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CRAFTING A NEW DETERRENCE STRATEGY FOR SOUTH KOREA TO COUNTER NUCLEAR NORTH KOREA

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CRAFTING A NEW DETERRENCE STRATEGY FOR SOUTH KOREA TO COUNTER NUCLEAR NORTH KOREA

by

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Following the Korean War, U.S. tactical nuclear weapons played a critical role in deterring North Korean aggression against South Korea. The presence of these weapons also assuaged South Korea's ambitions for a reunification war and a domestic nuclear weapons program. But, in 1991, the United States withdrew its tactical nuclear weapons, judging that the Cold War had ended and that improved conventional weapons could replace them as a deterrent, especially if North Korea denuclearized. Instead, the Kim Jong Un regime has rapidly expanded North Korea's nuclear and missile capabilities, simultaneously threatening the national security of South Korea and the United States. As a result, South Korean anxieties about U.S. extended deterrence are deepening. Many feel that South Korea should have an independent nuclear capability to counter North Korea. However, given South Korea's membership in the Non-Proliferation Treaty, nuclear options for South Korea face several challenges. Therefore, this thesis proposes that strengthening South Korea's space and cyber-electromagnetic programs is the most practical and effective means to enhance deterrence against North Korea, while also integrating South Korea's deterrent components and linking them more closely with the forces of the United States and Japan.

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CRAFTING A NEW DETERRENCE STRATEGY FOR SOUTH KOREA TO COUNTER NUCLEAR NORTH KOREA

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Captain, Republic of Korea Army
BABA, Korean Military Academy, 2015

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ABSTRACT

Following the Korean War, U.S. tactical nuclear weapons played a critical role in deterring North Korean aggression against South Korea. The presence of these weapons also assuaged South Korea's ambitions for a reunification war and a domestic nuclear weapons program. But, in 1991, the United States withdrew its tactical nuclear weapons, judging that the Cold War had ended and that improved conventional weapons could replace them as a deterrent, especially if North Korea denuclearized. Instead, the Kim Jong Un regime has rapidly expanded North Korea's nuclear and missile capabilities, simultaneously threatening the national security of South Korea and the United States. As a result, South Korean anxieties about U.S. extended deterrence are deepening. Many feel that South Korea should have an independent nuclear capability to counter North Korea. However, given South Korea's membership in the Non-Proliferation Treaty, nuclear options for South Korea face several challenges. Therefore, this thesis proposes that strengthening South Korea's space and cyber-electromagnetic programs is the most practical and effective means to enhance deterrence against North Korea, while also integrating South Korea's deterrent components and linking them more closely with the forces of the United States and Japan.

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LIST OF ACRONYMS AND ABBREVIATIONS

APRSAF	Asia-Pacific Regional Space Agency Forum
CDD	cross-domain deterrence
CEMA	cyberspace electromagnetic activities
CES	Cyber Excepted Service
CMCC	Counter Missile Capability Committee
COC	Cyber Operations Command
DIA	Defense Intelligence Agency
DCC	Dutch Cyber Command
DSC	Deterrence Strategy Committee
EA	electromagnetic attack
EDPC	Extended Deterrence Policy Committee
EDSCG	Extended Deterrence Strategy and Consultation Group
ELINT	electronic intelligence
EMP	electromagnetic pulse
EMS	electromagnetic spectrum
EP	electromagnetic protection
ES	electromagnetic support
ESPI	European Space Policy Institute
EW	electronic warfare
GEO	geostationary orbit
GMD	ground-based Midcourse Defense
HARMs	high-speed anti-radiation missiles
HEU	highly enriched uranium
IAEA	International Atomic Energy Agency
ICBM	intercontinental ballistic missile
IPB	intelligence preparation of the battle space
IRA	Internet Research Agency

IRBM	intermediate-range ballistic missile
ISR	intelligence, surveillance, and reconnaissance
ITAR	International Traffic in Arms Regulations
KARI	Korea Aerospace Research Institute
KIDD	Korea-U.S. Integrated Defense Dialogue
KJU	Kim Jong Un
KMPR	Korea Massive Punishment and Retaliation
KOMPsat	Korea Multi-Purpose Satellite
KPS	Korean Positioning System
KT	kiloton(s)
LEO	low-earth orbit
MEO	medium-earth orbit
MIRV	multiple independently targetable re-entry vehicles
MRBM	medium-range ballistic missile
MRL	multiple rocket launcher
MTCR	Missile Technology Control Regime
MWe	megawatt electric
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NCG	Nuclear Consultative Group
NDR	National Defense Strategy
NPG	Nuclear Planning Group
NPT	Non-Proliferation Treaty
NSC	National Security Council
OCO	offensive cyber operation
PNT	positioning, timing, and navigation
ROK	Republic of Korea
SCM	Security Consultative Meeting
SLBM	submarine launched ballistic missile

SRBM	short-range ballistic missile
SSBN	nuclear-powered ballistic missile submarine
TBM	theater ballistic missile
TEL	transporter erector launcher
UN	United Nations
UNSC	United Nations Security Council
USCYBERCOM	U.S. Cyber Command
USSPACECOM	U.S. Space Command
WWII	World War II

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I. INTRODUCTION

Is it possible for a non-nuclear state to counter a nuclear state? Considering the restrictions in the 1970 Non-Proliferation Treaty (NPT), is the only way for South Korea to deter North Korea's aggression the development of its own nuclear weapons program? How did the United States and South Korea deter North Korean aggression during the Cold War? This thesis examines what has been changed since the withdrawal of U.S. nuclear weapons from South Korea in 1991, including the worsening North Korean military threat but also the improving Republic of Korea (ROK)-U.S. alliance capabilities. It asks, in particular, what kind of deterrent strategy can South Korea adopt —in cooperation with the United States— to counter increasing nuclear and missile threats from North Korea.

A. SIGNIFICANCE OF THE RESEARCH

Today, South Korea is facing increasing nuclear threats from North Korea linked to North Korea's possible offensive use of nuclear weapons and missiles. The imminent future that an unpredictable "mad man," North Korean Kim Jong Un (KJU), will be equipped with sufficient nuclear weapons is a persistent nightmare for South Korea.

South Korea has developed its own deterrence strategy and has also relied upon the U.S. extended deterrent to discourage North Korean miscalculation and nuclear use. However, the security circumstances are more complex than in the past. North Korea enacted the "Statutes of the Democratic People's Republic of Korea on Nuclear Weapons Policy" on September 8, 2022,[1] and is currently adopting a coercive strategy with its nuclear weapons. Also, North Korea's growing missile capabilities are additional concerns for South Korea.

Considering these conditions, debates about the effectiveness of the potential redeployment of the U.S. tactical nuclear weapons or even an ROK nuclear arsenal are

[1] Korea Central News Agency, "Kim Jong Un of North Korea: 'The U.S. Objective is Regime Collapse, We Will Never Abandon Nuclear Weapons' . . . Pushes for Legislation on Nuclear Policy [북한 김정은 '미국의 목적은 정권 붕괴, 핵 포기 절대 안해' . . . 핵무력 정책 법제화]," *Korea Central News Agency*, September 9, 2022, https://www.voakorea.com/a/6737815.html.

vigorous in South Korea. This research analyzes past lessons from the U.S. deployment and withdrawal of tactical nuclear weapons from South Korea from the perspective of deterrence strategy. Also, this research discusses ongoing debates in South Korea about the means for countering North Korea's nuclear threat. Ultimately, the main goal of this research is to develop a more focused and more effective deterrent strategy for today's South Korea, in cooperation with the United States, for dealing with the new North Korean nuclear threat.

B. LITERATURE REVIEW

Nuclear deterrence strategy has a rich history, its roots tracing back to Bernard Brodie's insights in 1945, emphasizing the need for war plans due to the terrifying power of nuclear weapons. Deterrence relies on assessing and influencing an adversary's intentions and falls into categories of deterrence by punishment and deterrence by denial, with credibility and communication as key determinants of success.

The adoption of nuclear deterrence by the United States was influenced by its global position and the lessons learned from the bombings of Hiroshima and Nagasaki. During the Cold War, both superpowers, the United States and the Soviet Union, embraced nuclear deterrence over conventional deterrence, developing extensive strategies. South Korea also saw the deployment of tactical nuclear weapons by the United States during the Cold War, driven by various factors such as its geopolitical significance, the need to supplement reduced U.S. troops in South Korea, and U.S. budgetary considerations. Meanwhile, the international thaw and the appearance of regional nuclear powers at the end of the Cold War changed U.S. deterrence strategy over South Korea into extended deterrence. However, considering North Korea's growing nuclear and missile threats, South Koreans began to have anxieties about the effectiveness of U.S. extended deterrence and ignited debates, proposing measures such as its own nuclear weapons program and redeployment of U.S. tactical nuclear weapons.

New deterrence strategies are needed today due to increased international nuclear players and diversified threats from various domains. Concepts like cross-domain deterrence (CDD) synchronize military operations across multiple domains to address an

array of threats. Integrated deterrence, as outlined in the 2022 National Defense Strategy (NDR), emphasizes combining various capabilities to create tailored deterrence.

Advanced missile defense systems, such as those intercepting hypersonic missiles, play a crucial role in countering evolving threats. The space and cyber-electromagnetic domains complement missile defense, incorporating strategies like left-of-launch and missile warning systems. These evolving deterrence strategies face both challenges and opportunities in today's complex security environment.

1. Deterrence Strategy

To start this discussion, we must first analyze the principles of nuclear deterrence. Although there is a long literature on conventional deterrence, the concept of nuclear deterrence was first discussed by Bernard Brodie in 1945. Brodie portrayed the world after nuclear weapons where basic war plans would be needed in peacetime since it would be too late to develop them one once the war began.[2] For Brodie, "deterrence of general war" was prioritized even though it would require a high cost,[3] because the cost after a war broke out would surpass the size of the cost before such a war.[4] These principles created the foundation for the U.S. strategy of nuclear deterrence. As Therese Delpech reported, Brodie predicted that the advent of atomic bombs would change the purpose of the military from winning wars to preventing them. This tendency is attributed to the dreadful power of nuclear weapons, which have been regarded as the "absolute weapon" or "uncontestable weapon."[5] In the same context, Brodie also anticipated that once humankind possessed atomic bombs, the thought of nuclear war would become unacceptable for the global

[2] Bernard Brodie, *Strategy in the Missile Age* (Princeton, NJ: Princeton University Press, 1959), 267, https://press.princeton.edu/books/hardcover/9780691651187/strategy-in-the-missile-age.

[3] Brodie, 268–69.

[4] Brodie, 269.

[5] Patrick M. Morgan, T. V. Paul, and James J. Wirtz, *Complex Deterrence: Strategy in the Global Age* (Chicago: University of Chicago Press, 2009), https://press.uchicago.edu/ucp/books/book/chicago/C/bo6887686.html.

population.[6] Nevertheless, Kahn alleged the need for "thinking the unthinkable" regarding the possibility of a thermonuclear war and argued that the United States should prepare for that war.[7]

When it comes to the meaning of deterrence, Schelling suggested that deterrence meant "estimating" and "influencing" the adversary's intention at the same time.[8] Similarly, Glaser and Long suggest that deterrence refers to an action that tries to change the enemy's intentions and decisions.[9] Glaser and Long insist that deterrence can be accomplished with non-military actions. According to Glaser and Long, the method of deterrence is sorted out in two categories.[10] Glaser and Long introduce a first method, "deterrence by punishment," which indicates that by imposing costs which are bigger than the advantages of an offensive, those actions could be deterred. Glaser and Long suggest a second method, "deterrence by denial," in which the enemy is convinced that it will not be able to accomplish its objective through offensive action, so it will be "denied" any benefits. Glaser and Long state that credibility determines whether deterrence will succeed or not. On this point, credibility refers to the extent to which the adversary believes the state will carry out its threat to either punish or deny. Glaser and Long explain that credibility consists of a state's "capability" and "willingness" to implement the threat. On the other hand, for Kahn, credibility was determined by the ability and willingness to overcome the opponent's retaliation;[11] therefore, air defense and civil defense were inevitable prerequisites like other than simply will and offensive capability. Similarly, Schelling claimed that nuclear

[6] Thérèse Delpech, *Nuclear Deterrence in the 21st Century Lessons from the Cold War for a New Era of Strategic Piracy* (Santa Monica, CA: RAND, 2012), 25, https://www.rand.org/pubs/monographs/MG1103.html.

[7] Lawrence Freedman and Jeffrey H. Michaels, *The Evolution of Nuclear Strategy*, Fourth edition. (London: Palgrave Macmillan, 2019), 166, https://link.springer.com/book/10.1057/978-1-137-57350-6.

[8] Thomas C. Schelling, *Arms and Influence* (New Haven, CT: Yale University Press, 1966), 35, https://www.jstor.org/stable/j.ctt5vm52s.

[9] Charles Glaser, Brian Radzinsky, and Long Austin, eds., "Basics of Deterrence and U.S. Nuclear Doctrine and Forces," in *Managing U.S. Nuclear Operations in the 21st Century* (Washington, DC: Brookings Institution Press, 2022), 15, https://www.brookings.edu/books/managing-u-s-nuclear-operations-in-the-21st-century/.

[10] Glaser, Radzinsky, and Austin, 16.

[11] Freedman and Michaels, *The Evolution of Nuclear Strategy*, 167–68.

deterrence related to intentions whereas a traditional military planning usually focused on the adversary's capabilities.[12] On this point, Paul contends that "communication" to convey the threat to opponents has to be added as a basic component of both conventional and nuclear deterrence.[13] Uniquely, Lindsay and Gartzke define deterrence as "the use of threats to protect the status quo."[14] Lindsay and Gartzke also count compulsion as an offensive form of deterrence. According to their logic, compulsion can be unified with deterrent threats for preventing retaliation, as well as for demanding concessions.

When it comes to the reasons why the United States adopted nuclear deterrence, Brodie talks about the U.S. position in the world and historical experience. Brodie indicated that, given the power of thermonuclear bombs, a first strike is the most reasonable doctrine since it could remove the adversary's retaliatory forces and protect oneself.[15] According to Brodie, however, the U.S. position as a status quo power makes the United States pursue deterrence; in addition, the United States has to consider not only its own national interest but also those of other countries (especially democratic states). Also, Brodie claimed that the United States was reluctant to engage in a first strike due to the experience of bombing Hiroshima and Nagasaki.[16] From these experiences, the U.S. reluctance to engage in nuclear preventive war made the United States adopt deterrent strategy. To add to Brodie's point, Schelling illustrates that deterrence has been required to prevent possibly mistaken nuclear retaliation based on incorrect information or the desperate mind of an individual leader.[17]

After World War II (WWII), the United States did not anticipate the emergence of its strategic rival. Specifically, the United States and the West did not think that the Soviet

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[12] Schelling, *Arms and Influence*, 35.

[13] Morgan, Paul, and Wirtz, *Complex Deterrence*, 2.

[14] Jon R. Lindsay and Erik Gartzke, eds., *Cross-Domain Deterrence: Strategy in an Era of Complexity* (Oxford, UK: Oxford University Press, 2019), 14, https://academic.oup.com/book/35252.

[15] Brodie, *Strategy in the Missile Age*, 176.

[16] Brodie, 270; Alexander L. George and Richard Smoke, *Deterrence in American Foreign Policy: Theory and Practice* (New York: Columbia University Press, 1974), 26, https://web.stanford.edu/group/tomzgroup/pmwiki/uploads/0608-George%20Smoke-1974-a-PWJ.pdf.

[17] Freedman and Michaels, *The Evolution of Nuclear Strategy*, 241.

Union would initially be an adversary, since they were allies in WWII.[18] This mistaken belief lasted until the late 1940s, because the Soviet Union was still focusing its national efforts on recovering from World War II and the United States maintained its atomic monopoly.[19] George and Smoke suggest that the United States simply thought of "all-out" war to deter war with its monopoly over atomic weapons at that time. Deterrence theory also burgeoned in this time thanks to the U.S. monopoly of nuclear weapons.[20]

During the Cold War, the two superpowers, the United States and the Soviet Union, thoroughly embraced policies of nuclear deterrence rather than conventional deterrence. The background of this phenomenon was the advent of the nuclear age. The invention of nuclear weapons for the first time in the world was one factor that made the United States a superpower; it induced other countries not to challenge the United States in the 1940s. After the Soviet Union also obtained nuclear weapons, they became the symbol of the Cold War and became the main focus of deterrence strategy.[21] Both sides tried to achieve superiority and to keep their opponent from protecting itself and assuring its allies.[22] Especially, some experts during the Cold War believed that the bigger the size of nuclear arsenal, the greater deterrent value the United States could achieve.[23] According to these beliefs, U.S. nuclear strategy developed terms such as "massive retaliation," "flexible response," "assured destruction," "countervalue strategy," and "damage limitation," and

[18] George and Smoke, *Deterrence in American Foreign Policy*, 21–22.

[19] George and Smoke, 24.

[20] Robert Jervis, "Chapter 6. Deterrence, Rogue States, and the U.S. Policy," in *Complex Deterrence: Strategy in the Global Age*, edited by Patrick M. Morgan, T. V. Paul, and James J. Wirtz (Chicago: University of Chicago Press, 2009), 135, https://press.uchicago.edu/ucp/books/book/chicago/C/bo6887686.html; Lindsay and Gartzke, *Cross-Domain Deterrence*, 1.

[21] Stephen Michael Younger, *The Bomb: A New History*, 1st ed. (New York: Ecco Press, 2009), 4, https://archive.org/details/bombnewhistory0000youn; Jervis, "Chapter 6. Deterrence, Rogue States, and the U.S. Policy," 136.

[22] Jervis, 136; Lindsay and Gartzke, *Cross-Domain Deterrence*, 1–2.

[23] Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict*, vol. 143, Princeton Studies in International History and Politics (Princeton, NJ: Princeton University Press, 2014), 19, https://press.princeton.edu/books/paperback/9780691159836/nuclear-strategy-in-the-modern-era.

the United States and the Soviet Union devoted a great deal of money and effort to strategies to deter both conventional and nuclear attacks by the other superpower.[24]

The United States adopted nuclear deterrence in South Korea during the Cold War, too. The United States deployed tactical nuclear weapons in South Korea from 1958 to 1991. Tactical nuclear weapons deployed with the Pentomic Division in 1958.[25] The United States increased the number of deployed tactical nuclear weapons to roughly 540 warheads by 1967;[26] after the ax incident at Panmunjom, the United States dispatched strategic nuclear submarines to South Korea regularly for 35 visits by 1981. Wook Yang explains that most of the U.S. tactical nuclear weapons were destroyed and deployed tactical nuclear weapons in South Korea were decreased to only 150 warheads by the 1980s. After that, the United States withdrew all tactical nuclear weapons from South Korea in 1991, according to President Bush's withdrawal declaration, linked to a similar unilateral withdrawal policy adopted by the Soviet Union in its final year.

As for the background of the deployment, assumptions are largely divided into three categories: South Korea's strategic value to the free world, the role of nuclear weapons in making up for the withdrawn U.S. troops, and U.S. financial concerns about the costs of maintaining large conventional forces on the peninsula. The first speculation is that the United States was worried about the threats from the communists and considered South

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[24] Narang, 143:18–19.

[25] Wook Yang, "Tactical Nuclear Bombs Deployed on the Korean Peninsula [한반도에 배치되었던 전술핵폭탄]," *Defense and Technology*, 458 (April 2017): 30, https://www.dbpia.co.kr/pdf/pdfView.do?nodeId=NODE07131483; Sang-chul Cha, "Dwight D. Eisenhower, Rhee Syngman, and Korean-American Relations in the 1950s [아이젠하워, 이승만, 그리고 1950 년대의 한미관계]," *The Korean Journal of American History* 13 (May 2001): 145–60, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE01120972; Yeon-joo Lee and Geun-wook Lee, "For What 'Honest John' Came?: The Issue of Deploying U.S. Tactical Nuclear Weapons to Korea [재정절감과 동맹국 안전 보장의 기로에서: 1958 년 전술핵무기 배치에 대한 새로운 해석]," *Social Science Studies* 23, no. 2 (2015): 136–38, https://kiss.kstudy.com/thesis/thesis-view.asp?key=3352370; Byung-gu Lee, "U.S. First Offset Strategy and Deployment of Tactical Nuclear Weapons on the Korean Peninsula: With a Focus on the Connection with Reorganization to Pentomic Division [미국의 제 1 차 상쇄전략과 한반도 전술핵무기 배치: 펜토믹 사단 개편과의 연계성을 중심으로]," *Journal of International Area Studies* 25, no. 2 (April 2021): 205–11, http://kiss.kstudy.com/thesis/thesis-view.asp?g=kissmeta&m=exp&enc=B72F31E9C3D7D0B05BB07FBD80CE3DD5; Jun-seok Yang and Myung-seop Kim, "A Study on the Minutes of the R.O.K. Cabinet Meeting in 1958 [1958 년 대한민국 국무회의록 연구]," *Journal of Korean Political and Diplomatic History* 38, no. 1 (2016): 195–97, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE08784465.

[26] Yang, 31.

Korea's strategic value in terms of countering those threats.[27] The second one is that tactical nuclear weapons were the supplement to and modernization of a reduced U.S. troop presence in South Korea.[28] To this point, President Rhee Syng-man's request for modernized weapons may have played a role. According to the third perspective, the deployment of tactical nuclear weapons was caused by a planned reduction of the U.S. military budget.[29] All in all, the United States used tactical nuclear weapons in South Korea to offer a more effective deterrent against a future communist attack.

At around the time of the U.S. introduction of nuclear weapons into South Korea, Kahn introduced the idea of "escalation ladder" in 1962.[30] In this concept, Kahn suggested that 30 different steps would be possible after initiating a nuclear encounter.[31] According

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[27] Lee and Lee, "For What 'Honest John' Came?: The Issue of Deploying U.S. Tactical Nuclear Weapons to Korea [재정절감과 동맹국 안전 보장의 기로에서: 1958 년 전술핵무기 배치에 대한 새로운 해석]," 148–51; Min-sik Kim, "Reconsideration of the Factors in Deploying Tactical Nuclear Weapons on the Korean Peninsula in 1958—Focusing on the Changes of U.S. Policy toward Japan [1958 년 한반도 전술핵무기 배치 요인 재고찰—미국의 대일정책 변화를 중심으로]," *Military History*, no. 117 (December 2020): 219–41, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE10520843; Hans M. Kristensen and Robert S. Norris, "A History of U.S. Nuclear Weapons in South Korea," *Bulletin of the Atomic Scientists* 73, no. 6 (2017): 349, https://www.tandfonline.com/doi/epdf/10.1080/00963402.2017.1388656?needAccess=true; Michael Gordon Jackson, "Beyond Brinkmanship: Eisenhower, Nuclear War Fighting, and Korea, 1953–1968," *Presidential Studies Quarterly* 35, no. 1 (February 8, 2005): 55–68, https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1741-5705.2004.00235.x; Oh-shin Kwon, "The Foundations of Eisenhower's Foreign Policy: The 'New Look' Policy and the 'Eisenhower Doctrine' [아이젠하워 대외정책의 기조:'뉴룩(New Look)' 정책과 '아이젠하워 독트린']," *The Korean Journal of American History* 21 (May 2005): 160–63, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE01080197.

[28] Yang, "Tactical Nuclear Bombs Deployed on the Korean Peninsula [한반도에 배치되었던 전술핵폭탄]," 30; Cha, "Dwight D. Eisenhower, Rhee Syngman, and Korean-American Relations in the 1950s [아이젠하워, 이승만, 그리고 1950 년대의 한미관계]," 145–60; Lee and Lee, 136–38; Lee, "U.S. First Offset Strategy and Deployment of Tactical Nuclear Weapons on the Korean Peninsula: With a Focus on the Connection with Reorganization to Pentomic Division [미국의 제 1 차 상쇄전략과 한반도 전술핵무기 배치: 펜토믹 사단 개편과의 연계성을 중심으로]," 195–97.

[29] Kyung-doo Jung, "A Study on the Change of the Role of U.S. Tactical Nuclear Weapons in the Korean Peninsula According to U.S. Cognition of Threats in North-East Asia [미국의 동북아 위협인식 변화에 따른 한반도 내 전술핵무기의 역할 연구]," *Military History*, no. 83 (June 2012): 108–12, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE06507722; Kwon, "The Foundations of Eisenhower's Foreign Policy: The 'New Look' Policy and the 'Eisenhower Doctrine' [아이젠하워 대외정책의 기조:'뉴룩(New Look)' 정책과 '아이젠하워 독트린']," 158; Lee, 192–98; Yang and Kim, "A Study on the Minutes of the R.O.K. Cabinet Meeting in 1958 [1958 년 대한민국 국무회의록 연구]," 195–97; Andrew J. Bacevich, *The Pentomic Era: The U.S. Army Between Korea and Vietnam* (Washington, DC: National Defense University Press, 1986), 15–109, https://apps.dtic.mil/sti/pdfs/ADA956178.pdf.

[30] Freedman and Michaels, *The Evolution of Nuclear Strategy*, 315.

[31] Freedman and Michaels, 316.

to Kahn, "escalation" indicates that negotiation was always regarded as possible while each side still could augment its stakes. Therefore, Kahn thought that deterrence would continue to play an important role as much as denial before, during, and after an attack. Kahn discussed that if one side could achieve "escalation dominance" at a certain level, it could enjoy prominent benefits over the escalation ladder.[32] Freedman and Michaels explain this theory implied that we should not permit the chance to the latent competitor to develop abilities that would enable it to achieve escalation dominance at a specific spot on the ladder.

At the end of the Cold War, deterrence strategy altered with the international political thaw between the great powers, but also the appearance of new nuclear-armed regional powers. On the brink of the collapse of the Soviet Union, President George H.W. Bush announced that the United States would withdraw and destroy all ground-launched, short-range, nuclear weapons from Europe and from Asia.[33] According to this decision, the United States withdrew all of its tactical nuclear weapons from South Korea in 1991. Kyung-du Jung contends that the United States' concern about nuclear proliferation and the weakening of nuclear controls after the collapse of the Soviet Union accelerated rapid nuclear disarmament of tactical nuclear weapons.[34] The withdrawal of tactical nuclear weapons also aimed to denuclearize the Korean Peninsula and to promote nuclear negotiations between South and North Korea, since Pyongyang had used the U.S. tactical nuclear weapons in South Korea as a reason to develop its nuclear program.[35] But Jung reports, this objective was not achieved, given North Korea's withdrawal from the 1994 Agreed Framework and decision to develop and test nuclear weapons. Yang argues that the United States maintained intentional ambiguity in the process of withdrawal in order to

[32] Freedman and Michaels, 317.

[33] Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 349.

[34] Kyung-doo Jung, "A Study on the U.S. Decision to Withdraw Tactical Nuclear Weapons from Korean Peninsula [탈냉전기 미국의 한반도 내 전술핵무기 철수결정 연구]," *Military Forum*, no. 93 (Spring 2018): 121, https://kiss.kstudy.com/Detail/Ar?key=3581786.

[35] Jung, 122.

deter any North Korean miscalculation.[36] Kristensen explains that, from this time, the United States also began to provide "extended deterrence" based on nuclear weapons associated with dual-capable fighters and strategic submarines stationed off the peninsula.[37]

The emergence of regional nuclear powers at the end of the Cold War also made deterrence calculations more complicated. Experts like Kenneth Waltz and Robert Jervis suggested "minimum deterrence": or the concept that even a handful of nuclear weapons should enable a state to deter an adversary's aggression.[38] Brodie also assumed that, in the nuclear age, even a trivial country that possessed nuclear weapons could deter a more powerful country's aggression.[39] That is, Brodie claimed that, even if a state has a stronger capacity, it could not act freely considering the possibility of the weak state's nuclear use. Similarly, as Narang reports, McGeorge Bundy proposed "existential deterrence": once a state started to attain the capacity to build nuclear weapons, the state could deter nuclear and conventional conflicts. According to this theory, an emerging nuclear state like North Korea could stop a mighty state like the United States from initiating nuclear and conventional attacks in crises due to the possibility that it could quickly field nuclear weapon.[40] In the post-Cold War era, the concept of deterrence has changed dramatically and frequently. Jervis holds that, for the United States, it has been a challenge to deal with nuclear threats not only from a similar power but also many smaller actors in this more complicated environment.[41]

Nowadays, we cannot settle for the past deterrence theories. Despite the existence of threats to use military forces, we could identify cases where nuclear states failed to deter

[36] Yang, "Tactical Nuclear Bombs Deployed on the Korean Peninsula [한반도에 배치되었던 전술핵폭탄]," 31.

[37] Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 349.

[38] Narang, *Nuclear Strategy in the Modern Era*, 143:19.

[39] Brodie, *Strategy in the Missile Age*, 275.

[40] Narang, *Nuclear Strategy in the Modern Era*, 143:19–20.

[41] Jervis, "Chapter 6. Deterrence, Rogue States, and the U.S. Policy," 141.

war regardless of the power asymmetry.[42] Although some experts assert that deterrence has no value since the Cold War ended, others think that deterrence is still important in terms of dealing with "rogue" countries.[43] Jervis claims that although the end of the Cold War made us transition to another policy rather than classical nuclear deterrence, this era, with new and different problems, needs deterrence again.[44]

The first reason why new deterrence is necessary is that the number of international players who have nuclear weapons has increased. Unlike the Cold War with only two players who competed each other in the nuclear arms race and negotiated each other about arms control, calculations about deterrence strategy have now become more trickier.[45] Moreover, Bracken warns in the multi-nuclear states system the later nuclear entries will probably reveal their belligerency after their nuclear program have matured.[46] No one can guarantee that the world will manage to deal with these awful situations quickly and adequately to stop a nuclear catastrophe.[47] To this point, Stein discusses the issue of "rational deterrence against irrational adversaries,"[48] and asks if new political leaders will act rationally in regard to the use of weapons. Knopf makes the case for the necessity of a broader deterrent strategy.[49] He argues that deterrence is still cheaper than preventive war and a broader deterrent strategy is more effective to counter nonstate actors. Adler brings

[42] Brodie, *Strategy in the Missile Age*, 272.

[43] Morgan, Paul, and Wirtz, *Complex Deterrence*, 1.

[44] Jervis, "Chapter 6. Deterrence, Rogue States, and the U.S. Policy," 133.

[45] Paul J. Bracken, *The Second Nuclear Age: Strategy, Danger, and the New Power Politics*, 1st ed. (New York: Times Books, 2012), 271, https://archive.org/details/secondnuclearage0000brac.

[46] Bracken, 272.

[47] Bracken, 273.

[48] Janice Gross Stein, "Chapter 3. Rational Deterrence against 'Irrational' Adversaries? No Common Knowledge," in *Complex Deterrence: Strategy in the Global Age*, edited by Patrick M. Morgan, T. V. Paul, and James J. Wirtz (Chicago and London: University of Chicago Press, 2009), 58, https://press.uchicago.edu/ucp/books/book/chicago/C/bo6887686.html.

[49] Jeffrey W. Knopf, "Chapter 2. Three Items in One: Deterrence as Concept, Research Program, and Political Issue," in *Complex Deterrence: Strategy in the Global Age*, edited by Patrick M. Morgan, T. V. Paul, and James J. Wirtz (Chicago and London: University of Chicago Press, 2009), 33, https://press.uchicago.edu/ucp/books/book/chicago/C/bo6887686.html.

up the concept of a "deterrence trap."[50] Adler insists that as many states follow deterrence, weak states or non-states actors could gain benefits by acting violently and stronger states might fail to react or be self-deterred. Lehman argues that more work is needed on the interaction of space, cyber, and hybrid warfare to develop effective deterrent strategies in this complex nuclear era.[51]

The second reason for new deterrence is that the threats are becoming diversified and from various domains. Lindsay and Gartzke draw attention to the complexity of threats today.[52] They note the interaction between nuclear and conventional forces, and state that nuclear stability can actually promote the outbreak of limited conventional wars, which could then escalate into nuclear warfare.[53] Alternatively, Lindsay and Gartzke assert that the superiority of one side's conventional arsenal could encourage the inferior side's to turn to the cyber domain, secret infiltration, and "gray zone" activities, thus escalating risk under the threshold of nuclear retaliation. Consequently, nuclear and conventional weapons are also being replaced by progress in antisatellite systems, autonomous robotics, drones, cyber operations, biotechnology, and so on.[54]

Until a few years ago, it was a prevalent opinion among policymakers and experts that a non-nuclear power could not deter a nuclear power even if it was only a small nuclear power. The United States considered deploying highly precise conventional weapons rather than tactical nuclear weapons to target a small nuclear power like North Korea in the 2010s.[55] However, Bracken warns that, in this multi-nuclear player system, designing a

[50] Emanuel Adler, "Chapter 4. Complex Deterrence in the Asymmetric-Warfare Era," in *Complex Deterrence: Strategy in the Global Age*, edited by Patrick M. Morgan, T. V. Paul, and James J. Wirtz (Chicago and London: University of Chicago Press, 2009), 85, https://press.uchicago.edu/ucp/books/book/chicago/C/bo6887686.html.

[51] Ron Lehman, "Chapter 4. Simplicity and Complexity in the Nth Nuclear Era," in *Cross-Domain Deterrence: Strategy in an Era of Complexity*, ed. Jon R. Lindsay and Erik Gartzke (Oxford, UK: Oxford University Press, 2019), 71, https://academic.oup.com/book/35252.

[52] Lindsay and Gartzke, *Cross-Domain Deterrence*, 2.

[53] Lindsay and Gartzke, 15.

[54] Lindsay and Gartzke, 2.

[55] Bracken, *The Second Nuclear Age: Strategy, Danger, and the New Power Politics*, 110.

military strategy requires more deliberation.[56] Bracken explains that the U.S. consideration of employing conventional weapons to destroy hard targets in North Korea and Iran, in the hope of lifting the nuclear threshold, brought a reaction from China, India, and Pakistan to build more nuclear weapons.[57] Watman and Wilkening argue that conventional deterrence is less trustworthy compared to nuclear deterrence because conventional weapons are affected by many components, such as the solidarity of troops and leadership, making it difficult to estimate their deterrent value.[58]

These points have raised renewed debates about whether South Korea should develop its own nuclear arsenal or whether the United States should redeploy tactical nuclear weapons to South Korea. Today's aggressive political actions of North Korea have made nuclearization of South Korea a much more contested issue. According to recent polls, over 70% of South Koreans advocate a domestic nuclear weapons program.[59] Even President Yoon has mentioned that South Korea could host U.S. tactical nuclear weapons again or develop its own nuclear weapons, if the North Korean provocations worsen.[60] But Jung-sup Kim asserts that developing South Korea's own nuclear arsenal could harm arms control on the Korean Peninsula and even lead to unintended nuclear warfare; yet he also agrees with the idea that if the U.S. foreign policy toward the Korean Peninsula and the security surrounding Northeast Asia experienced fundamental change, the issue would be

[56] Bracken, 112.

[57] Bracken, 111.

[58] Kenneth Watman and Dean Wilkening, *U.S. Regional Deterrence Strategies* (Santa Monica, CA: RAND Corporation, 1995), 8–9, https://www.rand.org/pubs/monograph_reports/MR490.html.

[59] Jennifer Lind and Daryl G. Press, "Should South Korea Build Its Own Nuclear Bomb?: The Once-Strong Alliance Between South Korea and the U.S. Is Weakening.," *The Washington Post*, October 7, 2021, https://www.washingtonpost.com/outlook/should-south-korea-go-nuclear/2021/10/07/a40bb400-2628-11ec-8d53-67cfb452aa60_story.html.

[60] Yoon-hee Kim and Jong-min Seo, "President Yoon Mentioned 'Nuclear Armament'. . . For North Korea, Warn of 'Nuclear Response' and for the United States, Pressure on 'Nuclear Sharing' ['핵무장' 언급한 윤 대통령… 北엔 '핵대응' 경고, 美엔 '핵공유' 압박]," *Munwha Ilbo*, January 12, 2023, https://www.munhwa.com/news/view.html?no=2023011201070330039001.

a matter of sovereignty and national security.[61] Lind and Press argue that the world should accept the idea of a nuclearized South Korea, if North Korea refuses to limit its nuclear arsenal.[62]

In regard to the possible redeployment of the U.S. tactical nuclear weapon, Hwee-rhak Park contends that North Korea's severe nuclear threat makes South Korea consider all available countermeasures, including redeployment of tactical nuclear weapons. Park notes that, of course, a U.S. decision will be needed and China will strongly oppose it; such a redeployment will also violate the ceasefire agreement again.[63] Sung-han Kim points out that the U.S. extended deterrent may not be reliable in the face of growing North Korean nuclear and missile threats;[64] redeployment of the U.S. tactical nuclear weapons and sharing in a North Atlantic Treaty Organization (NATO)-like system should be considered in the face of North Korean strategic provocations, such as the launch of intercontinental ballistic missiles (ICBMs) and submarine launched ballistic missiles (SLBMs) and nuclear tests.

In spite of all these concerns, nuclear options facing South Korea still have pros and cons. Moreover, promoting these steps involves limitations such as NPT, the future of the ROK-U.S. alliance, neighbor states reactions, and so on,[65] which would require major political determination.

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[61] Jung-sup Kim, "North Korea's Tactical and Strategic Weapons after Hanoi Talks Development Trends and Implications of the Evolution of the Principle of Nuclear Suppression [하노이 회담 이후 북한 전술·전략 무기 개발 동향과 핵 억제 교리 진화의 함의]," *Sejong Policy Brief*, 2021–6 (March 30, 2021): 25, https://www.sejong.org/web/boad/1/egoread.php?bd=3&itm=0&txt=%ED%95%98%EB%85%B8%EC%9D%B4&pg=1&seq=5915.

[62] Jennifer Lind and Daryl G. Press, "South Korea's Nuclear Options," *Foreign Affairs*, April 19, 2023, https://www.foreignaffairs.com/united-states/south-koreas-nuclear-options-north-korea-deterrence.

[63] Hwee-rhak Park, "An Introductory Analysis for the Redeployment of U.S. Tactical Nuclear Weapons to South Korea [미 전술핵무기 한국 재배치에 대한 시론적 분석]," *New Asia* 24, no. 2 (January 2017): 62–63, https://www.kci.go.kr/kciportal/po/search/poTotalSearList.kci.

[64] Sung-han Kim, "Assessment of U.S. Extended Deterrence on the Korean Peninsula [미국의 한반도 확장억제 평가]," *Journal of International Politics* 25, no. 2 (December 2020): 53–54, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE10501687.

[65] Toby Dalton and Van Jackson, "South Korean Nuclear Weapons Would Make Things Worse," Global Asia, March 2023, https://www.globalasia.org/v18no1/cover/south-korean-nuclear-weapons-would-make-things-worse_toby-daltonvan-jackson.

2. Recent Developments in Deterrence Strategy

CDD could be an alternative for a non-nuclear-weapons state to deter a nuclear power. The concept of CDD was established by the George W. Bush administration in the late 1990s to cope with those new threats.[66] Accordingly, Lindsay and Gartzke say, the Pentagon now describes five domains of the U.S. military operations: land, sea, air, space, and cyberspace. Lindsay and Gartzke mention that the United States considers threats across these domains ranging from natural disaster and terrorism to conventional and nuclear warfare. Lindsay and Gartzke state that the United States synchronizes and combines these domains in conducting its military operations. These trends are not unique to the United States. Lindsay and Gartzke suggest that Chinese integrated strategic deterrence and Russian strategic deterrence are also rooted in these same considerations.[67] However, Sweijs and Zilincik evaluate CDD differently, treating CDD as closer to dissuasion rather than deterrence.[68] Specifically, they argue that CDD may serve to dissuade an opponent from taking any actions via diverse means. A new deterrent strategy based on CDD mechanism could be an effective option for South Korea as a non-nuclear-weapons state.

In today's security environment, CDD operations across the space, cyber, and hybrid domains are highly important to the United States, its allies, and its opponents too.[69] Mehta recommends that emerging technologies could change the dynamics of assurance and credibility between the United States and its allies that are protected by U.S. extended deterrence.[70] Particularly, Mehta highlights the importance of not only the space and cyber domains, but also such weapons as drones or unmanned aerial vehicles, and precision-

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[66] Lindsay and Gartzke, *Cross-Domain Deterrence*, 3.

[67] Lindsay and Gartzke, 3.

[68] Tim Sweijs and Samuel Zilincik, "Chapter 8. The Essence of Cross-Domain Deterrence," in *NL ARMS Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century—Insights from Theory and Practice*, ed. Frans Osinga and Tim Sweijs, NL ARMS (The Hague, The Netherlands: T.M.C. Asser Press, 2021), 152, https://academic.oup.com/book/35252.

[69] Lehman, "Chapter 4. Simplicity and Complexity in the Nth Nuclear Era," 91.

[70] Rupal N. Mehta, "Chapter 11. Extended Deterrence and Assurance in Multiple Domains," in *Cross-Domain Deterrence: Strategy in an Era of Complexity*, ed. Jon R. Lindsay and Erik Gartzke (Oxford, UK: Oxford University Press, 2019), 250–51, https://academic.oup.com/book/35252.

guide munitions.[71] Wilner and Babb discuss AI's role in deterrence, although AI has to overcome suspicion of undermining ordinary deterrence, as well as ethical problems.[72]

Similarly, integrated deterrence can offer another option for a new deterrent strategy for a non-nuclear-weapons state. Integrated deterrence is the main concept of the 2022 NDR of the Biden administration.[73] Broadly, the 2022 NDR says that it means that developing, combining, and coordinating the U.S. whole range of capabilities such as all warfighting domains, the full spectrum of conflict, the instruments of the U.S. national power, allies and partners.[74] In terms of specific mechanisms, 2022 NDR suggests that the United States will develop tailored deterrence by combining conventional, cyber, space, and information abilities with existing nuclear deterrence.[75]

In addition, advanced missile defense can be considered as a possible new deterrent or denial mechanism too. Recently, on May 4, 2023, in the Ukraine War, Russia's highly advanced Kinzhal hypersonic missile was intercepted by Ukraine's Phased Array Tracking Radar to Intercept on Target (Patriot) air defense systems.[76] Mitchell stresses that Russia's following saturation assault to destroy the Patriot system ended up only helped to prove the superiority of Ukraine's missile defenses. The Patriot air and missile defense system was provided by the United States on December 21, 2022.[77] According to Feickert, Patriot is a highly advanced air defense system, and can intercept cruise missiles, ballistic missiles, and aircraft. In addition, Japan has also deployed the ground-based Patriot system to

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[71] Mehta, 251–52.

[72] Alex Wilner and Casey Babb, "Chapter 21. New Technologies and Deterrence: Artificial Intelligence," in *Cross-Domain Deterrence: Strategy in an Era of Complexity*, ed. Jon R. Lindsay and Erik Gartzke (Oxford, UK: Oxford University Press, 2019), 415, https://academic.oup.com/book/35252.

[73] U.S. Department of Defense, *2022 National Defense Strategy* (Washington, DC: U.S. Department of Defense, 2022), IV, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-national-defense-strategy-npr-mdr.PDF.

[74] U.S. Department of Defense, IV, 1.

[75] U.S. Department of Defense, 9–10.

[76] Peter Mitchell, "Hypersonic Hype? Russia's Kinzhal Missiles and the Lessons for Air Defense," Modern War Institute at West Point, May 23, 2023, https://mwi.usma.edu/hypersonic-hype-russias-kinzhal-missiles-and-the-lessons-for-air-defense/.

[77] Andrew Feickert, *PATRIOT Air and Missile Defense System for Ukraine*, IF12297 (Washington, DC: Congressional Research Service, 2023), https://crsreports.congress.gov/product/pdf/IF/IF12297.

counter North Korea's missiles and possible military reconnaissance satellites.[78] Kosuke argues that Japanese multilayered missile defense system that consists of the Patriot and Aegis-equipped destroyers is the main of countermeasure against the growing North Korean ballistic missile threats.

In addition, the space and cyber-electromagnetic domains can supplement missile defense. This so-called left-of-launch concept encompasses counter-offensive operations that aim to destroy a certain part of a chain for launching of theater ballistic missiles (TBMs) since there are limitations in terminal missile defenses to cover all missile threats.[79] To conduct left-of-launch actions, detection and destruction of targets is required, and all physical and electronic constituents in a system such as Transporter Erector Launchers (TELs), complementary missiles and loaders, support vehicles, and command and control systems can be considered as targets. In this process, big data analytics and space-based sensors will have an important role in finding and characterizing targets.[80] On top of that, missile warning plays a key role in such a deterrent (and possibly denial) strategy.[81] In the case of the United States, the U.S. Space Force is developing a new space-based missile warning system, including low-earth orbit (LEO) and medium-earth orbit (MEO) satellites, to track different types of adversary threats.

C. OVERVIEW

This research addresses two related questions. First, what are the existing challenges facing South Korea's deterrence of North Korea, and second, what types of new mechanisms might be combined to create a new deterrent strategy, in cooperation with the United States, to convince North Korea that any attacks using its new capabilities will ultimately fail?

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[78] Takahashi Kosuke, "Japan Deploys PAC3 Interceptor System for North Korea Spy Satellite Launch," The Diplomat, April 27, 2023, https://thediplomat.com/2023/04/japan-deploys-pac3-interceptor-system-for-north-korea-spy-satellite-launch/.

[79] Herbert C. Kemp, "Left of Launch: Countering Theater Ballistic Missiles" (Atlantic Council, 2017), https://www.atlanticcouncil.org/wp-content/uploads/2017/07/Left_of_Launch_web_0731.pdf.

[80] Kemp, 5.

[81] Kimberly Underwood, "Space Force Advances Global Missile Warning," AFCEA International, May 1, 2023, https://www.afcea.org/signal-media/space-force-advances-global-missile-warning.

According to my questions, this chapter outlined the reasons why this analysis is critical and introduced the main outlines of deterrence theory in the past and today. Chapter II deals with the history and drivers in the process of deployment and withdrawal of U.S. tactical nuclear weapons and analyze them from the viewpoint of deterrence strategy. In Chapter III, this research analyzes the development of North Korean nuclear and missile threats. Chapter IV deals with U.S. extended deterrence and South Koreans perception about that. Chapter V summarizes my research proposing a new deterrent strategy to counter North Korea.

II. THE PAST ROLE OF NUCLEAR WEAPONS

The United States deployed tactical nuclear weapons in South Korea from January 1958 to December 1991.[82] Hans Kristensen and Robert Norris report that, during those 33 years, the United States maintained the deployment of tactical nuclear weapons, though the number of the weapons varied over the years. According to Kristensen and Norris, the number of deployed tactical nuclear weapons reached its peak at roughly 950 warheads in 1967 and shrank progressively until they were completely withdrawn in 1991. Since then, the United States has not reversed its withdrawal decision, although there has been a lingering controversy of the redeployment issues inside and outside of South Korea. This raises several important questions regarding deterrence: why did the United States choose to deploy tactical nuclear weapons beginning in 1958, and why was South Korea chosen by the United States as a deployment state? Also, why did the United States decide to withdraw all tactical nuclear weapons from South Korea in 1991? Finally, what was the linkage of both decisions to deterrence?

A. DEPLOYMENT OF U.S. TACTICAL NUCLEAR WEAPONS IN SOUTH KOREA

President Eisenhower ordered the deployment of tactical nuclear weapons to South Korea at meeting of the National Security Council (NSC) on June 13, 1957.[83] As a result, the United States deployed tactical nuclear weapons in 1958 in South Korea. Why did the United States choose these weapons, and why was South Korea chosen by the United States as a deployment state? In the deployment determination, the United States had three main considerations: the strategic extension of the Cold War to the Korean Peninsula, a massive retaliation strategy, and a conciliatory policy on President Rhee Syngman.

First, the United States chose tactical nuclear weapons within the context of the Cold War. The democratic United States was trying to deter a second communist invasion

[82] Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 349.

[83] U.S. Department of State, "Memorandum of Discussion at the 326th Meeting of the National Security Council, Washington, June 13, 1957" (Washington, DC: Department of State, 1957), https://history.state.gov/historicaldocuments/frus1955-57v23p2/d221.

from North Korea against South Korea.[84] The United States had deployed tactical nuclear weapons in NATO states in advance of their deployment in South Korea.[85] As Freedman and Michaels contend, consistent with Eisenhower's New Look policy, the United States calculated that the threat of early use of strategic or tactical nuclear weapons in a conflict could deter and, if necessary, prevent the rapid achievement of the enemy's goals.

To a certain degree, the United States also considered the threats from China and the Soviet Union upon its allies when it deployed its tactical nuclear weapons. In regard to South Korea, Beijing and Moscow had been accomplices and supporters of North Korea during the Korean War in the early 1950s.[86] For the West, it became clear that Korea was more than just a diversion or a prelude to a Soviet offensive in the West; the Korean War was the precursor of Soviet persistent aggressions on them.[87] Also, Lawrence Freedman and Jeffrey Michaels note that NSC-162 / 2 regarded all communists' diplomatic rhetoric suggesting peace as pretenses, because the West knew that the ultimate goal of the Soviet Union was to consolidate and expand communist power.

Indeed, the United States discovered ongoing covert movements of communist forces around the border of Korea in the mid-1950s, based on U.S. internal discussions with respect to this issue. According to Paragraph 13-d of the armistice agreement, the United States, China, and North Korea had promised not to bring in operational aircraft, armored vehicles, weapons, and ammunition for the purpose of reinforcement near the inter-Korean border.[88] However, General Hull asserted at the NSC on April 21, 1955, that the Soviets were continuously violating this clause by secretly introducing modernized weapons around the Korean border via seaport;[89] Hull insisted that continued ROK and

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84 Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 349.

85 Freedman and Michaels, *The Evolution of Nuclear Strategy*, 117.

86 Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 349.

87 Freedman and Michaels, *The Evolution of Nuclear Strategy*, 106.

88 Lee and Lee, "For What 'Honest John' Came?: The Issue of Deploying U.S. Tactical Nuclear Weapons to Korea [재정절감과 동맹국 안전 보장의 기로에서: 1958 년 전술핵무기 배치에 대한 새로운 해석]," 132.

89 U.S. Department of State, "Memorandum of Discussion at the 245th Meeting of the National Security Council, Washington, April 21, 1955" (Washington, DC: Department of State, 1955), https://history.state.gov/historicaldocuments/frus1955-57v23p2/d38.

U.S. compliance with paragraph 13-d of the armistice agreement would aggravate the security situation of the Korean Peninsula by making the ROK-U.S. alliance forces comparatively weaker than that of the communists, and that the United States should replace its older weapons with more modern ones. Subsequently, during a discussion between the Department of State and the Joint Chiefs of Staff on April 13, 1956, General Lemnitzer also contended that he could not understand why the United States was overlooking the communists' violation of the armistice provision, despite the United States being bound to the same provision.[90] He argued that, given that the communists were introducing tons of new military equipment, the United States could not uphold an equilibrium of power in Korea.

By contrast, Secretary of State John Foster Dulles had a different opinion than the Pentagon's. The major point of Dulles was that even though the communists had infringed on the 13-d provision first, any revision of the armistice agreement should observe the prescribed procedures, meaning that the United States needed to get political concurrence from the other 15 United Nations (UN) governments prior to any deployment.[91] In addition, Asian hostility to the Western and purported "white supremacy" was another concern when it came to the possible deployment of tactical nuclear weapons in South Korea, since deployment could provoke rage against the United States throughout Asia.[92]

However, Admiral Radford rebutted each of Dulles's points. Radford believed that U.S. allies were not convinced of the U.S. nuclear commitments in regard to their enemies, such that the United States needed to show its firm deterrent commitment through a willingness to deploy tactical nuclear weapons in South Korea.[93] Also, Radford asserted that he had verified these perspectives welcoming the possible deployment of U.S. tactical

[90] U.S. Department of State, "Memorandum on the Substance of Discussion at the Department of State—Joint Chiefs of Staff Meeting, Washington, April 13, 1956, 11:30 a.m." (Washington, DC: Department of State, 1956), https://history.state.gov/historicaldocuments/frus1955-57v23p2/d132.

[91] U.S. Department of State, "Telegram From the Department of the Army to the Commander in Chief, United Nations Command (Hull)" (Washington, DC: Department of State, 1955), https://history.state.gov/historicaldocuments/frus1955-57v23p2/d14.

[92] U.S. Department of State, "Memorandum of Discussion at the 326th Meeting of the National Security Council, Washington, June 13, 1957."

[93] U.S. Department of State.

nuclear weapons to South Korea during his visits to most Far Eastern countries, except for Japan. Yet, as Radford insisted, even some Japanese military and diplomatic officials recognized the significance of nuclear defense. Most of all, Radford persuaded his critics with the statement, "if the United States lost South Korea, it would presently lose its entire position in the Far East."[94] With this, the decision to deploy such weapons was taken.

In summary, the United States needed a reliable instrument to prohibit the recurrence of another Korean War and the feared the downfall of the Free World. In this regard, the United States deployed nuclear weapons in Okinawa after China and Taiwan battled in the Taiwan Strait crisis of 1954, in hopes of deterring the possibility of further Chinese aggression on its offshore islands.[95] A series of U.S. deployments of nuclear weapons in Guam, Hawaii, the Philippines, and South Korea could be understood as a preventive action of the United States in regard to worries about Chinese aggression.[96] The noteworthy point here is that the United States did not withdraw tactical nuclear weapons from South Korea until the termination of the Cold War era, whereas the United States removed them from Japan and the Philippines in the 1970s.[97] In this fact, we can guess that the United States evaluated the strategic value of South Korea as a forward base against communism.

Second, U.S. tactical nuclear weapons deployment was based on the U.S. massive retaliation strategy. NSC Paper (NSC-162 / 2) distilled the 1950s national security policy for countering the Soviet threat and prohibiting the Soviets from undermining the U.S. economy, fundamental values, and institutions by advancing the massive retaliation strategy.[98] It meant that the United States would respond with its nuclear weapons against the enemies' aggression even if it was with a conventional attack.[99] One of the reasons for

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[94] U.S. Department of State.

[95] Se-young Jang, "The Evolution of U.S. Extended Deterrence and South Korea's Nuclear Ambitions," *Journal of Strategic Studies* 39, no. 4 (April 18, 2016): 505, https://www.tandfonline.com/doi/epdf/10.1080/01402390.2016.1168012?needAccess=true.

[96] Jang, 506.

[97] Jang, 506.

[98] Freedman and Michaels, *The Evolution of Nuclear Strategy*, 108.

[99] Freedman and Michaels, 197.

this nuclear strategy was that the Eisenhower administration did not want to experience a "dirty little war"[100] like the Korean War again.[101] That is, the massive retaliation strategy was an alternative to mitigate the casualties, frustrations, and costs involved in dispatching conventional forces to contain the communists.[102] Practically, the West had felt that they could not prevail against the communists' conventional weapons.[103] Moreover, thanks to the success of hydrogen bomb testing, the United States was equipped with a full spectrum of nuclear capabilities ranging from massive bombs capable of obliterating entire cities to compact weaponry designed for battlefield operations.[104] By contrast, North Korea, China, and even the Soviet Union lacked such a range of nuclear options (even though the Soviet Union succeeded in hydrogen bomb testing in 1949, the United States was ahead of the Soviet Union in terms of the range and the number of weapons and delivery systems[105]). Therefore, the communists could launch the first aggression; still, they could not maintain the momentum of aggression according to the massive retaliation strategy.[106] In addition, the U.S. strategic weaponry would pose a significant threat of causing severe destruction to cities in the Soviet and Chinese regions; in contrast, tactical nuclear weapons would help offset the allies' shortage of personnel by boosting the firepower.[107] These advantageous conditions allowed the United States to be audacious and resolute in deploying its tactical nuclear weapons in South Korea.

Specifically, the U.S. experience in the negotiation for the armistice of the Korean War seemed to support the effectiveness of its massive retaliation strategy. When the United States and South Korea were consulting about the ceasefire with China and North Korea, the United States implied the usability of nuclear weapons to end the Korean War

100 George and Smoke, *Deterrence in American Foreign Policy*, 27.

101 George and Smoke, 27.

102 George and Smoke, 28.

103 Freedman and Michaels, *The Evolution of Nuclear Strategy*, 120.

104 Freedman and Michaels, 104.

105 Freedman and Michaels, 38, 84.

106 Freedman and Michaels, 104.

107 Freedman and Michaels, 105.

during the armistice meeting. The United States had genuinely considered the use of nuclear weapons in the Korean War, as we can see in the declassified U.S. documents now; the U.S B-29 bombers released dummy atomic bombs in Operation Hudson Harbor on the assumption of a situation to drop them on Pyongyang in late 1951.[108] Furthermore, after the United States suggested that "In the absence of satisfactory progress, we intended to move decisively without inhibition in our use of weapons, and would no longer be responsible for confining hostilities to the Korean Peninsula,"[109] the stalemate of the negotiations finally broke. This meant that the U.S. nuclear threat was aimed at China, too. Finally, although some critics doubt this connection, it appeared to observers at the time that it was the nuclear threat that broke three years of deadlock and led to an agreement on a ceasefire of the Korean War in 1953.[110] This experience seemed to prove to the Eisenhower administration the effectiveness of its massive retaliation strategy on the Korean Peninsula. Meanwhile, Rosemary J. Foot suggests an alternative interpretation as well as nuclear coercion; Foot insists Stalin's death, reduced economic support from the Soviet Union and China because of the worsened domestic situations, and the Soviet's sympathy with the need for peace like the Eisenhower administration.[111]

The massive retaliation strategy was deeply related to the New Look policy of the Eisenhower administration.[112] The United States struggled with a budget deficient in the 1950s, which caused it to seek to reduce the ROK Army, given that the United States was paying for the bulk of South Korean defense expenditures at this time.[113] Hence, the dual principles behind this policy were that the United States should not allow expansion by the

[108] Selig S. Harrison, *Korean Endgame: A Strategy for Reunification and U.S. Disengagement* (Princeton, NJ: Princeton University Press, 2002), https://press.princeton.edu/books/paperback/9780691116266/korean-endgame.

[109] Freedman and Michaels, *The Evolution of Nuclear Strategy*, 112.

[110] Harrison, *Korean Endgame: A Strategy for Reunification and U.S. Disengagement*, 197.

[111] Rosemary J. Foot, "Nuclear Coercion and the Ending of the Korean Conflict," *International Security* 13, no. 3 (1988): 107–11, https://www.jstor.org/stable/pdf/2538737.

[112] Kwon, "The Foundations of Eisenhower's Foreign Policy: The 'New Look' Policy and the 'Eisenhower Doctrine' [아이젠하워 대외정책의 기조:'뉴룩(New Look)' 정책과 '아이젠하워 독트린']," 156.

[113] Jang, "The Evolution of U.S. Extended Deterrence and South Korea's Nuclear Ambitions," 506.

communists and the capitalist economy should not be bankrupted by the costs of containment.[114] In other words, Oh-shin Kwon explains that this policy aimed at reducing the military budget, by relying on U.S. nuclear weapons and the superiority of U.S. Air Force instead of conventional forces. All in all, nuclear weapons served as a crucial equalizer for the Eisenhower administration in confronting the communists on the Korean Peninsula, who had superior conventional forces.[115] At the same time, the deployment of U.S. tactical nuclear weapons could be interpreted as a measure to appease Rhee and prevent him from stirring up a reckless war of anger against North Korea, while the weapons would enable the United States to compensate for the reductions in the ROK Army after the U.S.-ordered cutback.

The New Look policy had been laid out in a speech by Dulles' in January 1954, where he had stressed that the free world should maintain the upper hand.[116] Also, Dulles had clarified that, if necessary, the United States could use nuclear weapons in cases of adversary hostility against the United States, as well as in combat.[117] In the same context, Dulles claimed that the United States should reinforce its allies and collective security by using the deterrent power of massive retaliation. Otherwise, in Dulles's thought, the United States could not ensure that the United States could deter the adversaries' ambitions to use their superior manpower to attack the free world again. Likewise, when Admiral Radford, chairman of the Joint Chiefs of Staff, visited South Korea in 1955, he explained that the massive retaliation strategy could be applied to the Korean Peninsula and that the United States and South Korea "would be ready to use atomic weapons, if needed to stop any renewed [North] Korean aggression."[118]

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[114] Kwon, "The Foundations of Eisenhower's Foreign Policy: The 'New Look' Policy and the 'Eisenhower Doctrine' [아이젠하워 대외정책의 기조:'뉴룩(New Look)' 정책과 '아이젠하워 독트린']," 157.

[115] Younger, *The Bomb*, 50–51.

[116] Freedman and Michaels, *The Evolution of Nuclear Strategy*, 113.

[117] Freedman and Michaels, 113.

[118] Harrison, *Korean Endgame: A Strategy for Reunification and U.S. Disengagement*, 197.

Third, South Korean President Rhee Syngman also affected the U.S. deployment decision. President Rhee was well-known for his unyielding anti-communism.[119] The Rhee and Eisenhower administrations disagreed on many security issues. Above all, their understandings about the termination of the Korean War were different. For the United States, the Korean War ended with the agreement on the ceasefire; however, the ceasefire was no more than a temporary intermission of the war for Rhee.[120] Therefore, Rhee rabidly sabotaged the armistice by dogmatic releasing of anti-communist prisoners.[121] Also, Rhee Syngman continuously advocated his belief in the future unification of the peninsula by force, which was a major point of friction in the ROK-U.S. alliance after the ceasefire.[122] Rhee sent a bunch of letters to Eisenhower which contained his resolution that South Korea was prepared to stand and defend itself independently if required.[123]

In the meantime, when President Rhee learned of the late 1950s U.S. plan to downsize the ROK Army, Rhee strongly objected to this idea and organized a national movement to call international attention to this issue.[124] With this issue, Rhee expressed concern since the measure would change the military balance between South and North while the communists were increasing the size of their forces on the Korean Peninsula.[125] In fact, right after South Korea established its own government, Rhee had requested that the United States reinforce and modernize the ROK Army.[126] According to Cha, Rhee thought South Korea needed a new approach, believing that the Mutual Defense Treaty

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[119] Victor D. Cha, *Powerplay: The Origins of the American Alliance System in Asia*, Princeton Studies in International History and Politics (Princeton, NJ: Princeton University Press, 2016), 94, https://www.jstor.org/stable/j.ctvc778dz.

[120] Cha, "Dwight D. Eisenhower, Rhee Syngman, and Korean-American Relations in the 1950s [아이젠하워, 이승만, 그리고 1950 년대의 한미관계]," 144–45.

[121] Cha, *Powerplay*, 103.

[122] Cha, "Dwight D. Eisenhower, Rhee Syngman, and Korean-American Relations in the 1950s [아이젠하워, 이승만, 그리고 1950 년대의 한미관계]," 144–45.

[123] Cha, *Powerplay*, 102.

[124] Yang and Kim, "A Study on the Minutes of the R.O.K. Cabinet Meeting in 1958 [1958 년 대한민국 국무회의록 연구]," 195.

[125] Yang and Kim, 196.

[126] Cha, "Dwight D. Eisenhower, Rhee Syngman, and Korean-American Relations in the 1950s [아이젠하워, 이승만, 그리고 1950 년대의 한미관계]," 145.

could not guarantee South Korea's security and survival. However, Cha explains that the United States had shown a negative response to Rhee's demand because the United States was concerned that Rhee might undertake a war for reunification.

The United States predicted that a war aimed at reunification would quickly escalate to World War III, involving a U.S.–Soviet Union nuclear exchange.[127] In response to this U.S. prediction, Rhee answered that if the situation proceeded in the opposite direction to South Korean's expectation, South Korea could not help taking unilateral action, but said that, before acting, South Korea would inform the United States first.[128] President Eisenhower said in regard to Rhee, "he is a stubborn old fellow, and I don't know whether we'll be able to hold him in line indefinitely."[129] Later, President Rhee agreed that if the United States would introduce modern weapons into South Korea to maintain the military strength of the ROK Army, South Korea would seriously consider a reduction of troops.[130]

President Rhee was also highly sensitive to the issue of Japanese rearmament. However, in the late 1940s, the United States was concerned that neglecting Japan without rearmament would be dangerous for the Free World in terms of the Cold War competition because weak Japan could be susceptible to increasing and nearby Soviet threat.[131] But if the United States could make Japan sign a peace treaty and rearm Japan, the United States could expect the role of balancer against communist from this only latent great power country in Asia.[132] In addition, the United States believed that activating the Japanese

[127] U.S. Department of State, "Hagerty Diary, July 27, 1954" (Official memorandum, Washington, DC: Department of State, 1954), https://history.state.gov/historicaldocuments/frus1952-54v15p2/d923; Cha, "Dwight D. Eisenhower, Rhee Syngman, and Korean-American Relations in the 1950s [아이젠하워, 이승만, 그리고 1950 년대의 한미관계]," 156.

[128] Cha, 151.

[129] U.S. Department of State, "Hagerty Diary, July 27, 1954."

[130] U.S. Department of State, "Letter From President Rhee to President Eisenhower, June 24, 1957" (Washington, DC: Department of State, 1957), https://history.state.gov/historicaldocuments/frus1955-57v23p2/d227; U.S. Department of State, "The President of the Republic of Korea (Rhee) to President Eisenhower, February 4, 1957" (Washington, DC: Department of State, 1957), https://history.state.gov/historicaldocuments/frus1952-54v15p2/d868.

[131] Cha, *Powerplay*, 126.

[132] Cha, 122, 126–27.

economy and maintaining a strong Japan was significant for South Korea's national security because communization of Japan would lead to the same process in South Korea.[133] Even the Commander-in-Chief of the U.S. Armed Forces in the Far East stated in 1954 that only the level of how much South Korea could protect Japan militarily and support it economically determined the value of South Korea.[134]

Nevertheless, President Rhee had a totally different idea. Rhee was well-known for his strong anti-Japanese beliefs.[135] Rhee was severely worried about the potential possibility of a Japanese invasion of Korea throughout his presidential term.[136] Rhee expressed his resolute antagonism and deep worry about Japan in a letter to Eisenhower, stating that "if we have to be sold to either of our enemies [communists or Japan], we would rather fight until we are united with our own people."[137] In addition, Rhee was especially sensitive to the U.S. plan to deploy nuclear weapons in Japan.[138] Rhee insisted that the United States should not reinforce Japan too much and take precautions against Japan, which was leaning toward the Soviet Union and China.[139] Indeed, John M. Allison, the U.S. ambassador to Japan, reported about the anti-American sentiment in Japan rooted in the U.S. nuclear attack on its homeland, the atmosphere of neutralism between the two ideologies, and temptations from the communists.[140] Besides, Japanese had animosity toward the U.S. policy that practiced regular maneuvering of nuclear weapons across Japan despite the Japanese non-nuclear declaration, and the incident that Japanese fisher died of

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[133] Cha, "Dwight D. Eisenhower, Rhee Syngman, and Korean-American Relations in the 1950s [아이젠하워, 이승만, 그리고 1950 년대의 한미관계]," 145.

[134] Cha, 147–48.

[135] Cha, 145.

[136] Cha, 146.

[137] U.S. Department of State, "The President of the Republic of Korea (Rhee) to President Eisenhower, February 4, 1957."

[138] Yang and Kim, "A Study on the Minutes of the R.O.K. Cabinet Meeting in 1958 [1958 년 대한민국 국무회의록 연구]," 196.

[139] Cha, "Dwight D. Eisenhower, Rhee Syngman, and Korean-American Relations in the 1950s [아이젠하워, 이승만, 그리고 1950 년대의 한미관계]," 149.

[140] Kim, "Reconsideration of the Factors in Deploying Tactical Nuclear Weapons on the Korean Peninsula in 1958—Focusing on the Changes of U.S. Policy toward Japan [1958 년 한반도 전술핵무기 배치 요인 재고찰—미국의 대일정책 변화를 중심으로]," 220.

the close access to the location of the U.S. nuclear test terrified and offended Japanese more.[141]

Due to Japan's negative attitudes toward rearmament and anti-nuclear sentiments, the United States had to reexamine its policy in the Far East, reevaluating the strategic value of South Korea.[142] The United States could not wait until the Japanese changed their posture regarding the growing strength of communism in the Far East. Also, the United States perceived that South Korea and Japan geopolitically shared the defensive line in depth and started to consider the reinforcement of South Korea instead of Japan.[143] Of course, the South Korean government and military welcomed this U.S. Far East policy and nuclear strategy.[144]

B. WITHDRAWAL OF U.S. TACTICAL NUCLEAR WEAPONS FROM SOUTH KOREA

The George H. W. Bush administration announced the Presidential Nuclear Initiatives on September 27, 1991, which indicated that the United States would withdraw nearly all U.S. theater nuclear weapons deployed around the world.[145] Given that the United States had maintained tactical nuclear weapons in South Korea throughout the whole period since their deployment, their withdrawal and the decision thus far not to redeploy them raises questions about the factors behind this decision. What were the reasons for this withdrawal, and why didn't the United States worry about its effects on deterrence? We can summarize them into three factors: the impending termination of the Cold War, the improved conventional ability and reassessment of tactical nuclear weapons value, and the hope to halt North Korea's nuclearization.

141 Cha, *Powerplay*, 157.

142 Kim, "Reconsideration of the Factors in Deploying Tactical Nuclear Weapons on the Korean Peninsula in 1958—Focusing on the Changes of U.S. Policy toward Japan [1958 년 한반도 전술핵무기 배치 요인 재고찰—미국의 대일정책 변화를 중심으로]," 225.

143 Kim, 228.

144 Kim, 230.

145 Jang, "The Evolution of U.S. Extended Deterrence and South Korea's Nuclear Ambitions," 506.

First, the imminent end of the Cold War impacted the decision. Kristensen and Norris claim that the United States mainly considered the crumbling condition of the Soviet Union and that the security situation on the Korean Peninsula was a peripheral consideration.[146] However, the collapse of the Soviet Union meant that North Korea lost its first benefactor who had provided enormous military and economic support, either. Therefore, the United States judged that providing a nuclear umbrella to South Korea after withdrawal was sufficient to protect South Korea from the remnant threat of communists.[147]

Second, the dramatic advancement of conventional capabilities and changed judgment on tactical nuclear weapons were the other factors that led to the ultimate withdrawal of tactical nuclear weapons from South Korea. The United States thought it could defend South Korea with its advanced conventional weapons and strategic nuclear forces affected the withdrawal resolution. The United States felt confident with its accurate conventional weapons from the accomplishments in the Persian Gulf War.[148] The achievements of the unprecedented warfare with high-tech conventional weapons seemed to suggest that nuclear weapons would not be needed on the ground anymore in a future war.

Furthermore, the United States still promised to provide a nuclear umbrella (or extended deterrent) after removing tactical nuclear weapons from South Korea. In other words, U.S. B-52 bombers and other U.S. nuclear forces still would be ready to carry out nuclear retaliation in a crisis on the Korean Peninsula.[149] According to Kristensen and Norris, during the period that the United States enormously cut back deployed tactical nuclear weapons in South Korea in the late 1970s and early 1980s, U.S. nuclear-powered

[146] Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 349.

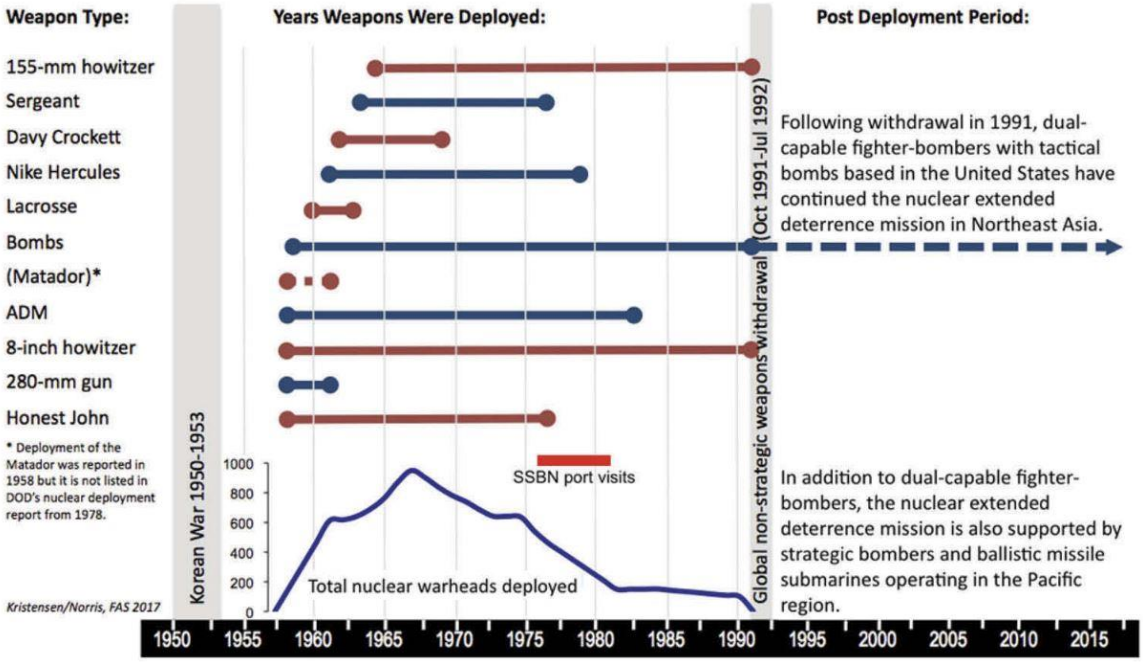
[147] Kristensen and Norris, 349.

[148] Wall Street Journal, "U.S. Says It Doesn't Need Nuclear Weapons in Korea," *Wall Street Journal*, October 21, 1991, https://www.proquest.com/hnpwallstreetjournal/docview/135483476/citation/C5584A8738FD4BF2PQ/10.

[149] Wall Street Journal.

ballistic missile submarines (SSBNs) suddenly started to visit South Korean ports.[150] This shows the transition in the focus of U.S. nuclear strategy in South Korea from tactical nuclear weapons to strategic ones.

To reflect this trend, the number of deployed tactical nuclear weapons had already decreased before its withdrawal. One can find the facts in Figure 1. From the mid-1960s, the U.S. nuclear weapons stockpile in South Korea had steadily declined during the previous 25 years because of the removal and decommissioning of tactical nuclear weapons and the progress made in conventional weapons.[151]



Source: Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 350.

Figure 1. The Change in the Number and Types of U.S. Tactical Nuclear Weapons in South Korea

Third, the withdrawal of tactical nuclear weapons from South Korea had the intention to stop North Korea's nuclearization. The United States found in 1989 via satellite

[150] Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 352.

[151] Kristensen and Norris, 349.

intelligence that North Korea had tried to develop its nuclear weapons.[152] Subsequently, North Korea exploited its nuclear and missile cards at the bargaining table to make up for shrunken subsidies from the Soviet Union and China by normalizing the relationship with the United States, Japan, and South Korea.[153] North Korea declared that if the United States removed its nuclear weapons from South Korea, North Korea would accept international inspections over its nuclear facilities[154]; this declaration expedited coordination upon the withdrawal of tactical nuclear weapons between the United States and South Korea. As Kristensen describes, in November 1991, South Korea announced the withdrawal, and in January 1992, North Korea agreed to International Atomic Energy Agency (IAEA) inspections. Likewise, because China and the Soviet Union did not want conflict between the two Koreas, they insisted that the United States should prevent North Korea's nuclearization by removing tactical nuclear weapons from South Korea.[155] According to *Hanguk Ilbo*, some Americans showed positive reactions to the Chinese and Soviet opinion. Likewise, as *Hanguk Ilbo* reported, there was the U.S. opinion that South Korea had the proper military capability to encounter North Korea's provocations without the presence of U.S. nuclear weapons; they contended that withdrawal of U.S. nuclear weapons from South Korea would help to prevent North Korea from making further provocations on the Korean Peninsula.

C. CONCLUSION

The historical context and geopolitical considerations played a significant role in the deployment and subsequent withdrawal of U.S. tactical nuclear weapons from South Korea. During the Cold War, the United States deployed these weapons as part of its

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[152] Harrison, *Korean Endgame: A Strategy for Reunification and U.S. Disengagement*, 245.

[153] Harrison, 201.

[154] Kristensen and Norris, "A History of U.S. Nuclear Weapons in South Korea," 352.

[155] Hanguk Ilbo, "USFK Nuclear Weapons Withdrawal Discussed," *Hanguk Ilbo*, May 3, 1991, https://infoweb-newsbank-com.libproxy.nps.edu/apps/readex/doc?p=TOPNAWMD&sort=_rank_%3AD&fld-base-0=alltext&val-base-0=korea%20tactical%20nuclear&val-database-0=&fld-database-0=database&docref=image/v2%3A11C33B0D5F860D98%40FBISX-12048897A85E2310%402448468-120488A4A7B1E938%4035-120488A4D5FA2110%40%2A%2BUSFK%2BNuclear%2BWeapons%2BWithdrawal%2BDiscussed&firsthit=yes.

extended war to deter communist aggression, particularly from North Korea, China, and the Soviet Union. The threat of massive retaliation with nuclear weapons was another way to prevent the enemy's attack. In addition, President Rhee's solid anti-communist stance and concerns about Japanese rearmament also influenced the U.S. decision to deploy nuclear weapons in South Korea.

However, as the Cold War neared its end, factors like the crumbling Soviet Union, advancements in conventional capabilities, and efforts to prevent North Korea's nuclearization led to the withdrawal of these weapons. The decision to maintain a nuclear umbrella over South Korea using U.S. strategic nuclear forces and advanced conventional weapons reflected a shift in U.S. nuclear strategy. The successful use of conventional weapons in conflicts like the Persian Gulf War reinforced the belief that ground-based nuclear weapons were no longer necessary.

The withdrawal of U.S. tactical nuclear weapons from South Korea had implications for the region's security and the ongoing challenge of North Korea's nuclear program. While removing these weapons was a significant step, the United States continued to provide extended deterrence to South Korea, emphasizing its commitment to defend its ally. However, the evolving dynamics in the region and the North Korean nuclear issue continued to shape the security landscape on the Korean Peninsula.

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III. EVOLVING NORTH KOREAN NUCLEAR AND MISSILE THREATS

Since the withdrawal of U.S. nuclear tactical nuclear weapons from South Korea in 1991, the comparative military strength between the two Koreas has been affected by two main factors. The first is the significant development and testing of nuclear weapons by North Korea. The second is the continued development of ballistic missiles by North Korea. This chapter charts these developments and discusses the risks they pose for South Korean security. These challenges suggest the possible need for new forms of deterrence in cooperation with the United States, a topic that is discussed in Chapter IV.

A. EVOLUTION OF NORTH KOREAN NUCLEAR CAPABILITIES

North Korean nuclear capabilities have developed over three different phases. In the initial phase, from the 1960s to the 1970s, North Korea's nuclear ambitions began to take shape, with motivations including establishing a deterrent against ROK-U.S. military forces and elevating the domestic reputation of the Kim family. Collaboration with the Soviet Union played a pivotal role in building North Korea's nuclear infrastructure. During the developmental stage, from the 1980s to early 2016, North Korea made significant strides in its independent nuclear weaponization, sparking international concerns and negotiations. The maturity phase, from late 2016 to the present, has witnessed rapid progress under KJU's leadership, with substantial improvements in nuclear test yields, focus on tactical nuclear weapons, and miniaturization of warheads. Estimates of the North Korean nuclear arsenal vary, but its continued accumulation of fissile materials keeps concerns alive. This evolution represents a substantial challenge to regional and international security.

1. Initial Phase of Nuclear Weapons (1960s–1970s)

North Korea's nuclear ambitions may have started during the Korean War. North Korea wanted to have its nuclear program for four main reasons: a cost-effective deterrent against the ROK-U.S. military forces, a means of boosting the domestic reputation of the Kim family, upgrading North Korean international position, and a diplomatic card for

future negotiations with the United States.[156] In this regard, North Korea outlined a plan for cooperation in the nuclear sector with the Soviet Union in 1959.[157]

Nuclear cooperation between the Soviet Union and North Korea had already begun to move forward in the following areas: geological research, the establishment of a nuclear research center, and the education of North Korean experts.[158] Immediately after the Korean War ended, North Korean nuclear scientists had started to seek nuclear-related technical education in the Soviet Union;[159] some 300 North Korean nuclear experts received training from the Soviet nuclear-related institutions during these years.[160] As Ankit Panda and Georgiy Kaurov report, even after the Yongbyon nuclear research center was fully completed with the cooperation of a Soviet-provided research reactor (the IRT-2000) in 1965, the Soviet Union helped North Korea by supervising North Korean nuclear facilities and supplying nuclear fuels for the research reactor.[161]

North Korea moved toward realizing its plans during the 1960s and 1970s thanks to Soviet help, although Pyongyang moved well beyond this assistance. The Soviet Union had planned for the research reactor to be used only for practical purposes because the Soviet Union did not advocate North Korea's nuclearization.[162] However, North Korea

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156 Natalya Bazhanova, "North Korea's Decision to Develop an Independent Nuclear Program," in *The North Korean Nuclear Program: Security, Strategy, and New Perspectives from Russia*, ed. James Clay Moltz and Alexandre Y. Mansourov (New York: Routledge, 2000), 136–37, https://www.taylorfrancis.com/books/mono/10.4324/9780203820391/north-korean-nuclear-program-james-moltz-clay-alexandre-mansourov.

157 Georgiy Kaurov, "A Technical History of Soviet-North Korean Nuclear Relations," in *The North Korean Nuclear Program: Security, Strategy, and New Perspectives from Russia*, ed. James Clay Moltz and Alexandre Y. Mansourov (New York: Routledge, 2000), 15, https://www.routledge.com/The-North-Korean-Nuclear-Program-Security-Strategy-and-New-Perspectiv/Mansourov-Moltz/p/book/9780415923699?_gl=1*1wai51o*_ga*MTU2NjI2ODIxMy4xNjk2NjMwOTkw*_ga_0HYE8YG0M6*MTY5OTc0NzI2Mi40LjAuMTY5OTc0NzI2Mi4wLjAuMA..

158 Kaurov, 16; Andrew O'neil, "Learning to Live with Uncertainty: The Strategic Implications of North Korea's Nuclear Weapons Capability," *Contemporary Security Policy* 26, no. 2 (August 1, 2005): 318, https://www.tandfonline.com/doi/epdf/10.1080/13523260500190435?needAccess=true.

159 O'neil, 318.

160 Kaurov, "A Technical History of Soviet-North Korean Nuclear Relations," 17.

161 Ankit Panda, *Kim Jong Un and the Bomb: Survival and Deterrence in North Korea* (Oxford, UK: Oxford University Press, 2020), 100, Kindle; Kaurov, "A Technical History of Soviet-North Korean Nuclear Relations," 17.

162 Panda, 100.

had obtained the basic nuclear facilities needed for weaponization from the Soviet Union during this time: a research reactor, a radiochemical laboratory capable of separating nuclear materials, a K-60,000 cobalt installation, and a B-25 betatron.[163] North Korea especially succeeded in separating small amounts of plutonium in 1975 from the research reactor.

2. Developmental Stage of Nuclear Weapons (1980s–Early 2016)

The period from the 1980s to early 2016 was a developmental stage for North Korea regarding its nuclear weapons. During this period, North Korea fulfilled its independent nuclear weaponization, declared itself a nuclear state, conducted reprocessing of fissile materials, and conducted four nuclear tests.

North Korea's nuclear capabilities significantly increased with a domestically produced 5-megawatt electric (MWe) reactor completion during the 1980s.[164] As Panda et al. report, North Korea commenced the operation of the 5-MWe reactor in 1986, which would become the cornerstone of North Korea's nuclear weaponization. North Korea developed technology autonomously to weaponize fissile materials from the reactor without the Soviet transfer of technology in this field.[165] At first, North Korea tried to obtain fuel for the 5-MWe reactor; after it was denied the uranium fuel, it processed natural uranium into fuel rods at its own Yongbyon fabrication facilities.[166] Panda argues the uranium fuel fabrication caused the Soviet Union to force Kim Il Sung to join the Treaty on the NPT. The 5-MWe reactor provided several benefits to North Korea. First, the reactor used natural uranium, which was readily available in North Korea compared to enriched

163 Kaurov, "A Technical History of Soviet-North Korean Nuclear Relations," 16.

164 Panda, *Kim Jong Un and the Bomb*, 101; Robert S. Norris, Hans M. Kristensen, and Joshua Handler, "North Korea's Nuclear Program, 2003," *Bulletin of the Atomic Scientists* 59, no. 2 (March 1, 2003): 74–75, https://journals.sagepub.com/doi/abs/10.2968/059002017.

165 Bruce W. Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, PE-A1015-1 (Santa Monica, CA: RAND Corporation, 2021), 26, https://www.rand.org/pubs/perspectives/PEA1015-1.html; Kaurov, "A Technical History of Soviet-North Korean Nuclear Relations," 15.

166 Panda, *Kim Jong Un and the Bomb*, 101.

uranium.[167] Second, the reactor produced considerable quantities of spent fuel, which can be reprocessed for nuclear weapons (indeed, North Korea built a reprocessing facility near the reactor).[168]

In the early 1990s, North Korea had exploited a gap in international surveillance by adjusting the time of its accession to international nuclear regimes and developing its nuclear program secretly. North Korea refused to negotiate a bilateral safeguards agreement with the IAEA until 1992, even though it had joined the NPT in 1985.[169] Andrew O'neil asserts that, at that time, many experts already had a strong suspicion that North Korea had skillfully avoided the provisions of the NPT and was reprocessing spent fuel rods from the Yongbyon reactor and separating plutonium for military purposes. These suspicions became an accomplished fact in 1992 when the IAEA discovered during its visit to North Korean nuclear facilities that North Korea had configured its nuclear materials and facilities aiming at weaponization.[170] This incident started the so-called "first North Korean nuclear crisis."[171]

After the visit of the IAEA, North Korea adopted a policy of stubborn rejection of additional inspections. North Korea prohibited the IAEA from entering the nuclear waste facilities that were assumed to be the storage site of fissile material in 1993.[172] Then, as O'neil reported, North Korea abruptly announced that it would withdraw from the NPT. O'neil maintains that to ease this crisis, the United States and the IAEA found some common ground to get North Korea to freeze its nuclear program in 1994, known as the Agreed Framework. However, the IAEA was concerned that North Korea could already manufacture two to six nuclear bombs, considering that North Korea could have previously

167 Panda, 101; Nicholas L. Miller and Vipin Narang, "North Korea Defied the Theoretical Odds: What Can We Learn from Its Successful Nuclearization?," *Texas National Security Review* 1, no. 2 (February 2018): 60, https://repositories.lib.utexas.edu/handle/2152/63943.

168 Panda, 101.

169 O'neil, "Learning to Live with Uncertainty," 318.

170 O'neil, 318.

171 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 26.

172 O'neil, "Learning to Live with Uncertainty," 318.

extracted enough fissile material.[173] Despite the Agreed Framework, North Korea acquired some uranium enrichment technology from Pakistan in return for Nodong missiles.[174]

In the early 2000s, the United States discovered what it saw as decisive evidence of North Korean nuclear weaponization, which Pyongyang initially acknowledged. In October 2002, U.S. intelligence assessed that North Korea had secretly acquired the capacity to develop highly enriched uranium (HEU) to build its nuclear weapons; in the same month, North Korea admitted the fact of its operation of a nuclear weapons program and triggered "the second nuclear crisis."[175] After North Korea's nuclear program was revealed to the world by the United States, North Korea quickly resumed operation of its 5-MWe reactor, restarted the reprocessing plant, and pledged to build two larger reactors, in violation of the Agreed Framework.[176] By that time, U.S. intelligence had already evaluated that North Korea could carry a nuclear warhead on its missiles.[177] "Notwithstanding the importance of diffusing the North Korean crisis in order to freeze, rollback, and ultimately dismantle its nuclear weapons program, the North Korean proliferation challenge is compounded by other military threats, including its robust ballistic missile arsenal."[178] Accordingly, South Korea and the United States felt they lost countermeasures for use in urgent crises as North Korea matured its weapons of mass destruction assets.[179]

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[173] O'neil, 319.

[174] Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 26.

[175] Chung-min Lee, "A View from Asia: The North Korean Missile Threat and Missile Defense in the Context of South Korea's Changing National Security Debate," *Comparative Strategy* 24, no. 3 (July 1, 2005): 253, https://www.tandfonline.com/doi/epdf/10.1080/01495930500197957?needAccess=true; Brad Roberts, *Living With a Nuclear-Arming North Korea: Deterrence Decisions in a Deteriorating Threat Environment* (Washington, DC: The Stimson Center, 2020), 319, https://cgsr.llnl.gov/content/assets/docs/38_North_SR_2011_Brad_Roberts_Nuclear_North_Korea_Deterrence.pdf; Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 26.

[176] Norris, Kristensen, and Handler, "North Korea's Nuclear Program, 2003," 75.

[177] Lee, "A View from Asia," 253.

[178] Lee, 253–54.

[179] Lee, 254.

On the other hand, North Korea's fissile materials, considering the nuclear reactors' number and size, implied the North could have produced plutonium and uranium nuclear weapons yearly. North Korea had been constructing a 50-MWe reactor in Yongbyon and a 200-MWe facility in Taechon before the Agreed Framework.[180] As Norris, Kristensen, and Handler report, North Korea stated that it would resume the construction of its incomplete reactors and the other two larger reactors after the U.S. intelligence revealed North Korea's nuclear program; however, North Korea had already enriched a considerable amount of uranium since 2001. Norris, Kristensen, and Handler estimate that North Korea has roughly 26 million tons of unenriched uranium as source material waiting to be mined.[181] As for plutonium, the United States evaluated that North Korea had obtained 6 to 9 kilograms of plutonium; at the same time, South Korea, Japan, and Russia assumed it could be as much as 24 kilograms.[182] Given that inexperienced engineers can make nuclear weapons of five kilotons (KT) yield with four kilograms of plutonium and 11 kilograms of uranium,[183] North Korea could have manufactured at least one to two plutonium nuclear weapons and numerous uranium nuclear weapons. A.K.Sachdev asserts that after North Korea constructed the two larger reactors, it could produce 200 kilogram of plutonium each year, which would be sufficient for approximately 50 atomic bombs annually.[184]

With that technological base, North Korea conducted four nuclear tests for developmental purposes. The world witnessed the first nuclear test by North Korea in 2006. Even though the yield of its first nuclear test was only 0.5 to 1 KT, the yield of North Korean nuclear weapons jumped up to 4 KT within three years, as revealed by its second nuclear test in 2009.[185] Bruce Bennett et al. indicate that North Korea could have mounted a 500-kilogram HEU warhead on a missile (most likely the Nodong missile) by 2006

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[180] Norris, Kristensen, and Handler, "North Korea's Nuclear Program, 2003," 75.

[181] Norris, Kristensen, and Handler, 75.

[182] Norris, Kristensen, and Handler, 75.

[183] Norris, Kristensen, and Handler, 76.

[184] A.K. Sachdev, "North Korea's Missile Programme: A Matter of Concern," *Strategic Analysis* 24, no. 9 (December 1, 2000): 1702–3, https://www.tandfonline.com/doi/epdf/10.1080/09700160008455313?needAccess=true.

[185] Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 27.

thanks to Pakistan's help in designing the warhead. Although North Korea contended that it tested a hydrogen weapon in its fourth nuclear test in January 2016, Bennett et al. evaluate that available evidence did not support major improvements in this test compared to the previous one.[186] Bennett et al. conclude that North Korea's assertion of success might be a political propaganda revealing its lofty aspiration for hydrogen bombs.

3. Maturity of Nuclear Weapons (Late 2016–Present)

North Korean nuclear capabilities have dramatically expanded under the KJU regime.[187] As a result, during this period, North Korea has accomplished swift progress through two nuclear tests, expansion of its types of nuclear weapons, more reliable missile technology, the quantity of its nuclear arsenal, and its ability to produce fissile materials.

In advance, North Korea showed a significant turning point in its nuclear tests in terms of yield. In the fifth nuclear test, which was the second nuclear test under the KJU regime, the yield of nuclear weapons drastically improved to 15 to 25 KT, which could inflict 450,000 to 630,000 casualties in Seoul.[188] As Bennett et al. reported, North Korea sharply raised the yield again to 250 KT in its sixth nuclear test in 2017. Even though North Korea asserted that the sixth test was about a thermonuclear bomb, there are controversies about the truth and falsehood of this assertion among North Korean experts. Sue Mi Terry believes it was a genuinely thermonuclear bomb test.[189] At the same time, Bennett et al. claim that it was not the test of a thermonuclear device, unlike North Korea's propaganda.[190] However, most experts agree that the yield of the sixth nuclear test could cause approximately 2.9 million casualties in New York City and 3.2 million casualties in

186 Bennett et al., 27.

187 Robert Einhorn, "South Korea's Nuclear Options," ed. Brad Roberts, *Center for Global Security Research*, Deterring A Nuclear-Armed North Korea, May 2023, 7, https://cgsr.llnl.gov/content/assets/docs/230427_CGSR_Deterring_Nuclear_Armed_North_Korea.pdf.

188 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 28.

189 Sue Mi Terry, "North Korea Raises the Nuclear Stakes: The Kim Regime's Dangerous New Capabilities and Doctrine," *Foreign Affairs*, October 25, 2022, https://www.foreignaffairs.com/north-korea/north-korea-raises-nuclear-stakes.

190 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 28.

Seoul when North Korea detonates the nuclear weapons there.[191] In addition, Bennett et al. warn that North Korea's nuclear capabilities will become faster and more sophisticated by 2027.

Currently, North Korea is prioritizing its advancement of tactical nuclear weapons. Robert Einhorn interprets it as North Korea bearing the initial use of tactical nuclear weapons on a battlefield in mind and messaging its strong willpower to use it.[192] In the 8th Party Congress of the Worker's Party of North Korea in January 2021, KJU asserted that North Korea "was able to 'miniaturize, lighten and standardize nuclear weapons and to make them tactical ones.'"[193] In January 2023, KJU ordered the country's exponential expansion of its nuclear arsenal and mass production of tactical nuclear weapons. In addition, on the 75th anniversary of the founding of North Korean military forces on February 8, 2023, tactical nuclear operation units appeared in a military parade for the first time.[194]

Additionally, North Korea seems to have achieved the miniaturization of nuclear warheads, which has been crucial in loading nuclear warheads on missiles. The U.S. Defense Intelligence Agency (DIA), Katrin Frase Katz, and Victor Cha assess that North Korea has accomplished the miniaturization of nuclear warheads to load them on from short-range ballistic missiles (SRBMs) to ICBMs.[195] Terry and Einhorn argue that North Korea has hinted at the possibility of the seventh nuclear test to experiment with miniaturized nuclear weapons for tactical nuclear weapons and multiple independently

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191 Bennett et al., 28.

192 Einhorn, "South Korea's Nuclear Options," 7.

193 Mary Beth D. Nikitin, *North Korea's Nuclear Weapons and Missile Programs*, IF10472 (Washington, DC: Congressional Research Service, 2023), https://crsreports.congress.gov/product/pdf/IF/IF10472/28.

194 Keun-pyung Lee, "North Aiming at The U.S. Mainland . . . Hwasung-17 Appeared in A Pile and Released A New ICBM [미 본토 겨눈 북...화성-17 형 무더기 등장, 신형 ICBM 도 내놨다]," *The JoongAng*, February 9, 2023, https://www.joongang.co.kr/article/25139483.

195 Katrin Fraser Katz and Victor Cha, "North Korea's Missile Message: How Kim's New Nuclear Capabilities Up the Ante," *Foreign Affairs*, April 29, 2022, https://www.foreignaffairs.com/articles/north-korea/2022-04-29/north-koreas-missile-message; Nikitin, *North Korea's Nuclear Weapons and Missile Programs*.

targetable re-entry vehicles (MIRVs).[196] Mary Beth D. Nikitin also suggests the potential nuclear testing, pointing out that North Korea recovered its destroyed nuclear test sites of Punggye-ri in 2022.[197]

Meanwhile, the estimates of the size of the North Korean nuclear arsenal vary considerably. Around mid-2017, the U.S. intelligence agency suggested that North Korea possessed 30 to 60 nuclear weapons.[198] In 2021, Bennett et al. expect that North Korea might have 67 to 116 nuclear weapons based on a calculation with estimated HEU and plutonium; as he argues that by 2027, it would be 151 to 242 weapons.[199] In 2023, David Albright of the Institute for Science and International Security surmises that North Korea has roughly 70 nuclear weapons considering his skewed distribution.[200]

On the other hand, North Korea has kept accumulating fissile materials at the maturity phase except for the duration of the Hanoi Summit in 2019. During the Hanoi summit, it looked as though North Korea would shut down and dismantle its nuclear facilities.[201] However, as Olli Heinonen reports, North Korea augmented nuclear facilities after the negotiation between KJU and President Trump failed. The IAEA also reports that North Korea appeared to recommence operations at its plutonium-production reactor in Yongbyon in July 2021.[202] Moreover, the Middlebury Institute of International Studies discovered the expansion of the Yongbyon uranium enrichment plant by approximately

196 Terry, "North Korea Raises the Nuclear Stakes: The Kim Regime's Dangerous New Capabilities and Doctrine."; Einhorn, "South Korea's Nuclear Options," 7.

197 Nikitin, *North Korea's Nuclear Weapons and Missile Programs*.

198 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 32.

199 Bennett et al., 33–37.

200 David Albright, "North Korean Nuclear Weapons Arsenal: New Estimates of Its Size and Configuration" (Institute for Science and International Security, April 10, 2023), 7, https://isis-online.org/isis-reports/detail/2023-north-korean-nuclear-weapons-arsenal-new-estimates.

201 Olli Heinonen, "Development of the Yongbyon Uranium Enrichment Plant Between 2009 and 2021—38 North: Informed Analysis of North Korea," 38 North, July 16, 2021, https://www.38north.org/2021/07/development-of-the-yongbyon-uranium-enrichment-plant-between-2009-and-2021/.

202 Paul Fraioli, ed., "The Arms Race on the Korean Peninsula," *Strategic Comments* 27, no. 8 (September 14, 2021): iv–vi, https://www.tandfonline.com/doi/epdf/10.1080/13567888.2021.1996065?needAccess=true.

25% through a satellite image.[203] If it is true, Paul Fraioli insists that North Korea can produce 75–120 kilograms HEU annually, which can manufacture four to six nuclear weapons per year. Considering this productivity, expanding the nuclear stockpile is a matter of time.

B. EVOLUTION OF NORTH KOREAN MISSILE CAPABILITIES

Likewise, North Korean missile capabilities have developed over three distinct phases. The initial phase, spanning the 1960s to the 1970s, was marked by North Korea's collaboration with countries like the Soviet Union, China, and Egypt in acquiring missiles and technologies. In the developmental stage, which extended from the 1980s to 2016, North Korea made significant progress in producing short-range and medium-range ballistic missiles, advancing to even intercontinental ballistic missiles. This stage was characterized by efforts to develop, test, and sometimes export various missile systems. As North Korean missile capabilities have shifted to the maturity phase, from 2017 to the present, they have demonstrated substantial advancements, particularly under the KJU regime. This phase has seen advancements in SRBMs, intermediate-range ballistic missiles (IRBMs), ICBMs, and so on. North Korea's frequent missile tests have proven that its missile capabilities can undermine U.S. missile defense systems.

1. Initial Phase of Missiles (1960s–1970s)

North Korea undertook the missile program with the help of the Soviet Union, China, and Egypt. North Korea had procured various types of missiles and missile technologies and required training from the Soviet Union since the 1960s; in addition, China also started to provide missile technologies in the 1970s, and Egypt rendered a few Soviet SCUD B missiles, launchers, and equipment.[204]

During the 1960s, the Soviet Union provided North Korea with shorter-range and tactical systems. These include surface-to-air missiles, coastal defense missiles, anti-ship

[203] Fraioli.

[204] Norris, Kristensen, and Handler, "North Korea's Nuclear Program, 2003," 76.

missiles, and unguided rocket artillery systems with battlefield-range capabilities.[205] Primarily, the Soviet rocket artillery systems (FROG missiles) contributed a technological base for North Korean ballistic missile development; the Soviet Union provided FROG missiles to North Korea with a small number of launch vehicles and related support equipment, which were presumably introduced around 1968.[206]

However, the Soviet Union suspected North Korea's underlying intentions regarding missile development, so it refused to supply North Korea with ballistic missiles.[207] For example, in the late 1960s, Brezhnev persuaded Kim Il Sung not to provoke the United States, but North Korea seized the USS Pueblo in 1968.[208] This unruly provocation might have made the Soviet Union think that North Korea might provoke the United States with ballistic missiles in the future. This independent action risked getting the Soviet Union dragged into a war with the United States triggered by North Korea.

By the 1970s, North Korea increased its reliance on China rather than the Soviet Union regarding missile development. Korea had felt uncomfortable in the late 1950s with the Khrushchev regime due to his criticism of Stalin, which it saw as threatening to North Korea's own Stalinist regime; adding to the unease, the Brezhnev administration's decision in the late 1960s to embrace détente and nuclear arms control with the United States made Kim Il Sung change his political alliance.[209] According to Panda, China and North Korea entered a military agreement in 1972, in which Beijing agreed to provide Pyongyang with a variety of missiles such as early Soviet versions that China had reverse-engineered and some that it had developed itself. In addition, Panda contends that China enabled North Korea to participate in China's design and manufacture of ballistic missiles.

Except for China, Egypt was the other reliable state for North Korea. Egypt also contributed Soviet-designed SCUD missiles to North Korea as a gesture of appreciation

[205] Panda, *Kim Jong Un and the Bomb*, 136.

[206] Panda, 136.

[207] Panda, 136.

[208] Panda, 137.

[209] Panda, 137.

from Egypt for Pyongyang's assistance of North Korea during the 1967 Six-Day War and the 1973 Yom Kippur War with Israel.[210] As Panda reports, North Korea supported Egypt by exporting arms during the Six-Day War; also, North Korea had also trained the Egyptian military in North Korea and sent approximately thirty pilots and technicians to Egypt during the Yom Kippur War.

2. Developmental Stage of Missiles (1980s–2016)

In the developmental stage of its missile programs from the 1980s to 2016, North Korea began to produce SRBMs and medium-range ballistic missiles (MRBMs). It almost finished the development of ICBMs with its technologies.

By the late 1980s, North Korea could produce SRBMs with its own capabilities, which targeted South Korea. North Korea engaged in reverse engineering of the SCUD B missiles and established a related manufacturing infrastructure, allowing them to produce their missiles; by 1987 and 1988, North Korea was able to manufacture SCUD B (Hwasung-5) missiles at a pace of approximately 8–10 per month.[211] Afterward, Norris, Kristensen, and Handler demonstrate that North Korea developed the SCUD C (Hwasung-6) missile, which had a more extended range (500 kilometers) than SCUD B (320 kilometers), and tested it in 1990.

From the 1990s, North Korea began to develop MRBMs as well as short-range SCUD missiles, expanding its targets to Japan and the U.S. troops in Japan. North Korea succeeded in launching the MRBM (Nodong) in 1993[212]; the Nodong missile (Hwasung-7) was known to fly 1,350–1,500 kilometers, which meant that it could target Japan and U.S. Okinawa bases as well as any parts of South Korea; Hwasung-7 was put into operational service in the middle of the 1990s.[213] Meanwhile, by the end of 1999, North Korea was estimated to generate 600 to 1,000 SCUD B and SCUD C missiles and sell them

[210] Panda, 138.

[211] Norris, Kristensen, and Handler, "North Korea's Nuclear Program, 2003," 76; O'neil, "Learning to Live with Uncertainty," 319.

[212] O'neil, 319.

[213] Norris, Kristensen, and Handler, "North Korea's Nuclear Program, 2003," 76; Sachdev, "North Korea's Missile Programme," 1699.

abroad.[214] O'neil interprets that North Korea made these SRBMs and MRBMs to aim at South Korea and Japan.[215] North Korea later enhanced these SCUD missiles into SCUD D and SCUD ER so they could fly much longer distances.[216]

As for ICBMs, North Korea began its Taepodong missile program in the late 1990s, which it tested for the first time in 1998.[217] The test launched the most extraordinary international repercussions because the second stage of the missile flight covered the main Japanese island, Honshu, and touched down about 330 kilometers from the Japanese port city of Hachinohe; however, the test failed as its satellite could not reach the third phase of the missile launch.[218] One can only guess the reason for the failure, but Sachdev suggests it was possible that North Korean satellite did not exist from the outset.[219] Even though the first Taepodong test was not successful, North Korea may have exported its large-scale missile to Egypt, Iran, Libya, Pakistan, and Syria and got immense revenue.[220]

North Korea had continuously promoted ICBMs with the Taepodong-2 and the Musudan missile programs during the 2000s, making up for the Taepodong-1. Norris, Kristensen, and Handler claimed that in the early 2000s, North Korea was preparing the test of the Taepodong-2, of which potential range could exceed 6,000 kilometers, granting it to target parts of Hawaii and Alaska. These authors anticipate North Korea will try to load nuclear warheads on ballistic missiles, although no one knows whether North Korea has already achieved this capability. In addition, North Korea improved the Taepodong missile to the Musudan missile (Hwasung-10) in 2004.[221] Bennett et al. illustrate that the Musudan potentially can strike Guam with its 4,000 kilometers of range. Until then, North

214 Norris, Kristensen, and Handler, 76.

215 O'neil, "Learning to Live with Uncertainty," 319.

216 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 29.

217 O'neil, "Learning to Live with Uncertainty," 319.

218 Norris, Kristensen, and Handler, "North Korea's Nuclear Program, 2003," 76; Sachdev, "North Korea's Missile Programme," 1697.

219 Sachdev, 1698.

220 O'neil, "Learning to Live with Uncertainty," 319.

221 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 29.

Korea's missile capabilities were controversial. Some American and Western experts were not concerned much about the development of North Korean missile capabilities because they thought North Korea could not pass its technological obstacles in the ICBMs to reach the U.S. mainland.[222] However, there were some U.S. politicians (especially from hawkish Republicans in Congress) who claimed North Korea could hit the United States with nuclear-loaded ICBMs; they repeated a theme about the threat of a North Korean electromagnetic pulse (EMP) attack over the United States, which would shut down and blind the whole United States.[223]

3. Maturity of Missiles (2017–Present)

The goal of the North Korean missile program has been to neutralize the ROK-U.S. missile defense system and attack the U.S. mainland for decades. In the maturity phase of the missile program, North Korea achieved the goal of overcoming technological barriers with the help of Russia and China as they enabled North Korea to avoid sanctions and procure required resources and technologies from international markets.[224] North Korea especially has developed these capabilities more rapidly under the KJU regime.[225] Starting with the 2017 missile test (Hwasung-14, KN-20), North Korea has continuously proved its ability to target the U.S. mainland with missile tests in 2022 and 2023.[226] Under the KJU control, North Korea conducted the tests of much larger missiles compared to Kim Il Sung and Kim Jong Il.[227] As Figure 2 shows, Markers Schiller also notes that KJU implemented twice as many missile tests as all of the earlier missile tests before he took power.

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[222] Katz and Cha, "North Korea's Missile Message: How Kim's New Nuclear Capabilities Up the Ante."

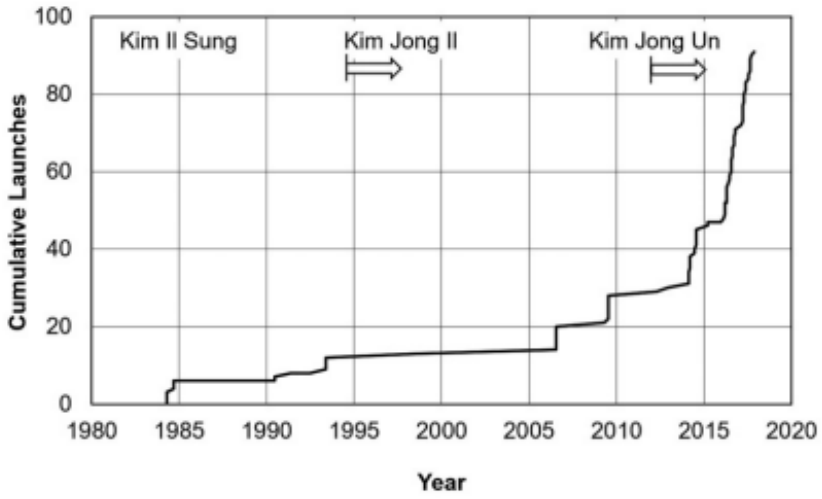
[223] Kells Hetherington, "US Defenseless Against North Korean EMP Threat," *Voice of America News / FIND* (Washington, DC: Federal Information & News Dispatch, LLC, August 19, 2014), https://www.voanews.com/a/us-defenseless-against-north-korean-emp-threat/2419448.html.

[224] Katz and Cha, "North Korea's Missile Message: How Kim's New Nuclear Capabilities Up the Ante."

[225] Einhorn, "South Korea's Nuclear Options," 7.

[226] Nikitin, *North Korea's Nuclear Weapons and Missile Programs*.

[227] Markus Schiller, "The Scope of Foreign Assistance to North Korea's Missile Program," *Science & Global Security* 27, no. 1 (January 2, 2019): 55–56, https://www.tandfonline.com/doi/epdf/10.1080/08929882.2019.1613805?needAccess=true.



Source: Schiller, "The Scope of Foreign Assistance to North Korea's Missile Program," 30.

Figure 2. North Korean Missile Launches (1980–2018)

First, North Korea has improved diverse SRBMs, which are more accurate, rapid, dual-capable, and survivable: KN-23, KN-24, KN-25, KN-17. Since 2019, North Korea has tested the KN-23 missile, the North Korean version of Iskander.[228] Bennett et al. demonstrate that it is solid-fueled, has a 700-kilometer range (SRBMs), and shows significantly improved accuracy than other North Korean missiles. The KN-23 is especially estimated to deliver a nuclear and conventional warhead (so-called dual-capable warhead) and be launched from a TEL (mobile launcher).[229] The fatal point is that the KN-23 has an atypical flight path; it showed a pull-up maneuver in the terminal phase.[230] These features of the KN-23 missile make detecting and intercepting the KN-23 far more arduous (even though Ukraine insisted it intercepted Russian Iskander missiles in June 2023, the authenticity is not yet known, and it is unknown what missile defense system Ukraine used to intercept in the battle).[231] Furthermore, in May 2019, North Korea launched multiple

[228] Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 30.

[229] Bennett et al., 30; Nikitin, *North Korea's Nuclear Weapons and Missile Programs*.

[230] Nikitin.

[231] Ellie Cook, "Putin's Iskander Missiles Fall Flat Despite Overnight Barrage," *Newsweek*, June 1, 2023, https://www.newsweek.com/ukraine-russia-iskander-ballistic-cruise-missiles-kyiv-strikes-air-defenses-1803733.

rocket launchers (MRL) and the KN-23, which have similar flight trajectories, at the same time to distract the ROK-U.S. air defense system.[232] In addition, North Korea launched the KN-23 in a silo method in 2023, which means that North Korea intends to use a silo as a launcher regarding its sturdiness to boost missile survivability (North Korea has constructed underground tunnels preparing for ROK-U.S. mass air strikes).[233]

Likewise, the KN-24 and KN-25 are the other SRBMs that threaten the ROK-U.S. missile defense system with their promptness and accuracy. The KN-24 uses a mobile launcher and solid fuel and can perform a series of fires, reinforcing the KN-24's readiness. Except for the readiness, the KN-24 is assumed as a dual-capable system; the accuracy of the KN-24 with a guidance system enables it precision strikes within 100 kilometers of circular error probability.[234] Meanwhile, the KN-25 demonstrated its rapid firing every 20 seconds in the tests of 2019 and 2020 so that it can exceed the capacity of the ROK-U.S. missile defense system;[235] the KN-25 is also known to have a guidance system and has 600mm of diameter, which is enormous in relation to the world's MRLs.[236]

The KN-17 (Hwasung-12) is IRBM, which is also able to disturb the ROK-U.S. missile defense system with its irregular flight track. If Hwasung-12 is assembled with the Hwasung-8 hypersonic gliding warhead as North Korea demonstrated by testing the combination on September 29, 2021, intercepting it becomes demanding because it flies

232 Kim, "North Korea's Tactical and Strategic Weapons after Hanoi Talks Development Trends and Implications of the Evolution of the Principle of Nuclear Suppression [하노이 회담 이후 북한 전술·전략 무기 개발 동향과 핵 억제 교리 진화의 함의]," 5; Cheol-jae Lee, "It's Hard to Intercept If It Is Mixed with A Multi Rocket Launcher. 'North Korean Tactical Nuclear Is for A Preemptive Strike on South Korea.' [방사포와 섞어쏘면 요격 힘들다 '北전술핵은 한국 선제공격용']," *The JoongAng*, January 5, 2022, https://www.joongang.co.kr/article/25038565#home.

233 Seung-gi Shin, "First Test Launch Evaluation and Implications of Hwasung-18 [화성 18 형 최초 시험 발사 평가 및 함의]," *Northeast Asia Strategic Analysis (NASA)*, May 3, 2023, 6, https://www.kida.re.kr/images/skin/doc.html?fn=b9307c35040b36e13d216d6e3962fcf3&rs=/images/convert.

234 Nikitin, *North Korea's Nuclear Weapons and Missile Programs*; Kim, "North Korea's Tactical and Strategic Weapons after Hanoi Talks Development Trends and Implications of the Evolution of the Principle of Nuclear Suppression [하노이 회담 이후 북한 전술·전략 무기 개발 동향과 핵 억제 교리 진화의 함의]," 4.

235 Nikitin.

236 Kim, "North Korea's Tactical and Strategic Weapons after Hanoi Talks Development Trends and Implications of the Evolution of the Principle of Nuclear Suppression [하노이 회담 이후 북한 전술·전략 무기 개발 동향과 핵 억제 교리 진화의 함의]," 4.

unpredictably.[237] Fraioli evaluates this high because only China, Russia, and the United States conducted hypersonic missile tests before.

North Korea also possesses ICBMs with various ranges: Hwasung-15, Hwasung-17, and Hwasung-18. The KN-22 (Hwasung-15) has a 12,000-kilometer range so that it can strike any location on the West Coast of the United States or even beyond.[238] The so-called enhanced version of the KN-22 (Hwasung-17) seems to target MIRV capability regarding its gigantic size.[239] North Korea presented Hwasung-17 in the 2020 military parade first and KJU highlighted the technological completion of MIRVs in the 8th Party Congress in 2021.[240] Considering that MIRVs can deliver combinations of three to four warheads and decoys simultaneously, the Hwasung-17 will pose a greater technological threat to U.S. missile defense systems after North Korea achieves MIRV capability.[241] In July 2023, North Korea finished the test of a solid-fueled ICBM (Hwasung-18) successfully and proved its ability to launch ICBMs from land or sea;[242] Paul LaCamera, the U.S. Armed Forces Commander in Korea, reported in the House Armed Services Committee Hearing that the success of Hwasung-18 affects the function of the U.S. sign detection and alarm ability due to the use of solid-fuel.[243]

Besides, North Korea has actively reinforced the resilience of its deterrent capabilities with SLBMs, nuclear submarines, train-launched missiles, advanced surface-

237 Fraioli, "The Arms Race on the Korean Peninsula."; Terry, "North Korea Raises the Nuclear Stakes: The Kim Regime's Dangerous New Capabilities and Doctrine."

238 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 30–31.

239 Nikitin, *North Korea's Nuclear Weapons and Missile Programs*.

240 Nikitin; Katz and Cha, "North Korea's Missile Message: How Kim's New Nuclear Capabilities Up the Ante."

241 Katz and Cha; Sue Mi Terry, "North Korea's Nuclear Opportunism: Why Kim Jong Un Chose to Exploit the Ukraine Crisis," *Foreign Affairs*, March 24, 2022, https://www.foreignaffairs.com/united-states/north-koreas-nuclear-opportunism.

242 Nikitin, *North Korea's Nuclear Weapons and Missile Programs*.

243 Byung-chul Kang, "U.S. Commander 'North Korea's Solid-Fuel ICBM Affects U.S. Symptom Detection and Warning Capability' (Comprehensive) [미군사령관 '北고체연료 ICBM, 美의 징후탐지·경보능력에 영향'(종합)]," *Yonhap News*, April 19, 2023, https://www.yna.co.kr/view/AKR20230419001751071.

to-air defense missile systems, and long-range strategic cruise missiles.[244] Among them, the SLBM Pukugksong-4 was introduced in the North Korean 2020 military parade and used solid-fuel to boost promptness.[245] In addition, the success of train-launched missiles (Pukguksong-2) means that North Korea can launch missiles from a moving launcher, which could complicate the regular operation of the terminal high-altitude defense missile system and the Aegis ballistic missile defense system.[246]

The most conspicuous point is that North Korea unprecedentedly began to conduct innumerable missile tests from 2021 to this day. North Korea has implemented its series of tests due to the military buildup plan that North Korea announced after the 8th Party Congress in January 2021; North Korea is accomplishing its national goal daily with numerous missile tests. [247] Just counting the occurrences in 2022, North Korea implemented 63 ballistic missile tests.[248] Moreover, North Korea established the General Bureau of Missiles, which directs North Korean missile development and showcases its existence in its official events.[249] Until 2020, even North Korean experts like Bennett et al. doubted whether the North Korean ICBMs had re-entry capability or not.[250] Now, thanks to those frequent missile tests, it is thought that North Korea has created re-entry vehicles capable of withstanding the extreme heat and pressure when a ballistic missile

244 Terry, "North Korea Raises the Nuclear Stakes: The Kim Regime's Dangerous New Capabilities and Doctrine."; Einhorn, "South Korea's Nuclear Options," 7; Nikitin, *North Korea's Nuclear Weapons and Missile Programs*.

245 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 31.

246 Sung-min Cho and Oriana Skylar Mastro, "North Korea Is Becoming an Asset for China," *Foreign Affairs*, February 3, 2022, https://www.foreignaffairs.com/articles/north-korea/2022-02-03/north-korea-becoming-asset-china.

247 Einhorn, "South Korea's Nuclear Options," 7.

248 Nikitin, *North Korea's Nuclear Weapons and Missile Programs*.

249 Lee, "North Aiming at The U.S. Mainland . . . Hwasung-17 Appeared in A Pile and Released A New ICBM [미 본토 겨눈 북...화성-17 형 무더기 등장, 신형 ICBM 도 내놨다]."

250 Bennett et al., *Countering the Risks of North Korean Nuclear Weapons*, 31.

enters Earth's atmosphere during its terminal phase; these re-entry vehicles were designed to deliver nuclear warheads to intended targets.[251]

Above all, the problem with the North Korean missile program is that it hinders the U.S. missile defense system at a small budget, while improving the missile system is expensive. Katz and Cha explain that North Korea has around 10 ICBM TELs, whereas the United States has 44 ground-based interceptor missiles against the ICBMs.[252] As Katz and Cha assert considering that four interceptor missiles are needed to destroy the ICBMs, North Korea can easily overwhelm the U.S. missile defense system by installing two more relatively cheap TELs.

C. CONCLUSION

North Korea started its nuclear program with the help of the Soviet Union and its missile program thanks to the Soviet Union, China, and Egypt in the 1960s. North Korea sought to establish its nuclear program as a cost-effective deterrent against the combined military forces of South Korea and the United States, to bolster the domestic reputation of the Kim family, to enhance North Korea's standing on the global stage, and to wield a diplomatic bargain chip in negotiations with the United States.

North Korea has developed nuclear and missile technologies since the 1980s and moved forward to a developmental stage in each program. From the 1980s to early 2016, North Korea accomplished several significant milestones in pursuing nuclear capabilities. These achievements included achieving independent nuclear weaponization, officially declaring itself a nuclear state, enriching fissile materials, and conducting four nuclear tests. Likewise, the North Korean missile program has been in the developmental stage by manufacturing SRBMs, MRBMs, and nearly ICBMs with independent strength since the 1980s.

[251] Katz and Cha, "North Korea's Missile Message: How Kim's New Nuclear Capabilities Up the Ante."; Terry, "North Korea's Nuclear Opportunism: Why Kim Jong Un Chose to Exploit the Ukraine Crisis."

[252] Katz and Cha; Terry.

However, after KJU took over the North Korean regime in 2012, North Korea has considerably improved its nuclear and missile capabilities. North Korea made rapid advancements in various aspects of its nuclear program, including conducting two remarkable nuclear tests, developing different types of nuclear weapons, improving technology for delivery system integration, expanding its nuclear arsenal, and increasing the production of fissile materials. As for missiles, North Korea has improved the speed and diversified the range and performance of its SRBMs, IRBMs, ICBMs, SLBMs, and other survivable delivery systems. Those missiles are evaluated to pierce the ROK-U.S. missile defense system and attack the U.S. mainland. Also, they signal that North Korean enemies cannot eradicate North Korean retaliatory forces with preemptive strikes.[253]

Overall, North Korea became a de facto regional nuclear power, threatening the ROK-U.S. alliance with its advanced nuclear weapons and missiles. Even though its nuclear capabilities and arsenal are trivial compared to those of the United States, the North Korean nuclear program is now estimated at a level that the ROK-U.S. alliance cannot ignore regarding its diverse destructive power in combination with its advanced missile capabilities and growth potential. This diagnosis from the North Korean experts poses profound doubt on the sustainability of the U.S. extended deterrent and confrontational ability of the ROK-U.S. alliance against North Korea's threats.

[253] The Economist, "Tactical Advantage," *The Economist* 445, no. 9318 (October 22, 2022): 50, https://www.proquest.com/docview/2727198859/abstract/7CC6168893264A83PQ/1.

IV. SOUTH KOREAN PERCEPTIONS OF U.S. EXTENDED DETERRENCE

Even though the U.S. extended deterrent over South Korea has evolved as North Korea has improved its nuclear and missile capabilities, South Korea's anxiety about the effectiveness of U.S. extended deterrence has not disappeared and has even increased. As we discussed in Chapter I, capability, willingness, and communication determine the credibility of a deterrent strategy. However, South Koreans perceive today's extended deterrent as deficient in capability and willingness, which are the two main axes of deterrence. North Korea's rapidly growing nuclear and missile threats, discussed in Chapter III, are powerful contributors to South Korea's anxious perception toward U.S. extended deterrence. This is the security dilemma that South Korea has to address. Therefore, Section A summarizes the development of U.S. extended deterrence over South Korea from its beginning to the present. Section B examines South Koreans' three anxieties about U.S. extended deterrence in terms of capability and willingness, then describes options for enhancing deterrence that South Koreans insist on and oppositions to those options.

A. U.S. EXTENDED DETERRENCE FOR SOUTH KOREA

The United States has clarified its policy of extending a nuclear umbrella to South Korea in the ROK-U.S. Security Consultative Meeting (SCM) joint communique every year since 1978,[254] but the policy took a more comprehensive form after North Korea conducted its nuclear tests in 2006 and 2009. In the 2006 SCM after North Korea's first nuclear test, the ROK-U.S. alliance introduced public statements as an explicit expression

[254] Sang-hyun Lee, "U.S. Extended Deterrence Policy in the Asia-Pacific and Its Implications for South Korea's Security [미국의 아태 확장억지 정책과 한국 안보]," *National Defense Research* 56, no. 2 (2013): 10, https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART001780334.

of extended deterrence.[255] The statements marked a departure from the previous approach of separating extended deterrence through the U.S. nuclear umbrella from conventional defenses, explicitly including all categories of military capabilities, encompassing both conventional and nuclear capabilities, in the 2009 SCM after North Korea's second nuclear test.[256]

Afterward, the ROK-U.S. alliance kept developing the content of extended deterrence concerning the intensification of North Korea's threats over South Korea. In the 2010 SCM, after North Korea sank the South Korean vessel Cheonan, the ROK-U.S. alliance agreed to institutionalize the Extended Deterrence Policy Committee (EDPC), a cooperation mechanism to enhance the effectiveness of U.S. extended deterrence.[257] According to Lee, the ROK-U.S. alliance conducted the command post exercise based on EDPC, in the sense of preparing for North Korea's nuclear use. In 2011, the two countries newly established the Korea-U.S. Integrated Defense Dialogue (KIDD) in response to North Korea's Yeonpyeong Island shelling; the KIDD was a high-level consultative body at the level of assistant secretary of defense of both countries.[258] In 2015, the EDPC was integrated with the Counter Missile Capability Committee (CMCC) and developed into the

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255 Han-byul Sohn, "The ROK-US Alliance in the Post-Cold War Era: Alliance Management for strengthening its Extended Deterrence [탈냉전과 한미동맹: 확장억제력 제고를 위한 동맹갈등 관리]," *The Studies of New Security Challenges*, no. 187 (2015): 43, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE10877356; Dong-jun Jo, "Implications of North Korea's Nuclear Progress to the U.S. Extended Deterrence in the Korean Peninsula [북한의 핵능력 증가가 미국의 확장억제에 주는 함의와 대처방안]," *Korean National Strategy* 2, no. 1 (February 8, 2017): 270, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE10817669.

256 Hyeong-pil Ham and Man-seok Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," *National Security and Strategy*, no. 86 (June 2022): 159, https://www.dbpia.co.kr/journal/articleDetail?nodeId=NODE11285345; Jo, 270; Terence Roehrig, "The U.S. Nuclear Umbrella over South Korea: Nuclear Weapons and Extended Deterrence," *Political Science Quarterly* 132, no. 4 (December 2017): 672, https://academic.oup.com/psq/article/132/4/651/6847467.

257 Lee, "U.S. Extended Deterrence Policy in the Asia-Pacific and Its Implications for South Korea's Security [미국의 아태 확장억지 정책과 한국 안보]," 10.

258 Yeoul-soo Kim, "NATO Extended Deterrence and ROK-US Alliance Extended Deterrence: Beyond Comparison [나토 확장억제와 한미동맹 확장억제: 비교를 넘어]," *Korean Journal of Military Affairs*, no. 13 (June 2023): 16, https://www.dbpia.co.kr/journal/articleDetail?nodeId=NODE11444095; Kyung-won Lee, "Strengthen Real Combat Capabilities Despite the Reduction of U.S. Troops in Korea . . . U.S. Strategic Asset Development Enhancement of Extended Deterrence Performance [주한미군 감축에도 실질 전투능력 강화...미 전략자산 전개로 확장억제 실행력 제고]," *Kookbang Ilbo*, April 17, 2023, https://kookbang.dema.mil.kr/newsWeb/20230410/1/ATCE_CTGR_0020010017/view.do.

Deterrence Strategy Committee (DSC); in the DSC, the ROK-U.S. assistant secretaries of defense focused on deterrence and crisis management of North Korea's nuclear and missile threats.[259] The DSC later developed into the Extended Deterrence Strategy and Consultation Group (EDSCG) in 2016 after North Korea's fifth nuclear test and as North Korean progress on ICBM capabilities raised deeper questions about the credibility of U.S. commitments.[260] The EDSCG expanded not only the attendees of the meeting to the ROK-U.S. foreign and defense vice ministers, but also the means of extended deterrence to diplomacy, intelligence, and the economy, such as diplomatic pressure and economic sanctions[261]

Presidents Biden and Yoon have affirmed U.S. extended deterrent several times since 2022 as North Korea continues its aggressive actions, including making nuclear and missile threats. In the first bilateral meeting with President Yoon (only 11 days after the inauguration of the Yoon administration), President Biden made explicit "the ironclad U.S. commitment to the defense of the Republic of Korea and substantive extended deterrence."[262] During the 2022 ROK-U.S. summit in Cambodia after North Korea's intercontinental ballistic missile test, Biden underscored "the U.S. extended deterrence commitment to the ROK using the full range of defense capabilities, including nuclear, conventional, and missile defense capabilities."[263] In addition, the ROK-U.S. alliance

259 Kim, 17.

260 Beom-chul Shin, "A ROK-U.S. Alliance Strategy Tailored to North Korea's Advanced Nuclear Capabilities [북핵 위협에 대응하기 위한 한미의 억제정책 방향]," *KRINS-Quarterly* 6, no. 1 (March 2021): 101, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE10753201; Ham and Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," 159.

261 Kim, "NATO Extended Deterrence and ROK-US Alliance Extended Deterrence: Beyond Comparison [나토 확장억제와 한미동맹 확장억제: 비교를 넘어]," 17.

262 The White House, "Remarks by President Biden and President Yoon Suk Yeol of the Republic of Korea in Joint Press Conference," (Washington, DC: The White House, May 21, 2022), https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/05/21/remarks-by-president-biden-and-president-yoon-suk-yeol-of-the-republic-of-korea-in-joint-press-conference/.

263 The White House, "Readout of President Joe Biden's Meeting with President Yoon Suk Yeol of the Republic of Korea," (Washington, DC: The White House, November 13, 2022), https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/11/13/readout-of-president-joe-bidens-meeting-with-president-yoon-suk-yeol-of-the-republic-of-korea-2/.

announced a joint communique after the third EDSCG in 2023, which verified both countries' use of the whole of their national power for deterrence, to share information about nuclear and non-nuclear threats, and to promote cooperative training.[264]

In 2023, the United States and South Korea have actively coordinated the details of the U.S. extended deterrent with the Washington Declaration. The Washington Declaration of April 26, 2023 has two notable features: the establishment of the Nuclear Consultative Group (NCG) and the regular visit of U.S. SSBNs to South Korean ports.[265] The concept of the NCG is superficially similar to the Nuclear Planning Group (NPG) of NATO. However, the NCG can make faster decisions in a crisis since it is a bilateral consultative group while the NPG is a multilateral one.[266] But, as Cho Eun-jung et al. explain, the NCG does not plan to deploy U.S. strategic assets around the Korean Peninsula, whereas the NPG has stipulated the deployment of the U.S. strategic assets in the territories of European allies. In addition, under the NPG, European allies have been sharing U.S. strategic assets during peacetime, and allies implement part of the nuclear employment and delivery mission; by contrast, the NCG copes with emergency cases (not peacetime cases) and discusses plans for the use of U.S. strategic assets in the context of extended deterrence by the United States (South Korea does not participate in employing or delivering nuclear weapons).[267]

Moreover, Biden pledged that U.S. SSBNs will regularly visit the Korean Peninsula.[268] According to Cho et al., this measure is intended to make up for the lack of a direct presence of U.S. nuclear weapons in South Korea, unlike in NATO's case. SSBNs

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[264] Kim, "NATO Extended Deterrence and ROK-US Alliance Extended Deterrence: Beyond Comparison [나토 확장억제와 한미동맹 확장억제: 비교를 넘어]," 17.

[265] The White House, "Washington Declaration," (Washington, DC: The White House, April 26, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/04/26/washington-declaration-2/.

[266] Eun-jung Cho et al., "The Achievements and Follow-up Tasks of the 2023 Korea-U.S. Summit: Focusing on Nuclear Security, Cyber Security, and Technology and Economic Security [2023 년 한미정상회담의 성과와 후속과제: 핵안보, 사이버안보, 기술·경제안보를 중심으로]," *Issue Brief*, no. 431 (April 28, 2023): 1–4, https://www.inss.kr/common/viewer.do?atchFileId=F20230428152944256&fileSn=0.

[267] Cho et al., 1–4.

[268] The White House, "Washington Declaration."

are challenging to detect, so KJU might feel the potential U.S. nuclear retaliation more directly than via the other means of the U.S. Triad when considering the use of his nuclear weapons if their presence is regularly displayed in South Korea.[269]

B. THE ASSURANCE ISSUES IN EXTENDED DETERRENCE IN SOUTH KOREA

However, the Washington Declaration has not removed South Korea's doubts regarding U.S. extended deterrence over South Korea. South Korean and even some U.S. security experts point out that the Washington Declaration will not satisfy South Koreans in terms of countering evolving adversary nuclear and missile threats.[270] South Koreans have shown growing fear and distrust of U.S. extended deterrence commitments as time goes by. South Koreans have three anxieties regarding U.S. extended deterrence:

- Suspicion of the ROK-U.S. capability to confront threats together
- Fear of alliance decoupling
- The improbability of the denuclearization of North Korea

First, South Koreans evaluate the current ROK-U.S. deterrent as insufficient in capability to confront North Korea's growing nuclear and missile threats for four reasons: North Korea's ICBM advancement, nuclear weapons' interruption in the ROK-U.S. wartime plan, the danger posed to South Korea's strategic assets by North nuclear weapons, and non-nuclear weapons' limitation. To begin with, South Korea doubts the United States will be able to provide extended deterrence when North Korea threatens the United States and South Korea simultaneously. Now that North Korean ICBMs can reach the U.S. mainland, South Koreans have questioned whether a U.S. administration would expose

269 Cho et al., "The Achievements and Follow-up Tasks of the 2023 Korea-U.S. Summit: Focusing on Nuclear Security, Cyber Security, and Technology and Economic Security [2023 년 한미정상회담의 성과와 후속과제: 핵안보, 사이버안보, 기술·경제안보를 중심으로]," 2.

270 Ankit Panda, "The Washington Declaration Is a Software Upgrade for the U.S.-South Korea Alliance," Carnegie Endowment for International Peace, May 1, 2023, https://carnegieendowment.org/2023/05/01/washington-declaration-is-software-upgrade-for-u.s.-south-korea-alliance-pub-89648; Woo-tak Lee, "South Korea's 'Nuclear Potential' Has Risen Sharply Since the 'Washington Declaration'['워싱턴 선언' 이후 한국 '핵 잠재력' 논의 급부상]," *Yonhap News*, May 15, 2023, https://www.yna.co.kr/view/AKR20230515045300009.

U.S. cities to the danger of North Korean nuclear attacks to defend South Korea.[271] To counter ballistic missile threats against the U.S. mainland from states like North Korea, the United States constructed the Ground-based Midcourse Defense (GMD) systems in Alaska and California and the Aegis ballistic missile defense systems.[272] However, some experts are concerned that the GMD system cannot counter all of North Korea's ICBMs if North Korea achieves MIRV capability and makes progress in its missile accuracy, speed, and hedge.[273] Despite there being no missile defense systems in 1949, this quandary is similar to the suspicion of French President de Gaulle in 1949 of whether Washington would be willing to "trade New York for Paris?"[274] According to Lind and Press, de Gaulle posed this question to the United States after the Soviet Union developed ICBMs with sufficient range to reach the U.S. mainland. France later developed independent nuclear weapons in the 1960s, doubting the U.S. promise to protect Europe from the Soviet nuclear threat.[275] Some experts also argue that the U.S. president can decide to implement extended deterrence, but the president still has to overcome possible objections from the Congress

[271] Einhorn, "South Korea's Nuclear Options," 10; Kim, "Assessment of U.S. Extended Deterrence on the Korean Peninsula [미국의 한반도 확장억제 평가]," 36; Hwee-rhak Park, "An Examination of the Probability of the U.S. Nuclear Extended Deterrence Under the Advanced North Korean Nuclear Threat [북핵 고도화 상황에서 미 확장억제의 이행 가능성 평가]," *Journal of International Politics* 22, no. 2 (December 2017): 96, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE07296950.

[272] U.S. Department of Defense, *2022 Missile Defense Review* (Washington, DC: U.S. Department of Defense, 2022), 6, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF; John Bedard, "Ballistic Missile Defense: Threats and Challenges," *Arms Control Today* 52, no. 2 (2022): 36, https://www.proquest.com/docview/2638772170?parentSessionId=6FErRTFvG9n0GT17qJrj9U2vrt1%2BnzEpqeX2QtPDUC8%3D&parentSessionId=lDm8sC8vZF83Pq4YNxpFzwfHArHcrAVzVFD%2Bdw71yUs%3D&pq-origsite=primo&accountid=12702.

[273] Bedard; Kim, "Assessment of U.S. Extended Deterrence on the Korean Peninsula [미국의 한반도 확장억제 평가]," 41; Ham and Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," 170.

[274] Lind and Press, "South Korea's Nuclear Options."

[275] Lind and Press.

and the people.[276] This is because the War Powers Resolution passed in 1973 limits the U.S. presidency in deciding about war without congressional approval, unless it is a national emergency resulting from an attack on the United States, its territories, possessions, or its armed forces, not against other states.[277] To this point, the existence of U.S. troops in South Korea rebuts this concern as long as they stay in South Korea because the United States would defend its own troops if they are threatened by a North Korean nuclear attack.

Likewise, some experts propose the possibility that North Korea's nuclear threat can interrupt the ROK-U.S. wartime plan and get South Korea in trouble by isolating it from reinforcement forces. Suppose North Korea warns the United States not to reinforce the U.S. troops on the Korean Peninsula by threatening nuclear retaliation on the U.S. mainland. In that case, Ham and Lee are concerned that the United States would not deploy reinforcement forces in the case of conventional warfare on the Korean Peninsula.[278] They argue that even if North Korea gets nuclear retaliation from the United States right after it uses nuclear weapons on the U.S. mainland, enormous damage to the U.S. mainland from North Korea's nuclear attack would be unavoidable as well. Furthermore, even if the United States considers the use of tactical nuclear weapons to protect South Korea, challengers like North Korea, Russia, and China could perceive the use as a signal to commence nuclear war.[279] As a result, some Korean analysts believe it is likely that the United States would hesitate to employ nuclear weapons; in contrast to the United States, North Korea is comparatively free from these constraints, so South Korean experts believe it will attempt to achieve supremacy on the battlefield under the combined strategy of

[276] Park, "An Examination of the Probability of the U.S. Nuclear Extended Deterrence Under the Advanced North Korean Nuclear Threat [북핵 고도화 상황에서 미 확장억제의 이행 가능성 평가]," 98; In-hyo Seol and Han-byul Sohn, "Measures to Strengthen Extended Deterrence in the United States: Focusing on North Korea's Tactical Nuclear Threat and South Korea-U.S. Integrated Nuclear Deterrence [미국의 확장억제 강화방안: 북한 전술핵 위협과 한미 통합 핵억제를 중심으로]," *National Security and Strategy* 23, no. 2 (2023): 22, http://www.inss.re.kr/common/viewer.do?atchFileId=F20230714102614648&fileSn=0.

[277] Park, 106.

[278] Ham and Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," 166–67.

[279] Ham and Lee, 174.

conventional and nuclear forces.[280] Kim Jong Il also considered this when North Korea launched the development of the Taepodong missile, claiming that "if we can develop this [ICBM], we have nothing to fear. Even the American Bastards won't be able to bother us."[281]

Moreover, North Korea's developing nuclear capabilities can diminish South Korea's warfighting capabilities, weakening the ROK-U.S. deterrent by boosting North Korea's confidence to win a war against the ROK-U.S. alliance. Currently, South Korea has comparative superiority over North Korea via the power of its Air Force and Navy.[282] However, Ham and Lee contend that if North Korea destroys South Korea's Air Force and Navy bases with tactical nuclear weapons at the beginning of a war, this superiority will be reversed. Ham and Lee anticipate that North Korea will improve the survivability of its long-range artillery by neutralizing South Korea's Air Force bases.[283] Furthermore, North Korea will likely halt reinforcements and oil transport routes by destroying South Korea's Navy bases, so that it will quickly enter political negotiations and solidify these achievements as a fact through nuclear coercion.[284]

Besides, a prevalent idea that South Korea's conventional weapons do not stand up to North Korea's nuclear weapons further contributes to its anxiety.[285] Sung-han Kim claims that even the world-class U.S. conventional forces cannot guarantee that they can offset North Korean nuclear capabilities and stop North Korea's possible retaliation against South Korea. Therefore, Kim argues that even though South Korea may try to modernize its conventional forces, time and budget obstacles still exist if South Korea wants to

280 Ham and Lee, 175.

281 Testimony from a North Korean defector which has been cited in various publications form the 1990s. Shane Smith, "Implications for U.S. Extended Deterrence and Assurance in East Asia" (US-Korea Institute at SAIS, November 1, 2015), 12, https://www.jstor.org/stable/resrep11163.

282 Ham and Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," 167.

283 Ham and Lee, 167.

284 Ham and Lee, 167.

285 Kim, "Assessment of U.S. Extended Deterrence on the Korean Peninsula [미국의 한반도 확장억제 평가]," 51.

successfully counterbalance North Korean nuclear forces with its conventional forces. Given that North Korea has a lower threshold for using tactical nuclear weapons than strategic nuclear weapons, the possibility that South Korea will have to fight against North Korea's nuclear weapons with its conventional weapons is nonnegligible.

Second, South Koreans perceive the signs of the alliance decoupling as weak willingness to follow through with extended deterrence; they point out several times of alliance crisis as evidence. Dean G. Acheson, the U.S. Secretary of State just before the Korean War, excluded South Korea from the U.S. Pacific defense line, suggesting that the United States had no plan to protect South Korea in the case of war.[286] In the 1970s, the Nixon and Carter administrations considered the thorough withdrawal of U.S. troops from South Korea, resulting in President Park Jung-hee's decision to develop the South Korean nuclear program.[287] Hwee-rhak Park asserts that if the strategic value of South Korea were vital to the United States, the United States would not exclude South Korea from the Pacific defense line or frequently plan to withdraw U.S. forces from Korea; simultaneously, Park emphasizes that the United States did not consider the same measures in Japan.[288] Furthermore, Shane Smith highlights the possibility of trilateral decoupling; Smith contends that North Korea can threaten Japan and South Korea with its nuclear weapons at the same time, such that the United States will face the choice of which country it will defend and would likely select Japan, considering its comparative strategic value.[289]

Moreover, certain administrations' personalities and their different perceptions of the necessity of actions according to North Korea's targeting can trigger the alliance decoupling. In the late 2010s, the Trump administration threatened Seoul to raise its financial contributions to U.S. forces in South Korea according to the U.S. requirement,

286 Park, "An Examination of the Probability of the U.S. Nuclear Extended Deterrence Under the Advanced North Korean Nuclear Threat [북핵 고도화 상황에서 미 확장억제의 이행 가능성 평가]," 100–101.

287 Einhorn, "South Korea's Nuclear Options," 9; Park, 101.

288 Einhorn, 9; Park, 101.

289 Smith, "Implications for U.S. Extended Deterrence and Assurance in East Asia," 12.

hinting at the withdrawal of U.S. forces again.[290] As Einhorn contends, there might be another American leader who feels unwilling to help their allies. We cannot affirm that it would not recur according to U.S. domestic politics. Conversely, if some South Korean government in the future shows an uncooperative attitude toward the United States in the U.S.–China strategic competition, the United States may prioritize Japan regarding its active role in the U.S.–China strategic competition if the United States faces the danger of trilateral decoupling among South Korea, Japan, and itself.[291] In addition, Ham and Lee point out the degradation of the ROK-U.S. alliance resulting from the perception gap regarding the target of North Korea's nuclear threat; they say that when North Korea threatens the United States with ICBMs, the United States will react more quickly. By contrast, Ham and Lee predict that when North Korea escalates the regional and tactical nuclear threat, South Korea expects the U.S. to be vigorously involved, but the United States wants to avoid unnecessary involvement and entrapment.[292]

Third, many South Koreans do not believe in the probability of North Korea's denuclearization considering three factors: KJU's resolute statements regarding continuous nuclear and missile development, North Korea's disadvantages from nuclear abandonment, and external assistance from its friendly nations and potentially the United States. Therefore, they think the U.S. willingness to implement a deterrent is weaker than North Korea's willingness to maintain nuclear forces when the United States demands North Korea's denuclearization. North Korea's asymmetric retention of nuclear weapons has been the primary source of South Korean concern in terms of its national security and national power compared to North Korea.[293] Robert Einhorn argues that South Korea could endure this unequal condition only as long as it believed in the feasibility of North Korea's denuclearization. However, given the present North Korean military

290 Einhorn, "South Korea's Nuclear Options," 9–10.

291 Kim, "Assessment of U.S. Extended Deterrence on the Korean Peninsula [미국의 한반도 확장억제 평가]," 43–44.

292 Ham and Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," 166.

293 Einhorn, "South Korea's Nuclear Options," 8.

manifestations, North Korea does not seem to be willing to give up its nuclear weapons. KJU keeps clarifying with his statements and political behaviors that North Korea wants to be acknowledged by the world (particularly by the United States) as a permanent and legitimate nuclear power; also, KJU highlights that external attempts to denuclearize North Korea are futile and that the North Korean nuclear program is irreversible.[294]

Recently, KJU has successively shown his strong willingness to maintain and reinforce North Korea's nuclear power and its potential use, which demonstrates a low probability of denuclearization. In the 2021 8th Party Congress, KJU set out a five-year plan for national defense to improve North Korea's nuclear and missile capabilities. Also, during the Supreme People's Assembly on September 8, 2022, KJU announced the statutes of the Democratic People's Republic of Korea on Nuclear Weapons Policy.[295] In the statutes, KJU conveyed a clear message that a nuclear strike by North Korea could be initiated automatically under specific circumstances, including his attempted assassination.[296] However, North Korea allows the possibility of nuclear use any time KJU thinks that his regime faces a severe threat.[297] This clause can be an excuse for using nuclear weapons if KJU wants regardless of the particulars of a situation. Considering that KJU is a so-called madman authoritarian who is not afraid of his people's survival or public opinion,[298] the possibility that KJU will not hesitate to use nuclear weapons against the United States becomes plausible. Moreover, KJU set the specific goals of national defense reinforcement: a new ICBM development, mass production of tactical nuclear weapons, launching North Korea's first military satellite, and expansion of North Korea's supply of

294 The Economist, "Tactical Advantage."; Einhorn, 8.

295 Korea Central News Agency, "Kim Jong Un of North Korea: 'The U.S. Objective is Regime Collapse, We Will Never Abandon Nuclear Weapons' . . . Pushes for Legislation on Nuclear Policy [북한 김정은 '미국의 목적은 정권 붕괴, 핵 포기 절대 안해' . . . 핵무력 정책 법제화]."

296 The Economist, "Tactical Advantage," 50.

297 Korea Central News Agency, "Kim Jong Un of North Korea: 'The U.S. Objective is Regime Collapse, We Will Never Abandon Nuclear Weapons' . . . Pushes for Legislation on Nuclear Policy [북한 김정은 '미국의 목적은 정권 붕괴, 핵 포기 절대 안해' . . . 핵무력 정책 법제화]."

298 EFE News, "Trump Responds to North Korea Threats, Brands Kim Jong-Un A Madman: USA NORTH KOREA," *EFE News*, September 22, 2017, https://www.proquest.com/docview/1941287189/citation/3C52E9FA35FA4E62PQ/1.

nuclear warheads.[299] Regarding these goals, KJU met Russian President Putin in September 2023 and announced that they discussed military cooperation in advancing the technology of military satellites and possibly ICBMs.[300]

North Korea does not consider denuclearization a better security option for two reasons: fear of regime collapse and presence of external support. First, KJU believes that if North Korea gives up its nuclear weapons, the regime cannot survive. Therefore, while the Biden and Yoon administrations continue to pursue the goal of North Korean denuclearization,[301] North Korea has rejected the U.S. mediation efforts, insisting that negotiations are pointless given the U.S. and its allies' antagonistic policies toward North Korea.[302] Furthermore, KJU seems to judge that his regime will be safer and more profitable by maintaining its nuclear weapons rather than agreeing to President Yoon's audacious initiative, which pledges unprecedented economic support for North Korea if North Korea decides to denuclearize.[303] According to Sue Mi Terry, North Korea might have decided that giving up nuclear weapons would lead to its invasion by other countries because it believes that if Ukraine had not given up its nuclear weapons, Russia would not have dared to invade it.[304] Likewise, Terry guesses that KJU thinks that the leaders of Iraq and Libya lost their positions due to their failure to develop nuclear weapons. Therefore, contrary to the statement of President Yoon that "North Korea has nothing to gain from

299 Sang-sook Lee, "The Outcome of the 6th Plenary Session of the 8th Central Committee and North Korea's Foreign Policy Outlook for 2023 [제 8 기 제 6 차 전원회의 결과와 2023 년 북한 대외정책 전망]," The Institute of Foreign Affairs and National Security, January 19, 2023, http://www.ifans.go.kr/knda/ifans/kor/pblct/PblctView.do?pblctDtaSn=14135&clCode=P07&koreanEngSe=KOR.

300 Chung-a Lee, "After Meeting with Putin, Kim Jong-un, What's Next . . . They're Looking for a Khabarovsk Fighter Jet Factory [푸틴과 회담 마친 김정은, 다음 일정은… 하바롭스크 전투기공장 찾을듯]," *Donga Ilbo*, September 13, 2023, https://www.donga.com/news/article/all/20230913/121166344/1.

301 The White House, "The Spirit of Camp David: Joint Statement of Japan, the Republic of Korea, and the United States," (Washington, DC: The White House, August 18, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/08/18/the-spirit-of-camp-david-joint-statement-of-japan-the-republic-of-korea-and-the-united-states/.

302 Einhorn, "South Korea's Nuclear Options," 9.

303 Einhorn, 9.

304 Terry, "North Korea's Nuclear Opportunism: Why Kim Jong Un Chose to Exploit the Ukraine Crisis."

nuclear weapons,"[305] nuclear weapons are the core of the KJU regime, not only for national stability but also for its survival.

The second reason for North Korea's reluctance to denuclearize is thanks to external help. Representative examples are Russia and China. They are two permanent members of the United Nations Security Council (UNSC), have vetoes over UNSC resolutions, and have protected North Korea whenever North Korea incurred military provocations; these protections could evade UNSC sanctions, as they have for the past two to three years.[306] On top of that, there is Pakistan, which was hit with international sanctions due to its development of nuclear weapons at first, but later received U.S. aid after 9/11.[307] This might provide a model for North Korea.

C. WHAT SOUTH KOREANS ARE DISCUSSING NOW

As the consequences of these anxieties, South Korea's public opinion has preferred more aggressive and active options for its deterrent: South Korean nuclear weapons program, redeployment of U.S. tactical nuclear weapons or nuclear sharing, and nuclear latency. According to a recent poll, over 70% of Koreans advocate an ROK nuclear weapons program.[308] Some politicians agree with the necessity of an independent South Korean nuclear weapons program, and even President Yoon implied its likelihood if North Korean nuclear issues become severe.[309] Yong-soo Park reports that some advocates

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305 The Economist, "Tactical Advantage." 50.

306 Katz and Cha, "North Korea's Missile Message: How Kim's New Nuclear Capabilities Up the Ante."; Einhorn, "South Korea's Nuclear Options," 9.

307 Terry, "North Korea's Nuclear Opportunism: Why Kim Jong Un Chose to Exploit the Ukraine Crisis."

308 Lind and Press, "Should South Korea Build Its Own Nuclear Bomb?"

309 Yong-soo Park, "The Probability of South Korea's Nuclear Armament [한국의 핵무장 가능성]," *The Journal of Asiatic Studies* 65, no. 2 (June 2022): 121, https://www.dbpia.co.kr/journal/articleDetail?nodeId=NODE11081919; Hwee-rhak Park, "An Introduction to the NATO's 'Nuclear Sharing' and a Preliminary Analysis on the Applicability of it to Northeast Asia [나토 '핵공유(nuclear sharing)' 체제의 현황과 동북아시아 도입에 관한 시론적 분석]," *National Strategy* 27, no. 1 (2021): 105, https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART002686697; Sang-hyun Lee, "North Korea's Nuclear Threat and South Korea's Response: How to Strengthen the South Korea-U.S. Expansionary Deterrence? [북핵 위협과 한국의 대응: 한미 확장억제, 어떻게 강화할 것인가?]," *KDI Review of the North Korean Economy* 25, no. 2 (February 2023): 26, https://www.kdi.re.kr/research/monNorth?pub_no=17874.

contend that, considering its multiple security threats, including China, Russia, and North Korea, South Korea should have independent nuclear weapons to secure a multi-layered security system, as well as to raise South Korea's international status.[310]

Other preferred options are the redeployment of the U.S. tactical nuclear weapons to South Korea and nuclear sharing among the ROK-U.S. alliance as in NATO.[311] Lind and Press argue that these measures would signal to North Korea an assertive U.S. will to use nuclear weapons to defend South Korea and provide more options for the United States against North Korea's limited nuclear war.

In addition, South Korea's advocacy for nuclear latency has existed for decades. Some South Korean experts assert that South Korea should have the same nuclear latency as Japan by revising the ROK-U.S. Atomic Energy Agreement.[312] The main assertion notes that it is unfair that Japan can enrich nuclear material itself while the United States bans South Korea from doing so; advocates of South Korean nuclear latency insist that South Korea could quickly possess nuclear potential with some deterrent effect because South Korea has already demonstrated capability with its nuclear technology and industrial foundation.[313] Besides, Bi-yeon Jo points out the limitations of the other nuclear options (expected sanctions by the international community against South Korea) and non-nuclear options (inadequate to counter nuclear weapons), and nuclear latency would be a supplement to alliance-based extended deterrence.[314] Hwee-rhak Park also agrees with the

310 Lee, 26.

311 Il-do Hwang, "Alliances and Nuclear Sharing: The NATO Case and the Implications on Reintroducing of TNW into the Korean Peninsula [동맹과 핵공유: NATO 사례와 한반도 전술핵 재배치에 대한 시사점]," *National Strategy* 23, no. 1 (2017): 6, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE08992159; Lind and Press, "South Korea's Nuclear Options."

312 Lee, "South Korea's 'Nuclear Potential' Has Risen Sharply Since the 'Washington Declaration' ['워싱턴 선언' 이후 한국 '핵 잠재력' 논의 급부상]."

313 Lee.

314 Bee Yun Jo, "Plan B for Non-Nuclear States in East Asia: Debating on Nuclear Latency as Means for Potential Deterrence [동아시아 비핵국가들의 Plan B: 핵잠재력 확보를 통한 잠재적·보험적 억제력 구축]," *National Strategy* 27, no. 4 (2021): 56–57, https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART002777801.

difficulty of countering nuclear weapons without independent nuclear forces.[315] Park justifies that a non-nuclear state, exposed to the nuclear threat has to consider any independent deterrent. Park also emphasizes that South Korea should prepare a phased road map of nuclear latency, while it clearly understands the technological restrictions and the diplomatic cost of independent nuclear weapons production.[316]

On the other hand, some South Korean and international experts object to the idea of a South Korean nuclear option, whether redeployment of U.S. tactical nuclear weapons, NATO-style nuclear sharing, or an independent ROK nuclear program. Ham, Lee, and Kim suggest that if South Korea gets a second-strike capability with independent nuclear weapons, the possibility of low-intensity or indirect war between the two Koreas will be increased, and the situation will be plagued by instability.[317] Seol and Sohn insist that North Korea and China would prioritize redeployed U.S. tactical nuclear weapons as targets in a crisis and the nuclear weapons would create a situation like the Cuban Missile Crisis on the Korean Peninsula.[318] Seol and Sohn are also concerned about South Korea's independent nuclearization because the action will likely drive Japan and Taiwan to nuclearize, which may threaten the whole U.S. alliance system.[319] Likewise, Einhorn expresses enormous worries about South Korea's nuclearization because of its probability of elevating instability on the Korean Peninsula, weakening the ROK-U.S. alliance, damaging the ROK-China relationship, harming the NPT regime, bringing international

315 Hwee-rhak Park, "Recommendations for a Self-reliant South Korean Nuclear Deterrence Strategy Against North Korea's Minimal Deterrence Nuclear Capabilities [북한의 최소억제 역량 확보에 대비한 한국의 독자억제책 제안]," *Strategic Studies* 27, no. 2 (July 2020): 49, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE09411405.

316 Park, 56.

317 Ham and Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," 173; Jung-sup Kim, "The Reconstitution of Extended Deterrence Policy for the Korean Peninsula: Limitations of Nuclear Umbrella and Search for Conventional Deterrence [한반도 확장억제의 재조명: 핵우산의 한계와 재래식 억제의 모색]," *National Strategy* 21, no. 2 (2015): 28, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE08992198.

318 Seol and Sohn, "Measures to Strengthen Extended Deterrence in the United States: Focusing on North Korea's Tactical Nuclear Threat and South Korea-U.S. Integrated Nuclear Deterrence [미국의 확장억제 강화방안: 북한 전술핵 위협과 한미 통합 핵억제를 중심으로]," 18.

319 Seol and Sohn, 19.

sanctions on South Korea's economy, and damaging South Korea's civil nuclear industry.[320] Siegfried S. Hecker also agrees about the danger of a South Korean nuclear buildup because of the damage it would do to the civilian nuclear industry, due to the NPT, undoubtedly involving sanctions. Hecker adds that South Korea's nuclear buildup would bring about a ruinous economic catastrophe due to the costs incurred in the construction and maintenance of nuclear forces and infrastructures, leading to the collapse of South Korea's soft power.

D. CONCLUSION

South Korean perceptions of U.S. extended deterrence, particularly in the context of North Korea's evolving nuclear and missile capabilities, have been marked by increasing anxiety and doubts about its credibility. As discussed in this analysis, three key factors contribute to South Korea's apprehension regarding extended deterrence: doubts about the combined capabilities of the ROK-U.S. forces, the willingness of the United States to act, and prospects for North Korean restraint.

First, South Koreans are increasingly skeptical about the confrontational capabilities of the ROK-U.S. alliance. The escalating nuclear and missile threats posed by North Korea have intensified doubts regarding the reliability of extended deterrence. South Korea is now concerned that the United States would not put its cities at risk to protect South Korea in the face of a North Korean nuclear threat. Additionally, there is apprehension that a North Korean tactical nuclear attack could severely undermine South Korea's capacity for independent reaction. Moreover, there is a common perception among South Koreans that conventional weapons cannot effectively counter nuclear threats.

Second, South Korea perceives a lack of willingness on the part of the United States to fully commit to extended deterrence. Historical instances of potential abandonment, such as exclusion from the U.S. Pacific defense line and discussions of U.S. troop withdrawal, have fueled doubts among South Koreans. The fear of trilateral decoupling, where the U.S. would prioritize Japan in a crisis, adds to South Korea's concerns.

[320] Einhorn, "South Korea's Nuclear Options," 19–23.

Lastly, North Korea is determined to keep its nuclear weapons, viewing them as vital for its survival and international recognition. KJU's aggressive defense plans demonstrate this commitment. North Korea fears regime change and relies on support from countries like Russia and China to evade sanctions, making denuclearization unlikely. The North also seems to anticipate that the United States will acknowledge it as a nuclear state and lift its sanctions as in the Pakistan case.

As a result of these concerns, South Korea is exploring alternatives, such as advocating for a domestic nuclear weapons program, the redeployment of U.S. tactical nuclear weapons to South Korea, or nuclear sharing.

In conclusion, the challenges surrounding South Korean perceptions of U.S. extended deterrence present a complex security landscape that requires nuanced solutions and ongoing dialogue to ensure the stability and security of the Korean Peninsula. The future of this relationship will depend on evolving regional dynamics and the ability of all stakeholders to adapt to changing circumstances while maintaining a strong and reliable alliance. In this context, options for South Korea may exist in the area of integrated deterrence encompassing space, cyber warfare, and advanced missile defenses. These topics will be analyzed in the next chapter.

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V. CRAFTING A NEW DETERRENCE STRATEGY TO COUNTER NORTH KOREAN NUCLEAR AND MISSILE THREATS

This chapter briefly describes South Korea's historical development in the space and cyber-electromagnetic domains. Then, it analyzes options for new South Korean deterrence strategy based on developing space and cyberspace electromagnetic activities (CEMA) capabilities in the context of integrated deterrence.[321]

As we indicated in the previous chapter, South Korea's anxieties about the viability of U.S. extended deterrence have arisen in recent years, given its doubts about the effectiveness of the ROK-U.S. capabilities to counter North Korea's increasing nuclear and missile capabilities, the fear of being abandoned by the United States, and the implausible prospect of North Korea denuclearizing.

To increase the credibility of the South Korean deterrent strategy against North Korea, South Korea should fortify its independent deterrent, while also strengthening its connections to the deterrent capabilities of its ally and partners. Independent deterrent capabilities increase the effectiveness of a state's deterrence. Also, the combined military power of alliances is a critical factor that strengthens deterrence effectiveness, so South Korea's reinforcement encourages U.S. resolution to be involved in a crisis on the Korean Peninsula.[322] Reinforcing South Korean military power also reduces the threats to U.S.

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[321] U.S. Army Field Manual of Cyberspace Operations and Electromagnetic Warfare (EW) defines that "A cyberspace capability is a device or computer program, including any combination of software, firmware, or hardware, designed to create an effect in or through cyberspace." The U.S. Army describes that "EW capabilities consist of the systems and weapons used to conduct EW missions to create lethal and non-lethal effects in and through the EMS (electromagnetic spectrum)." CEMA is "the process of planning, integrating, and synchronizing cyberspace operations and electromagnetic warfare in support of united land operations." U.S. Department of the Army, *Cyberspace Operations and Electromagnetic Warfare*, FM3-12 (Washington, DC: U.S. Department of the Army, 2021), 1 of Chapter 1, 1 of Chapter 2, https://irp.fas.org/doddir/army/fm3-12.pdf.

[322] Ham and Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," 156.

assets, so this advancement will strengthen the mutual benefits of the ROK-U.S. alliance.[323]

Considering that South Korea is bound by the NPT, for now, South Korea must consider asymmetric measures to counter North Korea's nuclear and missile threats. Thanks to the advancement of technologies, the space and cyber domains suggest new potentials for South Korea. To maximize its independent deterrent, South Korea should supplement its capabilities in the two domains and connect them with the capabilities of its main ally and partners and their deterrent capabilities, such as in the area of modern missile defense systems. Therefore, this chapter concludes that South Korea needs to strengthen specific elements to contribute to more effective integrated deterrence.

A. SOUTH KOREA'S SPACE STRATEGY

South Korea needs a more accurate and quick response and independent deterrent power against North Korea. In this vein, overcoming technological and budgetary barriers to space development is still a priority for South Korea's national security even though South Korea has achieved considerable space development.

1. The Present Status of the South Korean Space Program

South Korea's rapid space program development began in the 1970s and was initially hampered by the nation's difficult post-war status and limited resources.[324] However, President Park Jung-hee's (1972–1979) educational reforms and South Korea's growing economic stability led to the establishment of the Korea Advanced Institute of Science and Technology.[325] As Moltz reports, during the Park administration, South Korea initiated a surface-to-surface missile program in response to concerns about U.S. troop

[323] Park, "An Examination of the Probability of the U.S. Nuclear Extended Deterrence Under the Advanced North Korean Nuclear Threat [북핵 고도화 상황에서 미 확장억제의 이행 가능성 평가]," 109.

[324] James Clay Moltz, "The South Korean Space Program: Emerging from Dependency," in *Asia's Space Race: National Motivations, Regional Rivalries, and International Risks*, Contemporary Asia in the World (New York: Columbia University Press, 2011), 136–40, https://academic.oup.com/columbia-scholarship-online/book/23268.

[325] Moltz, 140.

withdrawal and North Korea's missile activities. Despite the domestic difficulties after the Korean War, it is important to note that South Korea achieved this development.

South Korea's space ambitions were boosted in the 1980s following North Korean terrorist actions, prompting its development of high-tech missiles.[326] The late 1980s and 1990s saw increased funding for space programs and the establishment of the Korea Aerospace Research Institute (KARI).[327] South Korea collaborated with Europe and the United States in satellite development from the early 1990s and made its first satellite, Uribyol-1, in 1992.[328]

Moreover, in the 1990s, South Korea advanced in its rocket, satellite, and missile programs. South Korea commenced the Korean Sounding Rocket program in the 1990s.[329] Meanwhile, North Korea's intercontinental ballistic missile test (Taepodong-1) and satellite activities expedited South Korea's overall space program.[330] Therefore, South Korea began the Korea Space Launch Vehicle program in the late 2000s and arrived at independent rocket technology in 2018.[331] Subsequently, South Korea has accelerated its satellite and missile development, expanding its capabilities and international partnerships, while it has relied on U.S. intelligence for missile threats.[332]

In the 2020s, South Korea has achieved several space milestones and laid out plans for expanding its space industry and collaborations. During President Yoon's presidential campaign, he pledged to make South Korea the seventh space power in the world before 2035.[333] As a result, South Korea succeeded in launching a satellite into LEO with a

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[326] Moltz, 141.

[327] Moltz, 141.

[328] Moltz, 142.

[329] John M. Logsdon et al., "Asia in Space: The Race to the Final Frontier," *Asia Policy* 15, no. 2 (April 2020): 37, https://www.nbr.org/wp-content/uploads/pdfs/publications/ap15-2_spacert_apr2020.pdf.

[330] Moltz, "The South Korean Space Program: Emerging from Dependency," 144; Logsdon et al., 37.

[331] Moltz, 145; Logsdon et al., 37.

[332] Moltz, 144.

[333] Sam Wilson and Nico Wood, "South Korea Country Brief," *National Policies & International Relations*, August 15, 2023, 3–4, https://csps.aerospace.org/sites/default/files/2023-08/Wilson-Wood_SouthKorea_20230802.pdf.

KARI-manufactured rocket (Nuri) in June 2022 and secured its place as the seventh state with this capability worldwide.[334] Currently, the Korea Multi-Purpose Satellite (KOMPsat) program consists of LEO observation satellites, which have optical imaging, radar, and infrared functions; the KOMPsat plays a significant role in national security by monitoring the Korean Peninsula.[335] Also, South Korea undertook its first lunar mission with its lunar orbiter (Danuri) in the same year.[336] Sam Wilson and Nico Wood expect that it can take pictures of the Moon's pole with the on-board Shadow-Cam provided by NASA and will contribute to the U.S.-led Moon exploration program, Artemis.[337] Furthermore, South Korea is expanding space cooperation with other space powers. For example, South Korea and the United States also began collaborating in military space programs.[338] The two countries agreed to lift the regulation on South Korea's missile range and payloads in 2021.[339] In addition, South Korea and India have discussed the establishment of a cooperative relationship between South Korea's aerospace agency and India's space agency.[340] Ki-min Lee also reports that the two leaders agreed, during this meeting, to promote joint research and personnel exchange in various fields, with a focus on space exploration, satellite navigation systems, and the utilization of artificial satellite data, through the Korea-India Research and Innovation Center established in India. Considering that India established its space agency in 1972, achieved the *Chandrayaan-3* landing on

334 Wilson and Wood, 1–2; Andy Hong, "South Korea's Space Program Is a Big Deal," The Diplomat, July 1, 2022, https://thediplomat.com/2022/07/south-koreas-space-program-is-a-big-deal/.

335 Logsdon et al., "Asia in Space: The Race to the Final Frontier," 38.

336 Wilson and Wood, "South Korea Country Brief," 1.

337 Jin-young Hwang, "Space Development and International Environmental Change [우주개발과 국제환경 변화]," *Circumstances and Policies* 2023–7 (July 3, 2023): 2, https://www.sejong.org/web/boad/1/egoread.php?bd=2&seq=7228.

338 Wilson and Wood, "South Korea Country Brief," 5–6.

339 Wilson and Wood, 2.

340 Ki-min Lee, "Presidents Yoon and Modi had the ROK-India Summit . . . South Korea Established Trade, Defense, and Space Cooperation with 'World's Factory' India [尹-모디, 정상회담…'세계의 공장' 인도와 교역·방산·우주 협력 교두보]," *Asia Economy*, September 10, 2023, https://www.asiae.co.kr/article/2023091019551661602.

the lunar South Pole, and launched solar observation satellites,[341] South Korea expects considerable space development from this cooperation.

Today, South Korea aspires to be a space power that has versatile space capabilities and cooperates with other space powers. In 2023, the Yoon administration issued its basic space plan for the next five years, emphasizing the necessity of building South Korea's own space industry.[342] Hence, the Yoon administration plans to multiply its space budget twofold by 2027 and operate 130 government satellites by 2030.[343] Wilson and Wood note that the administration wants to develop a space vehicle for the exploration of the Moon and Mars. They additionally note that the administration seeks to improve the level of space technologies for the military, space situational awareness, and civil domains. In the same vein, South Korea is trying to be the seventh country with a satellite positioning, timing, and navigation (PNT) constellation, the Korean Positioning System (KPS).[344]

2. Required Domestic Space Assets for Enhanced Deterrence Against North Korea

Even though South Korea has developed its space program rapidly over the past decades, it still needs fundamental domestic advancements of its space assets in four areas: the KPS, defensive space assets, human resources, and building domestic support to maintain space development.

First, South Korea should pursue the KPS, an optimized PNT system focused on the Korean Peninsula to increase the accuracy and precision of operations and to protect its assets from North Korea's jamming attack. Japan has already linked its PNT system with the United States; in contrast to Japan, South Korea only recently reached an agreement to cooperate with the United States in this area and has yet to produce any meaningful results.[345] If the U.S. GPS and the KPS were linked, South Korea would attain

[341] Lee.

[342] Wilson and Wood, "South Korea Country Brief," 1,4.

[343] Wilson and Wood, 5.

[344] Wilson and Wood, 1,3.

[345] Wilson and Wood, 7.

more interoperability with the United States for ROK-U.S. operations, KPS accuracy and precision, and anti-jamming ability.[346] Since South Korea is more endangered by North Korea's nuclear and missile threats than any other Asian country, developing the KPS is a major priority. Besides, if the KPS supplements the GPS's gaps with its optimized features, ROK-U.S. operations will be much more effective.[347]

Second, South Korea must develop defensive assets that can defend its space assets from North Korea's diversified threats like: jamming, EMP, and hacking of ground-based space assets.[348] According to Geun-ho Song, those threats from North Korea happen frequently now. Dr. Vincent Pry of the EMP Task Force on National-Homeland Security in the Secretary-General of the U.S. Congressional Advisory Group evaluates that North Korea has already completed the development of a super-powered EMP bomb.[349] Robert James Woolsey, the previous Central Intelligence Agency Chief, also reported in a 2014 Congressional report that Russia had helped in the development of North Korea's EMP bomb.[350] In addition, North Korean jamming and hacking can disturb and take advantage of South Korea's space assets. Hence, South Korea should be prepared for those threats with defensive space assets to protect normal operation of space assets, such as capabilities in the cyber-electromagnetic domain.

Third, South Korea needs to qualitatively and quantitatively supplement its space experts and technicians.[351] The RAND Corporation points out the old-fashioned quality of the graduate school system in South Korea, which contributes to the shortage of

346 Wilson and Wood, 6; Logsdon et al., "Asia in Space: The Race to the Final Frontier," 40.

347 Wilson and Wood, 6–7.

348 Geun-ho Song, "South Korea-U.S. Space Cooperation: Space Development Cooperation Issues and Suggestions on Ways to Strengthen Cooperation," *National Strategy* 27, no. 4 (Winter 2021): 116, https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART002777806.

349 Song, 116.

350 Yong-han Park, "North Korea Completes a Super-Strong EMP Bomb [단 한발에 석기시대 된다…"북한, 초강력 EMP 폭탄 완성"]," *The JoongAng*, June 18, 2021, https://www.joongang.co.kr/article/24085320.

351 Moltz, "The South Korean Space Program: Emerging from Dependency," 147.

competencies in basic science and innovation.[352] This technological deficiency is seen in the fact that only one South Korean private space enterprise could negotiate an export contract with other countries until now.[353] Although KARI has operated a Research Center for Satellite Information and a Satellite Test and Integration Center to solve the issue,[354] it is still uncertain whether South Korea can make innovative progress like other Asian countries, given that the number of KARI space specialists falls far short of those of China, India, and Japan.[355] Regarding the rapidly changing security conditions, including North Korea's nuclear and missile threat, this shortage of experts and technicians contributes to South Korea's fatal deficiency of confrontational abilities in space.

Finally, South Korea needs domestic consensus for space development to continue to build space-based deterrence. The majority of South Korean young people in their 20s and 30s answered that they have no interest in or reject the space program in a poll in 2018.[356] This phenomenon contrasts with young Japanese who empathize with the importance of security affairs and a Japanese independent defense system.[357] Given that the South Korean ruling party changes almost every 5 or 10 years, it will be difficult to maintain space development momentum without broad national consensus. To enhance the space progress after the Yoon administration and build up reliable deterrents in space against North Korea's nuclear and missile threats, the Yoon administration has to congregate cross-national support from its public and all politicians regardless of the political spectrum.

352 Moltz, 147–48.

353 Moltz, 148.

354 Moltz, 148.

355 Moltz, 148.

356 Hong, "South Korea's Space Program Is a Big Deal."

357 James Clay Moltz, "The Japanese Space Program: Moving Toward 'Normalcy,'" in *Asia's Space Race: National Motivations, Regional Rivalries, and International Risks*, Contemporary Asia in the World (New York: Columbia University Press, 2011), 44, https://academic.oup.com/columbia-scholarship-online/book/23268.

3. Required International Efforts for Enhanced Deterrence Against North Korea

To enhance deterrence against North Korea, South Korea needs international efforts: enhanced the ROK-Japan-U.S. space cooperation to increase total deterrent against North Korea, more discussions with the United States to relieve International Traffic in Arms Regulations (ITAR) for building up the South Korea's space-based deterrent, actively participating in international space activities.

First, the ROK-Japan-U.S. space cooperation is needed to counter North Korea's growing nuclear and missile threats. In this vein, South Korea should deepen its space cooperation with the United States, considering the alliance relationship and U.S. superiority in space. The United States has a greater space budget than the total amount of all other countries' space budgets combined.[358] The U.S. Department of Defense has established diverse space systems to improve U.S. warfighting capabilities, such as "communications, meteorological, positioning, navigation, timing, and early warning."[359] Besides, U.S. space-based reconnaissance systems are highly effective in collecting intelligence via photographic, radar, and electromagnetic means.[360] Additionally, Japan would be a good partner in space cooperation, considering that it faces the same threats from North Korea. Japan has developed advanced and domestically produced expertise in liquid- and solid-fuel rocket technologies since 2001 and 2013 respectively.[361] Also, since its first satellite launch in 1970, Japan's high-tech satellites and spacecraft have developed into a broad spectrum, including scientific exploration, communication, observation, navigation, and surveillance.[362] Under the Abe administration, Japan innovatively accelerated military space activities since 2008 after decades of civilian-only space developments and broadened defense cooperation with the United States.[363]

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[358] Logsdon et al., "Asia in Space: The Race to the Final Frontier," 5.

[359] Logsdon et al., 6.

[360] Logsdon et al., 7.

[361] Logsdon et al., 28.

[362] Logsdon et al., 28.

[363] Logsdon et al., 30.

Cooperation in constructing LEO satellite constellation between South Korea, Japan, and the United States is urgent to reinforce deterrence against North Korea's nuclear and missile threats due to the limitations of current missile defense systems. The current missile defense systems are imperfect for intercepting Russian and Chinese hypersonic glide missiles and North Korea's new missiles.[364] Shu Hatakeyama and Ramin Skibba report that those missiles have atypical trajectories, unlike usual ballistic missiles. They also indicate that those missiles are characterized by their extremely high speeds, typically traveling at five times the speed of sound or even faster. Moreover, Skibba reports that hypersonic missiles operate at significantly lower altitudes than intercontinental ballistic missiles. In response, Vivienne March and Hatakeyama expect that the United States will construct a LEO satellite early-warning constellation comprising a few hundred to 1,000 satellites for the purpose of detecting and tracking missiles, ground reconnaissance and monitoring, and identifying space debris.[365] The U.S. Space Force plans to launch 28 LEO satellites in 2023 and to construct a satellite constellation with more than 160 LEO satellites by 2024.[366] Skibba notes that these satellites will be deployed, primarily focused on tracking ballistic and hypersonic missiles, with a particular emphasis on monitoring those of China, Russia, and North Korea.

LEO satellites are more advantageous than geostationary orbit (GEO) early-warning satellites. A GEO satellite weighs 1 metric ton and orbits at an altitude of 36,000 kilometers.[367] Due to the high altitude, GEO satellites are inaccurate, with a reported 50% detection success rate.[368] In addition, missile defense systems based on a small number of

[364] Shu Hatakeyama, "Japan to Mull Joining U.S. 'Satellite Constellation' Initiative to Counter Missile Threats," *Mainichi Daily News*, January 12, 2021, https://mainichi.jp/english/articles/20210112/p2a/00m/0na/012000c; Ramin Skibba, "The Space Force Is Launching Its Own Swarm of Tiny Satellites," Space Development Agency, August 14, 2023, https://www.sda.mil/the-space-force-is-launching-its-own-swarm-of-tiny-satellites/.

[365] Vivienne March, "US Military Places a Bet on LEO," *Satellite Today*, June 4, 2021, https://interactive.satellitetoday.com/via/june-2021/us-military-places-a-bet-on-leo-for-space-security/; Hatakeyama.

[366] Skibba, "The Space Force Is Launching Its Own Swarm of Tiny Satellites."

[367] Hatakeyama, "Japan to Mull Joining U.S. 'Satellite Constellation' Initiative to Counter Missile Threats."

[368] Skibba, "The Space Force Is Launching Its Own Swarm of Tiny Satellites."

GEO satellites cannot guarantee sustainability if an adversary destroys even a just few satellites in the network.[369] By contrast, modern LEO satellites can be constructed much smaller and more cheaply, weighing only several hundred kilograms each and orbiting at altitudes ranging from 300 to 1,000 kilometers.[370] Also, Hatakeyama notes that having a large number of LEO satellites can prevent the loss of early-warning information in case an adversary's attacks destroy a few satellites. Therefore, shifting the missile early-warning system from a GEO to LEO constellation enhances sensitivity, speed, and survivability, while increasing capabilities for detecting atypical missiles, such as hypersonic missiles, thanks to the LEO satellites' low altitude and numbers. The U.S. Department of Defense and the Space Development Agency are planning to improve LEO satellite capabilities with a tactical space layer and the hypersonic and ballistic tracking space sensor; they insist that LEO satellites will be practical to detect and trace hypersonic weapons.[371] The infrared sensors are vital to detect hypersonic missiles' exhaust plumes and intense aerodynamic heating during their flight.[372] However, even the United States needs more terrestrial- and space-based sensors to realize this technology.[373]

Despite the significance of building up the LEO early-warning satellite constellation, cost, technology, maintenance, and management issues are barriers to implement the plan. It is important to understand that the cost of launching and development of collision avoidance technology challenges to establishing a constellation of the LEO satellites, despite most countries perceiving the value of the new, more resilient constellation.[374] In particular, NASA said that the U.S. military needed $54,500 per

369 Hatakeyama, "Japan to Mull Joining U.S. 'Satellite Constellation' Initiative to Counter Missile Threats."

370 Hatakeyama.

371 Laura A. Odell et al., *U.S. Low Earth Orbit Dominance Shifting with Gray Zone Competition*, D-22676 (Alexandria, VA: Institute for Defense Analysis, 2021), iii–iv, https://www.ida.org/-/media/feature/publications/u/us/us-low-earth-orbit-dominance-shifting-with-gray-zone-competition/d-22676.ashx.

372 Skibba, "The Space Force Is Launching Its Own Swarm of Tiny Satellites."

373 Odell et al., *U.S. Low Earth Orbit Dominance Shifting with Gray Zone Competition*, iii–iv.

374 Odell et al., 14–15 of Chapter II.

kilogram when it calculated the cost to launch a space shuttle.[375] Odell et al. highlight the lower cost of Space-X's Falcon 9 ($2,720 per kilogram). The major improvements in launch costs mean that it is much easier to deploy large constellations today for those countries that have access to low-cost launch. Also, space is getting crowded with thousands of satellites,[376] so collision avoidance capability realized by such sensors and propulsion capability is critical to constructing a LEO satellite early-warning constellation.[377] The Japanese government also perceives the necessity to supplement its missile defense system; it is considering the construction of LEO satellite early-warning constellation like Figure 3, but hesitates because of cost, technology, maintenance, and control issues.[378]

The great cost of producing, launching, and maintaining a large, distributed early-warning network in LEO underscores why South Korea, Japan, and the United States should cooperate in building this important missile early-warning constellation. In the past, South Korea's space capabilities were limited; presently, it has qualified itself as a cooperative partner with its more developed space capabilities. If South Korea, Japan, and the United States cooperate in building a missile-tracking constellation based on LEO satellites, then the three countries can expect cost-effective improvement in their early-warning system.[379] First, they can share launch costs and improve interoperability by using a shared LEO constellation. Second, they can supplement each other's technical shortages in building, maintaining, and managing the constellation. Third, the LEO satellite

[375] Odell et al., 14 of Chapter II. SpaceX's Falcon 9 rocket has reduced that cost significantly to only $2,720. Odell et al., 14 of Chapter II.

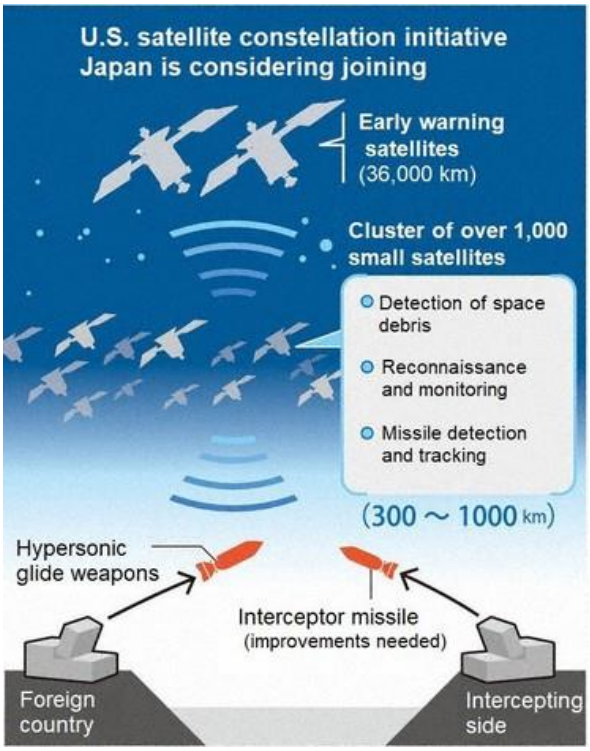
[376] U.S. Department of Defense, *Space Policy Review and Strategy on Protection of Satellites* (Washington, DC: U.S. Department of Defense, 2023), 10, https://www.spacecom.mil/Portals/57/Space%20Policy%20Review%20and%20Strategy%20on%20Protection%20of%20Satellites.PDF; Skibba, "The Space Force Is Launching Its Own Swarm of Tiny Satellites."

[377] Dmytro Rafalskyi et al., "In-Orbit Demonstration of An Iodine Electric Propulsion System," *Nature* 599, no. 7885 (November 18, 2021): 411–415,415A-415I, https://www.nature.com/articles/s41586-021-04015-y.

[378] Hatakeyama, "Japan to Mull Joining U.S. 'Satellite Constellation' Initiative to Counter Missile Threats."

[379] Nicholas Eftimiades, "Integrating U.S. and Allied Capabilities to Ensure Security in Space," *Issue Brief*, April 27, 2023, 3, https://www.atlanticcouncil.org/wp-content/uploads/2023/04/Integrating_US_and_Allied_Capabilities_to_Ensure_Security_in_Space.pdf.

constellation can be used for rapid data transfer and facilitating communications between satellites and ground-based systems.[380]



Source: Hatakeyama, "Japan to Mull Joining U.S. 'Satellite Constellation' Initiative to Counter Missile Threats."

Figure 3. U.S. Satellite Constellation Design

This cooperative effort looks promising, given that South Korea, Japan, and the United States recently announced a joint statement about the real-time sharing of missile-warning data and space cooperation. At the Camp David trilateral summit, they promised to improve the missile warning data sharing system by the end of 2023; also, they pledged to enhance joint and cooperative advancements in science and technology to promote innovation, including discussions on trilateral cooperation in space security.[381] The United States also refers to the importance of cooperation with allies and partners in its 2023 Space

[380] Skibba, "The Space Force Is Launching Its Own Swarm of Tiny Satellites."

[381] The White House, "The Spirit of Camp David."

Policy; it highlights the need for cooperation "to develop and maintain a robust, interoperable space infrastructure to enable joint and combined operations in all domains."[382]

Second, for the rapid construction of systems in space for deterrence against North Korea, such as the proposed LEO monitoring constellation, South Korea should engage in discussions with the United States on loosening restrictions related to the Missile Technology Control Regime (MTCR) and the ITAR. South Korea has been a member of MTCR, which regulates military use of other countries' missile technology and the transfer of this technology to third states since 2001.[383] The United States also follows the ITAR system, which, besides setting limits on the export of a variety of military and dual-use technologies, limits the launch of satellites made up of U.S. strategic parts on foreign rockets.[384] Therefore, Hwi Byeon and In-han Kim assert that ITAR restricts South Korea's satellite launch ability loading on domestic-developed missiles because South Korea uses the U.S. components in its satellites. Presidents Biden and Yoon recently mentioned the possibility of MTCR and ITAR relief in a joint statement in April 2023.[385] As a result, ITAR restrictions were partly loosened so that South Korea can get a case-by-case review from the United States.[386] However, it is unknown whether South Korea will get approval from the United States when it tries to build up deterrent systems in space, such as the LEO satellite constellation.

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382 U.S. Department of Defense, *Space Policy Review and Strategy on Protection of Satellites*, 9.

383 South Korean Ministry of Foreign Affairs and Trade, "[Handbook] In-Depth Analysis of Key Issues Related to Missile Technology Control Regime (MTCR) | Disarmament and Non-Proliferation Issues [[편람] 미사일기술통제체제(MTCR) 관련 주요 이슈 상세보기| 군축·비확산이슈]," South Korean Ministry of Foreign Affairs and Trade, June 2, 2023, https://www.mofa.go.kr/www/brd/m_3989/view.do?seq=307721.

384 Hwi Byeon and In-han Kim, "Launching K-Satellites with Rocket Nuri: The Uncomfortable Reality Requires U.S. Approval to Be Changed [누리호로 K-위성 발사, 美 허락해야…불편한 현실, 달라진다]," *Money Today*, May 2, 2023, https://news.mt.co.kr/mtview.php?no=2023050115022818311.

385 Wilson and Wood, "South Korea Country Brief," 3; Moltz, "The Japanese Space Program: Moving Toward 'Normalcy,'" 53.

386 Jun-ho Choi, "[Analysis] Third Success of Rocket Nuri: South Korea's First Step into the Civilian Space Age [[분석] 누리호 3 차 성공, 이제 첫 발 뗀 한국 민간 우주시대]," *The JoongAng*, May 25, 2023, https://www.joongang.co.kr/article/25165353.

Third, South Korea must strengthen its relationship with international space regimes because it is the base for space technology sharing and international space cooperation. South Korea is a member of the four UN space treaties: the Outer Space Treaty, the Rescue Agreement, the Liability Convention, and the Registration Convention; it also participates in several international space organizations and conferences.[387] However, Logsdon et al. argue that South Korea should not be satisfied with joining but should seek more substantive relationships with other regime members. These relationships with international specialists are critical when South Korea seeks to express its views in international space discussions dealing with emerging space issues, such as the utilization of outer space resources and the management of space debris.[388] Logsdon et al. contend that South Korea should be able to reinforce its relations with international experts as it is a responsible state, which has faithfully observed international space regimes. That is, strong relationships with international space regimes will be helpful when South Korea tries to access other countries' space technologies. Also, South Korea can get international support from the relationships when it builds space-based deterrence systems.

South Korea can look to Japan as a good role model for obtaining space technologies and getting support for its space activities from cooperative international networks. Japan joined the International Council of Scientific Unions' Committee on Space Research in the 1960s to exchange space data and ensure its participation in international space meetings.[389] Besides, the Japanese National Space Development Agency has given its people chances to access and procure foreign space technologies since 1969.[390] In the 1970s, Japan agreed to meet regularly and cooperate on projects with the European Space Agency, using its status as the fourth country to put a satellite into orbit with its technology.[391] In addition, Japan founded the Asia-Pacific Regional Space Agency Forum (APRSAF) in 1993 and became a de facto Asian space leader that collaborates with 500

[387] Logsdon et al., "Asia in Space: The Race to the Final Frontier," 42.

[388] Logsdon et al., 42.

[389] Moltz, "The Japanese Space Program: Moving Toward 'Normalcy,'" 49.

[390] Moltz, 49.

[391] Moltz, 50.

members of foreign space agencies, governments, universities, research, and private institutions from 30 countries.[392] According to the European Space Policy Institute, this forum exists to discuss space applications, space technology, space utilization, and space education. Also, Japan is sustaining space cooperation with foreign space organizations of 15 countries, including the U.S. National Aeronautics and Space Administration (NASA), European Space Agency, and Russian ROSCOSMOS.[393] Given South Korea's growing space power, it can approach similar cooperation routes to Japan.

B. SOUTH KOREA'S CYBER-ELECTROMAGNETIC STRATEGY

The CEMA capabilities provide non-nuclear options for South Korea to counter North Korea's growing nuclear weapons and missiles. Therefore, in addition to space strategy, South Korea needs to strengthen its CEMA capabilities.

Preconditions for South Korea's successful deterrence against North Korea are synchronizing offensive cyber-electromagnetic operation concepts with defensive-oriented cyber-electromagnetic operations and developing adequate personnel, interoperability with related organizations and cooperative countries, and systems for cyber-electromagnetic operations.

1. The Present Status of the South Korean Cyber-Electromagnetic Program

The main components to describe South Korea's cyber-electromagnetic program are its major personnel, its control center, and its level of CEMA proficiency.

First, South Korea tries to recruit cyber elites to South Korea's military cyber-electromagnetic program, cooperating with Korea University. The South Korean Department of Defense and Korea University founded the Cyber Defense Department at

[392] European Space Policy Institute (ESPI), *Securing Japan: An Assessment of Japan's Strategy for Space* (Vienna, Austria: European Space Policy Institute [ESPI], 2020), 54, https://www.espi.or.at/wp-content/uploads/2022/06/ESPI-Report-74-Securing-Japan-An-assessment-of-Japans-strategy-for-space-Full-Report.pdf.

[393] ESPI, 40.

Korea University in 2012, modeled after Israel's Talpiot Program.[394] The department recruits 30 students a year based on 2024 admission, including two candidates given special admission into the university for their cyber defense abilities; it provides four years of complimentary education; also, it employs the graduates in the military as cyber officers for seven years.[395] According to the Korea University Media Center, the department's competitive rate in 2023 was 4.73 to one; but only three of the first class of 28 graduates stayed in the military for long-term service; the others left after their seven years of service for private study or work.

As a result, despite the Cyber Defense Department at Korea University, South Korea is experiencing a deficiency in its cyber human resources. In 2023, only 17% of the students were commissioned as cyber officers, and the others pursued different employment options after they returned the education fee.[396] *Yonhap News* reports that the South Korean Department of Defense explained that the other 83% of the students departed from the military due to an excessive length of service, unfair compensation compared to the private security market, and dissatisfaction with entry-level tasks that do not align with the officers' expertise.[397]

By contrast, North Korea has systematically fostered its cyber forces since 1991. It has the advantages of selecting the best students from top high schools, including Kim Il-sung University and Kim Chaek University of Technology, and educating them at Mirim

394 Talpiot is an elite Israeli military program that selects and trains young scientific talents in math and physics during their military service; the Israel Defense Forces have used their expertise for military and industrial research and development. Kang-nnyeong Kim, "Israel's Cyber Security Strategy and Its Implications for the ROK [이스라엘의 사이버 안보전략과 한국에의 함의]," *Military Forum* 97 (March 2019): 26, https://kiss.kstudy.com/Detail/Ar?key=3666212.

395 Korea University Media Center, "2024 Online Admissions Briefing for Cyber Defense Department at Korea University [2024 년 고려대학교 사이버국방학과 온라인 입학설명회]," video, 1:30:15, August 8, 2023, https://www.youtube.com/watch?v=JO2FJdEmhB4.

396 Soo-yoon Park, "After Studying Cyber Warfare, Only 17% of Graduates from the Cyber Defense Academy Were Commissioned as Officers, With Many Pursuing Other Career Paths [사이버장교 교육했더니 딴길로…사이버국방학 졸업생 17%만 임관]," *Yonhap News*, September 17, 2023, https://www.yna.co.kr/view/AKR20230915148800504.

397 Park.

University for five years of intensive education.[398] Do-hyun Kim and Dong-soo Kang report that Mirim University has graduated more than 100 cyber students annually since 1991, most of whom are commissioned as military officers; some are assigned to the Reconnaissance General Bureau to specialize in hacking.[399] The Cyber Warfare Guidance Unit, a subdivision of the Reconnaissance General Bureau, conducts most of North Korea's electromagnetic and cyber warfare operations.[400] Kim and Kang emphasize that the Cyber Warfare Guidance Unit comprises more than 6,000 personnel and is known to operate not only within North Korea but also abroad in countries such as China, Russia, India, and Malaysia.[401] Kim and Kang also note that the unit is associated with hacking groups like Andarial, Bluenoroff, Lazarus, and the EW Jamming Regiment.[402] Given North Korea's number of newly generated cyber personnel per year and organized education systems, the disparity in cyber force between the two countries is widening every year.

Second, South Korea has operated the Cyber Operations Command (COC) as its cyber control center since 2018 and plans to establish a Strategic Command by 2024 as its main organization to counter North Korea's nuclear and missile threats. The COC has an operations center to enhance real-time situational awareness, information, and operational functions within the defense cyberspace.[403] According to *Kookbang Ilbo*, which is the newspaper of South Korea's Defense Ministry, the command also has mission-specific operations divisions for tasks such as information collection and operational execution. The COC started with roughly 350 personnel, but now approximately 1,000 people work

398 Do-hyun Kim and Dong-soo Kang, "A Study on Cyber Electronic Warfare Capabilities of North Korea [북한의 사이버전자전 능력 연구]," *KIISE Collection of Academic Papers*, December 2021, 38, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE11035601.

399 Kim and Kang, 38.

400 Kim and Kang, 39.

401 Kim and Kang, 39.

402 Kim and Kang, 39.

403 Cheol-whan Kim, "'Cyber Command' Renamed to 'Cyber Operations Command,' Completely Changing Its Mission and Functions ['사이버사'→ '사이버작전사령부'로 명칭 변경…임무·기능 다 바꾼다]," *Kookbang Ilbo*, August 9, 2018, https://kookbang.dema.mil.kr/newsWeb/20180810/16/ATCE_CTGR_0010010000/view.do.

there.[404] The COC personnel ranked first in the international cyber competition, CyberNet, for two consecutive years; the participants competed in real-time cyber-attack and defensive operations.[405] As this result indicates, South Korea's cyber warfare expertise is not far behind the international level despite its cyber forces' comparatively small size. Additionally, the Strategic Command will command and control South Korea's comprehensive national strengths to counter North Korea's nuclear and missile threats.[406] South Korean military leadership has a significant interest in CEMA-based offense and deterrence. Jong-sup Lee, the previous Minister of National Defense, ordered the South Korean Department of Defense to initiate the development of CEMA capabilities, which might stop the enemy's missiles before launch in early 2023.[407] According to the *Kookbang Ilbo*, Minister Lee plans to develop offensive cyber instruments such as hacking and electromagnetic waves and operate CEMA units under the Strategic Command.[408] Also, the Department of Defense reported its plan to reinforce the Three-Axis System with left-of-launch capabilities.[409]

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404 Seon-woong Kim et al., "Korean Military's Cyber and Electronic Warfare Development Direction: Emphasizing the Strengthening of U.S. Cyber and Electronic Warfare Weapon Organizational Framework [한국군 사이버 · 전자전 발전방향 제언: 미 사이버 · 전자전 무기 조직체계 강화방안을 중심으로]," *Defense & Technology*, no. 514 (December 2021): 67, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE10671500.

405 Hyun-woo Seo, "International Cyber Competition 'CyberNet' Won by Cyber Operations Officer for Two Consecutive Years [국제 사이버대회 '사이버넷' 사이버작전사, 2 년 연속 우승]," *Kookbang Ilbo*, May 21, 2023, https://kookbang.dema.mil.kr/newsWeb/20230522/2/ATCE_CTGR_0010010000/view.do. CyberNet is an international competition hosted by the Dutch Cyber Command (DCC). It involves the participation of NATO member countries and key partner nations. This year, 10 teams, including Germany, the UK, Japan, and the European Union (EU). Seo.

406 Won-jun Lee, "Department of Defense Plans to Establish 'Strategic Command' in 2024 to Strengthen Response to North Korean Threats [국방부, 北 위협 대응 강화 위한 '전략사령부' 2024 년 창설 계획]," *Kookbang Ilbo*, July 6, 2022, https://kookbang.dema.mil.kr/newsWeb/20220707/3/ATCE_CTGR_0010010000/view.do.

407 Tae-hoon Kim, "Initiating The 'Left of Launch' Response…The Establishment of a Dedicated Strategic Unit ['발사의 왼편' 대응 착수…전략사 별도 부대 창설]," *SBS News*, January 11, 2023, https://news.sbs.co.kr/news/endPage.do?news_id=N1007040932.

408 Kim.

409 Kim; Eun-jung Kim, "(LEAD) S. Korea Vows to Bolster Defense System against N. Korean Missile Threat," *Yonhap News*, October 23, 2023, https://www.msn.com/en-us/news/world/lead-s-korea-vows-to-bolster-defense-system-against-n-korean-missile-threat/ar-AA1iGn34?ocid=entnewsntp&pc=U531&cvid=e63915c464254994b5d7d6e0fc426ddc&ei=39.

Third, despite its accomplishments, South Korea's level of CEMA proficiency is limited compared to those of its neighboring states, which have strategic-level EW capabilities. For example, Japan employs high-altitude unmanned aerial vehicles with the United States, which can collect electronic intelligence (ELINT) from a distance.[410] China is constructing a broad ELINT library from its space, air, unmanned system, ground, and sea assets; China inputs this library into its weapons to deceive its enemy and to conduct jamming against its adversaries' assets.[411] Given that collecting the enemy's electromagnetic information is indispensable for CEMA-based offense and deterrence, South Korea's major assets are exposed to its neighbors' considerable CEMA capabilities without sufficient preparation.

Also, South Korea's EW capabilities mainly remain at the tactical level. For example, Young-duck Cho et al. report that the South Korean Army can collect non-wire signals from enemy ground forces' communication.[412] They also report that the Army Corps and Divisions have EW weapons for electromagnetic attack (EA) and electromagnetic support (ES). The Corps and Divisions can detect the adversary and inspect its communications by locating the adversary's signals in its tactical communication network; if necessary, they can monitor and disturb the enemy's

South Korea's Three-Axis System encompasses three key components. First, the Kill Chain, a preemptive strike system, targets potential threats. Second, the Korean Air and Missile Defense System, consists of multiple layers of missile interceptors to defend against airborne threats. Third, the Korea Massive Punishment and Retaliation (KMPR) focuses on eliminating an adversary's command-and-control structures by neutralizing leadership and military facilities. The Kill Chain and the KMPR are punitive deterrence, and the Korean Air and Missile Defense is denial deterrence. Ham and Lee, "Importance and Role of South Korea's Conventional Forces in Deterrence Posture of the ROK-U.S. Alliance: Enhancing the Credibility of U.S. Extended Deterrence [한국의 재래식 전력의 한반도 억제태세 기여와 역할: 확장억제 신뢰성 제고를 중심으로]," 176.

410 Yong-sik Lee et al., "The Past, Present, and Future of Japan's Self-Defense Forces' Electronic Warfare Capabilities [일본 자위대의 전자전 능력 과거와 현재. 그리고 미래]," *Military Forum* 110 (June 2022): 111, https://kiss.kstudy.com/Detail/Ar?key=3951631.

411 Yong-sik Lee et al., "PLA's Electronic Warfare Capabilities Threatening its Neighbor Countries [주변국을 위협하는 중국군의 전자전능력 (上)]," *Defense & Technology* 511 (September 2021): 90, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE10597346.

412 Young-duk Cho, Yong-seok Jung, and Dong-weon Yoon, "Korean Electromagnetic Spectrum Operations for Future Warfare [미래전을 위한 한국형 전자기스펙트럼 작전]," *Korean Journal of Military Art and Science* 78, no. 1 (February 2022): 441, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE11044177.

communication network with the ground EW system, TLQ-200K.[413] For the South Korean Navy, the ship-borne SLG-200K is a representative EW weapon that can perform precise direction-finding, radar targeting analysis, electromagnetic protection (EP) functions, and jamming; it serves the purpose of protecting naval vessels from enemy missiles and gunfire.[414] The South Korean Air Force has EA capabilities to assault the adversary's missiles, anti-aircraft guns, and air defense radars and EP capabilities to increase the survivability of its aircraft.[415] According to Cho et al., the Air Force has a sizable EW workforce and weapons compared to the Army and the Navy; it has classified ES systems, and for its EA system, it has Harpy (a loitering drone munition), high-speed anti-radiation missiles (HARMs), ALQ-88K, and ALQ-200K.[416] In particular, an EW system ALQ-200K has deception, noise, and composite or multiple jamming functions; it is operated on South Korea's primary aircraft model, the KF-16D. [417] Lastly, the South Korean Department of Defense has an operational organization that measures disruption and interference in the tactical-level spectrum and inspects radio stations to prevent radio frequency interference and maintain communication quality; it analyzes and evaluates weapons system frequencies for all services for stable frequency acquisition and operation; it also conducts civil-public-military joint radio disruption response training.[418] Cho et al. describe that the operational organization possesses specialized vehicles equipped with special antennas, spectrum analyzers, and self-generators for detecting and tracking sources of interference. However, Cho et al. point out that there is no strategic-level EW

[413] Cho, Jung, and Yoon, 441; Kim et al., "Korean Military's Cyber and Electronic Warfare Development Direction: Emphasizing the Strengthening of U.S. Cyber and Electronic Warfare Weapon Organizational Framework [한국군 사이버 · 전자전 발전방향 제언: 미 사이버 · 전자전 무기 조직체계 강화방안을 중심으로]," 67.

[414] Kim et al., 67.

[415] Cho, Jung, and Yoon, "Korean Electromagnetic Spectrum Operations for Future Warfare [미래전을 위한 한국형 전자기스펙트럼 작전]," 442.

[416] Cho, Jung, and Yoon, 442.

[417] Kim et al., "Korean Military's Cyber and Electronic Warfare Development Direction: Emphasizing the Strengthening of U.S. Cyber and Electronic Warfare Weapon Organizational Framework [한국군 사이버 · 전자전 발전방향 제언: 미 사이버 · 전자전 무기 조직체계 강화방안을 중심으로]," 67.

[418] Cho, Jung, and Yoon, "Korean Electromagnetic Spectrum Operations for Future Warfare [미래전을 위한 한국형 전자기스펙트럼 작전]," 442.

organization performing or any command-and-control systems that encompass all branches of the military.

2. Required Concepts for Enhanced Deterrence Against North Korea

To strengthen its independent deterrent against North Korea in the cyber-electromagnetic domain, South Korea needs to develop its CEMA capabilities in accordance with three concepts: persistent engagement, defending forward, and left-of-launch. These concepts are important because conventional missile defense systems are susceptible to being overwhelmed by the enemy's massive conventional attacks. As we witnessed at the onset of the Israel–Hamas War in 2023, Israel's Iron Dome was overwhelmed by Hamas's massive conventional rocket attacks (they launched roughly 5,000 rockets in 2023); this is much more than in the 2022 case, when the Iron Dome intercepted 267 out of 270 rockets from Hamas.[419] Jesse T. Wasson and Christopher E. Bluesteen had already predicted this situation in 2017, where the attacker could launch large volumes of relatively inexpensive yet sophisticated missiles while the defender would have to rely on high-cost weapon systems, such as missile defenses, to intercept these projectiles.[420] Recently, many countries have paid attention to CEMA capabilities that can reinforce deterrence against nuclear weapons and missiles. Accordingly, this subsection investigates two aspects: how the United States sees the cyber-electromagnetic domain and how it has developed deterrence in this area. South Korea could benefit from these external perspectives while developing its CEMA capabilities.

To begin with, targeting highly secured facilities, such as nuclear and missile facilities, with CEMA presents challenges due to its technical and duration limitations. First, gaining access to heavily fortified objectives and delivering impactful payloads demands a considerable amount of time, skill, organizational support, and an element of

[419] Dong-bin Yoon, "5,000 Conventional Rockets and Iron Dome Are Penetrated...10,000 Shots Per Hour. North Korean Long-Range Artillery Is on Alert [재래식 로켓 5 천발에 아이언돔 뚫려…'시간당 1 만발' 北장사정포 대응 비상]," *TV Chosun News*, October 9, 2023, http://news.tvchosun.com/site/data/html_dir/2023/10/09/2023100990148.html.

[420] Jesse T. Wasson and Christopher E. Bluesteen, "Taking the Archers for Granted: Emerging Threats to Nuclear Weapon Delivery Systems," *Defence Studies* 18, no. 4 (October 2, 2018): 439, https://www.tandfonline.com/doi/epdf/10.1080/14702436.2018.1528137?needAccess=true.

luck because a competent adversary regularly change passwords and security procedures to thwart network intrusion attempts.[421] Second, as Rovner notes that, even if access is successful, the effect of offensive cyber operations (OCO) remains transient and limited, as the enemy can swiftly restore normal systems through patching or reconfiguration.

To counter those limitations in cyberspace, General Paul M. Nakasone, a Commander of U.S. Cyber Command and Director of the National Security Agency, formulated two concepts: persistent engagement and defending forward.[422]

First, persistent engagement means to "continuously seek tactical, operational, and strategic initiative . . . remain ahead of them [adversaries] both in knowledge and in action . . . leverage our strengths across intelligence and operations to achieve this end."[423] In other words, persistent engagement indicates a condition involving "the constant contact of 'cyber strategic competitive space short of armed conflict . . . to advance national interests while avoiding war.'" [424] Jason Healey asserts that persistent engagement contributes to deterrence by fostering stability. In the process of competition to distinguish between tolerable and intolerable cyber actions and leads to establishing a shared red line.[425] Therefore, Healey contends that persistent engagement enables a defender to more easily avert crisis escalation.

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421 Joshua Rovner, "Cyberspace and Warfighting," in *Ten Years In: Implementing Strategic Approaches to Cyberspace*, ed. Jacquelyn G. Schneider, Emily O. Goldman, and Michael Warner, Naval War College Newport Papers 45 (Newport, RI: Naval War College Press, 2020), 86–87, https://permanent.fdlp.gov/gpo183843/Ten%20Years%20In_%20Implementing%20Strategic%20Approaches%20to%20Cyberspace.pdf.

422 Paul M. Nakasone, "A Cyber Force for Persistent Operations," ed. William T Eliason, *Joint Force Quarterly* 92 (First Quarter 2019): 10–14, https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-92/jfq-92_10-14_Nakasone.pdf.

423 Nakasone, 12.

424 Jason Healey, "The Implications of Persistent (and Permanent) Engagement in Cyberspace," *Journal of Cybersecurity* 5, no. 1 (2019): 6, https://academic.oup.com/cybersecurity/article/5/1/tyz008/5554878?login=true.

425 Healey, 6.

Second, defending forward means disrupting, lowering, and defeating the adversary's capabilities before it ruins one's country and its national interests.[426] In other words, it means operating cyber forces in the enemy's virtual areas.[427] Nakasone insists that the defender cannot achieve persistent engagement if it confines its actions to its internal network. He explains that the aim of defending forward is "to limit the terrain over which the enemy can gain influence or control. Defenders cannot afford to let adversaries breach its networks, systems, and data . . . If we are only defending in blue space, we have failed."[428] Lieutenant General Vicent Stewart, the previous deputy commander of the U.S. Cyber Command (USCYBERCOM), similarly explains that "defending forward is nothing more than being active in your defense . . . fight forward, disrupt forward, deny forward, make his servers less effective and have a minimal number of clean-up issues in blue [friendly] space."[429] Stewart adds that defending forward can manifest in various forms and strategies like employing suitable and proportional measures within the adversary's cyberspace to disrupt, thwart, and discourage adversary aggressions.[430]

The concepts of persistent engagement and defending forward can contribute to integrated deterrence by expanding its field to the cyber-electromagnetic domain beyond cyber-to-cyber strategy. For example, the 2023 U.S. Department of Defense Cyber Strategy is based on persistent engagement and defending forward concepts, stating "cyberspace operations represent an indispensable element of U.S. and Allied military strength and form a core component of integrated deterrence . . . the department will also use cyberspace operations for the purpose of campaigning, undertaking actions to limit, frustrate, or disrupt adversaries' activities below the level of armed conflict and to achieve favorable security

426 Jacquelyn G. Schneider, Emily O. Goldman, and Michael Warner, eds., *Ten Years In: Implementing Strategic Approaches to Cyberspace*, Naval War College Newport Papers 45 (Newport, RI: Naval War College Press, 2020), 140, https://permanent.fdlp.gov/gpo183843/Ten%20Years%20In_%20Implementing%20Strategic%20Approaches%20to%20Cyberspace.pdf.

427 Nakasone, "A Cyber Force for Persistent Operations," 12.

428 Nakasone, 13; Healey explains blue space as friendly space, which is contrary to areas of hostility. Healey, "The Implications of Persistent (and Permanent) Engagement in Cyberspace," 6.

429 Schneider, Goldman, and Warner, *Ten Years In*, 105.

430 Schneider, Goldman, and Warner, 105.

conditions."[431] Healey distinguishes defending forward from targeting enemies' strategic assets.[432] Healey is explaining that defending forward does not involve imposing strategic costs on enemies, which entails employing similar and symmetric measures when adversaries target the defender's national core facilities. However, Healey describes the mutual relation between defending forward and targeting enemies' strategic assets, proposing that imposition of strategic costs complements offensive cyber operations by endangering the adversary's critical infrastructure with the aim of deterrence.[433] In addition, Healey claims that implanting software code in the enemy's cyberspace is also not regarded as defending forward, but it can be used for surveillance or attacks to demoralize the enemy.[434] Considering the 2023 U.S. Cyber Strategy and Healey's explanations, the United States designed the concepts of persistent engagement and defending forward for cyber operations, but it also uses them as bases for integrated deterrence.

The left-of-launch concept is also based on integrated deterrence, using CEMA capabilities to neutralize enemy's missiles before launch. Wasson and Bluesteen report that left-of-launch means "neutralizing an adversary's offensive air and missile assets before use . . . the only practical means to defeat large threat inventories"[435] or "killing the archer rather than shooting down his arrows."[436] William J. Broad and David E. Sanger explain that left-of-launch is "to strike an enemy missile before liftoff or during the first seconds of flight."[437] Erik Gartzke and Jon Lindsay explain that "'left of launch' tools might

431 U.S. Department of Defense, *2023 Cyber Strategy* (Washington, DC: U.S. Department of Defense, 2023), 2, https://media.defense.gov/2023/Sep/12/2003299076/-1/-1/1/2023_DOD_Cyber_Strategy_Summary.PDF.

432 Healey, "The Implications of Persistent (and Permanent) Engagement in Cyberspace," 6.

433 Healey, 6.

434 Healey, 8.

435 Wasson and Bluesteen, "Taking the Archers for Granted," 439.

436 Wasson and Bluesteen, 439.

437 William J. Broad and David E. Sanger, "U.S. Strategy to Hobble North Korea Was Hidden in Plain Sight," *The New York Times*, March 4, 2017, https://www.nytimes.com/2017/03/04/world/asia/left-of-launch-missile-defense.html.

include cyber and EW techniques that sabotage missile components, impair command and control systems, or jam communication signals."[438]

The United States has tested its CEMA capabilities as a form of deterrence to neutralize the enemy's threats. The United States seemed to test its ability secretly during the Obama administration. According to the *New York Times*, President Obama requested the Pentagon in 2014 to develop cyber-electromagnetic methods to sabotage North Korea's missile tests within a few seconds after launching.[439] Even though the United States did not acknowledge that it had implemented a cyber-electromagnetic operation against North Korea's missile tests, those tests ended up with an 88% failure rate, ostensibly due to accident and design flaws after U.S. public announcement of left-of-launch capabilities in 2013.[440] As Broad and Sanger contend, given that North Korea had already verified the successful operation of the missile (Musudan) before, experts assume that the United States sabotaged the tests with cyber and electromagnetic measures. Even before the North Korean case, the United States and Israel were suspected by the international community of sabotaging Iran's nuclear centrifuges in 2010 by Stuxnet.[441] As Broad and Sanger report, the United States and Israel never claimed responsibility for the attack.

During the Trump administration, the United States officially announced that it was protecting its national strategic systems from its enemies' cyber-electromagnetic attacks and employing cyber-electromagnetic attacks against its enemies' weapons and core systems. The *Wall Street Journal* and *New York Times* report that USCYBERCOM got special authority to conduct OCO more easily after the Russian Internet Research Agency (IRA) tried to interfere with the U.S. midterm election in 2018; at that time, the IRA spread

438 Erik Gartzke and Jon Lindsay, "The U.S. Wants to Stop North Korean Missiles Before They Launch. That May Not Be a Great Idea.," *Washington Post*, December 7, 2021, https://www.washingtonpost.com/news/monkey-cage/wp/2017/03/15/the-u-s-wants-to-stop-north-korean-missiles-before-they-launch-that-may-not-be-a-great-idea/.

439 William J. Broad and David E. Sanger, "Trump Inherits a Secret Cyberwar Against North Korean Missiles," *The New York Times*, March 4, 2017, https://www.nytimes.com/2017/03/04/world/asia/north-korea-missile-program-sabotage.html.

440 Broad and Sanger.

441 Broad and Sanger; Mark Grzegorzewski, "Why U.S. Officials Are Revealing More about Cyber Ops," Defense One, January 9, 2020, https://www.defenseone.com/ideas/2020/01/why-us-officials-are-revealing-more-about-cyber-ops/162341/.

disinformation and attempted to hack U.S. election system, so the president and Congress significantly alleviated the restrictions on USCYBERCOM's operations.[442] Consequently, USCYBERCOM could execute OCO without president's approval using its pre-invasive computer codes in Russia's power grids, which might cut off power and paralyze Russian core infrastructures.[443] The *New York Times* explains that the measures were to warn Russia and be prepared for serious conflict with it. In June 2019, USCYBERCOM and U.S. Central Command struck Iran's missile and rocket launch control system after Iran shot down a U.S. surveillance drone and increased spear phishing against the United States.[444] In addition, President Trump approved USCYBERCOM's cyber-electromagnetic strike on Iran's capability to target shipping in September 2019 after Iran assaulted Saudi Arabian oil tankers.[445] The *New York Times* reports that Trump considered a conventional attack with a bomb or missile at that time, but he backed off because the expected Iranian casualties would be disproportionate. Besides, Iran has had a large number of failures in its rocket tests in 2019 because of technical defects.[446] Iran suspected U.S. sabotage made its satellites fail to reach orbit,[447] even though President Trump denied U.S. involvement

[442] Dustin Volz and Nancy Youssef, "U.S. Launched Cyberattacks on Iran," *The Wall Street Journal*, June 23, 2019, https://www.wsj.com/articles/u-s-launched-cyberattacks-on-iran-11561263454; David E. Sanger and Nicole Perlroth, "U.S. Escalates Online Attacks on Russia's Power Grid," *The New York Times*, June 15, 2019, https://www.nytimes.com/2019/06/15/us/politics/trump-cyber-russia-grid.html.

[443] Sanger and Perlroth.

[444] Volz and Youssef, "U.S. Launched Cyberattacks on Iran."; Tim Starks, "U.S.–Iran Cyber Skirmishes Break Out," Politico, June 24, 2019, https://www.politico.com/newsletters/morning-cybersecurity/2019/06/24/us-iran-cyber-skirmishes-break-out-663345; Joseph Marks, "The Cybersecurity 202: U.S. Businesses Are Preparing for Iranian Hacks After American Cyberattack," *The Washington Post*, June 24, 2019, https://www.washingtonpost.com/news/powerpost/paloma/the-cybersecurity-202/2019/06/24/the-cybersecurity-202-u-s-businesses-are-preparing-for-iranian-hacks-after-american-cyber-attack/5d1007a81ad2e552a21d507f/; Grzegorzewski, "Why U.S. Officials Are Revealing More about Cyber Ops."

[445] Peter Baker, Eric Schmitt, and Michael Crowley, "An Abrupt Move That Stunned Aides: Inside Trump's Aborted Attack on Iran," *The New York Times*, September 22, 2019, https://www.nytimes.com/2019/09/21/us/politics/trump-iran-decision.html; Grzegorzewski.

[446] Radio Farda, "Iran's Missile Launch Failures Likely Linked to U.S. Sabotage, Report Says," Radio Free Europe / Radio Liberty, February 14, 2019, https://en.radiofarda.com/a/iran-missile-launch-failures-likely-us-sabotage-nyt/29769460.html; Reuters, "Iran Space Launch Fails to Put Payloads into Orbit, Official Says," Voice of America, December 31, 2021, https://www.voanews.com/a/iran-space-launch-fails-to-put-payloads-into-orbit-official-says-/6377410.html.

[447] David E. Sanger and William J. Broad, "In a Tweet Taunting Iran, Trump Releases an Image Thought to Be Classified," *New York Times*, August 30, 2019, https://www.proquest.com/docview/2282685817/abstract/1F5B98AD1694BC1PQ/1.

interfering with Iranian rocket tests in 2019.[448] However, Broad and Sanger report that Trump posted an exploded Iranian Space Center image on his Twitter after the Iranian rocket failure. These examples all have implications for South Korea.

The advantages of CEMA-based offense and deterrence are its strategic effect, flexibility, cost, and credibility. First, CEMA-based offense and deterrence can achieve the same or greater strategic effect than nuclear weapons. As the previous two U.S. administrations have shown, if CEMA-based offense and deterrence operate successfully, they can neutralize the adversary's strategic assets, such as nuclear weapons, missiles, and national core infrastructure. This means that the defender can enjoy strategic effects without using its kinetic strategic weapons by offsetting the enemy's. Second, the defender has more flexibility in its actions because it can act anonymously or in disguise, even during peacetime or escalation situations.[449] Third, CEMA-based offense and deterrence saves missile defense costs because it is a non-kinetic approach. For example, Broad and Sanger report that the United States regards left-of-launch as a cheaper and novel method to neutralize North Korea's and Iran's missiles.[450] They also point out that the United States continuously develops this cost-effective means as the Pentagon requested a budget for the cyber-electromagnetic missile defense program Nimble Fire in 2017. Fourth, the defender feels able to more freely employ a CEMA-based deterrent given the flexibility and cost relief regarding retaliation against the enemy. Consequently, the attacker will consider the defender's retaliation as more credible when it knows the defender's CEMA capabilities.[451] Overall, CEMA-based offense and deterrence, considering the goals of

[448] Federal Information & News Dispatch, LLC, "Trump Says U.S. 'Not Involved' In Iranian Rocket Launch Explosion," *Federal Information & News Dispatch, LLC,* August 30, 2019, https://www.reuters.com/article/iran-space-launch-usa-idUKL2N25Q0YL/.

[449] Wasson and Bluesteen, "Taking the Archers for Granted," 441.

[450] Broad and Sanger, "U.S. Strategy to Hobble North Korea Was Hidden in Plain Sight."

[451] Wasson and Bluesteen, "Taking the Archers for Granted," 444. However, Gartzke and Lindsay refute the opening of this capability for the sake of credibility because it will trigger the action-reaction response in the enemy so it will change and dispatch its systems for protection; then, the defender's advantage disappears so easily. Gartzke and Lindsay, "The U.S. Wants to Stop North Korean Missiles Before They Launch. That May Not Be a Great Idea."

persistent engagement, defending forward, and left-of-launch, could be effective for non-nuclear South Korea against the North.

3. Required Efforts for Enhanced Deterrence Against North Korea

South Korea must further develop three areas in the cyber-electromagnetic domain to enhance its deterrent capabilities against North Korea: human resource management, CEMA systems, and improved connections among related departments.

The first significant axis for CEMA-based offense and deterrence is recruiting, training, and retaining talented human resources. Nakasone explains that the success of cyber operations relies on the most brilliant human resources who are at least 10 times cleverer than their peers in the area of operations, program development, and analysis.[452] However, competing with the private sector in recruiting and retaining talent is not straightforward, due to the limited budget of the military. Nevertheless, outstanding human resources are critical for South Korea to conduct successful CEMA. Considering that North Korea holds extensive human resources, including its professional cyber forces and foreign-based informational technology actors,[453] South Korea should prioritize acquiring high-quality human resources.

To improve its workforce shortage of cyber specialists in the military, South Korea can adopt the approach of the U.S. Cyber Excepted Service (CES). CES enables USCYBERCOM to utilize talented cyber professionals by providing them opportunities to apply their expertise and to make substantial contributions to the United States' national security.[454] The South Korean government should cooperate with the private information technology sector in drawing on the skills of their workforce. In exchange for cooperation,

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[452] William T. Eliason, ed., "An Interview with Paul M. Nakasone," *Joint Force Quarterly* 92 (Quarter 2019): 6, https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-92/jfq-92_4-9_Nakasone-Interview.pdf.

[453] U.S. Cyber Command, *Posture Statement of General Paul M. Nakasone Commander, United States Cyber Command Before the 118th Congress Senate Committee on Armed Services* (Washington, DC: U.S. Cyber Command, 2023), 3, https://www.armed-services.senate.gov/imo/media/doc/CDRUSCYBERCOM%20SASC%20Posture%20Statement%20FINAL%20.pdf.

[454] U.S. Cyber Command, 6.

the South Korean government can consider providing unique advantages for the companies, such as reducing taxes.

Second, to realize CEMA-based offense and deterrence, South Korea must reinforce and reorganize its CEMA systems with five tasks: building robust intelligence, surveillance, and reconnaissance (ISR) systems; developing non-kinetic strike capabilities; accumulating CEMA bases; connecting cyber and electromagnetic capabilities; and developing strategic-level EW weapons. Regarding persistent engagement, defending forward, and left-of-launch, robust ISR systems are imperative for South Korea to outpace North Korea in intelligence, information, and particularly implementation when dealing with the movement of North Korea's nuclear weapons and missiles. As Wasson and Bluesteen point out, left-of-launch requires "non-kinetic defensive capabilities, such as cyber warfare and directed energy."[455] Herbert C. Kemp highlights the importance of detecting and tracking mobile TBMs for left-of-launch.[456] To that end, Kemp suggests five prerequisites: reliable intelligence preparation of the battle space (IPB), extensive data analysis, space-based sensors, air-based sensors, and attack platforms and weapons. Kemp's prerequisites emphasize not only ISR and means of cyber-electromagnetic strikes but also the amassment of CEMA in the sense of information bases, such as IPB (regarding the enemy's military structure and weapons deployment) and databases (classified and unclassified information, including cyber-electromagnetic data on the enemies' strategic assets). Moreover, cyber and electromagnetic capabilities have to complement each other to achieve CEMA-based offense and deterrence. Woon-soo Song and Han-seung Cho note the necessity of the two capabilities working in concert, as cyber operations must be conducted with IP addresses in wire-wireless networks, while electromagnetic operations can access closed or isolated networks.[457] Song and Cho also explain that EW capabilities are used to affect the adversary's wireless EMS, while CEMA capabilities are used to

[455] Wasson and Bluesteen, "Taking the Archers for Granted," 439.

[456] Kemp, "Left of Launch," 5.

[457] Woon-soo Song and Han-seung Cho, "The Operation of 'Left of Launch' and Suggestion of Cyber Deterrence Strategy in Korean Peninsula [발사의 왼편작전과 한반도 사이버 억지전략 제언]," *Strategic Studies* 28, no. 3 (November 2021): 64, https://www.dbpia.co.kr/Journal/articleDetail?nodeId=NODE10820453.

paralyze the enemy's command-and-control systems or missile control system in non-lethal and non-physical ways. Furthermore, South Korea's Department of Defense has to assign strategic-level EW equipment to the tactical units and the Strategic Command to collect and analyze the enemy's EMS, developing communication methods between the two components.[458]

Finally, South Korea should build robust interagency relationships and also promote its CEMA control center's cooperation with the private sectors, major allies, and partners.[459] Considering the complexity of offense and defense in cyberspace, nobody can achieve persistent engagement and defending forward alone. For instance, USCYBERCOM maintains close relationships and mutual assistance with the Department of Homeland Security, the Federal Bureau of Investigation, and the private sector.[460] In the interview with Eliason, Nakasone says that the Department of Homeland Security and the Federal Bureau of Investigation can share information and intelligence with USCYBERCOM, supported by national infrastructure and resources; the private sector has the benefits of global reach, ubiquitousness, and the capability to amass vast quantities of data.[461] It is also essential for South Korea's CEMA control center to build relationships with domestic institutions, particularly national core infrastructures, which can be prioritized targets of North Korea.[462] Nakasone contends that these relationships with domestic institutions will be crucial in frustrating attackers before striking and improving the defender's resilience even if the attackers succeed in breaching defense. Furthermore, strengthening international cooperation with major allies and partners is essential for

458 Kim et al., "Korean Military's Cyber and Electronic Warfare Development Direction: Emphasizing the Strengthening of U.S. Cyber and Electronic Warfare Weapon Organizational Framework [한국군 사이버 · 전자전 발전방향 제언: 미 사이버 · 전자전 무기 조직체계 강화방안을 중심으로]," 67.

459 Schneider, Goldman, and Warner, *Ten Years In*, 105.

460 Eliason, "An Interview with Paul M. Nakasone," 5.

461 Eliason, 5.

462 Nakasone, "A Cyber Force for Persistent Operations," 12.

increasing the accuracy, speed, and feasibility of their intelligence against shared adversaries.[463]

C. CONCLUSION: INTEGRATED DETERRENCE

South Korea must think about its deterrence strategy at least two times more than North Korea does because South Korea has no available nuclear weapons. Therefore, South Koreans have had anxiety after the United States withdrew its tactical nuclear weapons from South Korea. The anxiety has deepened as North Korea has accomplished rapid development in its nuclear and missile capabilities. This chapter argues that integrated deterrence, supplemented by space and cyber-electromagnetic domains, could be effective and offer the most practical measures to strengthen South Korea's deterrence against North Korea, considering the limitations of geopolitics and the economy.

South Korean officials and experts focus on the significance of space and cyber-electromagnetic domains with respect to deterrence compared to decades ago. The South Korean space program, initiated in the 1970s, has grown in response to North Korean threats and eventually led to the development of independent satellites and rockets. To deter North Korean threats, South Korea must develop the KPS, establish defensive space assets, improve human resources, and build domestic support to sustain developments in the space domain. Internationally, South Korea must enhance cooperation with the United States and Japan, which face the same nuclear and missile threats from North Korea, sharing launch costs and combining space capabilities. In addition, discussing ITAR relief to strengthen space-based deterrents is crucial, especially for constructing robust LEO constellations. Active participation in international space activities will help South Korea access foreign technologies and gain international support for its space deterrence posture.

Additionally, South Korea is trying to bolster its CEMA capabilities to effectively deter North Korea's nuclear and missile threats, even though its cyber-electromagnetic program is currently in the initial developmental phase. South Korea has recruited cyber elites through the Cyber Defense Department at Korea University, but its existence has not

463 U.S. Cyber Command, *Posture Statement of General Paul M. Nakasone Commander, United States Cyber Command Before the 118th Congress Senate Committee on Armed Services*, 4.

led to military personnel improvements. South Korea operates the COC as a cyber control center and will establish a Strategic Command to command and control all operations related to North Korea's nuclear and missile threats. However, South Korea's level of CEMA proficiency is low compared to Japan and China, consisting of tactical-level capabilities. Therefore, South Korea must develop its CEMA capabilities in line with the concepts of persistent engagement, defending forward, and left-of-launch to effectively deter North Korea's threats, with new capabilities for disrupting the enemy's major systems and operations. Also, South Korea needs to focus on managing skilled human resources better, enhancing its CEMA systems, and improving interagency and international cooperation to strengthen its CEMA-based offense and deterrence.

Overall, the most critical point is to weave space and CEMA capabilities into a new deterrence strategy. To achieve effective integrated deterrence against North Korea, South Korea should ensure three things: cooperation with its major allies and partners, interconnection with other deterrent capabilities, and strong national-level support. First, South Korea is still a new player in the space and cyber-electromagnetic domains compared to the United States and Japan, so it needs international cooperation to develop its deterrents. Considering that the United States and Japan are exposed to common nuclear and missile threats by North Korea, the two countries are the best cooperative partners for South Korea. In this trilateral cooperation, the three countries should deal with the issues of establishing a cooperative working group, building an interconnected missile defense system based on space and CEMA capabilities, sharing technologies and information, designing cooperative strategy and interoperable operational platforms, and implementing cooperative exercises and operations.[464] However, acceptance by the cooperation partners as a suitable counterpart assumes mutual benefits from the cooperation. Therefore, South Korea must keep developing its independent capabilities in the space and cyber-electromagnetic domains. These efforts will make more long-lasting, effective partnerships to deter North Korea.

[464] Eftimiades, "Integrating U.S. and Allied Capabilities to Ensure Security in Space," 11.

Second, a deterrent can maximize its power when it integrates with other deterrents in ground, air, and sea, such as missile defense systems. In its 2023 Space Policy Review, the U.S. Space Command (USSPACECOM) emphasizes communication not only among space assets and space operators but also the other commands to deter and defeat enemies in a timely manner.[465] Also, USSPACECOM emphasizes the need to maintain EMS superiority, saying that "Denial of adversary freedom of action in the EMS requires an integrated and distributed capability to support the EMS Superiority strategy."[466] Accordingly, South Korea should link its two new deterrents in the space and cyber-electromagnetic domains with its current deterrent forces to exert their respective powers to the maximum effect. Given that the two domains are commonly related to ISR and missile defense systems, integration of the whole South Korean deterrent framework becomes more significant to countering North Korea's nuclear and missile threats.

Third, the South Korean government must support the development of CEMA capabilities. The cyber-electromagnetic domain has not attracted government interest until recently, whereas the government has had lots of strategic interest in space development with national support. Given the technical and duration limitations of cyberspace predominance, cyber operations require well-organized "infrastructure, tools, accesses, and authorities ready to execute missions" as well as well-organized teams.[467] The responsible department cannot implement such an approach alone; it needs national-level interest and assistance in terms of both budget support and systems development and operations.

Well-developed integrated deterrence, including the space and cyber-electromagnetic domains, will supplement South Korea's confidence in extended deterrence and its independent warfighting capabilities based on non-nuclear options. In the 1970s, South Korea halted its nuclear weapons program, while North Korea accelerated its program. Consequently, the comparative military power balance between the two

[465] U.S. Department of Defense, *Space Policy Review and Strategy on Protection of Satellites*, 17; Gregory Gagnon, "Why Military Space Matters," *Joint Force Quarterly*, no. 110 (July 3, 2023): 63, https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-110/jfq-110_61-63_Gagnon.pdf?ver=fdwx93oKPwtGt2dBr8tc1Q%3d%3d.

[466] U.S. Department of Defense, 17; Gagnon, 63.

[467] Nakasone, "A Cyber Force for Persistent Operations," 14.

Koreas leans to North Korea now, at least in some regards. Hopefully, South Korea will not concede the superiority in space and cyber-electromagnetic domains to North Korea and, instead, use them to its advantage.

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