likely not within the next decade. However, there is one emerging technology that could affordably deliver disruptive effects in the USW arena: distributed netted sensors (DNS). The DNS concept has the potential to combine the traditional advantages of air-deployed sonobuoy search fields (rapid deployability, geographic agility) with those of the

SOSUS array network (persistence). DNS systems can be deployed by aircraft, ships, or submarines. They minimize the power density problem through their lack of propulsion, and floating antenna and solar arrays can provide both an RF spectrum C2 link and generate solar electrical power to increase persistence. Prototype systems such as the Reliable Acoustic Path-Vertical Line Array (RAP-VLA), Transformational Reliable Acoustic Path System (TRAPS), and Deep Water Active Detection System (DWADS) have the potential for operational employment within the next five years. The cost of these DNS systems could be lowered through production economies of scale, and this technology should be offered to members of the USW coalition.

### **Counter Inferiority in One Domain by Leveraging Superiority in Another Domain.**

During the Cold War, the United States and NATO allies planned to overcome a capacity deficit versus Soviet armored and infantry land warfare forces in Europe through the employment of tactical airpower focused upon battlefield interdiction in a doctrine that became known as "AirLand Battle."<sup>72</sup> This is an example of an asymmetric approach that leveraged superiority in another domain (air, in this case) to counter capability or capacity deficits (or both) in a different domain (in this case, land).

However, a loss of superiority in the undersea domain also means a loss of superiority on the sea, as German U-boat forces demonstrated during the early days of World War II. The United States and its island nation allies, like Japan, Australia, New Zealand, and the Philippines, are wholly dependent upon the sea for the movement of commerce and military materiel, and superiority in the air domain cannot supplant the strategic imperative to utilize the sea as the means of transporting large volumes of sustainment materiel such as fuel and ammunition. While an alternative transportation strategy like truck or rail might work for a nation situated on the Eurasian land mass, it is infeasible for maritime nations that are dependent upon the sea.

## Recommendations

Based on the analysis of the feasibility of the strategic alternatives in Chapter 5, recommendations follow to bolster U.S. and allied USW capacity in the Indo-Asia-Pacific region within the next decade and employ it to deter conflict with China, North Korea, or Russia. Supporting recommendations are nested under each of the four principal recommendations. These recommendations are offered in conjunction with support for the Trump administration's proposal to build a 350-ship Navy. As previously noted, a 350-ship Navy would increase the strategic depth and surge capacity of the U.S. Navy and generate an incremental increase in steady-state deployed capacity in the Indo-Asia-Pacific region. However, it is not a feasible solution to remedy the capacity shortfall within the next decade in and of itself, and therefore other measures are necessary.

### 1. Build an Indo-Asia-Pacific Region USW Coalition

The U.S. maintains strong bilateral treaty alliance relationships with Canada, Japan, South Korea, Australia, and New Zealand and accordingly has developed effective USW information-sharing mechanisms and habitual training and operating relationships with each of those nations. This recommendation builds upon that nucleus and organizes those nations into a multilateral USW coalition that multiplies the effects generated by each national force. The USW coalition should be built around the following elements:

#### COALITION USW CHARTER

While this coalition will be centered upon military operations and defense hardware acquisition, it will require political agreement at the highest levels of government. The charter should be negotiated and signed at the minister of defense/secretary of defense level, and should be founded on the following principles:

1. No nation will be asked to execute exercises or operations against its will.
2. Information sharing is voluntary to provide the flexibility to protect the operational security of national USW operations.
3. Each member nation will retain operational control of its USW forces; nations may delegate tactical control to the coalition lead nation on a voluntary basis.
4. Lead nation status will rotate amongst coalition members.

#### COALITION UNDERSEA WARFARE COORDINATION CENTER

The establishment of a "CUSWCC" (pronounced "CUSS-wick") is necessary to facilitate USW information sharing and coordination. The word "command" is intentionally omitted in the spirit of coalition operations. Whenever the suggestion of a "center" is raised, the first question is inevitably "where?" The center would optimally be centrally located in the Indo-Asia-Pacific theater to minimize the effect of 14 hours of time zone difference between the East Coast of Africa and West Coast of the United States. However, it also must be located in a nation with the will to weather the political storm it will likely generate from China, North Korea, and possibly Russia. The U.S. territory of Guam would be a good birthing place, with an eye toward moving the center to the soil of a coalition nation after the coalition has matured and a coalition nation is willing to take on the political risk. Japan is proposed as a first-tier coalition member and is located closer to the longitudinal center of the Indo-Asia-Pacific region. However, it is also closer to China and North Korea and therefore more vulnerable to attack in the event of conflict. Australia is also located centrally within the Indo-Asia-Pacific region, and its distance from China and North Korea could give it a security buffer in case of conflict.

#### COMMON USW DOCTRINE

Coordinated USW involving ships, submarines, aircraft, unmanned vehicles, and other distributed sensors is a complex undertaking; it becomes even more complex in an environment of disparate doctrine and training coupled with language barriers. The coalition should adopt common USW doctrine and operating procedures, analogous to the NATO Allied Tactical Publication series.

#### USW INFORMATION SHARING REGIME, WITH A CLASSIFIED INFORMATION SYSTEMS TECHNOLOGY SOLUTION

It is essential that the coalition is able to share operational and tactical level information rapidly, to include a Common Operating Picture (COP). The existing AUSCANNZUKUS Command, Control, Communications, Computers, and Intelligence agreement offers a successful template on which to model the initial core coalition information systems design.

The formation of this coalition would more than double the USW force structure that the U.S. possesses alone.

Other Indo-Asia-Pacific nations should be considered for future coalition membership based on political orientation, geographic location, and USW capability and capacity. India, Singapore, Vietnam, the Philippines,

Malaysia, and Indonesia represent a second tier. Taiwan represents a third tier for consideration. While it is highly unlikely that any of the first-tier coalition members would be willing to violate their “One China” policy and admit Taiwan into the USW coalition in peacetime, it is likely that in any conflict that threatens Taiwan’s existence as a free-market, democratic polity, the U.S. and other allies in the region will fight in concert with Taiwanese armed forces, including in the undersea domain – and that will be exceptionally difficult without prior exercising and rehearsal.

## **2. Build Habitual Multilateral USW Training and Operating Relationships Beyond the Core Coalition**

Coordinated USW must be rehearsed and practiced in peacetime to ensure success in the event of conflict. The United States has led the execution of multilateral exercises that include USW, such as the RIMPAC biennial exercise off Hawaii, and for the past two years, Exercise Malabar was executed in the Indian Ocean as a trilateral exercise with U.S., Japanese, and Indian participation. However, the frequency and membership breadth of these multilateral exercises should be expanded, and USW should become a core mission focus. This recommendation is not solely aimed at USW coalition members. As an example, India might not choose to formally join the coalition for political considerations, but both the coalition and India would benefit greatly through the conduct of regular multilateral USW exercises.

## **3. Foster Coalition Research, Development, and Acquisition of Affordable Technologies to Increase Coalition USW Capacity**

The charter of the CUSWCC should include an acquisition provision that facilitates information sharing on USW technologies with an eye toward affordability and joint acquisition partnerships that leverage economies of scale. The United States is investing in the research and development of numerous technologies such as USVs; UUVs; and distributed, networked undersea surveillance technologies that may present affordable solutions for coalition partners to boost their distributed undersea surveillance capacity. Inviting coalition partners to participate in the development and acquisition strategies for these emerging technologies could increase the economies of scale of these programs and improve their affordability for all partners. Traditional barriers to cooperative acquisition programs include the fear of compromise of national and/or proprietary technologies. Additionally, there is a strong motivation to protect national industrial bases

and domestic employment in an increasingly globalized economy. The “Buy American Act,” first passed in 1933 and amended frequently since, serves as an illustrative example of the second barrier. However, exemptions may be granted to qualifying nations, and this coalition research and development initiative should facilitate multilateral sales of USW technologies, including U.S. purchases from coalition partners. None of the allied nations in the Indo-Asia-Pacific region can go it alone to maintain their undersea advantage in the region.

Accordingly, the acquisition provision of the charter should facilitate the following initiatives:

- *An Innovation Cell.* The CUSWCC should facilitate the exchange of emerging USW concepts and the technology to implement them.
- *A Marketplace for Foreign Military Sales.* The CUSWCC should provide a marketplace for the sale of affordable USW technologies between coalition members.
- *A Licensing Exchange.* The CUSWCC should facilitate licensing agreements for those nations that wish to build these technologies using their own national industrial base. The licensing of the manufacture of Lockheed’s P-3C Orion maritime patrol aircraft to Kawasaki Heavy Industries in Japan provides a historical model.

Critics of this coalition-building approach may point toward three significant barriers to achieving these recommendations:

1. The historic and cultural enmity that dominates the region, e.g., Japanese-Korean, Japanese-Filipino, American-Vietnamese, etc.
2. The inherently classified nature of undersea warfare, coupled with a strong desire to protect the security of coalition members’ undersea forces – national technology, tactics, techniques, and procedures, and USW operations that pursue national vice coalition objectives.
3. The fundamental flaw of coalition warfare in that it lacks political and strategic coherency that enables long-term planning to generate success in complex military operations like coordinated ASW.

While the United States and its allies and partners in the Indo-Asia-Pacific region currently lack the political coherency that underpins NATO, the regional security challenges they face are trending toward existential

threats, at least when viewed through the eyes of the Japanese and South Koreans – and their American treaty allies. The recent trilateral cooperation among Japan, South Korea, and the United States on BMD in the face of a rising North Korean threat dispels all three of those critiques. The historical enmity between the Japanese and Korean cultures is profound; BMD technologies and techniques are highly classified; and there is no overarching political agreement that underpins this effort; rather, the two countries have formed a coalition due to their common national security interests.<sup>73</sup> The same case should be made for preserving superiority in the undersea domain, as Japan and South Korea are dependent upon maritime flows of energy and commerce for their national security, and a loss of superiority in the undersea domain could threaten their security.

Independent of these three coalition-centric recommendations, a final recommendation is offered:

#### **4. Demonstrate Conventional Deterrence in the Undersea Domain Through “Hold at Risk” USW Operations**

Chinese, North Korean, or Russian submarines that venture beyond their territorial sea should be continuously tracked and signaled to be “held at risk” by the United States and its USW coalition partners. Political scientist Richard K. Betts called deterrence “the essential military strategy behind containing the Soviet Union and a crucial ingredient in winning the Cold War without fighting World War III.”<sup>74</sup> A key part of the United States’ and NATO’s deterrent strategy was demonstrating undersea superiority by holding at risk Soviet SSBNs and the SSNs that were deployed to protect them. In a similar fashion, the United States and its USW coalition partners should sow doubt in the minds of Russian and Chinese naval commanders that their submarine force would survive in the event of conflict and are left to question their utility.

Implementing this recommendation is not simply a matter of executing more effective USW operations. Rather, it is a policy decision by national leadership to permit USW forces to be more overt and aggressive in the prosecution of Chinese submarine deployments,

which is certain to induce friction in the broader Sino-American relationship and Sino relationships with regional coalition partners. During President Barack Obama’s administration, U.S. ASW forces were often prohibited from tracking Chinese submarines in the interest of sustaining Chinese cooperation on broader strategic interests such as climate change, fair trade and monetary policy, prevention of cybertheft, and North Korean denuclearization. Given the Chinese record of flouting American interests on each of those issues, it is time to accept more friction in the Sino-American relationship, including more aggressive prosecutions of PLAN submarines. Friction in the undersea domain will not necessarily proscribe cooperation on other areas of mutual security interest, such as maritime counterpiracy or sustaining the free flow of commerce, particularly maritime transshipment of hydrocarbons from the Middle East.

At the operational level, some U.S. commanders have expressed concerns that aggressive, sustained ASW operations will expose U.S. and allied tactics, techniques, and procedures to the Chinese and enable them to develop technological and doctrinal countermeasures that could erode American and allied advantages in the event of a conflict. There is a strong kernel of truth to that argument, but it is offset by the counter-argument that the best way for American and allied ASW forces to maintain a high level of readiness for undersea conflict with the Chinese is to gain and maintain familiarity with Chinese tactics, techniques, and procedures through peacetime prosecutions of Chinese submarines.

The United States, its Asia-Pacific allies, and their Indo-Asia Pacific partners must acknowledge that their undersea security is in grave danger, which translates into grave danger to their maritime security. The rational response to that acknowledgment is to devise an appropriate strategy and then demonstrate its efficacy to potential adversaries. Aggressive, sustained, multi-national ASW operations in peacetime would serve as a powerful deterrent to prevent great power conflict in the Indo-Asia-Pacific Region, just as it did versus the Soviet Union during the Cold War. Failure to sustain the United States’ and allied undersea superiority could result in a strategic disaster for not only the region but perhaps the entire global community.

## Appendix A

### Glossary of Terms and Acronyms<sup>75</sup>

**Alliance** – The relationship that results from a formal agreement between two or more nations for broad, long-term objectives that further the common interests of the members.

**Anti-submarine warfare (ASW)** – Operations conducted with the intention of denying the enemy the effective use of submarines.

**Coalition** – An arrangement between two or more nations for common action.

**Deterrence** – The prevention of action by the existence of a credible threat of unacceptable counteraction and/or belief that the cost of action outweighs the perceived benefits.

**Maritime superiority** – That degree of dominance of one force over another that permits the conduct of maritime operations by the former and its related land, maritime, and air forces at a given time and place without prohibitive interference by the opposing force.

**Multinational** – Between two or more forces or agencies of two or more nations or coalition partners.

**Operational [level of war]** – The level of war at which campaigns and major operations are planned, conducted, and sustained to achieve strategic objectives within theaters or other operational areas.

**Operational control (OPCON)** – The authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission.

**Partner nation** – A nation that the United States works with in a specific situation or operation.

**SLBM** – submarine-launched ballistic missile.

**Strategic [level of war]** – The level of war at which a nation, often as a member of a group of nations, determines national or multinational (alliance or coalition) strategic security objectives and guidance, then develops and uses national resources to achieve those objectives.

**Strategy** – For the purpose of this paper, strategy is defined as “the ways in which the available means will be employed to achieve the ends of policy.”<sup>76</sup>

**SSB** – ballistic-missile submarine (diesel powered)

**SSC** – coastal submarine (diesel powered)

**SSBN** – ballistic-missile submarine (nuclear powered)

**SSGN** – guided cruise missile submarine (nuclear powered)

**SSK** – hunter-killer attack submarine (diesel powered)

**SSN** – attack submarine (nuclear-powered)

**SSP** – attack submarine (diesel powered with air-independent propulsion [AIP])

**Tactical [level of war]** – The level of war at which battles and engagements are planned and executed to achieve military objectives assigned to tactical units or task forces.

**Tactical control (TACON)** – The authority over forces that is limited to the detailed direction and control of movements or maneuvers within the operational area necessary to accomplish missions or tasks assigned.

**Undersea warfare (USW)** – Military operations conducted to establish and maintain control of the undersea portion of the maritime domain.

## APPENDIX B

### Undersea Warfare Definition and Concepts

Undersea warfare is inherently challenging to write about in the unclassified realm, as the principal motivation for operating under the sea (as opposed to on its surface or in the air above it) is to utilize the visual, electromagnetic, and acoustic cloaking properties of water to conceal the location, strength, purpose, and intent of undersea forces. The USN's submarine force takes great pride in its *nom de guerre* as "the Silent Service", implying that its technology, tactics, and operations are best kept out of the public discourse. Few understand or appreciate that USW has many dimensions beyond anti-submarine warfare. For this paper, the following definition of USW is used:

Military operations conducted to establish and maintain control of the undersea portion of the maritime domain.<sup>77</sup>

Mine warfare (MIW) is a key element of USW and was employed extensively during 20th century conflicts in the Indo-Asia-Pacific region. However, it is not addressed because its force planning characteristics bring a unique set of considerations beyond the scope of this paper.<sup>78</sup> Additionally, undersea information warfare is becoming increasingly important as the Information Age pervades daily life around the globe. Ninety-five percent of international telecommunications travel on undersea infrastructure consisting of only 300 submarine cables.<sup>79</sup> The strategic considerations of undersea information warfare are implicit in this paper's argument as the sustainment of undersea superiority is necessary to protect that infrastructure.

A quick primer on ASW concepts is necessary to comprehend the recommendations of this report. There are five phases of ASW: search, classify, localize, track, and attack.

The *search* phase consists of employing sensors to detect a submarine's signature in the hydroacoustic, electromagnetic, infrared, or visual light spectra. An important characteristic of ASW search planning is the probability of detection (Pd), which is a function of the

expected detection range of the sensor and the volume of the search area. Pd directly correlates with sensor detection range, i.e., increased sensor detection ranges result in increased Pd if search area is held constant. Pd is inversely related to search area, i.e., the Pd will decrease as search area increases. The search phase is arguably the most difficult phase of ASW operations, requiring large numbers of search platforms/sensors employed over long periods of time – particularly if forced to search large areas of ocean not constrained by geography. Once a submarine is located, the problem of maintaining a track on it – and potentially attacking it – is greatly simplified. Accordingly, a key principle of modern ASW is to attempt to maintain a constant track on the submarine from the time it leaves its homeport until its return. Every moment that a submarine goes unlocated increases the area of ocean that must be searched to regain contact.

The *classification* phase begins when a sensor has detected contact on a possible submarine signature. It is incumbent upon ASW forces to quickly determine whether the contact is in fact a submarine or some other non-submarine phenomenon such as marine mammal activity, and if it is in fact a submarine, whether it is a friendly, neutral, or potentially hostile submarine. Once a submarine has been classified as a target of interest, ASW forces will strive to localize the submarine, which means to precisely determine the submarine's position, course, and speed. After a submarine has been localized, ASW forces will strive to maintain a track on the position, course, and speed of the submarine. In time of war, ASW forces may be called upon to attack the submarine using a torpedo or depth bombs.

Additionally, ASW has both offensive and defensive concepts. *Offensive ASW* is defined as destroying or neutralizing enemy submarines in their basing areas, during transit to/from their operating areas, or in their operating areas. *Defensive ASW* is defined as the protection of friendly naval forces and merchant shipping. Both offensive and defensive ASW have deterrent value; offensive ASW demonstrates the ability to "hold at risk" adversary submarines, while defensive ASW demonstrates the ability to deny an adversary submarines the capability to "hold at risk" friendly naval and merchant shipping.



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