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EFFECTS OF THE SUBSURFACE DOMAIN ON THE SECURITY OF THE KOREAN PENINSULA

by

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This thesis analyzes the effects of subsurface forces on security around the Korean Peninsula. It looks at the history, order of battle, and past provocations carried out by the Korean People's Navy (KPN) in the undersea environment and the threats posed to the South. Then, the thesis looks at the Republic of Korea Navy's undersea vulnerabilities, strategy, and recent responses to the North's provocations. Finally, the thesis explores various ways of integrating technology and possible allied cooperation to defend against the relentless provocations from the North. It concludes that integrating unmanned underwater vehicles, creating a wide-area surveillance system, and working with countries sharing common security interests (including the United States and Japan) could significantly improve South Korea's anti-submarine warfare capabilities by providing better indications and warnings of KPN submarine activity in its waters and doubling the number of submarines available to manage the North's large undersea fleet. Although many diplomatic and political hurdles need to be addressed before such strategic military cooperation could occur, the implications for better managing the subsurface domain, not just around the Korean Peninsula, but also in the rest of the region, would be significant.

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EFFECTS OF THE SUBSURFACE DOMAIN ON THE SECURITY OF THE KOREAN PENINSULA

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ABSTRACT

This thesis analyzes the effects of subsurface forces on security around the Korean Peninsula. It looks at the history, order of battle, and past provocations carried out by the Korean People's Navy (KPN) in the undersea environment and the threats posed to the South. Then, the thesis looks at the Republic of Korea Navy's undersea vulnerabilities, strategy, and recent responses to the North's provocations. Finally, the thesis explores various ways of integrating technology and possible allied cooperation to defend against the relentless provocations from the North. It concludes that integrating unmanned underwater vehicles, creating a wide-area surveillance system, and working with countries sharing common security interests (including the United States and Japan) could significantly improve South Korea's anti-submarine warfare capabilities by providing better indications and warnings of KPN submarine activity in its waters and doubling the number of submarines available to manage the North's large undersea fleet. Although many diplomatic and political hurdles need to be addressed before such strategic military cooperation could occur, the implications for better managing the subsurface domain, not just around the Korean Peninsula, but also in the rest of the region, would be significant.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAW	Anti-Air Warfare
AIP	air-independent propulsion
ASW	Anti-Submarine Warfare
ASuW	Anti-Surface Warfare
CSF	ROKN Submarine Force Command
DAPA	Defense Acquisition Program Administration
DMZ	de-militarized zone
DPRK	Democratic People's Republic of Korea
DSME	Daewoo Shipbuilding and Marine Engineering
FFG	guided missile frigate
FLOT 9	Flotilla 9
HHI	Hyundai Heavy Industries
HVU	high-value unit
JMSDF	Japanese Maritime Self-Defense Force
KAMD	Korean Air Missile Defense
KPA	Korean People's Army
KPN	Korean People's Navy
KTO	Korean Theater of Operations
MPA	maritime patrol aircraft
NLL	Norther Limit Line
ONI	Office of Naval Intelligence
OPLAN	operational plan
PC	patrol craft
PD	periscope depth
RGB	Reconnaissance General Bureau
ROE	Rules of Engagement
ROK	Republic of Korea
ROKN	Republic of Korea Navy
ROKS	Republic of Korea Ship
SHAREM	Ship ASW Readiness and Evaluation Measurement

SLBM	submarine launched ballistic missile
SLOC	Sea Lines of Communication
SOF	special operations forces
SONAR	sound navigation and ranging
SOSUS	Sound Surveillance System
SSB	ballistic submarine
SSC	coastal submarine
SSM	midget submarine
UAV	unmanned aerial vehicle
USN	United States Navy
UUV	unmanned underwater vehicle
VSV	very slender vessel
WMD	weapons of mass destruction

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I. INTRODUCTION

A. MAJOR RESEARCH QUESTION

Given advancements in submarine technology, the undersea domain poses a difficult problem for the Korean Peninsula. The possibility of conflict triggered by events in the undersea domain remains high. A robust South Korean undersea program in coordination with the United States could improve security in the subsurface realm and strengthen deterrence against a North Korean attack. This thesis will examine the past, present, and future direction of submarine forces on the Korean Peninsula and the implications for the U.S. Navy. The questions to be examined include the following:

1. How have North Korean submarine activities affected South Korean security programs: specifically, with respect to naval procurement, platform improvements, manning, training, procedures, and policies?

2. What is the role of the two submarine forces in security on the Korean Peninsula?

3. What influence does the U.S. Navy have on the balance of undersea forces?

B. SIGNIFICANCE OF THE RESEARCH QUESTION

The Korean War started on June 25, 1950, and has never officially ended. Since the signing of the armistice in 1953, pausing the fighting between the two Koreas, North Korea has executed countless provocations against South Korea but never escalated to the point of ending the armistice. Since then, many scenarios have presented various ways in which the fighting might recommence. The Republic of Korea (ROK) military, in conjunction with the United States military, conducts one of the largest combined joint military exercises in the world to combat these potential scenarios and test other military objectives. The scenarios vary, but the main objective does not: to be ready to defend the Republic of Korea if and when the fighting recommences on the Korean Peninsula.

North Korea is notorious for its million-man army, which dwarfs the other services. Therefore, the most common scenarios on reinitiating the fighting are land centric.[1] Common scenarios on the Korean Peninsula focus on skirmishes initiated by the North Korean army because of the massive buildup of Korean People's Army (KPA) forces near the DMZ.[2] For example, on November 23, 2010, North Korea conducted one of its most lethal provocations by firing approximately 170 rounds at Yeonpyeong Island, killing two ROK Marines and two civilians.[3] This incident is a good example of how the massive presence of KPA soldiers and artillery around the DMZ could be used to recommence the fighting between the two countries. Unfortunately, the provocations are not limited to the land.

Provocations from the North via the West Sea and East Sea have also driven tensions high on the Korean Peninsula; however, the most offensive sea-based provocation occurred in the West Sea in March of 2010. Republic of Korea Ship (ROKS) *Cheonan* was attacked by a torpedo that ripped the small corvette into two pieces, driving her to bottom of the West Sea in minutes.[4] An international investigative team, after almost six months of study, concluded that a KPN midget submarine shot and sank the *Cheonan* on that infamous night of March 26, 2010, claiming the lives of 46 members of her crew.[5] Based on emotions expressed at the mass funeral for the sailors that were trapped on the ship, it is a miracle that South Korea did not respond militarily to the clear act of war committed by the North. This incident alone highlights the dangers posed by even the smallest submarine in the North Korean Navy's order of battle, leaving one to wonder what the extent of the KPN's capabilities to exploit the undersea domain are.

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[1]Bruce E. Bechtol Jr., "Understanding the North Korean Military to the Security of the Korean Peninsula and Northeast Asia: Declined or Evolved?" *Korea Observer* 40, no. 1 (2009), 122.

[2]Ibid., 123.

[3]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul: Korea Institute for Maritime Strategy, 2011), 36.

[4]Ohm Tae-am, "Security Challenges and Policy Dilemmas of South Korea in 2012," *The Korean Journal of Defense Analysis* 24, no. 1 (March 2012), 20. Additionally, I was stationed in Korea at the time and remember watching the ship sink on TV.

[5]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul: Korea Institute for Maritime Strategy, 2011), 36.

Despite the threat even from relatively low-end diesel submarines, surprisingly few studies have been conducted in English that analyze the subsurface threat in the waters surrounding the Korean Peninsula. The potential reason for this lack of analysis of the subsurface threat may be the limited role the submarines played leading up to the *Cheonan* incident. The smaller North Korean submarines were used for infiltrating the South with North Korean special operations forces (SOF) vice conducting destructive operations against ROKN forces.

The main purpose of the North Korean submarine fleet is intended to conduct three separate missions: first, to deliver SOF deep behind enemy lines; second, to conduct mining operations; and third, to conduct offensive operations against the ROK and U.S. surface ships. These missions may continue to be the core of the submarine fleet, but the North Koreans have created a new class of submarines to maximize the asymmetric advantage they have developed over the South Koreans, nuclear weapons. According to one defector who worked as a nuclear technician in the North, the Kim regime successfully developed a nuclear bomb in the 1980s.[6] It is known to have conducted six nuclear tests since 2006. As North Korean nuclear physicists continue the march toward full nuclear capabilities, the KPN is working on successfully launching a ballistic missile from a domestically built *Gorae* class diesel submarine, although it is probably a heavily modified Russian *Golf* class submarine.[7] It appears as though North Korea was able to successfully launch a submarine launched ballistic missile (SLBM) on 23 May 2015.[8] The hermit kingdom somehow managed to take a dying submarine program and use it to provide a credible threat to not just South Korea, but all of its neighbors in the region, stirring the international community into a frenzy.

The single example of the lethal blow delivered by a beat-up low-end North Korean submarine in the complex shallow water environment of the West Sea should

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[6]Jasper Becker, "Building the Bomb: North Korean Exiles Reveal 15-Year History of Nuclear Cheating," *The Independent*,11 February 2004.

[7]Joseph S. Bermudez Jr. and Karl Dewey, "North Korea Modernises Submarine Fleet," *Jane's Intelligence Review*, 9 February 2016, 6.

[8]Karl Dewey, "North Korea Conducts SLBM Launch," *Jane's Defence Weekly* 53, no. 25 (2016), ProQuest ID: 1784018419.

serve as a calling to the South to expend the time and energy to better understand the threats and impacts the subsurface domain could have on the security of the Korean Peninsula. There is a good chance that North Korea may resort to using undersea platforms to destabilize the security situation on Korean Peninsula. The ROK Navy's submarine force is extremely capable and technologically advanced compared to the KPN, but it has significantly fewer vessels and physically unable to stop all of KPN's submarines from making past the Northern Limit Line (NLL). Additionally, the asymmetric threat posed by the inferior KPN, if not properly defended against, could and would cause significant damage, as evidenced by the somber loss of the ROKS *Cheonan*.

C. LITERATURE REVIEW

Military stability is the number one concern of hundreds of thousands of soldiers on both sides of the de-militarized zone (DMZ) on the Korean Peninsula. Contrary to the name, for over 60 years, young South and North Korean men, as well as U.S. and UN troops, have stood guard along the world's most heavily fortified border. A relic of the Cold War, the two Koreas were thrust into war when Kim Il Sung attacked the South on June 25, 1950, in hopes of uniting the country under communist control with the backing of the Soviets and Chinese.[9] Unfortunately, for Kim Il Sung, the United States was committed to preventing the Korean Peninsula from falling into communist hands. Following three years of combat, the fighting came to a standstill, eventually leading to an armistice. Although an armistice was signed on July 27,1953, the North continues periodic provocations for various reasons, ranging from blackmailing the international community for food and aid to establishing legitimacy for its new leader. Now, as one of the most isolated countries in the world, North Korea is infamous for its million-man army, armada of submarines, fortified artillery batteries along the DMZ, nuclear weapons program, and a whole string of provocations against the South.

The Korean War has been on pause for over 60 years, and one of the questions that comes up over and over again is how the fighting might recommence. One most

[9]Warren I. Cohen, "Diplomacy Needed to Prevent the Next Korean War," *The Sun* (Baltimore), 31 July 1994.

common theory in the existing literature is that the North Korea's main effort will be centered on the army coming across the DMZ. A study by Jim Dorschner in 2013 explains the purpose of the combined operational plan: "South Korean and U.S. military planning, as detailed in OPLAN 5027 which outlines the defence of South Korea, is based on the assumption of a large-scale, surprise North Korean invasion across the DMZ."[10] Bruce E. Bechtol, Jr., in his article "Understanding the North Korean Military Threat to the Security of the Korean Peninsula" lists the firepower the North Koreans have built up around the DMZ in preparation for a land battle that will ensue at some point in the future, including the stationing of "more than 70 percent of its active forces within 90 miles of the DMZ."[11] This heavily fortified arrangement by the North along the DMZ is the basis for OPLAN 5027, assuming a surprise attack by the KPA. By placing a large number of its army closer to the DMZ, the shorter distance required to travel by the KPA will also aid the surprise attack by shortening the response time the South will have upon recognition of an attack.[12] An August 1, 1994, article in *Jane's Defence Weekly* perfectly captures the presumed land-centric North Korean Army's thought process:

> Tactically, the guiding principles of the North Korea Army are: Annihilation of the enemy—to destroy the defending US/South Korean forces in situ, before they have an opportunity to react; Surprise attack—by using unconventional means of deployment to attack the US/South Korean forces in an unexpected manner, giving the allies little chance to counter-attack. Overwhelming fire power—by using multiple rocket launchers, long-range artillery, short-range battlefield rockets and other systems, thus allowing armored formations to crush the allied defences.[13]

It is understandable why a majority of the literature focuses on battles on land with the type of analysis provided. Nevertheless, North Korea's newly developed missiles, nuclear weapons, and maritime excursions provide other avenues to conflict.

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[10]Jim Dorschner, "Back from the Brink—Conflict Scenarios On the Korean Peninsula," *Jane's Intelligence Review*, 16 May 2013, 8.

[11]Bruce E. Bechtol Jr., "Understanding the North Korean Military to the Security of the Korean Peninsula and Northeast Asia: Declined or Evolved?" *Korea Observer* 40, no. 1 (2009), 122–3.

[12]Ibid., 128.

[13]"North Korea: If the Flashpoint Becomes War Global Update," *Jane's Defence Weekly*, 1 August 1994.

One area of major concern affecting the security of not just the Korean Peninsula but also the entire region is the emergence of nuclear weapons. Kim Il Sung started North Korea on its path toward creating a nuclear weapons program. Recent nuclear tests conducted by the North leave little to doubt the North's success in developing a nuclear bomb. Recent tests conducted in 2015 and 2016 suggest credible evidence of North Korean achievements in developing a functional nuclear bomb. A nuclear North has significant implications for the defense of the ROK. North Korean media claims the following for its purpose in pursuing nuclear weapons: the "North Korean nuclear deterrent is 'not a plaything to be put on the negotiating table, as it is the essential means to protect its sovereignty and vital rights from the U.S. nuclear threat and hostile policy, which have lasted for more than half a century.'"[14] This very well could be the case, but significant doubt exists on the North's restraint to not resort to its nuclear arsenal against a more technologically advanced South during a conflict. Furthermore, Brad Roberts proposes a more likely scenario where North Korea would rely on its nuclear weapons to conduct "nuclear blackmail" for the sake of obtaining political concessions.[15] Others, like Paul Davis et al., postulate on the military balance on the Korean Peninsula: "In looking at the Korean Peninsula today it is clear that most trends favor South Korea, but that North Korea's nuclear program is a great concern. Although war remains unlikely, it—even a limited nuclear war—is imaginable in the years ahead."[16] The question that needs to be asked then is when would the North decide to use its nuclear weapons if it decided to go to war? Using nuclear weapons at the onset of the conflict would be committing to a total war from the beginning, leaving no chances for de-escalation. The close proximity of Seoul to the DMZ should also give the North pause prior to resorting to its nuclear weapons because, depending on the winds, there is a good chance that some of the fallout would drift North. It seems to make the most sense for the North to hold off to the last

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[14]Quoted in James Hardy, et al., "Piecing Together the Puzzle: North Korea Country Briefing," in *Jane's Defence Weekly*, 19 August 2015, 2.

[15]Brad Roberts, "Tailored Options to Deter North Korea and WMD Threats," in *The Korean Journal of Defense Analysis* 28, no. 1 (March 2016), 27.

[16]Paul K. Davis et. al, "Deterrence and Stability for the Korean Peninsula," *The Korean Journal of Defense Analysis* 28, No. 1 (March 2016), 1.

minute to turn to its nuclear arsenal in a conflict, making the onset of war due to nuclear weapons unlikely, although their use at some point does seem to be a likely scenario.

Along with its controversial nuclear weapons program, North Korea is concurrently improving its missile program.[17] Included in the North's missile program is its SLBM, which could provide North Korea with its greatest threat to South Korea and her allies if it is able to work through the technical challenges. Gabriel Dominguez explains the North's efforts in improving its missile program in his analysis:

> Photographs released by Pyongyang on 24 April suggest North Korea has a second SLBM that uses a solid propellant propulsion system and "cold launch" technologies, in addition to the liquid-fuel Pukgeukseong-1 (Polaris-1) it has already revealed. Pyongyang's achievements in solid rocket fuel motors for larger missiles and cold-launch technology makes its near-term development of a ballistic missile submarine capability more credible, thus increasing the threat level for neighboring South Korea.[18]

In conjunction with its SLBM program, if North Korea is successful in miniaturizing a nuclear warhead to fit on the SLBM, North Korea might secure for itself a second-strike capability. An SLBM-capable KPN submarine would require constant monitoring if the South were to counter a ballistic missile attack from the North. The recent acquisition of maritime patrol aircraft (MPA) by the ROKN may be an attempt to do just that: "South Korea's decision to more than double its fleet of MPAs is the latest move to bolster its navy and in particular should see an improvement in its anti-submarine warfare capabilities, which were criticized in a March 2011 MoD report into the sinking of the corvette *Chon An* [sic] in March 2010 that was blamed on a North Korean submarine."[19]

Further hostilities between the two Koreas could result from maritime skirmishes. Jim Dorschner, along with others, highlights the significant maritime conventional threat posed by the KPN: "More dangerous is the sizeable KPN submarine fleet, which is kept

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[17]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul: Korea Institute for Maritime Strategy, 2011), 30.

[18]Gabriel Dominguez, "South Korea Developing SLMBs for KSS-III Attack Submarines," *Jane's Defence Weekly*, 2 June 2016.

[19]James Hardy, "South Korea Plans Expansion of MPA Fleet," *Jane's Defence Weekly*, 3 June 2013.

at a higher state of readiness than other elements of the navy."[20] William Sullivan also describes the maritime concern:

> Here in Korea, the threat of a million-man army to the north and thousands of tubes of artillery arrayed along the Demilitarized Zone (DMZ) is what captures the most attention. But, it is important to remember that in the last dozen years, all of the most serious clashes with North Korea have taken place at sea—most recently in the tragic torpedo attack on the Republic of Korea Ship (ROKS) *Cheonan.*[21]

Furthermore, Andrew Forbes and Yoon Sukjoon highlight the KPN submarine fleet's limited but lethal capabilities, as well as its ability to adapt to ever-changing mission sets as ROKN vessels become technologically more advanced. Specifically, they point out the different types of missions that the KPN submarines have conducted ranging from SOF insertion, to fishing boat harassments, to torpedo attacks against the *Cheonan*.[22] Up until the torpedo attack, KPN submarines were primarily used for SOF insertions because of their ability to clandestinely deliver a "platoon-sized" team onshore.[23] In September of 1996, a KPN *Sang-O* class submarine grounded while attempting to pick up a three man infiltration team it had dropped off a couple of days prior. The crew decided to abandon the submarine in an attempt to make it back to the North via foot resulting in a manhunt that lasted over a month with 24 KPN fatalities, 16 ROK fatalities, 27 ROK casualties, one KPN captured, and one KPN escaping.[24] This incident presents the chaos just one KPN submarine is able to produce against the South. The KPN's possession of 40 *Yugo* class and 20 *Sang-O* class submarines significantly challenge not just the ROKN submarine force, but the entire ROK armed forces as a whole. The KPN also demonstrated the extent of its submarine force's operational reach

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[20]Jim Dorschner, "Back from the Brink—Conflict Scenarios on the Korean Peninsula," Jane's Intelligence Review, 16 May 2013, 4.

[21]William D. Sullivan, "Old Issues and New Threats," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 5.

[22]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 19–36.

[23]Ibid., 24–25.

[24]Ibid.

by infiltrating the ROK's southernmost island of Jeju-do, expanding the ROKN's search area.[25]

All of the maritime clashes, especially in the West Sea, between the two sides indicate the volatility of the sea-based threats posed by North Korea; the *Cheonan* incident provides a sobering example of the threat posed by a technically inferior but well-trained North Korean submarine crew. The increasing trend in the violent provocations poses higher chances of unintended escalation leading to full-out conflict in the future.

If the North Koreans did decide to make another attempt at unifying the peninsula or gaining additional territory, an eventual land battle is inevitable, but the odds of North Korea making such a bold initial move against the ROK and the United States seems unlikely. Authors like William Sullivan are not alone in describing the North's inferiority against the South: "The North Korean navy is no match for conventional war at sea terms for the ROK Navy. For that reason, the most likely scenarios for naval warfare with North Korea will likely include many of the same tactics, techniques and procedures employed by non-state actors."[26] The asymmetric advantages that the North has over the South are what it may focus on to deliver a destructive initial blow to make up for its technological inferiority. This thesis aims at focusing on the threat posed by the North's undersea forces and the South's efforts to deter or combat that threat. A significant literature covering the land-centric focus of North and South Korea provides the foundation and history of the Korean Peninsula, but only a limited number of books and articles delve into laying out the threats, concerns, and potential ways ahead in combating the threats arising from the undersea domain. The goal of this thesis is not to predict that the next ensuing conflict on the Peninsula will commence from under the sea, but rather to delve into the possible threats ahead of time to hedge against surprise attacks from the undersea domain and to examine their potential role in larger conflicts.

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[25]Joseph S. Bermudez Jr., "Submarine was on Mission to Spy on South," *Jane's Defence Weekly*, September 35, 1996.

[26]William D. Sullivan, "Old Issues and New Threats," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 11.

The South Korean Navy has the responsibility of protecting the waters of the ROK. As mentioned before, the ROKN is significantly more modern and technologically advanced than the aging KPN. This advantage mostly makes up for the large discrepancy between the numbers of assets in the two navies. The ROKN submarine force of thirteen submarines is only five percent of the KPN's submarine force.[27] Even if all of the ROKN submarines were out at sea at the same time, they could not physically stop all of the KPN's submarines from reaching their destinations in South Korea. This is a significant threat that the ROKN needs to counter, as evidenced by the KPN's demonstration of getting over 50 percent of their submarine fleet under way in less than 24 hours. Additionally, the complex shallow water environment of the West Sea provides the perfect setting for a midget submarine trying to remain undetected by negating the advantages of the technologically advanced ROKN submarines and ships. The North Korean leadership understands the threats and challenges provided by its submarine fleet, making it likely to continue to rely on it for provocations and other clandestine objectives. If the frequency of North Korean submarine activity increases, that provides an increased chance of interaction with the ROKN. The more interactions there are between the two navies, the greater chance of escalation, leading to recommencement of the Korean war. The possible presence of nuclear weapons on the side of North Korean Navy only emboldens the KPN, complicating the undersea predicament facing Korean Peninsula security.

D. POTENTIAL EXPLANATIONS AND HYPOTHESES

The best example of the types of threats posed by the undersea domain around the Korean Peninsula is the March 26, 2010, attack on the ROKS *Cheonan*. This incident clearly demonstrates the advantage and threat that even an inferior submarine with aging weapons can have against a technologically superior navy; therefore, a technically advanced submarine can bring certain advantages to the fight if it has the advantage of surprise. Due to the large number of KPN submarines, their ability to operate clandestinely, and their lethal threat capability, it is presumable that Kim Jung Un will

[27] Joseph S. Bermudez Jr. and Karl Dewey, "North Korea Modernises Submarine Fleet," *Jane's Intelligence Review*, 9 February 2016.

continue to resort to the asymmetric advantage provided by the subsurface domain for future provocations. Additionally, the *Cheonan* incident created doubt in the South's capability to properly defend against the North's submarine threat. Andrew Forbes and Yoon Sukjoon not only question the ROKN's ability but question the ability of ROK Armed Forces as a whole in defending against the North's provocations.[28] Joseph S. Bermudez Jr. and Karl Dewey explain in their article in *Jane's Intelligence Review* that as a response to the sinking of the *Cheonan* "a number of South Korean government agencies have been tasked with the responsibility of developing weapons, systems, and platforms that can better protect the country against these underwater threats."[29] These reforms will have further implications on the security of the Peninsula.

The ROK navy's improvements in anti-submarine warfare (ASW) capabilities through training, acquisition of new platforms, and technological improvements will undoubtedly improve its ability to detect submerged contacts in the waters surrounding South Korea. Unfortunately, unless the subsurface threat is detected while it is surfaced, positive identification will remain a challenge. Assuming counter-detection of a known KPN submarine, the manner of prosecution by the ROKN will play a critical role in the outcome of the interaction. With the sinking of the *Cheonan* still fresh in the ROKN's memory, an aggressive prosecution of the KPN submarine is not hard to imagine. One could imagine a scenario where an aggressive prosecution by the South ignites a series of interactions between the two navies that quickly escalates out of control, producing unintended consequences for the security of the peninsula.

In order to counter the challenge posed by the KPN's superiority in the number of submarines, the ROK navy could investigate use of high-tech unmanned underwater vehicles (UUV) in the East Sea. The UUVs could be used to provide locating data of the KPN submarines that could then be used by MPA to take them out. Unfortunately, due to poor acoustics in and other shallow water disadvantages in the West Sea, use of UUVs

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[28]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 40.

[29]Joseph S. Bermudez Jr. and Karl Dewey, "North Korea Modernises Submarine Fleet," *Jane's Intelligence Review*, 9 February 2016, 10.

would not provide similar advantages. Unmanned aerial vehicles (UAV) with night vision or infrared capabilities would be better suited to visually detect KPN submarines attempting to infiltrate the South. If the ROKN or ROKAF develops a squadron of unmanned vehicles to assist in searching for KPN assets, it can be one viable option in countering the KPN subsurface threat. Additionally, apart from ROKN's internal ASW improvements, if the ROK Navy and the U.S. Navy cooperate and improve undersea detection and defense, security on the Korean Peninsula will be improved.

E. RESEARCH DESIGN

This research will take a comparative case study approach of the two Korea's undersea forces. Setting the likely outcome of conflicts between the two as the dependent variable, the research will focus on each country's subsurface forces and their relative capabilities, their historical use of submarines, and the U.S. subsurface force's possible contribution in affecting these outcomes. The comparative case studies provide the best method to examine the various ways conflict between the subsurface forces of the two countries may escalate into war. Considering the subsurface forces of the two sides provides a heuristic case study breaking from the common land-centric theme. Looking specifically at subsurface domain and its forces will focus attention to the different sources available to the KPN for disrupting the security on the Korean Peninsula and on the ROK for preserving it.

Looking at past maritime provocations and the continued increase in violence of the provocations, in conjunction with the North's advances in subsurface assets, this research will attempt to analyze how the North has used the undersea domain and how it may use it in the future. The research will draw upon U.S. and ROK defense journals and books to analyze how North and South Korea are exploiting the undersea domain with advances in technology or strategy to gain an advantage over their adversary. A special emphasis on the *Cheonan* incident will be used to determine its impact on the South Korean military and its defense strategy. This research will also look at current and future cooperation between the ROKN and the USN toward integrating their efforts and developing possible future dominance of the undersea domain during peacetime and in

case of hostilities to aiding the fight to maintain allied control of Sea Lines of Communications (SLOC) around the Korean Peninsula.

F. THESIS OVERVIEW

The thesis will start off with a description of the security challenges posed by the North on the Korean Peninsula. Following this introduction, two chapters will focus on North and South Korea. The North Korean chapter will discuss past KPN maritime provocations, order of battle, subsurface acquisition and industry capabilities, and its current and future maritime strategies. Similarly, the South Korean chapter will focus on the ROKN submarine force, order of battle, and acquisition and industry programs. The South Korean chapter will also discuss the military and political changes in the ROK navy and military as a result of the *Cheonan* incident. The next chapter will focus on the U.S. Navy and will discuss current and future cooperation with the ROKN to deter and combat KPN subsurface operations. Finally, the conclusion will highlight possible U.S.-ROK countermeasures to the threats posed by the KPN subsurface forces.

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II. THE NORTH KOREAN SUBMARINE FLEET

The North Korean People's Navy (KPN) is not the first thing that comes to mind when thinking about this secluded country. With its million-man army pre-positioned along the DMZ, the immediate threat posed by the North's land forces overshadow other dangers when thinking about security on the Korean Peninsula. Despite the land-centric focus on the peninsula, the KPN presents a formidable threat to the South. This chapter introduces the North Korean submarine force, starting off with a brief history of its origins and purpose. Then, it highlights the North's reliance on the seas surrounding the Korean Peninsula for provocations against the South. The North's inventory of submarines and their origins provide insight on the North's ability to purchase, replicate, develop and deploy subsurface vessels to meets its requirements. Following the introduction of the North's submarine inventory, the chapter will cover the two known examples of North Korean submarine infiltrations, as well as the sinking of the Cheonan, which serves to highlight the violence and dangers posed by the North's subsurface forces. Finally, the chapter looks at the KPN's current and future strategy in regard to its submarine force.

1. Brief History

The KPN has an inventory of approximately 750 vessels and 70 submarines, making it one of the biggest navies in the world.[30] The submarines are stationed on the west and east coasts of the country with responsibilities for protecting both shores. They are further separated into submarines operated by the KPN and the Reconnaissance General Bureau (RGB). Jane's World Navies provides that

> the KPN submarine fleet consists of approximately 20 Romeo-class diesel SSKs, and 30 smaller Sang-O and K-300-class [Sang-O II] SSCs. Meanwhile, the Reconnaissance General Bureau submarine fleet consists

[30] "Korea, North—Navy," *Jane's World Navies*, July 12, 2017, http://janes.ihs.com/Janes/Display/jwna0082-jwna.

> of approximately 10 Sang-O SSC, five Yono-class SSM, and five Yugo-class SSMs, all of which serve an infiltration role.[31]

The difference between the two commands is that the KPN is focused on conventional war time operations, whereas the RGB is more focused on peacetime operations. It is likely that following the onset of hostilities against the South, RGB submarines could join KPN forces upon completion of SOF infiltration duties.

The KPN submarine force's mission supports the overall goal of the North's naval strategy. Ken Gause explains that the "wartime employment [of KPN submarines] is believed to include coastal defence, insertion of special operations forces, mining, and attack of merchant ships and unescorted troop transports off South Korean ports."[32] Jane's World Navies expands on these missions by stating that "KPN submarines may extend this by conducting short-range offensive patrols off both Japanese coasts; [and] long-range offensive patrols in the East China Sea, approaches to Japan, and the Philippine Sea."[33] The short- and long-range KPN submarine patrols present a threat to ROK and U.S. forces because they also expand the operating area of KPN submarines, requiring the ROKN and the USN to make decisions on dedicating ASW assets to protect allied shipping and forces during contingencies. Bigger operating areas mean bigger search areas, which then results in further assets being dedicated to the search or assets being pulled away for a longer period of time to cover the entire area. Another dilemma a bigger operating area creates for the South is whether to search for the missing submarine or accept the risk of operating a high-value unit (HVU) in an area that has not been sanitized of enemy submarines. In contingencies, U.S. leadership will face the same dilemma prior to sending in U.S. carrier strike groups into the Korean Theater of Operations (KTO).

Peacetime operations of the KPN submarine force focus on provocations and clandestine operations in South Korean waters. Although the submarines in the RGB are

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[31]"Korea, North—Navy," *Jane's World Navies*, July 12, 2017, http://janes.ihs.com/Janes/Display/jwna0082-jwna.

[32]Ken Gause, "North Korean Navy Grows in Influence," *Jane's Intelligence Review*, August 12, 2002.

[33]"Korea, North—Navy," Janes World Navies (July 12, 2017), http://janes.ihs.com/Janes/Display/jwna0082-jwna.

of the same class as those in the KPN, they are specifically designed to infiltrate and recover SOF personnel in the South. Once on land, SOF personnel gather intelligence for future operations, spread propaganda for recruitment, and provide targeting information for key South Korean organizations.[34] These operations not only provide critical data for future conflicts, but also provide experience to both the KPN SOF and submarine forces. Along with the experience, another benefit of operating south of the NLL is that operations in South Korean waters provide the KPN with critical information about the maritime environment of potential battlegrounds. Understanding the operational environment is critical for preventing counter-detection, or vice versa, detecting the enemy, especially in shallow water environments like the West Sea. This is a significant advantage the KPN submarines enjoy over the ROKN because of operational limitations in South Korea preventing submarine operations north of the NLL.[35] Additionally, the free flow of North Korean submarines across the NLL creates safety concerns as subsurface activities increase in the region. Although the ocean is big, undersea features create lanes favorable for submarine operations, increasing possible encounters or, even worse, collisions with other submarines. The high clutter environment near the littorals and shallow waters off the Korean Peninsula significantly degrades submarine detection, even for the technologically advanced ROKN submarines, further increasing the risk of collisions. William Sullivan captures the difficulties of submarine detection in shallow water environments: "ASW in particular is much more difficult in shallow water where high powered sonars are virtually blinded by the effects of shallow water and where passive ASW is virtually impossible."[36] KPN submarine operations below the NLL not only create a security threat to the ROK, but also create a safety concern as well.

This does not mean the KPN submarines are immune to the same challenges. The shallow water environment limits deep operations that provide some safety from collision

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[34]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 20.

[35]Sukjoon Yoon, "Expanding the ROKN's Capabilities to Deal with the SLBM Threat From North Korea," *Naval War College Review* 70, no. 2 (2017), 63.

[36]William D. Sullivan, "Old Issues and New Threats," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 8–9.

with the large number of fishing vessels. Additionally, the high noise clutter environment that hides the KPN submarines has the same effect against the ROKN ASW forces. The high density of fishing vessels also presents a challenge for the submerged submarine to navigate through. Because of the shallow nature of the West Sea, it is likely for the KPN submarine to operate at periscope depth (PD). Operations at PD present a challenge to submerged operations, due to limits on speed and maneuverability, as well physically positioning the submarine closer to ships, raising the potential for collisions. The slower operating speeds at PD hinder maneuverability, and the submarine's ability to get out of the way of a merchant vessel steaming along at 10 to 12 knots is reduced. PD operations also place the submarine's sensors in the same column of water as the rest of the noise in the ocean, limiting the sensors' ability to pick out contacts that pose a counter-detection or collision threat to the boat. Finally, operating with masts sticking out of the water increases the submarine's chances of being detected visually or by radar. Although many challenges exist in shallow-water submarine operations, the difficulties associated with finding a submarine provide an advantage to the infiltrators over those defending an area.

From available open-source information, KPN Anti-Submarine Warfare (ASW) capability is extremely limited. The KPN surface ships that have any kind of sound navigation and ranging (SONAR) system are limited to two types (Stag Horn and Ear), which are high-frequency active SONARs.[37] Due to the high-frequency nature of the SONARs, one can conclude that detection ranges would be low due to the attenuation losses experienced in salt water and the reverberation in shallow water. Additionally, the fact that the only SONAR systems equipped on the ships are of the active variety limits its ASW tactics to flooding the water with active pulses to find submarines. Although active SONAR can be effective in finding submarines, it gives away the ship's position and lets the boats know that they have been detected or are suspected of being in the area. Again, the short ranges of the active pulses serve more as a signal to the ROKN submarines of KPN surface ship presence and provide targeting data, rather than providing asymmetric advantages for the KPN regarding the possible location of foreign submarines.

[37] "Democratic Republic of Korea," 20178-18 *Jane's Fighting Ships*, 2017, 469–75.

The number of classes of vessels and ships with ASW weapons indicate the level of importance placed on ASW by the KPN. KPN Guided Missile Frigates (FFGs) are the only ships that have torpedo tubes and SONAR systems as an integrated system.[38] The *Shenshen* class ships have torpedo tubes but no SONAR, making the class an Anti-Surface Warfare (ASuW) platform rather than for ASW. The same could be said about the Ku Song, Sin Hung, and Mod Sin Hung ships.[39] Other patrol craft in the KPN inventory are equipped with depth charges, but again do not have any SONAR to aid in detection of submarines operating deep. The KPN's exact ASW capabilities are difficult to determine without the North releasing information about them, but an initial review of its vessels and capabilities indicates a very limited number of devoted ASW vessels having relatively primitive means of detecting and engaging submarines. The North is either not concerned about the subsurface threat posed by the ROKN submarine force, or believes it cannot afford or obtain sophisticated ASW technologies. Along the same lines, this may be the weakness the ROKN needs to focus on, especially with its superiority in technologically advanced submarines.

a. Maritime Provocations

North Korea uses its submarine force to conduct maritime provocations against the South that range from intelligence collection via clandestine infiltration operations to overt sinking of ROKN ships.[40] The number of previously undetected submarine infiltrations prior to the capture of the KPN submarines in the late 1990s is unknown, but it is certain that infiltrations happened. Andrew Forbes and Captain (Ret) Yoon Sukjoon supports the claim by providing that "in general, from the late 1950s to the 1970s, the KPN conducted spy mission-oriented infiltration operations using the seas surrounding the Korean peninsula."[41] The most recent example is the Kangnung incident in 1996. A

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[38]Ibid.

[39]Ibid., 474.

[40]Yoon Sukjoon, "Some Current Issues in Korean Maritime Security and Maritime Strategy," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 156.

[41]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 20.

North Korean Sang-O class midget submarine grounded off the east coast of South Korea, near the city of Kangnung. The sailors onboard decided to make an attempt to return to the North by foot, resulting in a massive manhunt that disrupted the daily lives of the citizens in the region.[42] *Jane's Defence Weekly* explains that in response to the 26 or so KPN forces,

> South Korean authorities immediately initiated standard counter-infiltration procedures, placed army units on alert, rushed other troops and national police units to the Kangnung area. Blocking positions were established north of the city…search operations initiated…[with] additional security precautions taken nationwide, particularly in Seoul.[43]

The submarine- delivered commandos foreshadow the likely level of chaos posed by North Korean special forces in a time of war. It is hard to imagine what kind of impact a full-scale invasion by North Korean special forces from submarines would have on the South militarily and socially. More importantly, this incident highlighted the difficulties of and the South's weakness in guarding against KPN submarine operations. Regrettably, no real progress or movement to improve ASW was initiated until the sinking of the Cheonan, some ten years later.[44] Fortunately, as described by Wendell Minnick, it appears the North has shifted away from infiltrations and opted to take an asymmetric approach with its submarine force because of its technological inferiority against the South.[45] Not only was the approach of provocations altered, but the level of violence has increased as well.

The deadliest recent provocation against the South in the maritime domain by a North Korean submarine took place in the West Sea. Leon Sigal explains that "on March 26, 2016, North Korea sank a South Korean Navy corvette, the Cheonan, killing 46

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[42]Harry P. Dies Jr., "North Korean Special Forces: 1996 Kangnung Submarine Infiltration," *Military Intelligence Professional Bulletin* 30, no. 4 (Oct-Dec 2004), 29.

[43]Joseph Bermudez Jr., "Submarine was on Mission to Spy on South," *Jane's Defence Weekly,* September 25, 1996.

[44]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 40–3.

[45]Wendell Minnick, "Parry, Thrust on Korean Peninsula," *Defense News*, (Springfield, VA: April 4, 2011).

people, the deadliest encounter in Korea in two decades."[46] Some question the involvement of the North Korean submarine in the sinking of the Cheonan, but a joint investigation conducted by civilian and military experts from the ROK, U.S., UK, Australia, Sweden, and Canada determined that "the evidence overwhelmingly points to the conclusion that the torpedo was fired by a North Korean submarine."[47] Experts like Sigal believe that "North Korea carried out the attack [on the Cheonan] to avenge the destruction of one of its ships by South Korea last November."[48] Others argue that the North is shifting its focus to unconventional or asymmetric submarine operations to bridge the technological gap between the two navies.[49] William Sullivan predicts that "the North Korean navy is no match in conventional war at sea terms for the ROK Navy. For that reason, the most likely scenario for naval warfare with North Korea will likely include many of the same tactics, techniques and procedures employed by non-state actors."[50] Regardless of the North's intentions in attacking the Cheonan, it is evident that despite their technological inferiority, the KPN submarines continue to present a significant security threat to the ROKN. Furthermore, recent discovery of a new class of KPN submarine indicates a potential capability to launch ballistic missiles, further elevating the security situation around the Korean Peninsula.

Submarine-launched ballistic missiles (SLBMs) and a new class of submarine by the KPN create a new type of maritime threat not seen before on the Korean Peninsula. *Chosun Ilbo* points out that "the last remaining threat the North had up its sleeve was an

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[46]Leon V. Sigal, "Primer—North Korea, South Korea, and the United States: Reading Between the Lines of the Cheonan Attack," *Bulletin of the Atomic Scientists* 66, no. 5 (November 27, 2015), 35. http://dx.doi.org/10.1177/0096340210381461.

[47]Ministry of National Defense, *Investigation Report on the Sinking of ROK Ship "Cheonan,"* (Ministry of National Defense, Republic of Korea) May 20, 2010, 7.

[48]Leon V. Sigal, "Primer—North Korea, South Korea, and the United States: Reading Between the Lines of the Cheonan Attack," *Bulletin of the Atomic Scientists* 66, no. 5 (November 27, 2015), 36. http://dx.doi.org/10.1177/0096340210381461.

[49]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 22.

[50]William D. Sullivan, "Old Issues and New Threats," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 11.

SLBM, and now it has become a reality."[51] Although still in its infancy, a mature SLBM program could provide Kim with a second-strike nuclear capability. The *Chosun Ilbo* goes on to explain why a North Korean SLBM is so dangerous:

> An SLBM poses an entirely new level of threat. North Korean submarines can sneak into South Korea waters and fire a missile that would render existing defenses useless. The U.S. and Japan now fall under the threat of North Korean SLBMs, which could trigger major changes to the security environment here.[52]

They further add that "SLBM attacks would be difficult to detect unless a country's own submarine lie in wait in front of an enemy's submarine base and ambush them in crisis."[53] This may be the reason why former ROKN submarine officers are concerned with the North's investment in this new capability.[54] Gabriel Dominguez explains the North's efforts in improving its missile program in his analysis:

> Photographs released by Pyongyang on 24 April suggest North Korea has a second SLBM that uses a solid propellant propulsion system and 'cold launch' technologies, in addition to the liquid-fuel Pukgeukseong-1 (Polaris-1) it has already revealed. Pyongyang's achievements in solid rocket fuel motors for larger missiles and cold-launch technology makes its near-term development of a ballistic missile submarine capability more credible, thus increasing the threat level for neighboring South Korea.[55]

An SLBM-capable KPN submarine would require constant monitoring if the South were to counter a ballistic missile attack from the North. The best way to prevent the missile from being fired is to take out the submarine carrying the missile before it shoots it. That means the location of the submarine needs to be known at all times, which is why the non-nuclear ballistic missile submarine (SSB) requires monitoring. Once a submarine reaches the high seas, it gets significantly more difficult to detect and requires

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[51]"Seoul Must Strengthen Its Missile Defense At All Costs," *Chosun Ilbo*, (August 25, 2016), http://english/chosun.com/site/data/html_dir/2016/08/25/2016082501493.html.

[52]Ibid.

[53]"U.S. Tracked N. Korean Submarines," *Chosun Ilbo*, (August 26, 2016), http://english.chosun.com/site/data/html_dir/2016/08/26/2016082600772.html.

[54]"Korea, North—Navy," Janes World Navies (July 12, 2017), http://janes.ihs.com/Janes/Display/jwna0082-jwna.

[55]Gabriel Dominguez, "South Korea Developing SLBMs for KSS-III Attack Submarines," *Jane's Defence Weekly*, June 2, 2016.

a lot of dedicated assets to find it, even if the submarine is an old KPN diesel submarine. Following a submarine out of homeport and tracking it makes the process much more efficient. Unfortunately for the ROK, it is prohibited from making preemptive attacks and has to rely on methods of shooting down the missile once it is in the air. As mentioned earlier, current ROK policy makes the SLBM problem a reactive one rather than a proactive one.[56] The South has realized this limitation and is considering options to eliminate such restrictions.

Other maritime provocations in the late 1990s and early 2000s, not involving submarines, by the KPN emphasize the violence and the capability imbalance between the two navies. They also support Ken Gause's statement on Kim Jong-il's proclivity to make use of the surrounding seas to his advantage: "Since the beginning of the Kim Jong-il era, North Korea has used the seas around the Korean Peninsula to threaten and signal its neighbors to the South…. The area around the North Limit Line (NLL) provides Pyongyang with a uniquely suited venue to carry out its strategy of brinkmanship."[57] Naval skirmishes near the NLL of the West Sea in 1999 and 2002 represented this brinkmanship strategy, the violent nature of maritime provocations, and the threat to the security of the Korean Peninsula posed by the KPN.[58] The threat posed by the KPN submarine force continues to prove difficult for the ROKN to get a good handle on.

b. Order of Battle

North Korea builds all of its own submarines today, but that was not always the case. Before building its own submarines, North Korea purchased its submarines from

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[56]Sukjoon Yoon, "Expanding the ROKN's Capabilities to Deal with the SLBM Threat from North Korea," *Naval War College Review* 70, no. 2 (2017), 63.

[57]Ken E. Gause, "North Korean Calculus in the Maritime Environment: Covert versus Overt Provocations," in *The Changing Security Environment and Continuing North Korean Military Threat*, KIMS, (Seoul, Korea Institute for Maritime Strategy:2013), 187.

[58]Yoon Sukjoon, "Some Current Issues in Korean Maritime Security and Maritime Strategy," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 158.

China, the Soviet Union, and Yugoslavia.[59] The submarines purchased from other countries include the Whiskey-class, Romeo-class, and Yugo-class submarines, in that order.[60] Jane's World Navies explains that "the nominal vessels of the DPRK represent a mixture of former Chinese, North Korean, and Soviet construction."[61] The KPN made improvements to the original models, but the technology embedded in the submarines is not too far advanced from when they were acquired in the 1960s and '70s. The KPN Sang-O captured in 1996 revealed modifications using commercial equipment. Despite the fact that the submarines are old and have limited technology onboard, Youn Young-sik points out that the North Korean-built submarines "can carry out their missions around the entire Korean peninsula and well out into the China Sea and the Sea of Japan."[62] Furthermore, it is believed that the submarine force is at the highest state of readiness within the KPN organization, threatening the security of not just Korea, but the rest of the region as well.[63] In August of 2015, the KPN displayed the extent of the submarine force's readiness with "the emergency 'flushing' bringing approximately 70 percent of the KPN's submarines to patrol stations in the East Sea and West Sea. This was the largest ever deployment of KPN submarines," explains Jane's.[64] This flushing defies the common belief that the North's forces are dilapidated and undisciplined due to the North's economic struggles. Unfortunately, the opposite is true and, as discussed above, the sinking of the South Korean corvette in March of 2016 displayed the perfect

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[59]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 23.

[60]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 23.

[61]"Korea, North—Navy," *Jane's World Navies*, July 12, 2017, http://janes.ihs.com/Janes/Display/jwna0082-jwna.

[62]Youn Young-sik, *Korea: A Naval Strategy for 'C' Function Navies* (Aberdeen: Center for Defence Studies,1992), 22.

[63]"Korea, North—Navy," *Jane's World Navies*, July 12, 2017, http://janes.ihs.com/Janes/Display/jwna0082-jwna.

[64]Ibid.

example of the violent threat the KPN submarine force continues to pose against the South.[65]

The heart of the KPN submarine force is made up of the indigenously built Sang-O class submarines. Jane's World Navies explains that

> the Sang-O class SSC remains the primary submarine within the KPN. There are at least two variants of the original class, one being for specialised reconnaissance/infiltration and the second with a hull of slightly greater length as the lead vessel but with a significantly wider beam reportedly designed as a specialised SOF delivery boat.[66]

The Sang-O submarines were later updated in the 2000s leading with the Sang-O II, also known as the K-300 SSC.[67] Joseph Cohen explains that "production estimates run between two to five or six vessels built to date. It is expected the K-300 will replace the entire ROMEO boats. In terms of armaments, the K-300 closely resembles the original 'Sang-O' class, perhaps indicating this boat will serve as an eventual replacement for the aging 'Sang-O' hulls."[68] Along with the Sang-O class, the Yugo-class submarines continue to support KPN submarine missions. The Yugo's were bought from Yugoslavia in the 1980s probably because if their smaller size, making them ideal for the shallow water environment around the Korean Peninsula. The submarine's ability to operate closer to shore provides advantages over bigger submarines, which are limited to deeper waters, allowing it to access areas that were not feasible before. The main advantage is that the shallow water environment significantly complicates the sound propagation path, masking its presence against the South's technologically advanced SONAR systems. Along with the complicated path is the attenuation of sound in the shallow water environment, as well as the mixing of the sound with background noise that further complicates detection of KPN submarines. All of the mentioned factors have a net quieting effect for the submarine, making it extremely difficult to detect aurally. The

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[65]Ministry of National Defense, *Investigation Report on the Sinking of ROK Ship "Cheonan,"* (Ministry of National Defense, Republic of Korea) May 20, 2010, 1.

[66]"Korea, North—Navy," *Jane's World Navies*, July 12, 2017, http://janes.ihs.com/Janes/Display/jwna0082-jwna.

[67]Ibid.

[68]Joshua Cohen, "The Korea People's Army Naval Force," *Naval Forces* 35, no. 3 (2014), 16.

smaller size also makes it physically harder to see from a plane or radar. The midget submarines are ideal for insertion of SOF and other clandestine operations, but they are not suited for longer-term deployments or attacking shipping and allied troop escorts in the open ocean.

To accomplish the other leg of the KPN submarine mission, the Kim regime purchased Romeo-class submarines from the Chinese in the early 1970s.[69] Joshua Cohen explains the advantages of the Romeos over the smaller KPN submarines: "Nearing obsolescence, the ROMEO armament and endurance exceeds [sic] smaller 'Sang-O' and 'Yugo' class boats, making the type a better fit for operations in the vast Sea of Japan."[70] These 1,800-ton submarines present the biggest threat to ROKN destroyers, as well as to USN ships as they arrive into the Korean theater in a time of war, because of their ability to operate in deeper waters away from the coast where the majority of the KPN submarines are expected to operate. Although they are predicted to be decommissioning the Romeos and potentially replacing them with the Sang-O II's, recent observation of Romeo operations in the East Sea indicate their enduring threat to the South despite their age and low level of technology.[71]

The four major classes of KPN submarines and their numbers in the KPN support the North's offensive strategy of surprising the South with an overwhelming number of vessels at the onset of hostilities.[72] Certainly inferior in technology against the South, the Office of Naval Intelligence analysis explains the North's reasoning for maintaining such a large number of submarines by saying that

> North Korea lacks a sufficiently sophisticated technology base to field more advanced systems and so has chosen quantity over quality in its submarine force…Nevertheless, North Korea's strategy emphasizes

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[69]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 23.

[70]Joshua Cohen, "The Korea People's Army Naval Force," *Naval Forces* 35, no. 3 (2014), 15.

[71]Yu Yong-weon, "U.S. Watching Suspicious N. Korean Sub," *Chosun Ilbo* (July 24, 2017), http://english.chosun.com/site/data/html_dir/2017/07/24/2017072401158.html.

[72]Youn Young-sik, *Korea: A Naval Strategy for 'C' Function Navies* (Aberdeen: Center for Defence Studies, 1992), 20.

> employment of large numbers of low technology submarines and… saturate the defender's ASW forces.[73]

Youn Young-sik goes further to state that "although they are obsolescent by world standards, and particularly limited by noise and range, these range limitations, however, are no constraint in operations against the South, and in shallow water even noisy submarines would strain the South's ASW forces."[74] Unfortunately, recent discovery of a new class of submarine and North Korea's advancements in missile technology present a new subsurface threat.

North Korea continues to raise the stakes on threats against the security of the Korean Peninsula with the creation of a new class of submarine. In 2014, satellite imagery captured what is now believed to be an experimental ballistic missile submarine named Sinp'o or Gorae.[75] A KPN ballistic missile submarine significantly raises the North's ability to deliver a bigger payload or a second strike because of the difficulties of finding a submarine in the open ocean. An SLBM-capable KPN submarine would raise the demand for constant monitoring if the South were to counter a ballistic missile attack from the North. Again, a KPN submarine with a nuclear-tipped SLBM raises the threat in the region, moving the North closer to its goal of joining a handful of nuclear-armed states in the world with such capabilities. Joseph Bermudez explains the advantages of an SSB: "A core component of nuclear deterrence theory is having the ability to guarantee a nuclear response, regardless of the extent of the attack suffered. Ensuring this retaliatory, or 'second-strike' capability reinforces the credibility of a nuclear-armed state, as without this capability nuclear-armed adversaries may be tempted to launch a first strike."[76] At the same time Bermudez points out that although North Korea may have a second-strike capability, he believes that the technological inferiority of the KPN submarine fleet it

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[73]Office of Naval Intelligence, *Worldwide Submarine Challenges*, Washington, D.C., February 1997, 24, 28.

[74]Youn Young-sik, *Korea: A Naval Strategy for 'C' Function Navies* (Aberdeen: Center for Defence Studies, 1992), 21.

[75]Joseph S. Bermudez Jr. and Karl Dewey, "North Korea Modernises Submarine Fleet," *Jane's Intelligence Review*, February 9, 2016.

[76]Ibid.

provides a lower quality deterrent compared to other countries.[77] The Sinp'o/Gorae-class submarine's ability to deliver conventional or nuclear-tipped ballistic missiles may be in question now, but if the North is able to work through those challenges it will behoove the ROKN and the region to determine a method to hedge against it rather than trying to convince North Korea to give up this effort, which is likely to be futile. If China's difficulties in perfecting its SLBM program provides a sample timeline, it will likely require at least several years before the North secures this capability. But given Kim's relentless pursuit of becoming a nuclear-armed state coupled with his Byungjin policy, dual-track improvement in the North's economy and military, though, it is reasonable to assume that the SSB program will continue until at least some operational capability is achieved. In response to the North, the ROK government is pursuing an option of creating its own Korean Air and Missile Defense (KAMD) to defend against the North's missiles, as well as buying platforms from the United States to combat against the North's provocations.[78] As reported by Jane's World Navies, North Korea is continuing its march towards obtaining the capability to launch an SLBM from the depths of the deep sea.[79] Yoon explains that the threat of an SSB not only impacts South Korea, but has secondary effects in the region, elevating the security threat once more:

> The prospect of a North Korean deployment of Sinp'o/Gorae-class SSB in the East Sea drawing more attention from the ASW forces of the ROKN, the U.S. Navy, and JMSDF is most unwelcome to the Chinese military, especially if such scrutiny extends into the West Sea—a very sensitive area for the Chinese People's Liberation Army Navy, which bases its North Sea Fleet at Qingdao.[80]

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[77]Ibid.

[78]Karl Dewey and Nick Hansen, "Korea moves – South Korea Responds to Northern Provocation," *Jane's Intelligence Review*, May 30, 2014.

[79]"Korea, North—Navy," *Jane's World Navies*, July 12, 2017, http://janes.ihs.com/Janes/Display/jwna0082-jwna.

[80]Sukjoon Yoon, "Expanding the ROKN's Capabilities to Deal with the SLBM Threat from North Korea," *Naval War College Review* 70, no. 2 (2017), 60.

Table 1. KPN submarine procurement and development.[81]

Category	Class and Type	Tonnage & Building Year	Note
1st Phase	Whiskey class submarine	1350 ton, 1960	Purchased from the Soviet Union
2nd Phase	Romeo class submarine	1800 ton, 1973	Purchased from China and built locally
3rd Phase	Yugo class submarine	110 ton, 1987	Purchased from Yugoslavia and built locally
4th Phase	Sang-O class submarine	300 ton, 1995	Built by modifying the Yugo class
5th Phase	Yon-O class submarine	100 ton, unidentified	Used for special operations

2. DPRK Infiltration into and Attacks on the ROK

KPN submarines provide North Korea with an opportunity to engage the South with surprise and stealth. Because South Korea is essentially an island isolated by land from any of its neighbor besides North Korea, the only way to reach the South is via the seas. Surrounded by water on three sides with shallow features in the west and south, the environment provides the North with an ideal setting for exploiting the undersea domain. The shallow water enables clandestine operations south of the NLL for the vast inventory of the KPN's submarine force. As mentioned previously, it is hard to tell how many infiltration missions have been conducted in the past, but previously encountered events confirm that infiltrations happen. Surprisingly, the KPN demonstrated the extent of its submarine force's operational reach by infiltrating the ROK's southernmost island of Jeju-do, expanding the ROKN's search area.[82] This is significant because to reach Jeju-do, the midget submarines had to get past every layer of the ROKN defenses from the NLL on down. Assuming the ultimate goal of the submarines is to make it back home, it

[81]Adapted from Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 23

[82]Joseph S. Bermudez Jr., "Submarine was on Mission to Spy on South," *Jane's Defence Weekly*, September 25, 1996.

is highly likely that they did not operate too far off the coast due to their small size. This then would also indicate that whatever coastal detection and defenses the ROK has in place failed. It is hard to determine the goal of each infiltration, but each attempt carries with it significant potential for chaos in the South.

SOF insertion from submarines into the South has grave effects on its society, but it also points to the South's weaknesses in combating the submarine threat from the North. Forbes and Yoon highlights the North's practicability to continue resorting to its submarine fleet to apply pressure on the South: "While only two examples of major infiltration incidents are outlined above, there have been numerous instances over the years, as it is the simplest and easiest activity for the North to provoke the South."[83] Although the South has realized the weakness in its ASW capabilities and taken steps to address the problem, the long coastline, complexity of the environment, and number of interfering contacts provide stealth and advantage for the North Korean submarines. Within this setting, it makes sense for the North to continue to execute provocations against the South to delegitimize the ROKN's ability to combat the submarine threat. As stated by ONI, "the ability of a small, slow-moving diesel submarine to operate undetected in the shallows along the coast was demonstrated by a North Korean SANGO (shark) coastal submarine (SSC) in September 1996."[84] The report goes on to describe the SANGO's ability to freely enter and leave South Korean territorial waters over a period of three days.[85] The fact that the submarine was able to operate undetected for that long is a strong indication of the weakness in the ROKN's indications and warning of its ASW domain. Again, because of the ROKN's ASW weakness, according to Forbes and Yoon, "infiltration is predominantly by submarine, midget submarines and specialist vessels, usually via the West Sea, but also more recently the East Sea. Submarine insertion is the preferred method because of its obviously covert nature and the ability of

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[83]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 25.

[84]Office of Naval Intelligence, *Worldwide Submarine Challenges*, Washington, D.C., February 1997, 25.

[85]Ibid.

the KPN to insert around platoon-sized forces."[86] Major Harry Dies describes the level of impact a single KPN submarine can have on the South: "The North Koreans, numbering 26, abandoned their stranded submarine and rushed from the beach into the surrounding hills. What followed was a two-month bloody manhunt for the infiltrators that left all but two of the North Koreans dead. During the manhunt, 16 South Korean soldiers and civilians died and 27 were wounded."[87] Prior to the grounding, the submarine left and re-entered South Korean waters without detection.[88] Why did the infiltrators decide to land in Kangnung, which is just less than 100 miles from the DMZ? Did the North Korean's have intelligence that this area was less closely guarded by the South because of its proximity to the DMZ? The concerning part from the ROKN perspective is that the submarine did not sit and wait, but traveled in and out of its waters multiple times without counter-detection. Indeed, the initial spotting of the submarine was by a taxi driver.[89] As a result of the infiltration, the ROK military mobilized thousands of its soldiers and equipment in search of the infiltrators.[90] The infiltration in 1996 highlights the danger and threats posed by the North Korean special forces, but more important for the ROKN submarine force to take away is that, unlike its submarines, KPN submarines conduct operations on the other side of the NLL. Operations in waters that will one day become the battleground between the two countries provide a huge advantage for the North. Another major takeaway from this incident is the difficulty of defending the long coastline against the KPN submarine force.

North Korea delivered another blow to the ROKN when a second submarine was captured off the South's east coast on June 22, 1998, just two years from the incident in Kangnung. *Jane's Defence Weekly* explains that "this latest incident comes less than two

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[86]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 25.

[87]Harry P. Dies Jr., "North Korean Special Forces: 1996 Kangnung Submarine Infiltration," *Military Intelligence Professional Bulletin* 30, no. 4 (Oct-Dec 2004), 29.

[88]Ibid., 30–1.

[89]Ibid., 31.

[90]Ibid., 29.

years after a North Korean Sang-O class submarine ran aground in the same area."[91] As with the infiltration attempt in 1996, it was not the ROK military but a local fisherman that initially detected the submarine as it was trying to get lose from a fishing net.[92] This time, ROKN vessels were on the scene within an hour, but this event once again pointed out the ROKN's struggles to combat the KPN submarine threat. Not everything was negative about the capture of the Yugo-class submarine, however. The capture of a different class of submarine provided an insight into the KPN submarine program as described by Jane's: "Although variants of the Yugo class have been in production at the Yukdaeso-ri shipyard since the early 1960s, this latest seizure provides the South Korean and U.S. technical intelligence specialists with a rare opportunity to examine an in-service boat at first hand."[93] This is especially important due to the lack of information flowing out of North Korea. Unfortunately for the ROKN, North Korea's undersea efforts did not stop with the Yugo. This time, the KPN made it to the southern part of the peninsula, once again making it past the ROKN defenses and delivering another black eye to the organization. As described by Forbes and Yoon: "On 17 December 1998, a KPN semi-submersible high speed vessel was discovered a mile off the coast of Yeosu and a dozen ROKN ships were sent to intercept it."[94] The North's continued efforts to exploit the advantages of the subsurface domain increase the possibility of uncalculated engagements, which also carry with them the potential for another rendition of the West Sea battles or, worse, escalation into something bigger that neither side desires.

3. Acquisition and industry

North Korea's submarine force found its beginnings through foreign technology that eventually transferred into indigenous capability to create a force big enough to

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[91]Richard London, "Capture of North Korean Submarine Reveals New Capabilities," *Jane's Defence Weekly*, July 1, 1998.

[92]Ibid.

[93]Richard London, "Capture of North Korean Submarine Reveals New Capabilities," *Jane's Defence Weekly*, July 1, 1998.

[94]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 33

include it in the rankings as one of the top five largest submarine forces in the world.[95] The KPN has not only built submarines for its own use, but is now a supplier of submarines to countries like Iran, Myanmar, and Vietnam.[96] And as previously mentioned, the KPN is continuously making improvements to its inventory of submarines to fulfill its missions against the South.

The KPN purchased submarines from their fellow communist countries to establish their submarine force. North Korea purchased its first Romeo-class submarine from the Chinese. Quickly after obtaining the submarines, North Korea starting building its own. Joshua Cohen explains the role the Romeos purchased from China played for the KPN submarine force: "Serving as prototypes for Pyongyang's domestic production line, between 1976 and 1995 an estimated 17 Romeo [boats] were produced."[97] Jane's supports KPN's intentions of building a fleet of Romeo-class submarines: "This confirms the recent, annual construction of two to three units of the Chinese-Version (Type 033) of the 'Romeo' class patrol submarines. The submarine building programme is expected to continue, possibly peaking at about 30 boats. The KPN also retains the four ex-Russian 'Whiskey' class submarines."[98] The Whiskey and Romeo submarines were some of the first submarine purchases by the KPN. Although the KPN inventory included more than 20 Whiskey and Romeo submarines, it later stopped building the outdated Romeos and resorted to the Sang-O class submarines as the heart of its submarine force.[99] The North's shipbuilding industry gained critical experience from building the Romeos which, later enabled production of the follow-on submarines of its force.[100]

Although the KPN operated submarines for almost 30 years, the trend towards smaller submarines began with the purchase of the Yugo-class submarines from

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[95]"Korea, North—Navy," *Jane's World Navies,* July 12, 2017, http://janes.ihs.com/Janes/Display/jwna0082-jwna.

[96]Ibid.

[97]Joshua Cohen, "The Korea People's Army Naval Force," *Naval Forces* 35, no. 3 (2014), 16.

[98]"The Korean People's Navy—Further Perspectives," *Jane's Intelligence Review,* July 1, 1993.

[99]Office of Naval Intelligence, *Worldwide Submarine Challenges*, Washington, D.C., February 1997, 24, 28.

[100]\"Korea, North—Navy," *Jane's World Navies,* July 12, 2017, http://janes.ihs.com/Janes/Display/jwna0082-jwna.

Yugoslavia in 1987.[101] This was some thirty years after the North's purchase of the Whiskey.[102] Only a couple of year after the purchase of the Yugo, the North Korea introduced a class of submarines that would end up making up the core of its submarine force as described by Cohen: "In the early 1990s the 370 tons 'Sang-O' class was introduced. When production ended in 2003, approximately 38–40 boats were built."[103] Cohen further explains the North's commitment to its submarine force as it got creative to continue production of its midget submarines:

> In 1994, Pyongyang negotiated the sale of a reported 40 former Soviet GOLF and ROMEO submarines. Officially purchased for scrap metal, it is widely held components such as periscopes and torpedo tubes, among other were removed and fitted to several 'Sang-O' and 'Yugo' class mini-submarines built as hunter-killers rather than with lockout chambers for clandestine insertion. Several sources cite satellite imagery of ROMEO boats in dry-dock being dismantled as evidence the class is being cannibalized.[104]

This also supports the claim of Sang-O submarines replacing the Romeos in the KPN inventory. That was not the end of the North's creativity. The North introduced two more classes of midget submarines in the mid- and late 1990s, the Yono and P-4, for inclusion into its force.[105] The North's relentless pursuit of a fleet of midget submarines shows the incredible capability of its submarine-building program, as well as its commitment and reliance on the platforms to execute its peacetime and wartime maritime operations.

North Korea, however, is not finished making subsurface platforms. Jane's explains that the source of the North's innovations in its undersea domain is located in Pyongyang: "The factory in Pyongyang is known to modify and manufacture specialised

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[101]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 23.

[102]Ibid.

[103]Joshua Cohen, "The Korea People's Army Naval Force," *Naval Forces* 35, no. 3 (2014), 16.

[104]Ibid., 15.

[105]Ibid., 16.

military equipment such as midget submarines, very slender vessels (VSV), and unmanned aerial vehicles (UAV)."[106]

It is likely that improvements in technology and cheap cost of unmanned underwater vehicles provide another threat to the security on the Korean Peninsula will also be products of this factory. Not much is known with respect to the North's unmanned undersea capabilities yet, but it is rational to believe that they have a program looking to exploit the capability for their benefit and that it is only a matter of time before it is revealed. The North has used UAVs in the past to collect intelligence in the South. The advantages of stealth and freedom of maneuver provided by the subsurface domain may lead to a KPN UUV program that also needs to be addressed in the near future.

4. Current and Future Strategy

With its third leader at the helm, it is unclear if North Korea's ultimate goal of unifying Korea under its control continues to drive its military modernization. The economic gap between the two countries is so vast that it is hard for one to imagine a Korea controlled by the North. Nonetheless, the two countries remain at war and, therefore, it is plausible to expect the North to continue provocation against the South via the subsurface domain, pursue a second-strike capability with its SLBM program, and look to technology to come up with innovative ideas to further exploit the subsurface domain.

Provocations against the South via submarine infiltrations will continue for both wartime and peacetime operations. This is because the subsurface domain presents advantages for the capital-limited regime to exploit with its current fleet of submarines and deliver chaos without major improvements. The stealth provided by the subsurface domain enables the oldest and smallest of submarines to sneak into enemy waters and sink a ship with one torpedo, or it can send a squad or platoon of its SOF into the South creating havoc in major cities. Previous examples against the South only involved one submarine. One can only imagine what the North's fleet of 70 submarines could

[106] "Korea, North > Defence Production and R & D," *Jane's Sentinel Security Assessment – China and Northeast Asia*, December 3, 2015.

accomplish if it were fully deployed. Furthermore, the best way for North Korea to get its soldiers into the country is via a submarine. South Korea has proven that they do not have a system or assets that can detect a KPN submarine in its waters. They are taking strides to address the weakness in ASW, but that initiative did not take root until 2010. Joshua Cohen explains that "the ultimate goal is always to penetrate as far into the south possible, increasing chances of an undetected insertion mission. In late 1998, for example, a North Korean semi-submersible was intercepted only 2km off the coast of Yeosu in the Southern Jeolla Province."[107] The deep penetration into South Korean waters proves to the North Korean leadership that its subsurface forces remain its number one source of provocation against the South, able to meet its mission of inserting SOF deep into the South to create a second front, drawing forces away from the DMZ, and disrupting enemy shipping and troop escorts in war time scenarios. Cohen cites a recent study conducted by the U.S. Army Institute for Strategic studies that suggests that the KPN submarine force would present a challenge and survive longer than expected.[108] That prediction is probably based on the advantage the KPN has in numbers, which suggests that the North will continue to maintain its current inventory of submarines, if not increase it to secure that lead over the South.

From the North's perspective, there is no need to alter its submarine operations against the South. Throughout the years of operating its submarine force, the ROKN or the ROK military was not the reason for the capture of the two KPN submarines, rather, it was bad luck and lack of knowledge of the subsurface domain in the South. Bad luck is something that cannot be controlled, the latter can be fixed through purchase of updated charts of the South or clandestine surveys of the coasts that present favorable conditions for SOF infiltration. The reasons just mentioned supports ONI's statement that

> in wartime, North Korean submarines are expected to take full advantage of environmental conditions that exists off of South Korea…Heavy fishing and merchant traffic is present along the coast and will provide a cluttered

[107] Joshua Cohen, "The Korea People's Army Naval Force," *Naval Forces* 35, no. 3 (2014), 16.

[108] Ibid.

> environment generating high background noise levels that will help to hide a patrolling submarine's acoustic signature.[109]

The advantage provided by the natural environment plays a significant role in preventing early detection of the KPN submarines by ROK forces. It also negates the technological advances of the ROKN for counter-detection of the enemy.

The advent of SLBM and SSBs throws a twist in the existing defense structure of the South against the North. The new capability—once fully operational--will allow the North to use the subsurface domain to position its submarine anywhere around South Korea, probably the West coast of Japan, or even in the Yellow Sea against China, presenting a significant threat to all the countries in the region. Taking it one step further, once the North achieves the ability to load the SSB with a nuclear-tipped SLBM, North Korea will secure itself a legitimate second- strike capability, potentially deterring the use of nuclear weapons against it. Current ROKN capabilities may fall short of constant surveillance of the SSBs without U.S. involvement. From the North's perspective, it makes sense to hold onto its nuclear, missile, and SSB program, even in the face of strict sanctions against it.

Finally, as closed off as North Korea is to the rest of the world, innovations in technology make its way into the hermit kingdom. The advent of unmanned vehicles in the air and subsurface domain could provide a significant advantage at a relatively low cost. The North has already shown its ability to exploit those advantages via the UAVs with cameras mounted on them spying on the South. It is reasonable to assume that the North is also pursuing unmanned vehicles to exploit the subsurface domain as well. For example, one area where UUVs can play a significant role is in collecting environmental and sounding data against the South. Their small features make them extremely difficult to detect as well as allowing them to get extremely close to shore. Both capabilities enable it to obtain data close to shore that can prevent future KPN submarine infiltrations from going wrong.

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[109]Office of Naval Intelligence, *Worldwide Submarine Challenges*, Washington, D.C., February 1997, 28.

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III. SOUTH KOREAN SUBMARINE FLEET

A. INTRODUCTION

The Republic of Korea Navy (ROKN) bears the challenging responsibility of protecting its coasts. Surrounded by water on three sides, the ROK divides its maritime boundaries into three different fleets. Each fleet commander is responsible for everything that happens in the maritime domain of his area of responsibility. The vast expanse of the oceans, especially the dark and challenging undersea domain, presents the South with challenges of defending its coasts from the North's large inventory of outdated but dangerous submarines. Although historic figures like Admiral Yi Sun-shin realized the importance of the maritime domain in protecting the country in 1597, it was not until 1945 that the South Korean government recognized it.[110] Even then, significant modernization of its navy did not start until 1974.[111] The initial purpose of the South's navy was to protect its waters from the KPN, but it was the ROK's realization of its dependence on the seas to fuel its economy that drove modernization of its navy. The newfound importance of the seas, however, continues to challenge the ROKN leadership as it competes with the army for funding and resources. Despite the inter-service competition, the ROKN managed to establish itself amongst other navies, not just in the region, but around the world as a technologically advanced and capable force. This chapter introduces and provides the ROKN's history from the late 1940s to today, provides more specific details of the origins of the ROKN submarine force, its order of battle, and its acquisition and industry. Finally, it will analyze the evolution of ROKN Anti-Submarine Warfare (ASW) tactics and strategy before and after the Cheonan incident.

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[110] Park Yune-hee, *Admiral Yi Sun-Shin and His Turtleboat Armada*," (Seoul: Hanjin, 1978), 203–4.

[111] "New Interests Spur Force Development," *Jane's Defence Weekly*, May 22, 1996.

B. ROKN

The ROKN emerged from humble beginnings. Its origins were so modest that it did not possess a single warship at the time of its creation.[112] After Korea's independence from Japan in 1945, it started off as a Maritime Affairs Association, which quickly transformed into the Maritime Defense Corps on November 11, 1945.[113] This is the date that is recognized by the ROKN today as its birthday, but the official announcement of the ROKN did not come about until a few years later.[114] It was under the name of the Maritime Defense Corps that the first ROK built ship, a 300 ton patrol craft, entered service on February 7, 1947.[115] The Korean Coast Guard was established on June 1, 1946, but lacked any of the necessary skills to navigate the waters off its coast.[116] Commander Cho Young-Joo of the ROKN demonstrates the Korean Coast Guard's maritime competency by explaining that "although the advisory group [composed of members from the U.S. Coast Guard] had arranged for two LCIs [landing craft] to be transferred…it was not able to operate them and could not move them from Pusan to Jinhae by itself."[117] With the help of the advisory group, the Korean Coast Guard improved its competency to the point of acquiring the mission of patrolling its waters from the U.S. Navy's Seventh Fleet.[118] The advisory group also played a critical role in acquiring a total of 36 ships from the American military, creating the foundation of the ROKN.[119] Finally, the Korean Coast Guard was officially renamed the ROKN, still under

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[112]Kim Jong-Min, "North Korea's New Level of Threat and Improvement in the Republic of Korea Navy's Capabilities," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 260.

[113]Cho Young-Joo, *The Naval Policy of the Republic of Korea: From the Beginnings to the Twenty-First Century* (University of Hull, 2003), 25. https://hydra.hull.ac.uk/assets/hull:11085a/content.

[114]Ibid., 29–30.

[115]Ibid., 26.

[116]Ibid., 27.

[117]Ibid.

[118]Ibid.

[119]Cho Young-Joo, *The Naval Policy of the Republic of Korea: From the Beginnings to the Twenty-First Century*, (Hull, UK: University of Hull, 2003), 28. https://hydra.hull.ac.uk/assets/hull:11085a/content.

the leadership of Admiral Son Won-Il, on September 5, 1948, with the establishment of the ROK government.[120]

Three years after establishment of the Maritime Defense Corps, the ROK still lacked a respectable warship. Due to funding shortages, Admiral Son raised enough money "to purchase only one PC [patrol craft] of 450-tons full load (PC-701) equipped with a 3-inch gun for $60,000 [from the U.S. Department of State]…[and] three similar PCs from a civilian sales company for $36,000," explains Cho.[121] In three short years Admiral Son was able to raise a navy of over 30 ships, just before the start of the Korean war.[122] Although limited in capability to fend off the KPN, the ROKN contributed to the Korean War by partaking in coastal patrol missions, sea defense, evacuations, blockades, gunfire support missions, independent amphibious landings, mine warfare, and national coastal fishing grounds defense.[123] During the Korean War, the ROKN played a critical role by stopping a KPN ship carrying troops heading to capture Pusan, which later became a critical United Nations staging ground for the war.[124]

Following the Korean War, things changed rapidly for the ROKN as the South Korean economy really picked up steam during the second half of the 20th century. As Jane's Navy International says about the ROKN, "it has transitioned from a coastal defence force to one of five navies worldwide that fields surface combatants equipped with the Aegis combat system."[125] This is a significant achievement considering the ROKN's beginnings. Even with the incredible leap in capabilities and technology, the threat from North Korean People's Navy (KPN) remains serious and presents many challenges. The ROKN made significant improvements to its inventory of war craft to

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[120]Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2 (Spring 2010), 13; Cho Young-Joo, *The Naval Policy of the Republic of Korea: From the Beginnings to the Twenty-First Century*, (University of Hull, 2003), 28. https://hydra.hull.ac.uk/assets/hull:11085a/content.

[121]Cho Young-Joo, *The Naval Policy of the Republic of Korea: From the Beginnings to the Twenty-First Century*, (University of Hull, 2003), 30. https://hydra.hull.ac.uk/assets/hull:11085a/content.

[122]Ibid., 31.

[123]Ibid., 27, 32, 41–2, 45, 47.

[124]Ibid., 48.

[125]"Ambitions for a Blue Water Fleet Tempered by Start Realities," *Jane's Navy International*, April 20, 2011, https://janes.ihs.com/Janes/Display/jni74397-jni-2011.

combat North Korea's maritime threats. One of the major programs it undertook was in creating a formidable submarine force.

1. ROKN Submarine Force

The ROKN boasts a fleet of technologically advanced submarines with capabilities to challenge many nations around the world. The ROKN operates nine Jangbogo-I class (Type 209), nine Son Won-Il-class (Type 214) submarines. However, like its parent organization, the ROKN submarine force emerged from humble beginnings. Almost 30 years after commissioning its first vessel, in 1974, the ROKN was looking to modernize its navy to better defend against the KPN. Jane's provides an explanation of the origins of the ROKN's modernization program:

> Initially known as the Yulgok programme, the modernization push began in 1974 has more recently become known as the Force Improvement Programme (FIP)…The main elements of this modernization phase include the locally developed KDX destroyer, the Chang Bogo class [Type 209] diesel electric patrol submarine built under license from Germany and the U.S.-made P-3C Update II maritime patrol aircraft (MPA).[126]

The FIP initiated the first submarine purchase from Italy in 1974.[127] Unlike today's ROKN submarines, the one Cosmos-class submarine, which was equipped with anti-surface weapons, was purchased to conduct clandestine insertions into North Korea.[128] With this purchase, due to the South's lack of experience with submarines, Italy also provided instructors for operations and maintenance.[129] Following almost ten years of midget submarine operations, in 1985 the ROKN produced its first indigenous boat named the Dologorae (SS 051).[130] The two classes of midget submarines served to

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[126]"New Interests Spur Force Development," *Jane's Defence Weekly*, May 22, 1996.

[127] Yang, Nak-kyu, "The First Submarine Was to Infiltrate the North," *Asian Economy* (September 18, 2017), http://www.asiae.co.kr/news/view.htm?idxno=2017091512094767288.

[128]Yang, Nak-kyu, "The First Submarine Was to Infiltrate the North," *Asian Economy* (September 18, 2017), http://www.asiae.co.kr/news/view.htm?idxno=2017091512094767288.

[129]Ibid.

[130]Yang Nak-kyu, "Navy's First Submarine *Dolgorae*…Join History After 25 Years (Translated by author)," *Asia Economy* (June 30, 2016). http://asiae.co.kr/news/print.htm?idxno=2016063008251100539&udt=1.

conduct infiltrations and coastal operations, respectively.[131] But these submarines were not capable of extended open ocean operations to defend against KPN surface or subsurface vessels. Conversely, by this point, the KPN submarine force had approximately 30 years of submarine operations. This included Romeo operations, which supported long-range, open-ocean missions. The North also built its own submarines, supplementing its force of purchased vessels.[132] Thus, the ROKN was significantly behind the North with respect to dominating the subsurface domain around the Korean Peninsula up to the 1980s and well into the 1990s.

As late as 1992, the ROKN did not have a submarine capable of countering the KPN subsurface threat.[133] Although the KPN submarine force started with its first purchase of one submarine in the 1960s,[134] the ROKN did not acquire its first attack submarine until the early 1990s.[135] Additionally, due to the lack of expertise and the high cost of designing and creating its own submarine at the time, the ROKN decided to purchase its first submarine, the Type 209, from the Germans.[136] As explained by Zachary Keck, "the purchase of Type 209 and Type 214 submarines included technology transfers from HDW [Howaldtswerke-Deutsche Werft]."[137] Despite the late start, 19 years after acquiring the Jangbogo-I submarines, the ROKN submarine force celebrated

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[131]Yang, Nak-kyu, "The First Submarine Was to Infiltrate the North," *Asian Economy* (September 18, 2017), http://www.asiae.co.kr/news/view.htm?idxno=2017091512094767288; Yang, Nak-kyu, "Navy's Submarine Force Command Establishment Next Month…ROK Submarine History (Translated by the author)," *Asian Economy* (January 11, 2015), http://www.asiae.co.kr/news/print.htm?idxno=2016063008251100539&udt=1.

[132] Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 23.

[133]Youn Young-sik, *Korea: A Naval Strategy for 'C' Function Navies* (Aberdeen: Center for Defence Studies, 1992), 22.

[134]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 23.

[135]Yang, Nak-kyu, "Navy's Submarine Force Command Establishment Next Month…ROK Submarine History (Translated by the author)," *Asian Economy* 15, no. 11 (January 11, 2015), http://www.asiae.co.kr/news/print.htm?idxno=2016063008251100539&udt=1.

[136]"ROKN Chang Bogo Class Submarines, South Korea," *Naval Technology*, accessed September 27, 2017. http://www.naval-technology.com/projects/chang-bogo-class-submarine-south-korea-rokn/.

[137]Zachary Keck, "South Korea Goes 'All In' on Submarines," *The Diplomat* (August 17, 2013). http://thediplomat.com/2013/08/south-korea-goes-all-in-on-submarines/?allpages=yes&print=yes.

200,000 miles of accident-free submarine operations.[138] Additionally, Cho Ah-mi explains that "the force not only successfully conducted over 300 submarine operations, but participated in over 19 foreign-led exercises, displaying its ability to execute missions in the Pacific and India oceans."[139] South Korea not only boasts a professional and capable submarine force, but its submarine-building capability has matured to a level acknowledged by those in the region. This is supported by Indonesia's purchase of three Type 209 submarines built by Korea's Daewoo Shipbuilding and Marine Engineering (DSME) under license from Germany.[140]

One reason why the ROKN was behind in establishing its subsurface forces was because it placed a higher priority on combating the maritime threat from the North's surface forces first.[141] Japan Maritime Self-Defense Force (JMSDF) Vice Admiral (ret.) Yoji Koda suggests that the ROKN may have been influenced to focus on the anti-surface fight because of Western assumptions of the KPN's intentions.[142] Another reason for the submarine force and later the ROKN Anti-Submarine Warfare (ASW) capabilities taking a back seat is related to the land-centric focus of the times in South Korea. Justifiably, the South Korean government focused on deterring the large North Korean army from flooding across the DMZ. This meant the army received a bigger portion of the defense budget over the navy during and following the Korean War. This explains Admiral Son's fundraising to buy the ROKN's first combat ship as mentioned earlier. The competition amongst the ROK services, coupled with a heavy reliance on U.S. naval support, influenced the size of the ROKN in its early stages of development.[143] Thanks to the

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[138]Cho Ah-mi, "Navy's Flotilla Nine (Translated by the author)," *National Defense Press* (September 13, 2012), https://bemil.chosun.com/nbrd/bbs/view.html?b_bbs_id=10002&num=2672.

[139]Ibid.

[140]"Indonesia Signs Pact with South Korean Firm on Purchase of Three Submarines," *BBC Monitoring Asia* (January 6, 2012), ProQuest ID: 914275343.

[141]Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2 (Spring 2010), 19.

[142]Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2 (Spring 2010), 19.

[143]Bruce Klingner, "Measures to Enhance Combined South Korean – U.S. Naval Capabilities," *The Journal of East Asian Affairs* 27, no. 1 (2013), 4.

recent rapid economic growth of South Korea, however, the ROKN has since managed to build a world-class submarine force since the mid-1980s.

Shortly after the arrival of the first submarine in Korea, the ROKN decided to create a separate flotilla for its subsurface forces as Cho explains: "FLOT 9 was initially the 57th Submarine squadron under Flotilla 5 until its creation in on October 1, 1995."[144] FLOT 9's responsibilities focused on administrative matters, and the ROK Fleet headquarters controlled submarine operations. One of the major changes with the establishment of the submarine forces command is that submarine operations are now commanded from Jinhae.[145]

The ROKN Submarine Force Command (CSF), established in 2015, serves as the single commander of its fleet of Type 214 and Type 209 submarines. Prior to the establishment of its submarine force command, ROKN submarines reported to the one star in charge of Submarine Flotilla Nine (FLOT 9) based in Jinhae. The small city of Jinhae on the southeastern corner of the South continues to be the center of submarine operations, as well as the location of the Submarine Force Command. The stand-up of the submarine force is an indicator of the newfound significance of subsurface operations, as well as ASW, within the ROKN. An Asian Economy article implies that the stand-up of the Submarine Force Command and making its leader the equivalent rank to those of the fleet commanders captures the rising significance of submarine operations in the ROKN.[146] The creation of the command also aligns well with the receipt of the ninth and final Son Won-Il-class submarine, officially ending the second phase of its submarine improvement program.[147] A bigger staff with the appropriate communications and support structure provided by the new command is necessary to support the 18

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[144]Cho Ah-mi, "Navy's Flotilla Nine (Translated by the author)," *National Defense Press* (September 13, 2012), https://bemil.chosun.com/nbrd/bbs/view.html?b_bbs_id=10002&num=2672.

[145]Ministry of National Defense, "2016 Defense White Paper," 50.

[146]Yang, Nak-kyu, "Navy's Submarine Force Command Establishment Next Month…ROK Submarine History (Translated by the author)," *Asian Economy* 15, no. 11 (January 11, 2015), http://www.asiae.co.kr/news/print.htm?idxno=2016063008251100539&udt=1.

[147]Yoon, Byung-noh, "Delivery of the 9th Type-214 Class Submarine (KSS-II), ROKS *Shin Dol-suk*,(Translated by author)" *Defense Daily* (September 7, 2017), http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20170907&parent_no=5&bbs_id=BBSMSTR_000000000005.

submarines in its inventory, as well as the nine KSS III 3,000-ton submarines scheduled to start production in 2020.[148]

The ROKN submarine force adds to the navy's capabilities to defend its seas and maintain the sea lanes of communications critical to sustaining its economy open. The Defense Daily explains the role of the ROKN submarines: "During war time, submarines observe and attack the enemy on the front lines, but during peacetime its role is to prevent wars and protect the sea lanes of communication (SLOC) by displaying its asymmetric capabilities to ensure success of the country."[149] Jane's Sentinel Security Assessment adds that the submarine's primary mission is to counter the KPN submarine threat and support maritime strike. These are in addition anti-surface operations to defend its surrounding seas. Although the ROKN submarine's main mission is to counter KPN submarines, Bruce Klingner mentions that

> the greatest South Korean vulnerability continues to be from North Korean submarines. Despite post-Cheonan efforts, ROK ASW capabilities remain limited due to low manning, insufficient sonobuoys, outdated sensors and weapons, and insufficient C4I capabilities, particularly interoperability with U.S. forces.[150]

Vice Admiral (ret.) Yoji Koda explains that "with respect to ASW, however, it was inadequate, even after the introduction of the three KDX-I destroyers and the Lynx helicopter. The ASW posture of the ROKN still remains questionable today, in relation to the perceived threat of North Korean submarines and the geopolitical nature of the country."[151] Recommended remedies for the weakness in ASW will be covered later on in the chapter, but it is important to remember that ROKN submarines undoubtedly have the technological advantage over KPN submarines in sensors, weapons and navigation

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[148]Yang, Nak-kyu, "Navy's Submarine Force Command Establishment Next Month…ROK Submarine History (Translated by the author)," *Asian Economy* 15, no. 11 (January 11, 2015), http://www.asiae.co.kr/news/print.htm?idxno=2016063008251100539&udt=1.

[149]Song Chang-kyu, LCDR ROKN, "Submarine, Its Secretive Appeal (Translated by Author)," *Defense Daily* (August 13, 2013), http://kookbang.dema.mil.kr/kookbangWeb/print.do.

[150]Bruce Klingner, "Measures to Enhance Combined South Korean – U.S. Naval Capabilities," *The Journal of East Asian Affairs* 27, no. 1 (2013), 11–2.

[151]Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2 (Spring 2010), 22.

systems, but the force's relatively young age, complex environment, and limitations in current technology continue to challenge the force from successfully countering the KPN subsurface threat.

2. ROKN Submarine Order of Battle

The ROKN operates some of the world's technologically advanced submarines today. The Jangbogo I and Il submarines make up the ROKN's submarine force. The navy received delivery of its ninth Jangbogo II (Type 214) class submarine on September 7, 2017.[152] This delivery marks the end of the second phase of the ROKN submarine improvement program, which set an ambitious goal of acquiring nine Jangbogo II submarines by 2018 and upgrading its Jangbogo I submarines.[153] The delivery of the Republic of Korea Ship (ROKS) Shin Dol-suk brings the ROKN submarine inventory to 18 diesel-electric attack submarines: nine Type 209s and nine Type 214s.[154] The South is planning on replacing the midget submarines with a newer class of midget submarines in the third phase of its submarine program.[155]

The Jangbogo I class (Type 209) submarines served as the first ROKN subsurface unit capable of extended operations. As mentioned before, the 209s were purchased from the Germans to counter the KPN submarine force.[156] Kim explains that

> the ROK Navy introduced Jangbogo I class submarine 209, which was built in Germany, in 1992. This was the beginning of the ROK Navy to secure underwater operational ability. Although the ROK Navy secured

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[152]Yoon, Byung-noh, "Delivery of the 9th Type-214 Class Submarine (KSS-II), ROKS *Shin Dol-suk*,(Translated by author)" *Defense Daily* (September 7, 2017), http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20170907&parent_no=5&bbs_id=BBSMSTR_000000000005.

[153]"Korea, South-Navy," *Jane's Sentinel Security Assessment*, September 8, 2017, http://janes.ihs.com/Janes/Display/1322709.

[154]Yoon, Byung-noh, "Delivery of the 9th Type-214 Class Submarine (KSS-II), ROKS *Shin Dol-suk*,(Translated by author)" *Defense Daily*, September 7, 2017, http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20170907&parent_no=5&bbs_id=BBSMSTR_000000000005.

[155]"Korea, South-Navy," *Jane's Sentinel Security Assessment*, September 8, 2017, http://janes.ihs.com/Janes/Display/1322709.

[156]"Ambitions for a Blue Water Fleet Tempered by Start Realities," *Jane's International*, April 20, 2011, https://janes.ihs.com/Janes/Display/jni74397-jni-2011.

> and employed midget submarines in 1980s, those submarines had many limitations… for the ROK Navy to operate… [them] for covert operations for a long term.[157]

The 209s thwart the competition with their newer technology, size, weapons systems, and quality of their crew. But, the submarine is not the best asset to conduct wide-area searches in support of the ASW mission. This is especially the case with the Jangbogo I class because it is limited to hull-mounted sensors as its primary acoustic source to detect the enemy. The hull-mounted sensors, combined with the effects of shallow waters of the West Sea, essentially remove the submarine's ability to detect KPN submarines operating on the battery at a range considered to be an advantage. Unless the adversary is snorkeling to charge its battery, it is more likely that the ROKN's first flight submarines will not detect their target until it is too late, as they are passing each other. This scenario is likely the case in the East Sea as well because it is believed that the KPN midget submarines will remain close to the coasts rather than heading out to the open ocean as they enter ROKN waters. KPN submarine littoral operations minimize the technological advances of the 209s. Regrettably, the advantages of the first flight Jangbogo submarines only provide a platform with better armament and extended operations compared to the Dolgorae class submarines. This does not, however, mean that the submarines are incapable of carrying out their anti-surface warfare mission. Due to the louder nature of KPN surface ships and the ROKN's ability to detect ships via multiple sources, ROKN submarines maintain the advantage to strike first. Upgraded hardware and software will definitely improve the submarine's ability to execute its anti-surface and SLOC control missions, but without a breakthrough in passive SONAR technology, it is unlikely that they will improve their ASW capability. In the deep waters of the East Sea, any upgrades will improve initial detection ranges, but that will require the KPN submarines to venture further out into the open ocean.

Type 214 submarines are significantly more advanced compared not only to the KPN's submarines, but also compared to the Jangbogo Is. The new class boasts an

[157] Kim Jong-Min, "North Korea's New Level of Threat and Improvement in the Republic of Korea Navy's Capabilities," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 263–4.

advertised ability to track up to 300 contacts at once, remain submerged up to two weeks without recharging, and launch cruise missiles to support maritime strike operations.[158] The *Chosun Ilbo* exclaimed that "it is touted as one of the world's quietest submarines."[159] One of the main improvements to the new flight is the advent of the air-independent propulsion (AIP). This new technology coupled with improved battery cells is what enables longer submerged operations, allowing the unit to maximize its stealth and minimize counter-detection.[160] The 214s also boast the capability to conduct maritime strikes. With extremely short warning and reaction time to military operations on the Korean Peninsula, the added ability to strike strategic North Korean targets with little to no warning provides the South with pre-emptive or preventative options. As mentioned before, however, executing such options would require a change in current ROKN procedures to allow its forces to operate north of the NLL. Regardless, having the ability to conduct such strikes could help level the playing field against the massive number of Northern artillery pieces pre-positioned or against weapons of mass destruction (WMD) sites in the North.

3. Acquisition and Industry

The ROK's military industry includes general shipbuilding, which operates and competes at the international level. Its submarine-building history goes back to the mid-1980s with the production of its Dolgorae class midget submarines.[161] As Yang explains, "the National Defense Science Research Center established the foundation for submarine production and played a critical role in advancements in ROKN subsurface weaponry."[162] Since the launching of the Dolgorae, the ROK's shipbuilding industry—carried out by Hyundai Heavy Industries (HHI) and Daewoo Shipbuilding and Marine

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[158] Yu Yong-won, "Navy takes delivery of 1,800-Ton Submarine," *Chosun Ilbo* (July 11, 2017), http://english.chosun.com/site/data/html_dir/2017/07/11/2017071101005.html.

[159] Ibid.

[160] "Korea, South-Navy," *Jane's Sentinel Security Assessment*, September 8, 2017, http://janes.ihs.com/Janes/Display/1322709.

[161] Yang Nak-kyu, "Navy's First Submarine *Dolgorae*…Join History After 25 Years (Translated by author)," *Asia Economy* (June 30, 2016). http://asiae.co.kr/news/print.htm?idxno=2016063008251100539&udt=1.

[162] Ibid.

Engineering (DSME)—has produced 19 submarines in total.[163] Vice Admiral Koda's comment accurately captures the extraordinary feat the ROKN accomplished in just over 25 years: "The ROKN, which had started its submarine force from nothing, paved the way to a real undersea-warfare capability—establishing training procedures for the crews, developing operational concepts, and learning the technology needed for building diesel-electric submarines."[164] The industry is now exporting submarines to other nations in the region.[165]

The ROK government operates a robust acquisition program to supplement any technology they do not have at this time. The Defense Acquisition Program Administration (DAPA) is the organization responsible for coordinating any and all imports for the ROK military. DAPA's website lists in mission function as: acquisition planning; defense industry promotion and export cooperation; analysis, testing and evaluation; defense improvement project management; and military supplies and contract management.[166]

a. Indigenous Submarine Production Program

South Korea has a robust, capable, and ambitious submarine-building program, producing one of the world's quietest submarines. The ROKN's purchase of the Cosmos and operation of Dolgorae midget submarines served as a precursor to acquire and develop the technology and industry for its latest class of Jangbogo III attack submarines. As explained by Koda, "the ROKN selected the German-developed Type 209 submarine for its first-generation submarine (known as the Chang Bogo class). The navy imported the first boat; the South Korean shipbuilding industry assembled the second and the third

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[163]Ibid.; "Korea, South-Navy," *Jane's Sentinel Security Assessment*, September 8, 2017, http://janes.ihs.com/Janes/Display/1322709; and Yoon, Byung-noh, "Delivery of the 9th Type-214 Class Submarine (KSS-II), ROKS *Shin Dol-suk*,(Translated by author)" *Defense Daily*, September 7, 2017, http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20170907&parent_no=5&bbs_id=BBSMSTR_000000000005.

[164]Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2 (Spring 2010), 22.

[165]"Indonesia Signs Pact with South Korean Firm on Purchase of Three Submarines," *BBC Monitoring Asia*, January 6, 2012, ProQuest ID: 914275343.

[166]Defense Acquisition Program Administration, http://www.dapa.go.kr/mbshome/mbs/dapa_eng/subview.jsp?id=dapa_eng_020100000000

boats; and the fourth was built in country, from keel laying to final fitting-out."[167] The technology transfer and experience from building the Jangbogo submarine enabled the industry to then go on and build the follow-on Type 214 with help from the Germans. Unlike its predecessor, all nine of the Son Won-Il class boats were built by HHI and DSME. ROKN is not finished with building submarines. The submarine force has initiated a three-phase submarine modernization plan. Jane's explains that Phase 1 is to upgrade the Jangbogo I boats; Phase 2 will include the production of nine Jangbogo II submarines as well as up to nine 3,000 ton KSS 3 or Jangbogo III submarines; and final Phase 3 will replace the midget submarine force with a new class.[168] It is anticipated that Jangbogo III submarines will replace the aging Type 209s.

As mentioned before, the ROK submarine industry has matured to the point of exporting its technology to other countries, as well as providing maintenance. Moon Kun-shik, a professor at the Hannam University, explains that with the ROK's sale of its submarines to Indonesia "it not only joins eight other countries with capabilities to export them, but stands amongst Germany, France, Russia, and Sweden who actually sell them around the world."[169] All the while, Kim Jong-Min explains that the ROK continues to build its fleet of next-generation submarines, further solidifying its building expertise. He explains: "In 2000, the ROK government decided on the German 214 class submarine as the ROK Navy's main submarine and the ROK Navy built one 214 class submarine in each year sequentially from 2007."[170] Kim also explains the country's desire to build a new class of submarines that will certainly test its shipbuilding ability:

> The ROK Navy is pushing forwards a plan to secure the 3,000-ton class Jangbogo-III submarine as following a [sic] 214 class submarine. Based

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[167] Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2 (Spring 2010), 21.

[168] "Korea, South-Navy," *Jane's Sentinel Security Assessment*, September 8, 2017, http://janes.ihs.com/Janes/Display/1322709

[169] Moon Kun-shik, "20 Year After Obtaining Building Technology Korea wins Indonesian Bid Over TKMS Shipbuilding, (Translated by author)," January 20, 2013, http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20130121&parent_no=10&bbs_id=BBSMSTR_000000000138.

[170] Kim Jong-Min, "North Korea's New Level of Threat and Improvement in the Republic of Korea Navy's Capabilities," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 266.

> on submarine building capability from [the] 209 and 214 classes submarines, it is estimated that the ROKS Jangbogo-III submarine's equipments and systems including combat system, detecting system and embarked weapons will be domestically produced.[171]

Successful completion of the Jangbogo III will certainly be an engineering feat for a country that knew nothing about building submarines just some 30 years ago. A quote from Jane's accurately captures the industry and the Navy's continued desire for innovation and to push its ambitions to the limit: "It is nevertheless known that the navy intends to seek a submarine capable of operating further from South Korean shores, either by upgrading the Chang Bogo class or introducing a new type."[172] It will be interesting to see the changes the ROK's 3,000-ton submarine could bring once it is finished sometime around 2020. Finally, to take shipbuilding to the next level as a response to the North, many in the ROK are discussing options of building their own nuclear submarines.[173] This will certain push the ROK's abilities to the limit, likely resulting in outreach to those countries with experience building nuclear submarines.

b. Potential Integration of Non-traditional Subsurface Forces

Technological advances today provide alternative options to overcome challenges in the subsurface domain. The advent of computers with complex communications equipment enable coordination among air, surface, and subsurface assets, bringing multiple domains to support the fight beneath the waters. Perrett and Sweetman explain that "facing great difficulty in finding North Korean submarines, the South Korean navy is pushing for a big increase in its maritime aviation force…. The country will have a force of 16 upgraded Lockheed Martin P-3 Orion maritime aircraft by 2018."[174] Aircraft present a significant threat for submarines due to their ability to quickly get on top of a

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[171]Kim Jong-Min, "North Korea's New Level of Threat and Improvement in the Republic of Korea Navy's Capabilities," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea: Institute for Maritime Strategy, 2011), 270.

[172]"New Interests Spur Force Development," *Jane's Defence Weekly*, May 22, 1996.

[173]Ridzwan Rahmat, "South Korean Navy Reiterates Calls for Nuclear Submarine During Parliamentary Hearing," *Jane's Defence Weekly*, October 12, 2016.

[174]Bradley Perrett and Bill Sweetman, "Sub-Hunting," *Aviation Week & Space Technology* 175, no. 23, July 8, 2013, 27.

submarine's reported position. Though their time on station is limited and significantly shorter than a surface ship or submarine, 16 aircraft would enable the ROKN to provide over 10 hours of continuous coverage in an area with suspected submarine operations.

Unmanned aerial and submerged vehicles are another recent invention that could play a big part in ASW for the ROKN. Unmanned Aerial Vehicles (UAVs) could be used in conjunction with Maritime Patrol Aircraft (MPA) or by themselves to increase KPN submarine detection. Their smaller size and smaller engines provide a smaller and quieter target for detection by KPN submarines, enabling a UAV to track the submarine for constant targeting data. During wartime scenarios, UAV operations would provide early warning of KPN submarine locations without the dangers of losing an aircraft and its crew prior to taking out the North's coastal defense cruise missile sites. UUVs provides the same type of advantages to the ROKN, allowing presence without the dangers of losing the crew in contested or uncontested waters at a relatively cheaper price. For the numerically inferior South, a fleet of UUVs could serve to keep tabs on the numerous KPN submarines, providing continuous or periodic contact reports for other manned platforms to engage once available. This would be ideal for use against the KPN SSB if that program comes to fruition. Finally, UUVs can also be utilized to infiltrate deep into the North without needing to snorkel in to obtain the much-needed environmental data for the ROKN. As mentioned before, local environmental data can help ensure weapons and sensor optimization to maximize effectiveness against the North.

Sound Surveillance System (SOSUS) have been around for a while in the United States. SOSUS is another wide-area search capability that would provide cueing for the ROKN to detect KPN submarines. The ROKN's SOSUS system would allow operators on land to surveil its surrounding waters without putting crews at risk. The only drawback to the system is that shallow water effects would have the same impact on performance as they do for submarines and other naval platforms. As Vice Admiral Koda points out, "the ROKN has been continuously modernizing its fleet, but its wide-area

ocean-surveillance capability—which is indispensable to both coastal defense and blue-water operations—does not look sufficient at present."[175]

Finally, a ROKN nuclear submarine is an option available to the South to overcome the growing threat from the KPN's SSB and SLBM program.[176] The significantly long on-station time provided by a nuclear submarine will surely provide an advantage for the South. However, they may not be worth the cost of designing, building, operating, and maintaining a nuclear boat. As mentioned by Zachary Keck and Henry Sokolski, "South Korea could acquire nuclear submarines…by buying or leasing American-built SSNs…[but] a more realistic option is for South Korea to build its own."[177] Buying or leasing an SSN from the United States is highly unlikely due to the U.S. Navy's close hold on its nuclear technology. Additionally, South Korea's recent compromise of Top-Secret material to the North, and its attempted cover-up, strengthens the USN's reluctance to sell the technology.[178] Plus, with the ROKN's Son Won-Il class submarines being able to remain submerged for greater than two weeks, this capability should provide sufficient on-station time to defend against the KPN SSBs. The funds an effort required to build a Korean-built nuclear submarine would be better spent on buying more diesel submarines or investing in improving current battery technology.

C. EVOLUTION OF ROKN ASW TACTICS AND STRATEGY

1. Before the ROKS Cheonan Incident

ASW is not a submarine-only warfare area. It is true that the best platform to go against a submarine is another submarine, but the submarine is not necessarily the best platform to initially detect another submarine. ASW, dubbed "awfully slow warfare" by

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[175]Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2 (Spring 2010), 29.

[176]Yi Whan-woo, "Seoul Designs Nuclear Submarine Reactor," *Korea Times* (October 1, 2017), http://koreatimes.co.kr/www/news/nation/2017/10/113_237239.html.

[177]Zachary Keck and Henry Sokolski, "South Korea is About to Make a $7 Billion Nuclear Submarine Blunder," *The National Interest* (September 30, 2017), http://nationalinterest.org/blog/the-buzz/south-korea-about-make-7-billion-nuclear-submarine-blunder-22540

[178]"S. Korea's Military Can Afford No More Incompetence and Lies," *Chosun Ilbo* (October 11, 2017). http://english.chosun.com/site/data/html_dir/2017/10/11/2017101101537.html.

some, captures the time-intensive nature of the pursuit. Finding a needle in a haystack takes time, especially when the environmental conditions and human factors are included. Therefore, by combining surface, air, and subsurface assets available to the navy, the awfully slow process speeds up. Placing multiple sensors from surface ships, helicopters, airplanes and submarines in an area suspected of containing an enemy subsurface unit increases the probability of finding a submarine. Multiple sensors finding the same contact allows for triangulation of the enemy providing an accurate position for friendly forces to exploit. One of the many difficulties in ASW is the coordination of all the different assets partaking in the hunt. Controlling the different assets operating in different domains requires significant communication capabilities and expertise in the different warfare areas. Additionally, the limited communication options beneath the water present challenges for coordinating with friendly submarines. For that reason, traditionally in the ROK, the ROKN Operations Command, also known and ROK Fleet, played the role of the overall ASW commander. First, Second, and Third Fleets served as the on-scene commanders but, mainly due to their lack of subsurface picture, they had to reach back to ROK Fleet for coordination with friendly submarines. As Perrett and Sweetman comment on the ROKN's limited ability to detect KPN submarines, citing an ROK legislator: "South Korean warships detected only 28% of North Korean submarines that exercised in the first quarter of 2010…."[179]

Before Cheonan, the ROKN focused on securing its blue-water capabilities. Its ambition before the sinking was focused outward to the rest of the region and the world. As Yoon explains,

> Before the sinking of the ROKS Cheonan and the shelling of Yeonpyeong-do, the ROKN's naval operational concepts focused on large, widely dispersed naval warfare, mainly conducted on the high seas i.e., deep water anti-submarine warfare (ASW) and anti-air warfare (AAW) and anti-surface warfare (ASuW).[180]

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[179]Bradley Perrett and Bill Sweetman, "Sub-Hunting," *Aviation Week & Space Technology* 175, no. 23, July 8, 2013, 28.

[180]Yoon Sukjoon, "Some Current Issues in Korean Maritime Security and Maritime Strategy," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 163.

Although the common belief is that the Jangbogo submarines were acquired for the ASW mission, as discussed above, they are better as ASuW platforms. Their bigger size and armament, compared to the Dolgorae midget submarines, make them sea-worthy in many of the world's oceans, supporting the ROKN's desire to push beyond the Korean Peninsula. FLOT 9's motto at the time was: "To the Sea, To the World." This was also supported by President Lee Myung-bak's decision to participate in the anti-piracy operations near the Gulf of Aden, making it the ROKN's first mission outside of the Korean Peninsula.[181] Jane's also observes that "one year after the corvette was lost, the RoKN is having to balance its blue water ambitions with the need to construct an effective counter to littoral asymmetric threats."[182] It is not that the ROKN was not concerned about the KPN submarine problem, but that they believed they had it under control, and therefore focused on its blue-water goals.

The ROKN did not completely disregard ASW or shallow water operations. Forbes and Yoon state that "between 1970 and 1990 the ROKN conducted combined submarine exercises with the U.S. Navy, and since 1997 has also focused on Ship ASW Readiness and Evaluation Measurement (SHAREM) [*sic*]."[183] The problem with these exercises was that they were driven by the surface commands in the ROK, instead of the submarine commands. FLOT 9 mostly provided a real submarine for the surface ships to detect and track, as opposed to getting involved in the planning of tactics and strategy. Additionally, although exercises in areas of possible conflicts in the future best prepare the crews, these exercises did not reflect reality because operating in excessively shallow water unnecessarily jeopardizes the crew of the submarine. Forbes and Yoon clearly spells out that "as demonstrated by the ROKS Cheonan, the ROKN does not have the requisite capability (or number of vessels) to sufficiently interdict North Korean midget

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[181] Jun Seung-yup, "Sending Navy Ship to Somalia (Translated by Author)," *Yonhap News Agency* (October 29, 2008). http://v.media.daum.net/v/20081029150006765; "Korea, South-Navy," *Jane's Sentinel Security Assessment*, September 8, 2017, http://janes.ihs.com/Janes/Display/1322709.

[182] "Ambitions for a Blue Water Fleet Tempered by Stark Realities," *Jane's Navy International*, April 20, 2011, https://janes.ihs.com/Janes/Display/jni74397-jin-2011.

[183] Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 50.

submarines in shallow waters."[184] Unfortunately, the 46 lives lost in the sinking of the Cheonan served as the wake-up call for the ROKN to realize the extent of its weakness in this area and make improvements.

2. Post-ROKS Cheonan Incident

Significant changes followed the notorious sinking of the Cheonan in the West Sea near the Northwest islands. As Jane's points out, the incident "exposed weaknesses in the South's early warning, command, control and intelligence and anti-submarine warfare (ASW) capabilities as well as a general lack of preparedness to counter unexpected threats."[185] Forbes and Yoon explain that in recognizing its weaknesses, the government altered its strategy to include "a more active deterrent posture (particularly against submarines); enhancement of the ROK- U.S. alliance; revising the self-restraining RoE; reinforcement of assets to defend the five islands in the disputed NLL; and increasing the defence budget to acquire more hard power-oriented capabilities."[186] Especially in the ASW realm, the ROKN intends to increase surveillance of KPN submarine bases, develop an early warning system, and acquire technologically advanced assets to assist in combating the threat.[187] These efforts indicate the South's realization of the importance of ASW in protecting its seas. Other initiatives in improving defense were accomplished with procedural changes.

Previous restrictions on the on-scene commander were removed following the Cheonan incident. Yoon explains that "the ROKN has changed its combat readiness posture to become more robust… to allow more importance to be granted to the right of self-defense…. In consequence, more authority has been delegated from senior levels of

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[184]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 45.

[185]"Ambitions for a Blue Water Fleet Tempered by Stark Realities," *Jane's Navy International*, April 20, 2011, https://janes.ihs.com/Janes/Display/jni74397-jin-2011.

[186]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 40–1.

[187]Ibid., 51.

the ROKN to commanders on the scene."[188] Although this revision is a step in the right direction, it does not apply to all ASW scenarios. For example, this procedural change makes sense for scenarios against surface and air units where the enemy's identity is clear. However, in the opaque subsurface realm, where positive identification of the enemy is murky at best, it may carry with it unintended consequences. Initial detection ranges in shallow waters can be very short, but with the environmental factors and traffic density off the Korean Peninsula, this could make the ranges even shorter, which ultimately means less time to react. Although the regulation provides latitude for the unit commander to determine if an action is required for self-defense, it is significantly harder to decipher the enemy's intent when you can barely hear him, let alone physically locate him. The margin for error is comparatively greater in the subsurface realm.

The above scenario is for submarine versus submarine, but how does the calculus for self-defense change for a KPN submarine versus a ROKN surface ship? Due to the clandestine nature of submarine operations, it is highly likely that the surface ship will not know the whereabouts of friendly submarines. The ship has to reach out to higher headquarters as it attempts to determine if the unidentified submarine is one of its own or not. Even if it figures out that it is not one of its own, that does not automatically make it a KPN submarine. With the proliferation of submarines and proximity to China and Japan, depending on the location, the sub may or may not be from the North. During these trying times of figuring out the origins of the submarine, how does the sinking of the Cheonan impact the unit commander? The implication is that the change in policy, although made with good intentions, combined with previous KPN behavior, significantly lowers the margin for error, possibly leading to bigger problems. Alison Evans' description of the South's revised doctrine underlines the uncertainties and raises concerns: "South Korea's new doctrine…allows its armed forces to pre-emptively strike North Korean targets, rather than only meet an attack with proportional response."[189]

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[188]Yoon Sukjoon, "Some Current Issues in Korean Maritime Security and Maritime Strategy," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 164.

[189]Alison Evans, "North Korean Attacks and South Korea's New Defence Doctrine Mean Escalation but Not All-out War Is More Likely," *Jane's Intelligence Weekly* 7, no. 37 (August 19, 2015).

Additionally, Geoffrey Till hints at the potential for rash and hasty decisions by unit commanders associated with instant retaliation to provocations: "We will instantly retaliate against any provocation from now on and wrap up our operation at the scene of the provocation."[190] The strong stance against KPN submarine operations in the South continues with the current leadership. A reporter for Defense Daily quoted Admiral Um, the ROKN Chief of Naval Operations, during a visit to the ROKN Submarine Force Command as saying, "'Submarines are the daggers of the undersea domain, and as the silent assassins of the country, they need to be ready for the nation's calling no matter the time or mission, and quietly and flawlessly accomplish its mission.' Additionally, he stressed the importance of sinking enemy submarine in the event of infiltration or provocation."[191] Although the change came about for justifiable reason, the vengeful origins of the change carry with them a recipe for escalation.

The ROKN and its submarine force have evolved into a technologically advanced capable force recognized around the world. However, even with the ROKN's advanced ships, aircraft, and submarines, the force continues to struggle with defending against the North's subsurface threats. The South's attempts to strengthen this weak area in its defense came at the cost of 46 lives of the crew of the ROKS Cheonan. The ROKN's inventory of ASW forces capable of detecting KPN submarines remains limited to its AEGIS destroyers, P-3 Orion aircraft, Lynx helicopters, and Type 214 submarines. The platforms have the capability to deal with the KPN submarine threat in small numbers, but the limited number of platforms may be insufficient to deal with the entirety of the North's submarine force. Its platforms, besides the P-3s, are not wide area search platforms, therefore they do not address the weakness in early detection and warning. The sinking of the Cheonan, and the ROKN's realization for the need to strengthen its ASW capability, has led to various efforts in dealing with the subsurface threats through

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[190]Geoffrey Till, "The Development of Modern Maritime Strategy: Its Implication for the ROK," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 100.

[191]Yoon Byung-noh, "In Case of Enemy Submarine Provocation, Sink it On-scene (Translated by Author)," *Defense Daily*, August 22, 2017, http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20170823&parent_no=2&bbs_id=BBSMSTR_000000000005

acquisition, training, and cooperation with its allies. This chapter highlighted the unilateral efforts by the ROKN and their limited effectiveness in the subsurface domain. The next chapter will focus on the ROKN's interaction with the subsurface forces of the United States in the Western Pacific in combating the KPN submarine threat.

IV. CURRENT AND FUTURE COOPERATION WITH ALLIED SUBMARINE FORCES

As a global force, the U.S. Navy (USN) conducts many operations around the world. In recent history, the Western Pacific has stolen the spotlight from other regions of the world. This new focus on the Pacific has resulted in shifting portions of the U.S. military to the region.[192] This chapter explains the United States submarine presence in the region and its interactions with the ROKN submarine force. Then, it identifies and analyzes a few areas of possible future cooperation between the two navies to improve ASW capabilities. The chapter also discusses the specific impacts of the KPN submarine force on ROKN ASW and U.S. involvement to assist. Finally, possible ROK-U.S.-Japan cooperation will be explored in the context of the common threat posed by North Korea's provocative military activities.

A. U.S. UNDERSEA FORCES IN THE REGION

The most technically advanced submarine force in the world, the USN boasts a force of 71 nuclear-powered submarines.[193] The Navy divides its forces into the Pacific and the Atlantic Oceans, but due to their worldwide deployments, the U.S. submarine presence is all over the globe. Boats in the Pacific conduct deployments to the Indo-Pacific areas. During the six-month-long Western Pacific (WestPac) deployments, the boats conduct various missions in support of the nation's priorities. All submarine operations west of the international dateline to the Indian Ocean are overseen by Commander Submarine Group 7 (CSG7) based in Yokosuka, Japan. Commander Submarine Force Pacific Fleet's (CSP) website explains that "Submarine Group 7 was established during the Korean Crisis in the 1950's as Submarine Group Western Pacific," dating U.S. submarine force interaction with the ROKN to the Korean war.[194] The

[192]Re-balancing the Rebalance Resourcing U.S. Diplomatic Strategy in the Asia-Pacific Region: A Majority Staff Report Prepared for the Use of the Committee on Foreign Relations, United States Senate, One Hundred Thirteenth Congress, Second Session, April 17, 2014. Washington, 2014.

[193]U.S. Navy, "Submarine Force Facts," https://www.public.navy.mil/subfor/hq/Pages/Facts.aspx.

[194]U.S. Navy, "About Submarine Group 7," www.csp.navy.mil/csg7/about-COMSUBGRU-SEVEN.

commander is also responsible for submarine operations in the 5th Fleet Area of Responsibility (AOR) as the Commander of Task Force 54 (CTF 54). The CSP homepage also explains, "Group 7 is comprised of submarines deployed to the Western Pacific and a permanent, forward-deployed fleet including the submarine tenders USS Frank Cable (AS-40) and USS Emory S. Land (AS-39), and four fast-attack nuclear submarines assigned to Commander, Submarine Squadron 15, when deployed from Guam."[195] CSG 7, as a command, does not have forces permanently assigned, rather, it is provided with a continuous rotation of all the fast attack submarines homeported in the Pacific to accomplish its missions. The constant stream of new units ensures seamless presence in the region. Of the many missions assigned to CSG 7, it works with other submarine forces in the region to promote peace and stability from the subsurface domain. As will be discussed in more detail, the command, with the submarines assigned, accomplish their mission by conducting exercises with the various submarine forces in the region, enhancing interoperability, improving general submarine operations by establishing and encouraging undersea norms, and ensuring access to sea lanes of communications. The two closest relationships in the region are with the Japanese and Korean submarine forces. Due to the headquarters being stationed in Japan, the command interacts closely with the Japanese Maritime Self-Defense Force (JMSDF) submarine force. The CSG 7 also has a long history with the ROKN submarine force.

CSG 7 has been working closely with the ROKN submarine force since the establishment of Flotilla 9 in 1994.[196] As described by Jane's, "the South Korean submarine service interacts very closely with its USN counterpart through exercises and the flag-level Submarine Warfare Committee Meetings, where tactics, force integration and future submarine developments are discussed."[197] The two subsurface forces cooperate on a daily basis to promote submarine safety and development. As explained

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[195]Ibid.

[196]U.S. Navy, LT Lauren Gaidry, "US, Republic of Korea Submarine Forces Strengthen Alliance," April 4, 2016, http://www.csp.navy.mil/Media/News-Articles/Display-News/Article/713052/us-republic-of-korea-submarine-forces-strengthen-alliance/.

[197]"Ambitions for a Blue Water Fleet Tempered by Stark Realities," *Jane's Navy International*, April 20, 2011, https://janes.ihs.com/Janes/Display/jni74397-jni-2011.

by USN LT Lauren Gaidry, Squadron 15 Public Affairs Officer, the relationship between the two forces grew through what was once called the Brotherhood Agreement which was later renamed the Submarine Warfare Committee Meeting (SWCM). As she explains: "Established in 1994 during the birth of the ROKN submarine fleet, the SWCM has evolved into a discussion between U.S. and ROKN submarine forces on submarine tactics, force integration, and future submarine development."[198] This biennial meeting with the ROKN's highest-ranking operational submarine officer and the commander of all submarine operations in the 7th Fleet AOR plays a significant role in enhancing both countries' submarine operations. RADM Youn Jeong Sang (ROKN's first CSF commander) mentioned during SWCM 43 that the ROKN submarine force has benefited tremendously from its relationship with CSG 7.[199] Although FLOT 9 has expanded its role as the ROKN Submarine Force Command, its relationship with CSG 7 will continue to flourish and strengthen as the two forces work closely to solve the KPN subsurface problem.

B. UNDERSEA ACTIVITIES IN THE REGION

CSG 7's missions include combat readiness, regional presence, and capability development.[200] For many military forces, the priority is to enhance its own readiness and capability, but for the United States a significant amount of effort is also invested in to improving allied capabilities as well. U.S. submarines participate in multiple exercises throughout the year with ROKN submarines. The submarine-only exercises provide an excellent opportunity for U.S. units to detect and track high-end diesel submarines, while providing ROKN crews an opportunity to do the same against high-end nuclear submarines. Another aspect of the exercises is that it provides a medium to test and validate tactics and techniques. Because the two forces operate two different types of submarines, nuclear and conventional, old tactics for one force may be new to the other.

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[198]U.S. Navy, LT Lauren Gaidry, "US, Republic of Korea Submarine Forces Strengthen Alliance," April 4, 2016, http://www.csp.navy.mil/Media/News-Articles/Display-News/Article/713052/us-republic-of-korea-submarine-forces-strengthen-alliance/.

[199]Ibid.

[200]U.S. Navy, "About Submarine Group 7," www.csp.navy.mil/csg7/About-COMSUBGR-SEVEN/.

The exercises also enforce subsurface norms to improve submarine safety, as well as improving interoperability in the region. Additionally, because these exercises occur around the Korean Peninsula, they also serve to familiarize U.S. submarine crews on a potential battlefield in the future. As mentioned in previous chapters, prior understanding of the environment's effects on sensors and weapons can provide a significant advantage. The two forces also take part in other exercises hosted by surface or air components of the two navies around the Korean Peninsula. These type of "full-spectrum ASW" exercises are critical to improving interoperability between the two navies, but they also help identify problem areas. For example, in a communication-heavy operation like ASW, the ROKN and USN units' inability to communicate directly via secure channels because they lack the required equipment hinders efficient execution of the mission and creates chances for error. Communication is not the only area of concern with ROKN ASW.

The submarine infiltrations into the South by the KPN in the late 1990s were the first indication of the weaknesses of the ROKN's ASW program. But the limits of funding and importance of hedging against land threats trumped the need to address ASW capabilities. Unfortunately, not until the sinking of the Cheonan in 2010 did the issue of ASW take center stage. With virtually little to no modifications to its submarine fleet, one KPN midget submarine upset the entire ROKN ASW program, resulting in a change and strategic review of the ROKN to address the question: How was it that a midget submarine with inferior technology was capable of sinking a ROKN corvette and freely entered and left ROKN territorial waters at will? Jane's pointed out that the sinking "exposed weaknesses in the South's early warning, command, control and intelligence and anti-submarine warfare (ASW) capabilities as well as a general lack of preparedness to counter unexpected threats."[201] To bolster its weak areas, the ROKN established a new command, created a new committee, and enhanced its inventory of ASW assets.

[201]"Ambitions for a Blue Water Fleet Tempered by Stark Realities," *Jane's Navy International*, April 20, 2011, https://janes.ihs.com/Janes/Display/jni74397-jni-2011.

With the establishment of the ROKN Submarine Force Command (CSF) in 2015, the responsibility for submarine operations shifted from the ROK Fleet to the CSF.[202] This was a significant shift in command and control of ROKN submarines. ASW requires a strong command and control infrastructure and team to quarterback the assets assigned to accomplish the mission. Once an enemy submarine is detected, the ASW commander needs to determine what asset assigned is most fit to accomplish the task. If the desire is to take it out, the commander has multiple platforms to consider. If the objective is to keep tabs on the enemy, then other assets are better at accomplishing that task. For example, during peacetime, it is more likely that the commander will desire to know the location of the enemy submarine at all times, but not destroy it. In this situation, it would be best to use an AIP boat, due to its longer on-station time. A nuclear submarine, which the ROKN is considering the option of building, would provide the longest on-station time, but the advantages of unlimited duration do not outweigh the costs associated with building, maintaining, and operating a nuclear boat. If the KPN submarine's endurance is one week, a nuclear submarine with unlimited endurance does not provide much of an advantage over an AIP with an endurance of one month. If a submarine is not immediately available, the commander can decide to use surface ships or Maritime Patrol Aircraft (MPA), in that order, because of the aircraft's on-station time. Other considerations include sensor capabilities on the different platforms available for the prosecution. The bottom line is that the commander on-shore is responsible for making such decision, as opposed to the on-scene commander. Because of the various platforms involved, it is best to ensure that representatives from the different communities provide expertise to the ASW command center. Once the decision has been made, the commander's desires need to be communicated to the units on the scene. This requires robust communication capabilities to all assets participating. The communications between units and the commander become even more important when engagements

[202] Yoon Byung-noh, "Sixth In The World Stronger National Seas (Translated by Author)," *Defense Daily*, February 1, 2015, http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20150202&parent_no=2&bbs_id=BBSMSTR_000000000005.

against the enemy occur. Clear and concise communications can mean the difference between shooting the enemy or shooting a friendly submarine.

Efforts to improve ROKN ASW continue. In 2014, the senior leaders in the ROKN and USN navies agreed to and signed a new charter to enhance ASW with the ROKN. As the U.S. Pacific Fleet webpage reported, "Vice Admiral Robert L. Thomas, U.S. 7th Fleet and Vice Admiral Jung Ho-sub, Commander of the Republic of Korea Fleet, sign[ed] a charter pledging cooperation in anti-submarine warfare."[203] This was an effort from the leadership to continue the close relationship between the two navies, while addressing the problems with ASW.[204] The ASW committee, jointly hosted by ROK Fleet and the U.S. Seventh Fleet, brings the air, surface, and subsurface communities and their expertise and capabilities to bear on the KPN subsurface problem. As mentioned by Commander Naval Forces Korea's (CNFK) assistant chief of staff for security cooperation, the combined meetings and exercises improve both navies' warfare capabilities.[205] Although still a relatively new line of effort from the two navies, the committee possesses considerable potential to improve ASW capabilities and interoperability for both navies.

Prior to the charter, the ROKN and USN had conducted bilateral exercises focusing on ASW and other maritime tactics since the 1970s.[206] Starting in the late 1990s the ROKN started participating in a shallow-water ASW centric exercise called the Ship ASW Readiness/Effectiveness Measurement (SHAREM).[207] Other than SHAREM, USN Petty Officer 2nd Class Brian McReynolds explains that the two submarine forces also execute exercise SILENT SHARK to "integrate U.S. and Republic of Korean anti-

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[203]U.S. Navy, LT Arlo Abrahamson, "US, ROK Navies Sign Anti-Submarine Warfare Charter," http://www.cpf.navy.mil/news.aspx/030465.

[204]Ibid.

[205]Ibid.

[206]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 50.

[207]Ibid.

submarine warfare assets to bolster relations and interoperability."[208] During this exercise, the ROKN and USN submarines practice ASW with surface ships as well as submarine versus submarine events.[209] SILENT SHARK presents a different environment for the ROKN submarines, as the exercise takes place in waters surrounding Guam. Through the exercises, the two submarine forces develop and refine specific procedures and conduct experiments to continue to push the envelope on subsurface tactics and engagements. The same types of exercises happen in the ROKN air and surface domains with their counterparts for the same purpose. These exercises are those that will enable safe and successful combined execution of ASW operations against the KPN submarine fleet in battle.

Another area of ASW reform in the wake of the Cheonan sinking is in the ROKN procurement of ASW technology. Korea Times reports that "the service [ROKN] will also speed up efforts to acquire high-tech naval defense systems, in particular anti-submarine warfare (ASW) equipment. Key procurement items include minesweepers, anti-submarine helicopters and sonar systems."[210] Yoon explains that "the ROK needs to urgently re-establish sea control of its littorals, which will require new naval capability to counter maritime attacks by the KPN. This will take the form of complex and sophisticated ASW and mine counter measures (MCM) in shallow waters."[211] Jane's quotes an unnamed Yonhap News Agency military source elaborating on the ROKN looking at the international market to acquire the technology required for detecting KPN submarines.[212] Some of the technologies include, but are not limited to: U.S. S-3 Viking

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[208]U.S. Navy, MC2 Brian Reynolds, "USN and ROK Bolster Alliance in Silent Shark Exercise," June 8, 2015, http://www.navy.mil/submit/display.asp?story_id=87531.

[209]Ibid.

[210]Jung Sung-ki, "Navy to Focus On Littoral Warfare," *The Korea Times*, September 15, 2010, http://koreatimes.co.kr/www/news/nation/2010/09/113_73102.html.

[211]Yoon Sukjoon, "Some Current Issues in Korean Maritime Security and Maritime Strategy," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 164.

[212]Jon Grevatt, "South Korea Likely to Propose Anti-Sub Capability Under Defence Plan," *Jane's Asia-Pacific Industry Reporter*, May 7, 2010, https://janes.ihs.com/Janes/Display/1148701.

ASW aircraft,[213] unmanned surveillance aircraft,[214] and Italian AW-159 Wildcat helicopters.[215] In addition to the purchase of Vikings, Jane's reports that "the South Korean military may buy four Boeing P-8 Poseidon maritime surveillance aircraft in the wake of the successful test-firing of a submarine-launched ballistic missile (SLBM) by North Korea."[216] The increase in navy air assets should better equip the ROKN to respond to KPN submarine threats.

Simultaneously, as it looks to foreign markets for technology, the ROKN is asking its own industry for weapons and platforms. *Chosun Ilbo* announced the South's anti-submarine torpedo, Hongsangeo (Red Shark), explaining that "the Hongsangeo is an anti-submarine missile that is launched vertically to avoid detection by enemy submarines and to increase its range. The torpedo is dropped by parachute near the intended target. After release, the torpedo falls into the water and independently searches for the target."[217] In order to improve its early-warning capabilities, Perrett and Sweetman report that "South Korea is reportedly installing a fixed underwater acoustic-detection chain."[218] This is significant because this type of system, if it exists, addresses the lack of wide-area search capabilities for the ROKN. This can be further integrated into a network of underwater sensors and platforms to improve subsurface awareness.

Finally, as mentioned earlier, the ROK government is exploring options for building its own nuclear submarines. The desire to build an ROKN nuclear submarine is not a new concept. A Korea Times article explains that "the Navy has worked on a nuclear submarine program, the '362 Project,' after it was approved by then-President

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[213]Gareth Jennings, "FIDAE 2016: South Korea to Pave Way for Further S-3 Viking Sales," *Jane's Navy International*, March 31, 2016, https://janes.ihs.com/Janes/Display/1766040.

[214]"South Korea Said Plans to Buy Two Unmanned Surveillance Aircraft," *BBC Monitoring Asia Pacific*, April 20, 2011, ProQuest ID: 862587728.

[215]Lee Chi-dong, "S. Korean Navy Deploys 4 More Wildcat Helicopters," *Yonhap News Agency*, July 4, 2017, http://english.yonhapnews.co.kr/search1/2603000000.html?cid=AEN20170705004000315.

[216]"South Korea Mulls Purchase of Four Boeing P-8 Poseidon Aircraft, Says Report," *Jane's Defence Weekly*, September 1, 2016, https://janes.ihs.com/Janes/Display/1782542.

[217]"Seoul to Deploy Sub-Killer Torpedoes," *Chosun Ilbo*, August 15, 2011, http://english.chosun.com/site/data/html_dir/2011/08/15/2011081500444.html.

[218]Bradley Perrett and Bill Sweetman, "Sub-Hunting," *Aviation Week & Space Technology* 175, no. 23, July 8, 2013, 27.

Roh Moo-hyun in June 2003."[219] This information carries with it two important points: that the desire for a nuclear submarine stemmed from the highest position in the ROK government and, as mentioned in the same article, that Roh's chief of staff Moon, who is the current president, "appears to have a desire to revive Roh's pursuit of [ROKN] nuclear submarines."[220] For this to become reality, however, many challenges need to be met first. But, with the North's continued efforts at obtaining SLBM capabilities, a supportive ROKN population, and an administration in favor of the idea, the potential for the initiative gaining momentum is greater than ever. Conversely, others think that the ROK's investment in a nuclear submarine would be a mistake. The cost of building or buying a nuclear submarine for the ROKN is estimated to be around the neighborhood of $2.5 billion.[221] This estimate does not include the costs associated with maintaining nuclear submarines. Thus, the ROKN needs to weigh the environmental, political, economic, and military costs and benefits to determine if nuclear submarines are really the right choice. Many in the United States believe a ROKN nuclear-powered submarine is unnecessary, especially when their Son Won-Il submarines are capable of achieving similar results at a cheaper cost. Additionally, the ROK-built Jangbogo III submarine due to be commissioned in the 2020 timeframe will improve the ROKN's ability to counter the various KPN threats.

The ROKN clearly understands its current limitations in the ASW fight. The initiatives mentioned do not include all the different options the ROKN is pursuing, but indicate the range of options that are being considered. They also represent a difference in approach to ASW prior to the sinking of the Cheonan. Bruce Klingner captures some of the other efforts being proposed by the ROK to defend against the KPN submarine threat:

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[219]Yi Whan-woo, "Seoul Designs Nuclear Submarine Reactor," *Korea Times*, October 1, 2017, http://koreatimes.co.kr/www/news/nation/2017/10/113_237239.html.

[220]Ibid.

[221]Zachary Kreck and Henry Sokolski, "South Korea Is About to Make a $7 Billion Nuclear Submarine Blunder," *The Nonproliferation Policy Education Center*, September 30, 2017. www.npolicy.org.

> South Korea is devoting resources to defeat submarines after they depart their bases and enter South Korean waters. But Seoul is also considering the need to attack North Korean submarine bases prior to the submarines departing. This approach would be consistent with Seoul's newly announced preemptive deterrence strategy. Since the North Korean attack on Cheonan, there has been greater advocacy to change the South Korean military policy from passive defense to proactive deterrence. A South Korean presidential committee on military reforms proposed that Seoul adopt an operational plan that allows preemptive strikes on North Korean bases if South Korea sees signs of impending aggression.[222]

The combination of technological and procedural improvements will significantly reform the ROKN's ASW capability commensurate for a navy of its stature and the rising threat level it faces. The initiatives in place should build a balanced ASW fleet better suited to combat infiltrations and provocations from the KPN.[223]

Following the sinking of the Cheonan, the ROKN and USN coordinated joint exercises to send a signal to the KPN about the enduring strength of the relationship between the two navies. Andrew Forbes and Yoon Sukjoon report that "it was quickly agreed that the ROKN and the U.S. Navy would conduct an anti-submarine warfare exercise in the West Sea, to improve the ability of the ROKN to defend against KPN underwater attacks,"[224] but the exercise also contained clear signals of the U.S. commitment to the South's defense to the North. Lately, the exercises also serve as a "show of force" to the North.

All the efforts mentioned above pertain to local or platform upgrades and some initiatives with the United States, but what the ROKN still lacks critical to ASW is a wide-area sensor. Vice Admiral Koda provides an excellent analogy of the ROKN's current ASW capabilities: "The ROKN has built robust submarine and destroyer forces…in figurative language, its 'spear.' However, the navy has yet to improve the

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[222]Bruce Klingner, "Measures to Enhance Combined South Korean – US Naval Capabilities," *The Journal of East Asian Affairs* 27, no. 1 (2013), 12.

[223]Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2, Spring 2010, 28.

[224]Andrew Forbes and Yoon Sukjoon, "Old and New Threats from North Korea Against the Republic of Korea," in *Korean Maritime Strategy: Issues and Challenges*, ed. Geoffrey Till and Yoon Sukjoon (Seoul, Korea Institute for Maritime Strategy: 2011), 37.

wide-area ocean surveillance that it must develop in order to point and thrust this spear."[225] This, in addition to other capabilities, may be a future area of cooperation between the USN and ROKN to further improve ASW on the Korean Peninsula.

Today's North Korean submarine inventory looks similar to its composition back in the mid-1990s. The ROKN learned, through the capture of KPN midget submarines in the late 1990s, that technology remained relatively stagnant as well, with the exception of minor improvements from the integration of commercial navigation and communication equipment. Yet, the mostly outdated and archaic KPN submarines have been able to take advantage of their rudimentary design and combine it with the crew's knowledge of the littoral environment to successfully evade significantly more advanced ROKN units. The realization of the KPN submarine problem led to the creation of a USN-ROKN ASW Committee, acquisition of advanced aircraft, and procedural changes in the ROKN. The USN's role has been to support the ROKN by not giving them the tools for ASW, but instead by aiding in the development of its own capabilities. Although this takes much longer and requires more effort, in the long run a ROKN-developed ASW doctrine will enable its forces to unilaterally deal with the KPN submarine threat, as U.S. subsurface forces dwindle down to their lowest levels in the coming future and returning to its current level in about twenty years.[226] Additionally, due to the relatively small size of the Korean theater of operations (KTO) any action by the KPN submarine force is likely to be met directly by the ROKN ASW forces with USN forces arriving at a later date, further emphasizing the need for a ROKN ASW doctrine for its forces. The only exception to rapid USN involvement would be if U.S. submarines were already in the KTO for exercises or routine port visits. Even still, this would only add one additional submarine to the list of friendly submarines against the North's inventory of over 70 submarines. Creating solid ROKN ASW capabilities is critical to holding off and

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[225]Yoji Koda, "The Emerging Republic of Korea Navy," *Naval War College Review* 63, no. 2, Spring 2010, 30.

[226]Steven Stashwick, "US Designing New Unmanned Vehicles to Help Its Subs Detect Adversaries," *The Diplomat*, July 19, 2017, https://thediplomat.com/2017/07/us-designing-new-unmanned-vehicles-to-help-its subs-detect-adversaries/?allpages=yes&print=yes.

preventing the creation of a second front deep in the South by North Korean SOF in the event of a full-scale invasion of the South.

Complicating matters in defending against the KPN threat is the regime's awareness of its advantages in numbers over the ROKN ASW forces. If faced with the overwhelming number of KPN surface and subsurface units at the same time, not all of the initial wave of KPN units may make it past ROKN defenses, but it is also safe to assume that a sizable number of KPN units will make it through. This assumption may be part of the calculus for the KPN in maintaining such large inventories of maritime units. This may also be the reason for the ROK government's decision to purchase and expand ASW aircraft and ships. Technological superiority and parity in numbers of ASW assets should enable the ROKN to counter the KPN subsurface forces. Upon arrival of USN ASW forces in the KTO, the ROKN-USN ASW team should be able to defeat the KPN subsurface threat and establish sea control to maintain the SLOCS open.

C. FUTURE PROSPECTS FOR USN-ROKN UNDERSEA COOPERATION

Many ROKN-USN initiatives are underway to improve the security situation on the Korean Peninsula today. Various foreign military sales programs, intelligence sharing, and extensive military engagements constantly occur between the two forces. Undoubtedly, unilateral research and experiments to improve ASW capabilities should be occurring as well. While it is unknown if the United States or South Korea have any desires for joint research and development, one area of cooperation in the future could be in the technology field. With the rapid pace of the technological innovations occurring all around the world, combining undersea innovation efforts between the two countries may prove beneficial to both sides. Specific areas of cooperation that could boost ASW capability, specifically for the undersea domain for the future, may be joint technology projects in systems like SOSUS-type wide-area search sensors, UUVs, and underwater wireless communications.

Of course, for any kind of coordination to occur, both parties involved need to be willing and able. Additionally, some sort of benefit, other than just defeating a common adversary (DPRK), would need to be identified for both sides to willingly share the latest

and best military technology with each other. Additionally, because the projects are subsurface focused, advocates will encounter significant resistance in the United States, rooted in its norms of total secrecy and protection of undersea forces and technology. Such joint ventures would also face criticism from the United States in general, due to the perception that the ROK has more to gain from the joint undertakings. This, however, may not be the case; both sides would benefit greatly from such joint endeavors, especially in the UUV and undersea wireless communications area, given the USN's eagerness to exploit the financial and tactical advantages of drones. Assuming no restrictions on the sharing of information and technology, it may be worth exploring some of the advantages and disadvantages for both sides of such joint research and development.

Wide-area search capability is critical for successful ASW operations. The USN developed and used SOSUS sensors to maintain situational awareness against Soviet submarines during the Cold War. So, in this specific case, it would seem as though the South has more to gain than the United States. However, in times of reducing numbers of subsurface units for the USN, a ROK controlled SOSUS-type system would enable a close ally to establish a clear subsurface picture. This, in turn would improve ROKN ASW, while also reducing the need for U.S. submarine presence in that part of the region. The units could be used elsewhere, where subsurface control needs additional support. The end state would be to share the duties of promoting submarine norms, safety, and awareness in the region with the ROKN. Ultimately, sharing some of the responsibilities should alleviate the need and desire for U.S. submarine presence, freeing the boat(s) for other operations.

Another area of potential coordination may be in unmanned underwater vehicles (UUVs). The United States Navy has always been keen to incorporate new technology into its operations. With improvements in autonomous UUVs and battery technology, the navy is incorporating UUVs in the subsurface domain. The Navy's investment in the technology is captured by a Navy Times article: "And now, the service has taken its next step in embracing the rapidly growing technology with the standing up of its first

underwater drone squadron."[227] UUVs present an economically pragmatic method of providing coverage in areas of the world for the USN, especially with the steadily decreasing number of its fast attack submarines. James Holmes explains that "unmanned vehicles [are not the] cure-all for everything that ails a cash-strapped navy…but their potential is worth tapping to the max."[228] The U.S. underwater drone squadron will assume an increasing role in the subsurface fight as the command and technology matures. Joint research between the two navies could shorten the long timelines associated with technology integration into both navies.

Unmanned vehicles could provide significant advantages for the ROKN. South Korea is technologically advanced enough to build and operate its own fleet of UUVs. *Chosun Ilbo* explains that in 2011 the ROK Ministry of Land, Transport, and Maritime Affairs sponsored new projects focusing on underwater wireless communications as well as deep-sea robotic submarines.[229] The newspaper also confirmed use of remote-controlled underwater vehicles in recovery operations as in the Sewol ferry disaster in 2014.[230] A fleet of UUVs strategically positioned in the waters off the Korean Peninsula could serve as the wide area search sensor providing the much-needed early warning of a KPN submarine intrusion south of the NLL. UUVs within attenuation range of signals from other UUVs could create a daisy chain of sensors to relay information. Furthermore, with autonomous operations, the UUVs can be pre-programmed to surface and transmit information alerting and cueing shore-side commands of intruding submarines. It is unclear if the ROKN has initiated any UUV programs for its navy, but it is clear that the civilian sector is employing them. Additionally, Admiral Jung Ok-kun, a former ROKN Chief of Naval Operations, stressed the importance for the ROKN to "obtain unmanned

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[227] Geoff Ziezulewicz, "Navy Stands Up First Underwater Drone Squadron," *Navy Times*, October 11, 2017. https://www.navytimes.com/news/your-navy/2017/10/11/navy-stands-up-first-underwater-drone-squadron/.

[228] James Holms, "The U.S. Navy's Next Super Weapon? Here Come Unmanned Underwater Vehicles," *The National Interest*, January 5, 2015. http://nationalinterest.org/feature/the-us-navys-next-super-weapon-here-comes-unmanned-11959?page=show.

[229] "Korea to Launch 11 Maritime R&D Projects," *Chosun Ilbo*, June 8, 2011. http://english.chosun.com/site/data/html_dir/2011/06/08/2011060801185.html.

[230] "Remote-Controlled Vehicles to Join Ferry Search," *Chosun Ilbo*, June 4, 2014. http://english.chosun.com/site/data/html_dir/2014/06/04/2014060401080.html.

and C4ISR [command, control, computer, communications, intelligence, surveillance, and reconnaissance] capabilities in the 21st century security environment."[231] Although he did not specify UUVs, his comments confirm the top leadership's vision of exploiting the advantages of unmanned vehicles in the future.

Joint or individual efforts in the UUV or Autonomous UUV (AUV) platform areas by the United States and the ROK could provide significant benefits to both sides. The technology involved with such platforms and systems is undoubtedly sensitive, but, from the U.S. perspective, it will not be the first time for such collaboration. A Defense Daily article brings to light an "announcement made by the Japanese Defense Ministry [in 2014] to conduct a month-long U.S.-Japan combined research effort toward an unmanned underwater surveillance vehicle."[232] Again, while the sensitivities associated with such platforms may dissuade full collaboration between the two countries, joint research may alleviate financial and technical challenges associated with UUVs. Collaboration may also shorten the timeline to acquiring fully operational AUVs that meet military requirements. Underwater wireless communications are another area yielding significant technological challenges.

One last area of potential coordination that could benefit both navies is in the creation of a subsurface network of communications. A breakthrough in underwater communications would plug the submarines into the robust network of sensors and platforms in the ASW fight. For example, if the submarine is able to receive targeting data for enemy forces or maritime strike missions without having to transmit from periscope depth, it would enable the submarine to maintain its stealth, especially if the submarine was close to enemy shores. Additionally as Admiral Richardson commented in reference to the increasing challenges of anti-access and aerial denial (A2AD) environments, "networked undersea forces will act as a key to unlock the door for

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[231] Kim Byung-ryun, "Future of the Navy is dependent on Unmanned and C4ISR Capabilities," (Translated by Author) *Defense Daily*, December 4, 2008, http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20081204&parent_no=2&bbs_id=BBSMSTR_000000000005.

[232] "US-Japan UUV Collaboration," (Translated by Author), *Defense Daily*, August 10, 2014, http://kookbang.dema.mil.kr/kookbangWeb/view.do?ntt_writ_date=20140811&parent_no=6&bbs_id=BBSMSTR_000000000120.

decisive force to enter the fight and seize and maintain the initiative."[233] Due to the submarines' nature of operating underwater, they are able to operate relatively freely in an enemy A2AD environment, making them the perfect platform to penetrate into enemy territory and eliminate the threat, thus opening the gates for the rest of the friendly forces to enter the battle area.[234] Similarly in the Korean Peninsula, this same network could serve as the wide-area search system providing locating data for KPN submarines. The ROKN ASW commander could then choose the best platform he has available to prosecute the enemy. With the KPN submarine force possessing more than three times the number of submarines compared to the South, the importance of obtaining accurate locating data cannot be over emphasized. One potential system for such a network is the Naval Postgraduate School (NPS) innovation called the Seaweb, which Barbara Honegger explains as an underwater sensor network that "[integrates] autonomous sensor systems into coherent networks to provide timely and relevant information."[235] As with the other two areas, possible coordination in this field also depends on the U.S. desire and ability to share the technology due to its sensitive nature.

The question going forward is how much information and technology the United States is willing to share with the ROK. Admiral Um Hyun-seong, ROKN Chief of Naval Operations, says that "ROK-U.S. information sharing on North Korean submarine capabilities and combined ASW exercises with the U.S. Seventh Fleet and Third Fleets will greatly enhance the ROKN's ASW capabilities."[236] But he is only talking about operational information vice technological information. South Korea's shipbuilding and military industries are robust and will eventually build systems like SOSUS and AUVs that can improve ASW, but collaboration with the USN could significantly reduce the timeline. As mentioned above, the United States is already selling platforms and other

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[233]Vice Admiral John M. Richardson and Lieutenant Joel Ira Holwitt, "Preparing for Today's Undersea Warfare," *Proceedings* 138, no. 6, June 2012, 21.

[234]Rear Admiral Michael J Connor, "Investing in the Undersea Future," *Proceedings* 137, no. 6, June 2011, 16.

[235]Barbara Honegger, "NPS Pioneers 'Seaweb' Underwater Sensor Network," *Undersea Warfare*, no. 45, Summer 2011. http://www.public.navy.mil/subfor/underseawarfaremagazine/Issues/PDF/USW_Summer_2011.pdf.

[236]"The Commanders Response," *Proceedings* 143, no. 3, March 2017, 29-30.

sensitive technology, such as for ballistic missile defense (BMD), to the South. It is unclear, however, if the USN is ready to start sharing subsurface technology with its ally. The U.S. submarine force is, in particular, very secretive about its submarine technology and operations even within its own navy organization. Clay Moltz illustrates the navy's reluctance in sharing its secrets: "While the United States sold a large number of surplus World War II submarines, the U.S. government implemented strict export controls over nuclear submarine technology…and kept its ASW techniques secret."[237] The U.S. government has since changed its mind on ASW and techniques are now being shared with the ROKN as depicted by the ASW charter. But submarine technology remains tightly regulated. In light of recent developments on the Korean Peninsula, to include the ROKN's desire to build nuclear submarines, it would be interesting to consider whether U.S. nuclear submarine-related technology should become available for sale to the ROKN. Sharing nuclear technology with its allies is not unprecedented, as Moltz notes: "The United States considered providing nuclear submarine technology to the Netherlands, Canada, and France in the late 1950s during the Eisenhower administration."[238] If KPN subsurface threats continue to worsen and with the different efforts in progress between the two navies with ASW, it would be interesting to see if more detailed and enhanced levels of ASW tactics, techniques, and procedures would get shared with the ROKN. However, even with the increasing tensions in the Korean Peninsula, it is doubtful that any submarine technology-sharing agreements like the one between the United States and the United Kingdom would occur with South Korea.[239] The one wildcard is the current U.S. administration's perception of the DPRK threat. President Donald Trump has stirred up quite a bit of controversy around the world with his rhetoric of exterminating the North, should it make an attack on the United States. With such rhetoric, coupled with growing evidence of the North possessing a missile capable of reaching the continental United States, the possibility of United States sharing or sale of nuclear-submarine technology cannot be ruled out entirely. With a strong

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[237]James Clay Moltz, "Submarine and Autonomous Vessel Proliferation: Implications for Future Strategic Stability at Sea," Naval Postgraduate School, December 2012, 6.

[238]Ibid.

[239]Ibid.

industry and experience in building submarines and nuclear power plants the ROK may not need much assistance in building its own nuclear-powered submarine should it decide to do so. Additionally, it would not be impossible for the ROKN to work with the Russians for nuclear submarine technology if nothing could be worked out with the United States—as the ROK has done in the space-launch field—(assuming the ROKN is seeking such assistance).[240]

D. POSSIBLE ROK-USN-JMSDF UNDERSEA COOPERATION

One last area of possible cooperation in the region might be ROKN, USN, and JMSDF cooperation in the fight against KPN subsurface threats. On the surface, this may be portrayed as political suicide from for the ROKN in terms of domestic politics, but the benefits to the ROKN ASW could be significant. The JMSDF submarine force operates 18 very capable diesel submarines; a fleet of U.S. P-3C, P-8, and Japanese P-1; an armada of ASW capable surface ships; and a robust ocean surveillance system that could potentially play a role in defending against a common KPN submarine threat.[241] The Japanese assets would instantaneously double the number of friendly ASW forces going against the archaic KPN submarines, but this is only likely to happen during combat situations. The more likely capability provided by Japan in a peacetime setting is indications and cueing of KPN subsurface threats in the East Sea (or Sea of Japan) from its vast network of ocean surveillance systems.[242] This type of information exchange between the two navies could occur quietly, away from political scrutiny, while improving relations between the two countries. Similarly, submarine exercises including ROKN, JMSDF, and USN submarines could be another way of improving interoperability amongst the three countries, which face common threats from North Korea. Trilateral exercises including the three navies have occurred in the past as a

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[240] James Clay Moltz, "Submarine and Autonomous Vessel Proliferation: Implications for Future Strategic Stability at Sea," Naval Postgraduate School, December 2012, 7.

[241] "Japan: Maritime Self-Defense Force (MSDF)," *Jane's Fighting Ships*, 432-34, 445

[242] Desmond Ball and Richard Tanter, *Tools of the Owatsumi: Japan's Ocean Surveillance and Coastal Defense Capabilities*, (Canberra: Australian National University Press 2015), 103.

response to the North's continued nuclear and SLBM tests.[243] These could later evolve into something bigger, should China or Russia present similar threats in the future. Submarine exercises also provide the advantage of avoiding political scrutiny because submarine activities out at sea are unknown to many and shared with only a select few. Plenty of other exercises like the U.S.-hosted Rim of the Pacific (RIMPAC) and Pacific Reach (PACREACH) set precedents for future trilateral submarine exercises under a common goal.

The DPRK's continued nuclear, missile, and SLBM tests serve to strengthen Japan's pursuit of a shift away from its pacifist post-war posture. As the DRPK continues to lob ballistic missiles over Japan, it is forcing the Japanese to take a defensive stance. The dangers associated with North Korean missiles flying over Hokkaido not only illustrate the North's disregard for international norms, but its likely ability to hit Japan with its missiles. This has to reinforce the perception of the North Korean threat among average Japanese citizens. This gives the newly-re-elected Prime Minister Shinzo Abe, who is an avid anti-DPRK activist, more of a reason to push for Japanese military reform. The timing for military coordination between Japan and South Korea, although it will require overcoming some political hurdles, may be ripe. Initiatives like the Defense Trilateral Talks (DTT) and General Security of Military Information Agreement (GSOMIA) are positive indications for further cooperation in the future.[244]

One certainty is that ASW remains a weakness for the South, which the ROKN is taking steps to amend. Due to the nature of ASW being a platform- and manpower-intensive capability, the most pragmatic approach, for not just the ROKN but for the USN as well, is to share the burden with allies. South Korea and the United States, who will end up fighting side-by-side should hostilities resume, have real incentives to share the burden of ensuring interoperability and maintaining subsurface awareness at all times. Establishing undersea dominance by the combined submarine forces is critical to ensuring timely participation of USN aircraft carriers in the war off the Korean

[243]Lee Chi-Dong, "S. Korea, U.S., Japan hold Joint Drills Against N. Korean Submarines," *Yonhap News*, April 3, 2017, http://english.yonhapnews.co.kr/search1/2603000000.html?cid=AEN20170403002352315.

[244]Ibid.

Peninsula.[245] The question is if the USN is willing to share, and to what extent, subsurface information and technology that it currently holds secretly, even within its own military. As nice as it would be to improving security conditions on the Korean Peninsula, the sharing of U.S. submarine and subsurface technology still may be too provocative an idea for the unforeseeable future. All hope is not lost, however, as some of the ASW weaknesses can be made up by other means of cooperation with the United States and Japan. Even if it starts with just the sharing of sensor information among the three countries, that alone would lay the groundwork for further integration, prodded along by North Korea's continued provocative nuclear and missile tests.

[245]Timothy S. McElhannon, CDR USN, "*Operational Maneuver and Anti-Submarine Warfare*," June 16, 1995, 4,10.

V. CONCLUSION

Security risks on the Korean Peninsula continue to cause serious concerns in the region. Recent nuclear and missile developments by the North Korean regime have expanded a security problem previously limited to the region out to the Western Hemisphere. The DPRK regime hopes to target the United States with an inter-continental ballistic missile, but still requires a credible re-entry vehicle. As experts focus on the threats posed by these nuclear and missile developments, the KPN subsurface threats remain a problem for the ROKN and the USN. The KPN's fleet of aging submarines present a very real threat that was realized with the sinking of the ROKN corvette Cheonan in 2010. While the technology of the KPN's boats is outdated compared to the highly advanced and capable ROKN submarines, they are sufficient to split a ROKN combatant ship in half and freely travel through ROKN territorial waters without getting detected. If challenged one-on-one against the ROKN's Son Won-Il class submarines, the KPN boats do not stand a chance. But, as with all other KPN capabilities, the combined power of their massive inventory of subsurface assets can create an overwhelming threat. The North has proven it can flush its submarines out to sea in less than 24 hours. The South has admitted that it does not have the ability to track all of the boats simultaneously going out to sea in a combined attack on the South. This is a great example of the limits of technology, despite today's advanced state of innovation. Furthermore, even if the ROKN subsurface units were able to track all of the KPN submarines underway, it would be a challenge to prevent all of the enemy boats from reaching their destinations. The ROKN submarine's ability to engage multiple KPN submarines is limited by the number of torpedo tubes an operator sitting at the fire control console has at his disposal. Additionally, the complex shallow water environment of the Korean Peninsula presents a challenging problem for the South and complicates the ROKN's capability to detect infiltrating KPN submarines.

Technological advances pose new challenges and potential solutions to the subsurface problems around the Korean Peninsula. With more money to address the problem than the North, the South has more opportunities to harness the new capabilities

that technological innovation brings to the undersea fight. Similarly, the same capabilities could be available to the North, however, because of its economic situation the North would have to prioritize UUVs over its nuclear and missile programs, which may be too big an accomplishment for the KPN. New breeds of UUVs have the potential to significantly improve subsurface capabilities to those on either side of the DMZ. UUVs are economically pragmatic and covert compared to the bigger and louder diesel submarines. Additionally, because no humans are required onboard to operate the unit, a higher risk tolerance can be justified in its operations, pushing them further inland to obtain better intelligence. UUVs are the perfect vehicles for gathering environmental data as well as serving as long-term cueing platforms for detecting KPN submarines venturing into South Korean waters. The advantages provided by UUVs over conventional submarines, such as cheaper production costs, are surely going to make them a potent player in the subsurface fight in the near future.

Despite heavy sanctions imposed on the North's economy, Kim Jung Un has figured out a way to continue funding his nuclear and missile programs, while acquiring a subsurface test platform to continue SLBM testing. However, the KPN faces many technological challenges to perfecting a submarine-launched ballistic missile (SLBM) capability. Despite the long road ahead for KPN SLBMs, the presence of a ballistic missile submarine would raise the security threat on the Korean Peninsula, creating concern in the South to counter the new KPN threat. The North's maintenance of a large submarine force and recent experiment with the Gorae class SSB also indicates the North's intentions of continued use of the subsurface domain in the future.

The ROKN has made significant strides in improving its ASW capabilities. The Son Won-Il class submarines are one of the quietest submarines in operation today. Its ability to operate submerged without having to snorkel often to recharge its batteries almost doubles the endurance of its predecessors. The longer endurance enables the ROKN submarine to patrol for a longer period of time to prevent KPN submarines from entering its waters. With the experience in shipbuilding and submarine operations by the South's industry, the completely indigenous Janbogo III's capabilities will only enhance the ROKN's submarine ASW capabilities. Additionally, in conjunction with

improvements to its submarines, the ROKN's purchase of ASW aircraft and commissioning of new frigates are likely to step up its ability to defend against KPN submarine threats.

The next step required in improving ROKN ASW is to acquire wide-area surveillance capabilities. Well-armed ROKN ASW assets lack the cueing required to combat the KPN submarine threat. A SOSUS-type surveillance system constructed in the waters surrounding the Korean Peninsula could provide the critical alerts necessary to direct its ASW forces for successful prosecution of unidentified submerged contacts. Such systems are undoubtedly expensive, but compared to the costs associated with building nuclear submarines, they are economically much more pragmatic. The subsurface situational awareness provided by a wide-area search system also aids the ASW commander in allocating the best platform for prosecution. This is critical for the ROKN due to its inferiority in numbers. Combining the whole of its ASW forces, to include integration of UUVs and UAVs, could make a significant contribution toward improving ROKN ASW in the future. Whatever decision the ROKN makes to take its ASW capabilities to the next level, it seems to be well on its way.

Many options exist for the ROKN to acquire such capabilities. It can choose to develop its own capabilities or purchase them from its allies like the United States. The latest meeting of President Trump and President Moon showed signs of the latter.[246] It is questionable how much and what the U.S. government plans to make available to the South. The South's pursuit of its own nuclear-powered submarines carries with it more than just a high price tag. It may spark nuclear proliferation within the region, causing the JMSDF to obtain one as well. Additionally, if the U.S. government decides to sell or share nuclear-submarine technology, it will face significant resistance from the navy, not to mention possible other requests from different allies. The benefit of such a sale is that it would strengthen the commitment of the two countries in defeating the KPN threat and further solidify the U.S. presence in the region. Despite these advantages, however, it seems unlikely that sales or sharing of nuclear technology will occur. What seems more

[246]Kim Rahn, "ROK to Purchase Strategic Arms from the US," *The Korea Times*, November 7, 2017, http://www.koreatimes.co.kr/www/nation/2017/11/205_238939.html#.

likely is some sort of combined effort between the two navies in UUVs or weapons systems. Because of the strong relationship between the two submarine forces, it is certain the United States will aid the ROKN, but not at the expense of one of its most protected secrets, which nuclear-powered submarines are a part of.

The subsurface vulnerability surrounding the Korean Peninsula remains a problem to be solved. It continues to pose a deadly threat to the ROKN and USN, but both countries are making strides in the effort to contain and defeat the enemy submarine threat if and when required. Much has been accomplished with respect to ROKN ASW—including in the areas of acquisition, doctrine, policy, and training--since the sinking of the Cheonan. Combining efforts with the United States and potentially others, such as the JMSDF, may be the next step required to not just contain the submarine threat surrounding the Korean Peninsula, but to solving related ASW problems facing the United States and its allies in the rest of the region.

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