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THE STRATEGIC CONSEQUENCES OF A SOUTH KOREAN NUCLEAR SUBMARINE
-RISKS AND REWARDS FOR THE US-ROK ALLIANCE-

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Ⅰ. INTRODUCTION

In response to the Democratic People's Republic of Korea's (DPRK) progress toward a functional submarine launched ballistic missile (SLBM), the Republic of Korea (ROK) is determining whether to acquire nuclear-powered attack submarines (SSNs).[1] The US may soon face a similar debate: will it assist the ROK in developing this platform? Proponents of the platform argue that SSNs will amplify the US-ROK alliance's combined anti-submarine warfare (ASW) capabilities to offset the DPRK's SLBM threat.[2] Skeptics claim, however, that the platform is unnecessary and could prompt an arms race in the region. Expanding on this debate, this paper highlights how a ROK SSN could result in both strategic benefits and risks for the allies.

A US supported effort to develop ROKN SSNs could have several beneficial consequences for the allies. First, this program could act as a force multiplier to strengthen the allies' ASW capabilities, improving their ability to detect, disrupt, destroy, and defend against DPRK SLBM threats. Second ROKN SSNs could improve the allies' coercive diplomacy toward the DPRK by enhancing allied capabilities and signaling allied resolve, allowing the allies to both deter and compel DPRK. Third, a US-ROK SSN program could bolster intra-alliance cohesion by reinforcing US' commitment and allowing the ROK to bear more of the burden for allied security. Fourth, ROKN SSNs could have the long-term benefit of strengthening the ROKN's power projection

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1) For readers less familiar with naval technology, it is important to clarify at the outset that a nuclear powered attack submarine (SSN) is not the same thing as a submarine armed with nuclear weaponry. It is not a nuclear powered ballistic missile submarine (SSBN). The allies have no interest in developing a ROKN SSBN or the ROK nuclear weaponry required to arm such a boat. Such measures would cause irreparable harm to the global non-proliferation regime, as well as denuclearization efforts on the Korean peninsula.

2) Jun Ji-hye, "Can S. Korea get US approval for nuclear submarine?" *The Korea Times*, November 11, 2016.

capabilities, improving the allies' ability to cooperate on security contingencies beyond the peninsula.

The allies must approach a ROKN SSN program cautiously however, as a ROKN SSN program could lead to unintended risks. First, if handled improperly, a US supported ROKN SSN program could trigger an unnecessary regional arms race. Second, a ROKN SSN program could lead to unwarranted concerns about ROKN latent nuclear capabilities.

This paper will explore these strategic benefits and risks in more depth. It presents the core logic undergirding each potential effect, discusses historical and contemporary examples that highlight this logic, and explores the strategic factors that make each effect more or less likely. It concludes with an assessment of the policy steps that the allies should undertake to maximize the benefits and mitigate the risks of a ROKN SSN program.

THE STRATEGIC CONTEXT

Any discussion of the strategic implications of ROKN SSNs for the US-ROK alliance must begin with an overview of the allies' core interests and the main challenges to those interests in the Asia-Pacific. First, the US and ROK have an interest in preserving their national security against military aggression. As such, the allies must be able to both deter and defend against the most immediate regional threat to their security: the DPRK.[3] Second, the allies are committed to preserving the economic growth and prosperity that has allowed their respective nations to flourish.[4] Both recognize that this prosperity is dependent on the peace and stability of the Korean peninsula, which in turn depends on the alliance's ability to deter the DPRK. Third, the allies share common values.[5] Both understand the

3) "Joint Statement between the United States and Republic of Korea," June 30, 2017.
4) "Joint Statement Between the United States and Republic of Korea."

importance of democratic governance and core human rights. Similarly, both are committed to the rule of law, both domestically and internationally. This provides both allies with an additional incentive to resist the DPRK's aggressive designs on the Korean peninsula, defending the ROK's successful democracy against the authoritarian regime in the north.

These allied interests face significant challenges from the DPRK's accelerating nuclear, intercontinental ballistic missile (ICBM), and SLBM programs.[6] These capabilities greatly increase the destructive potential of a peninsular war for both the ROK and US. If the DPRK is able to use these capabilities to establish a secure nuclear deterrent, it might also embolden the DPRK's to behave still more belligerently and undercut the allied ability to deter DPRK aggression short of war.[7] These capabilities also make it far more difficult for the allies to defend against the DPRK should deterrence fail.

The allies have begun to develop measures to offset the DPRK's ICBM threat. This includes the "4D" Operational Concept and the ROK's "Kill Chain" and Korean Air and Missile Defense (KAMD) systems. The 4D Operational Concept, agreed to by the allies in 2015, seeks to detect, disrupt, destroy, and defend against DPRK missile threats, taking preemptive action if necessary.[8] A key pillar of this concept is the ROK Kill Chain system, a series of sensors and capabilities

5) "Joint Statement Between the United States and Republic of Korea."

6) Zachary Cohen and Ryan Browne, "US detects 'highly unusual' North Korean submarine activity," *CNN*, August 1, 2017. Sofia Persio, "North Korea Wants to Launch Missiles From Sea Amid 'Unprecedented' Submarine Activity," *Newsweek*, August 1, 2017.

7) This effect has been observed in India-Pakistan relations following Pakistan's acquisition of a nuclear deterrent. See: S. Paul Kapur, *Dangerous Deterrent: Nuclear Weapons Proliferation and Conflict in South Asia* (Stanford: Stanford University Press, 2007). S. Paul Kapur, "India and Pakistan's Unstable Peace: Why Nuclear South Asia is Not Like Cold War Europe," *International Security* 30, no. 2 (2005). For a similar argument about Iran, see: Matthew Kroenig, *A Time To Attack: The Looming Iranian Nuclear Threat* (NY: Palgrave Macmillan, 2014).

8) "Korea, US to devise plan to negate N.K. launchers," *Korea Herald,* April 16, 2015. Elizabeth Shim, "Strategy to 'destroy' North Korea missiles to be applied during exercises," *UPI*, February 7, 2017.

integrated to find and – if necessary – preemptively neutralize DPRK missiles before they are launched.[9)] It includes Green Pine radar systems and aerial monitoring, including satellite reconnaissance and airborne early warning and control systems (AWACS) aircraft, coupled with surface-to-surface missiles on land and at sea. A second pillar, KAMD, relies on terminal high-altitude area defense (THAAD) systems as well as other missile defense technology to destroy DPRK missiles once they have been launched.

The DPRK's development of SLBMs and ballistic missile submarines, however, threatens to circumvent some of these measures.[10)] SLBMs hidden on conventionally-powered ballistic missile submarines (SSBs) are far more challenging for the Kill Chain system to detect. If the DPRK succeeds in its plan to develop a quieter, faster, and longer-ranged nuclear-propelled ballistic missile submarine (SSBN) by 2018, this will only further compound the challenge. SLBMs are not only more difficult to track and detect, they are far more difficult for THAAD systems to intercept – complicating KAMD.[11)] Ultimately, the successful execution of 4D will depend on developing a stronger and more comprehensive Kill Chain and neutralizing the SLBM challenge to KAMD.

Overall, these developments threaten allied security, prosperity, and common values. The increased risk of war threatens both allies' security, as well as their commercial interests in a stable and prosperous Asia. The DPRK's activities also threaten the allies' interest in maintaining the rules-based international order: its development of nuclear weaponry undermines the legitimacy of the global nonproliferation regimes.[12)]

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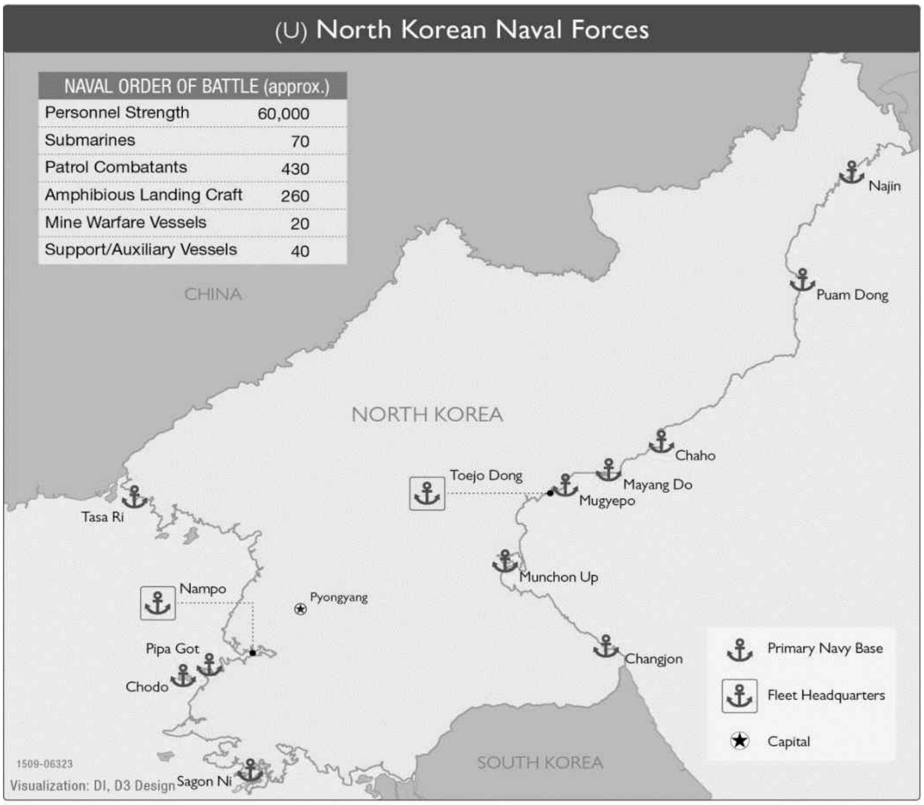
9) Kyle Mizokami, "This is How South Korea Plans to Stop a Nuclear Attack from North Korea," *The National Interest,* July 10, 2017. Jun Ji-hye, "3 military systems to counter N. Korea: Kill Chain, KAMD, and KMPR," *The Korea Times*, November 20, 2016.

10) See: Bruce Klinger, "Gamechanger: North Korea's Submarine Launched Missile Test," *The National Interest*, May 13, 2015.

11) "US expert says THAAD can't intercept North Korea's SLBM," *Hankyoreh*, August 31, 2016.

12) Robert Einhorn, *Non-Proliferation Challenges Facing the Trump Administration*, (Washington: The Brookings Institute, 2017).

[Picture 1] DPRK Naval Bases and Forces



Source: US Department of Defense

Ⅱ. THE STRATEGIC BENEFITS OF ROKN SSNs

SUBMARINE PROPULSION SYSTEMS: AN OVERVIEW

Modern conventional attack submarines (SSKs) rely on diesel-electric propulsion systems rather than nuclear power. SSK propellers are driven via an electric battery which is in turn connected to and charged by a diesel engine. These propulsion systems depend on regular refueling for the diesel generator, limiting the range of SSKs. The system also prevents SSKs from remaining submerged for extended periods of time, limiting the endurance of SSKs. SSKs must regularly "snorkel" at periscope depth to run their diesel engines to recharge their batteries.[13] This renders them vulnerable and easy to detect.[14] The recent introduction of air-independent propulsion (AIP) systems to augment the diesel-electric system has improved the undersea endurance of SSKs, but even the most advanced SSKs must snorkel to recharge at least once every few weeks.[15]

Nuclear submarines, in contrast, are propelled by onboard nuclear reactors. These reactors utilize enriched uranium to prove the power needed to drive the submarines' propellers. This gives SSNs and SSBNs virtually unlimited range and endurance, allowing them to remain at sea and/or underwater almost indefinitely: neither diesel fuel nor air is required to propel these boats. The only limitation on the range and endurance of an SSN is food for the crew.[16] Nuclear reactors also generate more power, supporting a faster and larger boat capable of carrying more extensive weaponry and sensors.[17] This added endurance, range, speed, and equipment comes at a price, however. SSNs are noisier and less maneuverable than many modern SSKs. The reactors also require enriched uranium as fuel, creating proliferation concerns. Indeed, many SSNs utilize "highly-enriched uranium" (HEU) which is over 20% U^{235}.

Developing and operating a SSN is a technologically challenging and financially costly endeavor which only a few maritime powers have mastered. Presently, the US, Russia, the People's Republic of China (PRC), France, and the United Kingdom (UK), and India are the only states that operate SSNs. Brazil is also developing its own SSN with

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13) Sangram Singh Byce and Rajni Kant Tewari, *Anti-submarine Warfare: Fighting the Invisible Enemy* (Anamaya Publishers, 2006).

14) Byce and Tewari, *Anti-submarine Warfare*.

15) Edward Whitman, "Air-Independent Propulsion: AIP Technology Creates a New Undersea Threat," *Undersea Warfare* 13 (2001).

16) Byce and Tewari, *Anti-submarine Warfare*.

17) Simon Cowan, *Future Submarine Project Should Raise Periscope for Another Look* (The Center for Independent Studies, 2012).

assistance from France.[18] The significant technological and financial hurdles to acquiring a SSN suggest that the club of states operating these boats will remain relatively small for the foreseeable future.

The US fields a sizeable fleet of SSNs; indeed, the US submarine fleet is exclusively nuclear-powered. The US Pacific Fleet under Pacific Command (PACOM) operates 31 SSNs.[19] These includes 24 of the older but formidable *Los Angeles* class SSNs and 7 of the newer and more powerful *Virginia* and *Seawolf* class SSNs based in Guam, Hawaii, and along the West Coast.

The ROKN currently possesses only conventional diesel-electric SSKs. Although the early ROKN primarily fielded "midget submarines," the Korean Attack Submarine (KSS) program began the process of modernizing the submarine fleet in 1989.[20] The contemporary ROKN operates nine Type 209 (*Chang Bogo* class, KSS-1) and six Type 214 (*Son Won-Il* class, KSS-2) SSKs. It is also developing three 3,000-ton SSX indigenous diesel-electric submarines (also known as KSS-3). ROK President Moon Jae-in has expressed an interest in developing a SSN, however, recently raising this idea in a phone conversation with US President Donald Trump.[21] The new ROK Minister of Defense Song Young-moo has similarly announced that the ROK would be considering the development of a SSN.[22] The US has been reluctant to transfer the technology necessary for nuclear naval propulsion to the ROK in the past.[23] The Moon administration's renewed interest in this technology,

18) Wilder Alejandro Sanchez, "The Status of Brazil's Ambitious Prosub Program," Center for International Maritime Security, November 22, 2016.

19) USN Submarine Force Pacific, "SUBPAC Commands," available: http://www.csp.navy.mil/subpac-commands/(accessed August 10, 2017).

20) Zachary Keck, "South Korea Goes "All In" On Submarines," *The Diplomat*, August 17, 2013.

21) Ser Myo-Ja, "President calls on military to toughen up," *Korea JoongAng Daily*, August 10, 2017.

22) Choi Yeon-jin, "Seoul to Review Building Nuclear-Powered Submarine," *Chosun Ilbo*, August 1, 2017.

23) Sohn Ji-young, "Can South Korea develop its own nuclear submarine," *The Korea Herald*, August 1, 2017.

however, should spark a new debate in the US on the merits of assisting the ROKN in the development of its own SSNs.

[Table 1] Allied and DPRK Attack Submarines

DPRKN	ROKN	USN PACOM
10 x *Yugo* class (midget sub)	9 x *Chang Bogo* class (SSK)	24 x *Los Angeles* class (SSN)
5 x *Yono* class (midget sub)	6 x *Son Won-Il* class (SSK)	4 x *Virginia* class (SSN)
40 x *Sang-O* class (SSK)		3 x *Seawolf* class (SSN)
20 x *Romeo* class (SSK)		
1 x *Sinpo* class		

An Undersea Kill Chain: Enhanced Allied ASW

The first strategic effect of a ROKN SSN program would be to enhance the allies' littoral ASW capabilities. If utilized properly, ROKN SSNs could provide a force multiplier by improving allied intelligence gathering, allowing the allies to better carry out the "4D" operational concept. In particular, these SSNs could form the basis for a stronger ROK Kill Chain, enhancing the allies' ability to detect, disrupt, and destroy DPRK SLBMs.

SSNs would enhance the ROKN's intelligence, surveillance, and reconnaissance (ISR) capabilities for ASW against DPRK ballistic missile submarines (SSBs) or SSBNs. A SSN could loiter for extended periods of time concealed beneath the surface at a safe distance from DPRK submarine bases like Mayang Do to monitor SSB/SSBN activity using passive and active sonar and seabed sensors. SSKs would struggle with this task as they are required to surface periodically; even with AIP technology, the ROKN's *Son Won-Il* class boats have an endurance of only two weeks. SSNs also do not need to conserve power while submerged and can therefore operate much more powerful sensors for ISR while submerged, giving them an edge in the challenging ASW environment in the Korean littoral waters.[24)]

This ISR capability could be strengthened further using sensor nets and unmanned underwater vehicles (UUVs). The allies could collaborate in further developing seabed sensors that could be used to encircle key DPRK submarine facilities.[25)] The ROKN SSN could then forward deploy to monitor these sensors. Similarly, SSNs could carry, deploy, and recharge UUVs that could spread out and quietly monitor the DPRK coast.[26)] Using a sensor net and UUVs, SSNs could act as forward deployed ISR hubs, greatly enhancing the allies' 4D capability.[27)] If a DPRK SSB or SSBN were to deploy, the ROKN SSN could also tail and monitor the SSB/SSBN independently or with the assistance allied destroyers and US P3 Orion aircraft.

In the event of a confrontation, ROKN SSNs could further assist with the ROK Kill Chain by preemptively eliminating the threat posed by SSB/SSBNs. The superior weapons and speed offered by ROKN SSNs would allow them to torpedo the DPRK's submarines at sea before they could surface to deploy SLBMs, "killing the arrow."[28)] Alternatively, if the SSNs were equipped with vertical launch systems and cruise missiles, they could target DPRK ports directly before DPRK submarines put to sea, "killing the archer."[29)] ROKN SSNs could also deploy anti-submarine mines around key DPRK ports in the event of a conflict to impede the operation of DPRK nuclear or conventional submarines.

The increase in local capabilities offered by a ROKN SSN program

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24) The sea is relatively shallow and has a high degree of commercial traffic, disrupting both active and passive sensors.

25) This would be similar to the US SOSUS, utilized to monitor Soviet SSBNs during the Cold War.

26) Ronald O'Rourke, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, (Washington DC: Congressional Research Service, 2017).

27) For a similar idea for Australian submarines, see: Cowan, "Future Submarine Project."

28) William J. Toti, "The Hunt for Full-Spectrum ASW," *Proceedings* (2014).

29) Toti, "The Hunt for Full-Spectrum ASW."

would augment existing US forces and increase the feasibility of allied 4D. ROKN SSNs can be permanently committed to the Korean littoral waters, which should allow them to respond immediately to a contingency if no USN SSNs are in the area. This should vastly improve the allied ASW and undersea ISR capabilities, as the US naval forces assigned to secure the Korean peninsula against DPRK missile threats presently have few assets specializing in ASW.[30] This designated role should also allow ROKN SSNs to specialize in their Kill Chain mission, obtaining experience, developing doctrine, and fielding equipment tailored to address DPRK SLBM challenges. Perhaps most importantly, this capability will free up the USN's increasingly overtaxed SSN fleet to operate where they are needed elsewhere; there will be no need to pull SSNs away from missions elsewhere (particularly in the South China Sea and the North Atlantic) to confront the DPRK SLBM threat.[31]

[Table 2] The Advantages of Nuclear Propulsion for Littoral ASW[32]

Platform	ROKN *Son Won-II* Class	USN *Virginia* Class
Propulsion	Diesel-electric with AIP	Nuclear: S9G reactor
Endurance	2 weeks	Unlimited
Top Speed (Submerged)	20 knots (kt)	35 kt
Displacement (Submerged)	1,860 tons	7,800 tons
UUV capable	No	Yes

The unique contributions of SSNs to ASW in littoral environments have long been recognized by the world's leading navies. The USN's fast and stealthy *Sturgeon* class SSNs were used in Operation

30) Sukjoon Yoon, "Expanding the ROKN's ASW capabilities to deal with North Korean SLBMs," *PacNet* 31 (2015).
31) Steven Stashwick, "US Pacific Command Needs More Submarines as Navy Struggles to Maintain Force," *The Diplomat*, May 12, 2017.
32) US Navy, *US Navy Fact File: Virginia Class Submarine*, accessible at: http://www.navy.mil/navydata/fact_print.asp?cid=4100&tid=100&ct=4&page=1 (accessed 9/10/2017). "South Korea to Order 5 More U-214 AIP Submarines to Bridge to Indigenous Boats," *Defense Industry Daily,* May 8, 2015.

Holystone during the Cold War for ISR around submarine bases in the Russian littoral. Although these operations at times led to incidents – most notably two collisions with Russian submarines – they succeeded in obtaining high-quality intelligence on Russian submarine capabilities and covertly trailing Russian SSNs and SSBNs.[33)]

More recently, the US has deployed SSNs to the Korean littoral waters during periods of high tension to engage in ASW exercises and conduct ISR. Several *Los Angeles* class SSNs engaged in ASW drills in the East Sea in response to the DPRK's torpedoing of the *ROKS Cheonan* in 2010.[34)] Similarly, in response to the DPRK's SLBM tests in 2015, the US deployed *Virginia* class and *Los Angeles* class SSNs for port visits in the ROK. The US' continued use of its SSNs for these operations in the East and West Seas serves as a testament to the potential value of this platform for addressing DPRK submarine-based threats.

A number of factors will shape the extent to which ROKN SSNs will enhance allied ASW and 4D. Design choices matter substantially. As the US *Virginia* class highlights, a SSN designed for littoral ASW must prize maneuverability, stealth, and sensors over alternative priorities like top speed and diving depth that are important for operations in the open seas. In particular, the ROK will need to prioritize new, upgraded passive and active sensors if it is to cope with the challenging ASW environment in the Korean littoral waters.

The benefits of SSNs for littoral ASW also hinge in no small part on the DPRK's own ASW capabilities. There is limited intelligence on the extent of the DPRK's ability to wage ASW. Its known ASW capabilities include two new small helicopter frigates and antiquated Mil Mi-4 and Mil Mi-14 ASW helicopters.[35)]

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33) Jeffrey T Richelson, *The US Intelligence Community* (Boulder: Westview Press, 2015).
34) US Department of Defense, "US, South Korea Plan Anti-submarine Exercise," September 24, 2010.
35) Joseph Bermudez Jr., "New North Korean Helicopter Frigate Spotted," *38 North,* May 15, 2014.

Finally, the effectiveness of ROKN SSNs for littoral operations will depend on how closely the ROK integrates its efforts with the US. Ensuring complementarity rather than redundancy in operations and sharing intelligence will be critical to the allies' ability to track and defeat DPRK submarines. Furthermore, the ROKN will need assistance from the USN in developing and refining the human capital necessary to manage a SSN: exchanges, education programs, and joint exercises will be critical to developing a fully operational SSN.[36)]

COERCIVE BARGAINING: DETERRING THE DPRK'S SLBM THREAT

A SSN program could potentially strengthen the allies' coercive diplomacy toward the DPRK. Coercive diplomacy refers to the allies' efforts to bring the DPRK into compliance with their will through threats to use force.[37)] The US and ROK seek to use coercive diplomacy to deter DPRK aggression and compel an end to the DPRK's advancing nuclear and missile programs – including its SLBM program. A ROKN SSN program can assist with this task by 1) serving as a signal of resolve, 2) reducing the incentives for the DPRK to pursue SLBMs, and 3) providing a flexible platform for gunboat diplomacy.

A SSN program could be employed as a costly signal to the DPRK of the allies' resolve to secure the Korean littoral and prevent the continued advancement of the DPRK's SLBM capabilities. SSNs are expensive, controversial, and technically challenging platforms given the nuclear technology required for their development and operation. If

36) For the importance of human capital in determining capability, particular for submarines, see: John Schaus, Lauren Dickey, and Andrew Metrick, "Asia's Looming Subsurface Challenge," *War on the Rocks*, August 11, 2016.

37) See: Thomas Schelling, *Arms and Influence* (New Haven: Yale University Press, 1966). Thomas Schelling, *The Strategy of Conflict* (Cambridge: Harvard University Press, 1960).

the ROK were willing to bear the costs of acquiring and operating this platform, it would serve as a costly and credible signal reinforcing the ROK's unwillingness to tolerate the continued development of a DPRK SLBM capability.[38] Similarly, if the US were willing to offer the advanced technological assistance necessary for the ROKN to develop a SSN, it would highlight its resolve to defend the ROK against the emerging SLBM threat. By suffering costs that irresolute states would be unwilling to bear, the allies reduce the chances that the DPRK will underestimate their commitment to their defense.[39]

ROKN SSNs could also help deter the DPRK's development of SLBM technology and use of SSBs through denial.[40] As mentioned above, SSNs enhance the allies' ability to pursue 4D: in effect, enhancing their ability to neutralize DPRK SSB/SSBNs. This should reduce the DPRK's incentives to a) continue pursuing a SLBM capability and b) deploy or utilize any SSB/SSBNs it develops.[41] If the DPRK appreciates that a SLBM will be unable to give it a secure second-strike capability given the allies' ability to preemptively destroy this capability, it may be less willing to bear the significant cost of further developing this challenging technology. Similarly, if the DPRK understands that any SSB it does develop is likely to be tracked and potentially eliminated if it puts to sea, it may be less likely deploy these assets. If the ROK can deny the DPRK the ability to utilize its SSB/SSBNs, the DPRK will also be less emboldened by any SLBM capability it acquires. Without the secure second strike capability offered by a SSB/SSBN, the DPRK will find it riskier to engage in "salami slicing tactics" or other steps short of war designed to undermine allied security.[42]

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38) James Fearon, "Signaling Foreign Policy Interests: Tying Hands versus Sinking Costs," *The Journal of Conflict Resolution* 41, no. 1 (1997). Glenn Snyder and Paul Diesing, *Conflict Among Nations: Bargaining, Decision-Making, and System Structure in International Crises* (Princeton: Princeton University Press, 1977).

39) Fearon, "Signaling Foreign Policy Interests." Snyder and Diesing, *Conflict Among Nations*.

40) See: Glenn Snyder, *Deterrence and Defense: Toward a Theory of National Security* (Princeton: Princeton University Press, 1961).

41) Snyder, *Deterrence and Defense*.

ROKN SSNs could also be useful for "gunboat diplomacy" – that is, maneuvering naval assets to signal capabilities to an adversary during a dispute. SSNs, able to move stealthily and remain concealed for extended periods of time, can be surfaced in sensitive areas as implicit threats.[43] This gunboat diplomacy would highlight the ROKN's ability to strike key DPRK maritime capabilities, serving as a useful reminder of the costs of conflict with the allies.

States have frequently relied upon naval capabilities to bolster coercive diplomacy. US President Ronald Reagan used a major naval buildup coupled with the 1982 "Maritime Strategy" to signal US resolve to resist Soviet revisionism and maintain maritime supremacy.[44] As one of the strategy's key architects, US Navy Secretary Joseph Lehman, argues: "a key element of the 1982 Strategy was signaling America's renewed commitment to naval power to both our adversaries and allies."[45] The Maritime Strategy also bolstered deterrence by denial by strengthening the US' naval war fighting capabilities, allowing the US to deny the Soviets' ability to interdict US supply lines to Europe. Furthermore, it augmented the US' ability to hold Soviet SSBNs at risk, raising the cost to the Soviet Union should it engage in conventional escalation in Europe.[46]

British military operations around the Falkland Islands provide particularly useful insights into the utility of SSNs for deterrence. In 1977, Operation Journeyman saw British SSNs deployed to the waters surrounding the contested islands successfully deter Argentine encroachment.[47] Again, in 1982, during the Falklands War, the

42) Schelling, *Arms and Influence*.

43) James Stebbins, "Broaching the Ship: Rethinking Submarines as a Signaling Tool in Naval Diplomacy," (Master's Thesis, Naval Postgraduate School, 2015).

44) For an in-depth look at this strategy, see: John Hattendorf, *The Evolution of the US Navy's Maritime Strategy, 1977-1986* (Newport: Naval War College Press, 2004).

45) John Lehman and J Randy Forbes, "What Navy's New Maritime Strategy Should Say," *Breaking Defense*, March 11, 2015.

46) See: Linton Brooks, "Naval Power and National Security: The Case for the Maritime Strategy," *International Security* 11, no. 2 (1986).

presence of several British SSNs helped deter Argentina from operating in the British-delineated military exclusion zone.[48] Furthermore, after a UK SSN, the *HMS Conqueror,* sank an Argentine light cruiser, the *ARA General Belgrano*, the entire Argentine Navy remained consigned to port, unable to put to sea for fear of being destroyed by British SSN.[49] Subsequently, Britain was able to secure control of the sea and cut off Argentinian ground forces on the Falklands from sea supply.[50]

Russia's frequent use of SSNs for gunboat diplomacy during the Cold War similarly highlights the platform's usefulness for coercive signaling. As Brent Ditzler argues: "In what has become a standard pattern, a portion of the Soviet submarines involved in exercises and other diplomatic shows of force, routinely surface for prolonged periods and/or subsequently make highly visible port calls to friendly nations in the vicinity. This exposure is tactically unnecessary, and can therefore be assumed to have some diplomatic meaning."[51] Reinforcing this argument, a retired Russian admiral argues that during the 1971 Indo-Pakistani war, the Soviet Navy used SSNs expressly for the express purpose of gunboat diplomacy: "The Chief Commander's order was that our submarines should surface when the Americans appear. It was done to demonstrate to them that we had nuclear submarines in the Indian Ocean. So when our subs surfaced, they recognized us. In the way of the American Navy stood the Soviet cruisers, destroyers and atomic submarines equipped with anti-ship missiles."[52]

The consequences of SSNs for coercive diplomacy will depend in part on how these capabilities are framed diplomatically. If the allies make

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47) Press Association, "How Britain averted a Falklands invasion in 1977," *The Guardian*, Tuesday 31, 2005.

48) Brent Ditzler, "Naval diplomacy beneath the waves: a study of the coercive use of submarines" (Master's Thesis, Naval War College, 1989).

49) Ditzler, "Naval diplomacy beneath the waves."

50) Ditzler, "Naval diplomacy beneath the waves."

51) Ditzler, "Naval diplomacy beneath the waves."

52) Rakesh Krishnan Simha, "1971 War; How Russia sank Nixon's gunboat diplomacy," *Russia & India Report*, December 20, 2011.

the intentions undergirding their military signals clear in corresponding public statements, it will maximize their deterrent and compellent effects.[53] The SSNs will be most effective for coercive diplomacy if they are accompanied by additional measures to strengthen resolve, deny DPRK missile threats, and exercise gunboat diplomacy. SSNs will provide additional leverage, but are no strategic panacea: they will supplement but not replace additional naval capabilities and anti-missile defenses.

ALLIANCE COHESION: COMMITMENT AND BURDEN-SHARING

A US-assisted ROKN SSN program would also have substantial ramifications for the strength of the US-ROK alliance relationship. First, it would send a costly signal to the US that the ROK is willing to assume more of the burden for its own defense. One of the key causes of recent alliance friction has been US concerns about ROK burden-sharing. Some in the US argue that the ROK should commit more of its own resources to defending stability on the peninsula.[54] If the ROK commits to developing and operating SSNs, contributing additional resources to 4D in the East and West seas, it should help alleviate some of these concerns and provide a stronger foundation for continued security cooperation.

This burden-sharing at sea would represent a significant step toward the "1,000 ship navy" partnership concept advocated by retired US Admiral and Chairman of the Joint Chiefs of Staff Mike Mullen.[55]

53) For the importance of public statements in signaling, see: Fearon, "Signaling Foreign Policy Interests." Also see: Brad Roberts, *The Case for US Nuclear Weapons in the 21st Century* (Stanford: Stanford University Press, 2016).

54) Scott Snyder, "Launch of the Trump-Moon Era in U.S.-Korea Relations," *Asia Unbound*, July 12, 2017. Hanbyeoi Sohn, "3 Obstacles to US-South Korea Cooperation on the North Korea Issue," *The Diplomat*, June 27, 2017.

Mullen first proposed this concept in 2006, arguing that:

> *"Because today's challenges are global in nature, we must be collective in our response. We are bound together in our dependence on the seas and in our need for security of this vast commons. This is a requisite for national security, global stability, and economic prosperity… As we combine our advantages, I envision a 1,000-ship Navy—a fleet-in-being, if you will, made up of the best capabilities of all freedom-loving navies of the world."*[56]

Mullen claims that the US needs stronger partnerships with more capable regional navies to help defend against the many threats looming in the maritime domain. Friendly navies willing to assume greater responsibility and acquire more robust capabilities are a welcome prospect under this concept; while the US will continue to bear much of the burden for maritime security throughout the world, it cannot carry the load alone.[57] The ROKN is uniquely well-positioned to form a key part of this partnership in the Asia-Pacific, strengthening and broadening the US-ROKN alliance.

Second, US assistance with a SSN program would also provide a costly signal to the ROK that the US is still firmly committed to supporting its ally in the face of continued DPRK provocation and strong missile capabilities. Recent political developments in the US have caused some concern in the ROK over the strength of the US commitment to ROK security.[58] Assisting the ROK with this capability

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55) For an excellent overview of this concept, see: Ronald Ratcliff, "Building Partners' Capacity: The Thousand-Ship Navy," *Naval War College Review* 60 (2007).

56) Admiral Mike Mullen, "Remarks as delivered for the 17th International Seapower Symposium," *Naval War College,* September 21, 2005.

57) Bates Gill and Michael Green, "Unbundling Asia's New Multilateralism," in Bates Gill and Michael Green eds., *Asia' New Multilateralism: Cooperation, Competition, and the Search for Community* (New York: Columbia University Press, 2009).

58) Sohn, "3 Obstacles." Demetri Sevastopulo and Katrina Manson, "US faces struggle to ease Asian allies' fears of retreat," *Financial Times*, June 2, 2017. John Power, "Donald Trump's Problem with the US-Korea Alliance," *The Diplomat*, July 23, 2015.

could go a long way toward building trust and confidence in the US as an ally.[59] In particular, this program would demonstrate that the US is willing to entrust the ROK with sensitive technology for the sake of its defense. It would also highlight the enduring benefits of the security partnership for the ROK.

The US has successfully used the transfer of military technology to reinforce its alliances and security partnerships in the past. US-UK cooperation on naval nuclear propulsion in the late 1950s provides a telling example. The US-UK dispute during the divisive Suez Crisis in 1956 had left US President Dwight Eisenhower looking for a way to reinforce the shaken US-UK alliance. At the same time, Eisenhower hoped to build up the UK's military capabilities so that the UK and NATO more broadly could assume more responsibility for the growing burden of deterring an increasingly powerful Soviet Union. To accomplish these objectives, Eisenhower sought to transfer naval nuclear technology to assist the UK in developing its own SSN.[60] Under the leadership of US Admiral Hyman Rickover and UK Admiral Louis Mountbattan, the allies began sharing technological knowledge about naval nuclear propulsion to strengthen the US-UK alliance and reinforce the UK's independent capabilities.[61]

Although US domestic politics complicated this process, the allies successfully concluded the US-UK Mutual Defense Agreement in 1958 authorizing technology transfers in nuclear propulsion between the

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59) Keren Yarhi-Milo, Alexander Lanoszka, and Zack Cooper, "How can Donald Trump reassure nervous US allies? By giving them weapons," *The Washington Post: The Monkey Cage*, January, 13, 2017. Keren Yarhi-Milo, Alexander Lanoszka, and Zack Cooper, "To Arm or to Ally? The Patron's Dilemma and the Strategic Logic and Arms Transfers and Alliances," *International Security* 41, no. 2 (2016).

60) James Jinks and Peter Hennessy, *The Silent Deep: The Royal Navy Submarine Service Since 1945* (Allen Lane, 2015). John Baylis, "The 1958 Anglo-American Mutual Defence Agreement: The Search for nuclear Interdependence," *Journal of Strategic Studies* 31, no. 3 (2008). Duncan Redford, "The 'Hallmark of a First-Class Navy': The Nuclear-Powered Submarine in the Royal Navy, 1960-77," *Contemporary British History* 23, no. 2 (2009), 171.

61) Jinks and Hennessy, *The Silent Deep*.

allies. This included the sale of an American-made Westinghouse S5W naval nuclear reactor to the UK and the training of British submariners in the US. This allowed the UK to develop its first SSN – the *HMS Dreadnought* – powered by the S5W. It also facilitated the development of the UK's first fully-indigenous SSNs, the *Valiant* class, powered by the "son of S5W" Rolls-Royce pressurized water reactor.[62]

This cooperation had a major impact on the strength and cohesion of the US-UK alliance. Upon completion of the *HMS Dreadnought,* UK leaders praised the US contribution to British naval capabilities. [63] Two leading UK naval officers would later remark that "The UK's debt to the US Navy, and to Admiral Rickover in particular, is incalculable."[64] The UK's mastery of SSN technology also increased its ability to assume a bigger role in allied deterrence and defense against the Soviet Union at sea. The UK was able to contribute more to allied ISR on the Soviet Navy given the added endurance and sensor capabilities of its SSNs.[65] As Anthony Wells highlights, the US and UK used their advanced capabilities to great effect: "the United States and United Kingdom together built a data base on every Soviet submarine class and every hull within each class… Speed, depth, operating characteristics, and crew performance could all be observed and recorded… The superior stealth of well-handled US and UK submarines permitted penetration of the most sensitive and dangerous areas to observe and record weapons trials."[66] The UK SSNs not only strengthened the UK's contribution to its own territorial defense; they also contributed to the territorial defense of the US by guarding the Iceland-Greenland gap.[67]

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62) Jinks and Hennessy, *The Silent Deep.*

63) Walter Waggoner, "Atom Submarine Begun By Britain: Prince Philip Hails US Help as He Symbolically Lays Keel of Dreadnought," *The New York Times*, June 13, 1959.

64) R. Baker and L. J. Rydill, "The Building of the Two Dreadnoughts," in F.M. Walker and A. Slaven (eds.,) *European Shipbuilding: One Hundred Years of Change* (London: Marine Publications International, 1983).

65) Anthony Wells, *A Tale of Two Navies: Geopolitics, Technology, and Strategy in the United States Navy and Royal Navy, 1960-2015* (Annapolis: Naval Institute Press, 2017).

66) Wells, *Two Navies,* s

Overall, US-UK cooperation on a SSN highlights the potential advantages of defense industry collaboration for alliance cohesion.

The potential benefits of a US-assisted ROKN SSN program for alliance cohesion will depend on several factors. Both allies must appreciate the common interests they have in peninsular security and regional stability more broadly if this program is to enhance their alliance. They must also continue to reinforce their mutual commitments through public statements, private assurances, and close strategic coordination: this SSN program must simply be one step of many to buttress the critical US-ROK alliance. Furthermore, if the SSN program is to allow the ROK to assume greater responsibility for allied security, the two countries' operations must be closely coordinated to avoid redundancy and maximize complementarity.

SECONDARY EFFECTS: ALLIED POWER PROJECTION CAPABILITIES

It is important to note that SSNs might also offer the ROKN the ability to bolster its emerging power projection and blue water naval capabilities, strengthening the alliance's global potential. Presently, the ROKN is limited largely to green-water capabilities; it prioritizes the defense of the Korean littoral waters rather than operations on the high seas or in foreign littoral waters.[68] Its primary existing blue-water asset is the *Dokdo* class amphibious assault ship, designed as the centerpiece of a future rapid response fleet.[69] The *Dokdo* class

67) John Simpson, "The Future of the Anglo-US Nuclear Deterrence," In Kenneth Thompson (ed), *Arms Control: Alliances, Arms Sales, and the Future* (Laham: University Press of America, 1992).

68) Paul Pryce, "The Republic of Korea Navy: Blue-Water Bound?" *CIMSEC*, January 28, 2016.

69) Richard Bitzinger, *Arming Asia: Technonationalism and Its Impact on Local Defense Industries* (New York: Routledge, 2017).

will be supported by the ships built under the KDX program, including the *Gwanggaeto the Great* (KDX-I), *Chungmugong Yi Sun-shin* (KDX-II), and *Sejong the Great* class (KDX-III) destroyers.[70] Currently, the underwater support for the *Dokdo* is limited to the *Son Won-Il* class SSK, which will limit the range and speed of the rapid response fleet.[71] A SSN could provide better support for this blue water fleet, allowing it to move faster and farther from friendly ports. Overall, a ROKN SSN would constitute key step forward toward a more effective rapid response fleet and a stronger blue-water capability.

The greater power-projection and blue-water capabilities conferred by a ROKN SSN fleet could allow the US-ROK alliance to contribute more actively to regional and global security beyond the Korean Peninsula. The ROK could utilize SSNs to track and interdict illegal shipments bound for the DPRK, in line with the Proliferation Security Initiative (PSI). SSNs would also provide a more effective escort for rapid response fleets deployed for peacekeeping, humanitarian, and counter-piracy operations abroad.[72] They could help patrol and protect sea lanes of communication throughout East Asia which the ROK depends heavily on for trade.[73] Indeed, the ROKN has already demonstrated its interest in assuming a broader role in global sea lane security alongside the US, contributing forces to protecting shipping lanes against piracy in the distant Gulf of Aden.[74] ROKN SSNs could similarly support USN operations similar to those listed above by providing additional ISR and escorting US carrier battle groups.[75]

Bitzinger, *Arming Asia*.

71) Arthur Dominic J Villasanta, "Another of South Korea's Largest Warships Set to Launch in 2020," *Telegiz*, May 1, 2017.

72) Yoji Koda, "The Emerging Republic of Korea Navy: A Japanese Perspective," *Naval War College Review* 63, no. 2 (2010).

73) Koda, "The Emerging Republic of Korea Navy."

74) Terence Roehrig, "South Korea's Counterpiracy Operations in the Gulf of Aden," in Scott Bruce, John Hemmings, Balbina Y. Hwang, Terence Roehrig, and Scott A. Snyder, *Global Korea: South Korea's Contributions to International Security* (CFR Press, 2012).

75) Yoon, "Expanding the ROKN's ASW capabilities."

These contributions would be well-suited to strengthening the "global partnership" advanced in US-ROK alliance diplomacy. As Presidents Moon and Trump recently emphasized, "United States-ROK cooperation on global issues is an indispensable and expanding aspect of the Alliance."[76)]

[Table 3] The Advantages of Nuclear Propulsion for Power Projection[77)]

Boat	ROKN *Son Won-II* Class	USN *Virginia* Class
Propulsion	Diesel-electric with AIP	Nuclear: S9G reactor
Top Speed (Submerged)	20 kt	35 kt
Range (Submerged)	420 nautical miles (nm) at 8 kt	Unlimited
Top Speed (Surfaced)	12 kt	25 kt
Range (Surfaced)	12,000 nm at 6 kt	Unlimited

The role of SSNs in enhancing a maritime power's blue-water and power-projection capabilities is widely recognized. The Soviet Union relied on SSNs as the basis for its blue-water fleet rather than a large surface fleet or naval aviation.[78)] Brazil's fledgling SSN program is similarly viewed as the centerpiece of a new blue water navy: Brazilian Admiral Eduardo Ferreira argues that Brazil must "possess a blue water Navy in case of a hypothetical conflict in the South or East China Seas."[79)] The US also regularly utilizes SSNs as part of its forward deployed naval presence - both independently and as support for its carrier battle groups- far from US shores.

The British experience against Argentina in the Falklands War provides the best example of the potential impact of SSNs as a blue-water, power projection capability. The speed and range of British

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76) "Joint Statement between the United States and Republic of Korea," June 30, 2017.
77) Richard Tomkins, "New GenDyn submarine completes alpha trials," *UPI Press*, August 7, 2014. "South Korea to Order 5 More U-214 AIP Submarines to Bridge to Indigenous Boats," *Defense Industry Daily*.
78) James R. Holmes, "Question: Just How Strong Was the Soviet Navy?" *Real Clear Defense*, March 6, 2015.
79) Wilder Alejandro Sanchez, "The Status of Brazil's Ambitious Prosub Program," *CIMSEC*, 2016.

SSNs allowed them to be deployed promptly to the distant waters around the Falkland Islands in the Western Hemisphere.[80] When the conflict escalated, the *HMS Conqueror's* sinking of the *ARA General Belgrano* resulted in the death of 321 crew members and the neutralization of the rest of the Argentinian navy.[81] Clearly these SSNs proved vital to UK power projection during this conflict.

The extent to which SSNs improve the ROKN's power projection capabilities is contingent on several variables. SSNs will only bolster the ROKN's blue-water capabilities if the ROKN spends the appropriate time and effort in training and preparing for power-projection missions.[82] Additionally, the USN must assist the ROKN, offering best-practices and training drawing on the USN longstanding expertise in conducting SSN operations far from American shores. A ROKN rapid response fleet - the SSN included - will also need to strengthen interoperability with USN forces to maximize its impact in blue-water contingencies.

Ⅲ. THE STRATEGIC RISKS OF ROKN SSNs

ARMS RACING

While a SSN program could signal allied resolve and strengthen deterrence, it also raises the risk of an arms race with the ROK's neighbors. Neighboring states might feel threatened by this new platform, worrying that the ROK harbors revisionist intent and that the

80) Steven Harper, *Submarine Operations During the Falklands War*, (Newport: Naval War College, 1994).

81) Harper, *Submarine Operations During the Falklands War*.

82) As with ASW and littoral combat, the ROKN will need to focus on and invest in human capital, not just technology, to secure a blue water capability.

new SSNs might be used against their own forces.[83] As a consequence, these neighbors might speed up their own naval modernization efforts, triggering an unnecessary regional arms competition that leaves all sides worse off.

SSNs may prove acutely problematic for arms race instability. A number of strategic theorists have pointed out that "offensive" capabilities - those assets that are uniquely well-suited for offensive operation - are the most likely to create fear and insecurity among neighboring states.[84] As discussed above, SSNs can greatly enhance a state's ability to project power, and their stealth and endurance makes them difficult to defend against; this makes SSNs particularly adept at offensive action. The nuclear technology involved only compounds this problem: if a SSN program is perceived as strengthening the ROK's latent nuclear capabilities (discussed further below), it would greatly increase the insecurity of nearby states and raise the chances of reciprocal armament.

Of the regional states that might react negatively to a ROK SSN program, Japan and the PRC are the most likely candidates given their proximity and maritime disputes. Of these two candidates, Japan is considerably less likely than the PRC to perceive a ROKN SSN as a threat, despite the rocky history of ROK-Japan relations.[85] Japan's powerful Maritime Self Defense Force (MSDF), strong alliance with the US, and budding defense cooperation ROK make it unlikely that Japan would feel immediately threatened by ROKN SSN's. Japan also shares the US-ROK alliance's concern over the mounting DPRK missile threat and might very well welcome an expanded allied Kill Chain capability.

The PRC, on the other hand, has a more problematic relationship

83) Dave Majumdar, "Is South Korea Getting Ready to Build Nuclear Submarines," *The National Interest*, October 19, 2016.

84) See, for example: Stephen Walt, *The Origins of Alliance* (Ithaca: Cornell University Press, 1987).

85) For a discussion of recent bilateral challenges, see: Brad Glosserman and Scott Snyder, *The Japan-South Korea Identity Clash* (New York: Columbia University Press, 2015).

with the ROK. It views the US alliance system in East Asia primarily in adversarial terms and has responded poorly to previous advances in allied military capabilities.[86] In particular, the PRC reacted strongly to the alliance's most recent attempt to introduce a new military system to deal with the DPRK missile threat: the THAAD system. The PRC issued a formal diplomatic protest, suspended high-level security dialogues, cut Chinese tourism to the ROK by 20%, and deployed its own long-range radar systems to Inner Mongolia in a thinly-veiled tit-for-tat maneuver.[87] As such, it seems possible that the PRC might respond similarly to a ROKN SSN in the absence of deft allied diplomatic outreach. In particular, relations between the PRC and the allies might deteriorate and the PRC might focus on developing new undersea assets to offset the ROK's new platforms. This might, in turn, provoke other regional countries to react and develop their own new capabilities – leading to an unstable and expensive arms competition.

History is replete with examples of problematic naval arms races. The German decision to acquire a large fleet in the early 20th century triggered a major naval arms race with the UK in the lead up to World War I.[88] The UK decision to develop a dreadnought – a large, advanced warship with only heavy guns – acted as a critical catalyst for the escalation of this arms race; not long after this platform was introduced, the Anglo-German arms race intensified further with both sides acquiring new capital ships.[89] Around the same time, Brazil's purchase of several British dreadnoughts touched off a local arms race with the Argentinian and Chilean navies.

The Asia-Pacific itself may already be in the midst of a nascent

86) Adam Liff, "China and the US Alliance System," *The China Quarterly* (2017).

87) Michael D. Swaine, "China's Views on South Korea's Deployment of THAAD," *China Leadership Monitor* 52 (2017). Hwang Hojun, "China Installs Radar That Can Monitor S. Korea, Japan and Western Pacific: Media," *Arirang News*, March 13, 2017.

88) Paul Kennedy, *The Rise of the Anglo-German Antagonism: 1860-1914* (Amherst, Humanity Books, 1980).

89) Giles Edwards, "How the Dreadnought sparked the 20th Century's first arms race," *BBC Magazine*, June 2, 2014.

submarine arms race, with various regional countries acquiring new attack submarines. In the 1990s, in the aftermath of the Taiwan Strait Crisis, the PRC began rapidly acquiring a larger fleet of SSNs as part of an anti-access/area-denial approach to challenge the US' ability to operate in the region.[90) These acquisitions and fear of Chinese intentions in turn provoked a broader regional undersea race, with a number of states enhancing their undersea capabilities qualitatively and/or quantitatively.[91) These steps raised tensions further, and inspired additional states to seek their own SSKs – often from the PRC.[92) As Singapore's defense ministry recently highlighted, the number of submarines in the West Pacific may rise from 200 to 250 by 2025.[93)

The Asia-Pacific Undersea Arms Race[94)

New SSKs and SSNs since the mid-1990s	
PRC	*42 SSKs and 6 SSNs acquired*
Australia	*12 SSKs planned*
India	*2 SSNs acquired, 24 SSKs planned*
Indonesia	*12 SSKs planned*
Vietnam	*6 SSKs planned*
Singapore	*2 SSKs acquired*
Malaysia	*2 SSKs acquired*
Thailand	*3 SSKs planned*
Myanmar	*Unspecified number of SSKs planned*
Bangladesh	*2 SSKs acquired*
Philippines	*3 SSKs planned*
Taiwan	*Unspecified number of SSKs planned*

90) Mackenzie Eaglen and Jon Rodeback, *Submarine Arms Race in the Pacific: The Chinese Challenge to US Undersea Supremacy* (Heritage Foundation, 2010). Elias Groll and Dan De Luce, "China is Fueling a Submarine Arms Race in the Asia-Pacific," *Foreign Policy,* August 26, 2016.

91) Groll and De Luce, "China is Fueling a Submarine Arms Race."

92) For instance, see: Prashanth Parameswaran, "Did Thailand Secretly Approve Its China Submarine Buy?" *The Diplomat*, April 27, 2017.

93) Jeevan Vasagar, "Asian submarine race raises security concerns," *Financial Times*, May 17, 2017.

94) This table was developed based on a review of the reporting on these states' submarine programs in various international newspapers.

The extent to which a ROKN SSN causes an arms race with either Japan or the PRC will hinge significantly on the quality of allied diplomacy. If the US and ROK engage in an extensive effort to reassure the PRC and Japan of their intentions, it could mitigate the potential for an arms race.[95] Specifically, much will depend on public commitments by the allies that the SSNs will be used defensively against the DPRK and are not intended to threaten the ROK's other neighbors. The quality and quantity of regional confidence-building measures will also be a critical factor in shaping the regional response to this new asset. Similarly, military-to-military contacts between the allies and the PRC are likely to shape the PRC's threat perception; the more robust such contacts are, the less likely the PRC is to fear new ROKN capabilities.

The potential of this new capability to spark an arms race will also be shaped by the manner in which it is deployed. If the allies utilize ROKN SSNs primarily to target DPRK submarines or to defend the global commons in places like the Gulf of Aden, the PRC and Japan will have little reason to fear these assets. If, however, ROKN SSNs are used to track and tail PRC SSBNs or in territorial disputes with Japan over the Dokdo Islands, the potential for an arms race will loom much larger.

LATENT NUCLEAR CAPABILITIES

Just as problematically, a nuclear propulsion system could be seen as increasing the potency of ROK latent nuclear capabilities. Joseph Pilat defines nuclear latency as "the possession of many or all of the technologies, facilities, materials, expertise (including tacit knowledge), resources and other capabilities necessary for the development of nuclear

95) For examples of this strategy, see: James Steinberg and Michael O'Hanlon, *Strategic Reassurance and Resolve: US-China Relations in the Twenty-First Century* (Princeton: Princeton University Press, 2014).

weapons, without full operational weaponization."[96] Uranium enrichment and reprocessing both can form the basis for the development of nuclear weapons – the former can be used to develop highly-enriched uranium and the latter can produce weaponized plutonium. Both are therefore considered part of a latent nuclear weapons capability. Both enrichment and reprocessing in the ROK are currently disallowed by the "123 Agreement" between the ROK and US.[97]

If the US and ROK were to revise the agreement to allow the ROK to independently fuel a SSN naval reactor, it would improve the ROK's ability to enrich and reprocess uranium. First, fueling a SSN reactor requires uranium enrichment; in fact, many SSN reactors (particularly the smaller reactors that would be ideal for a smaller ROKN SSN that could operate in the narrow and shallow passages in the West Sea) utilize HEU that contains over 20% U^{235} which could be used for developing a nuclear weapon. Second, a SSN reactor would produce uranium waste which could be reprocessed into plutonium which could in turn be utilized in a nuclear weapons program. Indeed, some in the ROK have argued that reprocessing (including pyro-processing) is a must given the ROK's dwindling storage space for spent fuel. Overall, operating a SSN naval reactor *could* bring the ROK closer to mastering the full nuclear fuel cycle, advancing its latent nuclear capabilities.

Other states have utilized naval reactor programs for this purpose. In the 1970s, for instance, Brazil used work on its naval reactor as part of a broader push to conquer the nuclear fuel cycle and potentially develop a nuclear weapon. Iran has similarly threatened to use a work on a naval reactor to advance their latent nuclear capability. In 2012, during negotiations over the Iranian nuclear accord, Iran announced it would be developing a SSN in an attempt to strengthen its bargaining

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96) Joseph Pilat, *Exploring Nuclear Latency*, (Washington DC: The Wilson International Center for Scholars, 2014).

97) Duyeon Kim, *Decoding the US-South Korea Civil Nuclear Cooperation Agreement: From Political Differences to Win-Win Compromises* (Washington DC: Office of the Korea Chair at CSIS, 2015).

position by threatening to expand its latent nuclear potential.[98] Similarly, in 2017, Iran resumed its work on this naval reactor to put pressure on the new US administration.[99]

A potentially dangerous implication of a ROKN SSN program is that it might erode the longstanding global nonproliferation regime. The US and ROK could choose to leverage a SSN program to strengthen the ROK's latent nuclear capability and therefore strengthen the ROK's deterrent – but doing so would damage the legitimacy of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and undermine the 1992 Joint Declaration of South and North Korea on the Denuclearization of the Korean Peninsula.

SSN Fuel Enrichment Levels by Country[100]

Country	SSN Fuel: Level of Enrichment (% U^{235})
US	HEU (93–97.5%)
UK	HEU (93%)
Russia*	HEU (40%)
India	HEU (40%)
Brazil**	LEU (18–19%)
France	LEU (5–7.5%)
PRC	LEU (3–5%)

* 3rd and 4th generation SSNs
** Experimental reactor

The extent to which an SSN program would risk advancing the ROK's nuclear latency depends on a number of variables. First, how will the ROK obtain this uranium? If the ROK chooses to enrich the uranium itself (which would require a revision of the 123 Agreement), it will improve its latent nuclear capability significantly. Alternatively,

98) "Iran plans nuclear-powered submarine: report," *Reuters*, July 12, 2012.
99) "Blasting US nuke-deal "violations," Iran vows new nuclear project," *CBS News*, December 13, 2016.
100) George Moore, Cervando Banuelos, and Thomas Gray, *Replacing Highly Enriched Uranium in Naval Reactors* (NTI, 2016).

if the ROK elects to purchase its uranium on the global market, other countries are less likely to fear its latent nuclear capability.

Second, what level enriched uranium will the ROK use to fuel its reactor? The ROK can either utilize HEU like the US or low enriched uranium (LEU) like France and the PRC. Using LEU would help reduce proliferation concerns significantly. Unfortunately, this would also require a larger reactor (and therefore a larger, less maneuverable SSN) than HEU.

Third, how will the spent fuel be managed? Again, the ROK has a choice: reprocess the spent fuel (which would also require a revision of the 123 Agreement), or find new ways of storing it (such as dry cask technology). Reprocessing would provide the ROK with greater mastery over the nuclear fuel cycle; it would also vastly increase regional states' fears of the intentions behind the ROK SSN program. Utilizing an alternative means for storing the spent fuel would, conversely, help decrease fears about ROK nuclear latency.

Ⅳ. CONCLUSION AND RECOMMENDATIONS

Overall, a ROKN SSN program presents a host of potential benefits and risks for the US-ROK alliance. As this paper discusses, this capability could strengthen allied 4D and coercive diplomacy, alliance cohesion, and ROKN blue water capabilities. But a SSN program could, if handled imprudently, prompt an arms race, create alliance drift, or lead to fears about ROK latent nuclear capabilities. If the allies choose to move forward with this program, they must make a concerted effort to maximize the beneficial consequences and mitigate the risks. To do this, this paper makes the following recommendations:

Platform Design

The allies should design these ROKN SSNs specifically for littoral operations. As such, they should prize stealth, powerful sensors, and maneuverability. The allies should work to incorporate UUV technologies and extended seabed sensors to enhance ISR. This will allow the allies to utilize ROKN SSNs as forward-deployed "intelligence hubs" at the center of a broader network of ISR assets.

The allies should also strongly consider a similar model as the 1958 US-UK deal: a sale of a US naval nuclear reactor to the ROK, and an indigenous design for the hull. The use of a US HEU reactor will allow ROKN SSNs to remain compact and maneuverable. US HEU reactors will also give the ROKN the benefit of drawing on the US' extensive technological development to advance its own capabilities much faster than it could do independently. Additionally, using US reactors would maximize the extent to which the ROKN could benefit from US training, best-practices, and doctrine. Although using a HEU reactor could lead to proliferation concerns, these concerns can be mitigated if the allies handle fuel procurement and disposal appropriately.

Fuel Procurement and Disposal

The ROK should acquire the enriched uranium it needs to fuel these SSNs from the US rather than developing enrichment facilities itself. If the ROK were to enrich its own fuel, it would drastically increase non-proliferation concerns and likely drive an unnecessary wedge between the US and ROK. At the least, it would require the renegotiation of the 123 Agreement between the US and ROK, creating a challenging diplomatic barrier the development of a ROKN SSN.

The ROK should also focus on new ways of storing spent SSN fuel rather than reprocessing; the US should provide technological and financial support for these efforts. The US should continue to share its expertise and best-practices in using dry-cask storage.[101] Reprocessing rather than storage would require a renegotiation of the 123 Agreement, divide the allies, and create new and unnecessary non-proliferation concerns.

Military Coordination

Both allies must coordinate in the initial development of this program. Without this coordination, the program may divide the allies rather than bringing them closer together. The allies must similarly prioritize extensive military-to-military contacts throughout the development and early operation of these SSNs. In particular, the USN must assist the ROKN as it develops the human capital needed to operate SSNs and familiarizes itself with the workings of naval nuclear reactors. The US-ROK alliance must also incorporate these new capabilities smoothly into joint military planning. This will include working together to develop new operational concepts and plans, discussing the role of these SSNs in both military-to-military and government-to-government settings.

Diplomatic Coordination

The allies must coordinate their public diplomatic efforts. Both states must emphasize that the SSN program signifies their resolve to end DPRK provocations and that it will neutralize DPRK SLBM

101) Robert Einhorn, "US-ROK Civil Nuclear Cooperation Agreement: Overcoming the Impasse," Remarks Delivered at the Asan Institute for Policy Studies, 2013.

capabilities. They must also harmonize their diplomatic outreach to the PRC, Japan, and other regional states with respect to the ROKN SSN program. In relations with Japan, the allies should work to assure Japan that they will share important intelligence on DPRK SLBMs, take advantage of the recent General Security of Military Information Agreement to share intelligence. They may wish to encourage enhanced military-to-military contacts and confidence building measures with the PRC to allay potential suspicions about this new capability.

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요 약

한국의 핵추진잠수함 확보를 위한 도전과 과제 -한미동맹 측면에서의 전략적 효용성을 중심으로-

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고도화 및 가시화되고 있는 북한의 '**잠수함발사탄도미사일**(SLBM: Submarine Launched Ballistic Missile)'위협에 대응하기 위한 효과적인 전략수단으로써 핵추진잠수함의 필요성에 대한 국민적 관심이 고조되고 있다. 핵추진잠수함의 전략적 가치에 대한 논의가 활발히 진행되고 있는 가운데, 주변국과의 갈등과 국제사회의 비핵화 규범의 미 준수 논란 등 핵추진잠수함 확보과정에서 야기될 수 있는 대・내외의 정치・외교적 파장에 대한 우려의 목소리 또한 높아지고 있다.

그러나, 핵추진잠수함의 필요성 및 확보와 관련한 지금까지의 대부분의 논의들은 한국의 '**내부적 논의**(Just our own scenario)'에 그치는 한계를 보이고 있다. 전략무기체계로써의 상징성과 그에 따르는 대외적 민감성을 고려 시 일방적이고 독자적인 핵추진잠수함 확보노력은 과정상의 시행착오와 불확실성을 더욱 가중시켜 정책적 실패로 귀결될 수 있는 위험성을 내포하고 있다.

특히, 한반도 평화와 아태지역의 안전보장이라는 공동의 전략적 목표를 공유하고 있는 동맹국인 미국의 공감대와 지지가 뒷받침되지 않은 독자적인 핵추진잠수함 확보노력은 큰 난항이 예상되며 자칫 서로간의 '**전략적 신뢰**(Strategic Trust)'**를 무너뜨려** '**한미동맹의 결속력**(Alliance Cohesion)'을 약화시키는 요인으로 작용할 수 있다. 미국의 동의와 지지에 기반한 핵추진잠수함 확보를 위해서는 한국의 핵추진잠수함 확보가 동맹의 전략목표 및 미국의 전략적 이해관계에 미칠 수 있는 긍정적, 부정적 효과에 대한 충분한 검토와 논의가 선행되어야 한다. 한미동맹의 공동의 전략목표와 미국의 전략적 이익

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에 상충하는 한국의 핵추진잠수함 확보시도는 성공 가능성이 낮기 때문이다.

본 연구에서는 현실화되고 있는 북한의 핵위협에 대응하고 지역안전보장에 기여할 수 있는 미국과의 연합방위력 증강차원에서의 한국의 핵추진잠수함의 전략적 효용성을 분석하였다. 더불어, 한국의 핵추진잠수함 확보과정에서 야기될 수 있는 대・내외의 기술적, 정치・외교적 사안들을 살펴본 후 한미동맹 차원에서의 정책적 해결방안을 제시하였다.

연구목적을 위해 유사한 역사적 사례연구를 통해 교훈을 도출하였으며, 미국 오바마 1기 행정부에서 미국의 아태지역 및 대북정책을 주도한 전 미국 국무부부장관 제임스 스타인버그(James Steinberg) 및 여러 미국 내 한반도 전문가들의 의견을 수렴하였다.

본 연구가 한국의 핵잠수함 확보를 위한 한미간 발전적 논의의 시발점이 되기를 기대한다.

핵심어: 잠수함발사탄도미사일, 전략적 신뢰, 한미동맹, 전략목표, 핵위협, 핵추진잠수함

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