

Advancement of North Korea's Nuclear Weapons and Survivability under the Kim Jong Un Regime: An Assessment based on Nuclear Deterrence Theory

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Abstract:

The purpose of this article is to verify the advancement of nuclear weapons under the Kim Jong Un regime and its survivability in terms of Nuclear Deterrence Theory, which would become the first step, to providing an answer to the question: What brought about the historic June 2018 summit between the US and the DPRK that had not been held for over 70 years? Firstly, this article will explore the development of its advanced nuclear weapons by both qualitative and quantitative methods by examining how the Kim Jong Un regime made the decision to accelerate its nuclear development and then put it into practice. Secondly, I will review how the Trump administration and the Kim Jong Un regime changed their perceptions of each other after North Korea proved its ability to invulnerably attack the US mainland and its allies through its advancement of nuclear weapons. Finally, the survivability of the Kim Jong Un regime will be considered according to its analytical framework, namely the nuclear deterrence theory. Based on these verification results where the DPRK's survivability has been consolidated in a military sense and crisis stability between the US and the DPRK has been improved, this article also clarifies implications for North Korea's new security strategy, regional studies on the DPRK, and Nuclear Deterrence Theory itself.

Keywords: *North Korea, Nuclear Weapons, Kim Jong Un, Nuclear Deterrence, US-DPRK Relations.*

1. Introduction

The North Korean Nuclear issue is one of the hottest issues in the world today. In 2017, a lot of mass media, intellectuals, policy makers, politicians and decision makers, including Donald J. Trump, the current US president, publicly pointed out that the world was at the brink of the second Korean War that would have escalated to a nuclear war and triggered World War III if the US had committed to preventive attacks on military complexes in North Korea.

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Received on 2018/12/19, accepted after peer reviews on 2019/6/1.

However, the tension between the D. Trump and Kim Jong Un administrations has drastically calmed down after the historic first summit between the US and the Democratic People's Republic of Korea (DPRK), or North Korea, that had never been held since 1948. We seem to have entered a new and unprecedented phase.

Then, a research question emerges here: What transformations have brought about these changes culminating in the historic summit? Regarding the recent history of the North Korean Nuclear Issue, the answer should be found by the process of examining why the Trump administration, which had been taking an extremely aggressive attitude on North Korea, made the decision to hold direct talks with the Kim Jong Un regime (KJU regime) beyond the traditional US policy, which has been maintaining a status-quo with North Korea. US traditional policy has made use of the perceived threat of North Korea's military expansion to justify its contribution to the “status quo” in the Korean Peninsula as a last resort. The question, 'Why did D. Trump choose to be a challenger to break the status quo?' is the underlying foundation of this article.

Toward providing an answer to the question, this article will employ a “historical explanatory” approach based on nuclear deterrence theory to assess the advancement of nuclear weapons under the KJU regime and its effect on the survivability of the DPRK. This verification process consists of three stages: the first stage is to analyze the advanced development of the nuclear weapons of North Korea in a qualitative manner. The historical approach is taken here on how the DPRK's nuclear weapons' program has advanced since the KJU regime officially began in 2012. Next, I am going to go over its nuclear development quantitatively. To achieve this, statistical data on the nuclear tests and ballistic missile tests conducted by the KJU regime will be examined. Finally, the DPRK's survivability during and after its progress in the development of nuclear weapons, which has brought about perception changes of both the US and DPRK, will be validated.

There are two reasons why I will focus on Kim Jong Un's advanced nuclear weapons arsenal as an independent variable to assess its survivability, considering my hypothesis that the advancement of nuclear weapons would enhance its survivability from the viewpoint of nuclear deterrence theory. Firstly, with regard to the extremely asymmetric relationship when the US, the only superpower, and the DPRK confront each other, the survivability of the regime mainly depends on whether or not the US determines to conduct a preventive attack to it. History tells us that this is true. In retrospect, the US invasion of Iraq in 2003 ended the Saddam Hussein regime, one of the three named the “Axis of Evil”, the other two being Iran and North Korea back then, while the US-led NATO military intervention in the Libyan Civil War in 2011 ended the Muammar Gaddafi regime which had already abandoned its nuclear development in 2003 after getting tremendously shocked by the tragic consequences of the Iraq War.

North Korea was shocked by the collapse of these regimes that had been overwhelmingly threatened by the US. Actually, North Korea perceived the US military strikes that brought about the end of the Iraqi and Libyan regimes as great historical lessons for securing its survivability. Thus the DPRK determined to accelerate its development of nuclear weapons to be able to deter the US², as

1 S. V. Evera, *Guide to Methods for Students of Political Science* (“Seizigaku no lisaachimesodo” in Japanese), Keisou Syobou, 2009, pp. 91-97.

2 KCNA (Mar. 21, 2003), “DPRK Foreign Ministry spokesman on U.S. start of Iraqi war”, <http://www.kcna.co.jp/item/2003/200303/news03/22.htm#1>, accessed on Mar. 27, 2019, KCNA (Mar. 22, 2011), “Foreign Ministry Spokesman Denounces US Military Attack on Libya”, <http://www.kcna.co.jp/item/2011/201103/>

detering a US preventive attack was crucial for its survival. Therefore, I decided to assess the DPRK's survivability by verifying its advancement of nuclear weapons that can strengthen its deterrent against the US despite the extremely asymmetric deterrence relationship between the US and the DPRK.

The second reason for selecting the Kim Jong Un's advanced nuclear weapons arsenal as an independent variable to its survivability from the viewpoint of security is the emergence of advanced nuclear weapons including Inter-Continental Ballistic Missiles (ICBMs) with H-bombs, which is a most novel variable that has not been observed over the past 28 years. Before 2017, it was unlikely that North Korean ballistic missiles could hit the US mainland directly. However, three tests of ICBMs, one of which has been estimated to have about a 13,000km-range, were successfully conducted in 2017, which means the possibility that the DPRK's ICBMs armed with thermonuclear bombs could strike Washington D.C. has become a game-changer in terms of Nuclear Deterrence Theory.

Comparatively, domestic politics and economic-related factors, which can also have an influence on the survivability of the KJU regime, are not such fresh and currently significant variables as the DPRK's ICBMs equipped with H-bombs. The bipartisan structure of domestic politics and the decision-making process in the US seems not to have fundamentally changed before or after the embarkation of the Trump administration, while the opaque North Korean domestic politics and decision-making process in the monolithic ideological system based on the "Juche Idea" has not fluctuated under the KJU regime so far³. Moreover, economic sanctions have been imposed on the DPRK since the Korean War⁴. Although the US- and the UN-led economic sanctions have become more comprehensive after the DPRK's first nuclear test than before, their potential to critically squeeze the DPRK's economy is limited because of both internal factors, its relatively low dependency on trade and energy, and external factors, such as China⁵. Furthermore, the current status of the DPRK's economy cannot be viewed as worse than its devastated status in the mid-1990s, when a serious famine in which allegedly more than million North Koreans died of starvation took place during the period called "the Arduous March" in North Korea⁶, since there had been no significant signs of such a serious famine in the DPRK as of March of 2019⁷. In this May, International organizations such as WFP, FAO suddenly issued a report that a food shortage had occurred in North Korea, which has invoked arguments that the North Korean economy was successfully weakened by the US-led economic sanctions. However, there has been no robust proof to verify that economic

news22/20110322-34ee.html, accessed on Mar. 27, 2019.

- 3 Not to mention, what is also significant here is to escape from the trap of reductionism focusing on the inner thoughts of the decision-makers, namely D. Trump and Kim Jong Un, some of which can be speculated but nobody fully knows. It is quite hard to scientifically prove how linked the thoughts in their heads and their actual actions are.
- 4 For example, on June 28, 1950, the US invoked a total embargo on exports on the DPRK. Following the export control act, the US Trading with Enemy Act was imposed on North Korea.
- 5 See the Chap. 8 "Why have not the UN sanctions on North Korea made a breakthrough?", written by Yamamoto Takehiko, in Y. Takehiko ed., *the Studies on Economic Sanctions*, Shigakusya, Mar. 2017.
- 6 For example, see Andrew S. Natsios (1999), "The Politics of Famine in North Korea", https://www.usip.org/sites/default/files/sr_990802.pdf, accessed on Nov. 29, 2018.
- 7 Yonhap News (Mar. 30, 2019), "South Korean National Intelligence Service, NK's Food Situation Seems to be Worsening, but No Sign of Death by Starvation (in Korean)", <https://www.yna.co.kr/view/AKR20190329119900001?section=nk/news/all>, accessed on Mar. 31, 2019.

sanctions are the decisive variable on the aforementioned food shortage.

Rather, the food shortage could have been caused by more complex factors, regarding the occurrence of the greatest drought that has ever happened in the DPRK since 1917 for example⁸. Additionally, a food shortage might not have taken place in North Korea, allowing for the data that the number of imported foods from China stayed lower than the previous year during the first quarter of 2019⁹, while the Chinese government directly provided food and fertilizers as a grant aid to North Korea along with the DPRK-China Summits held in 2017. Furthermore, the prices of food in its domestic market reportedly remained comparatively stable¹⁰.

Hence, this article will analyze whether the DPRK's survivability has increased or decreased due to the advanced nuclear weapons of the KJU regime in a military sense, while hypothesizing them as the most plausible independent variable that has brought about a change in the US attitude and strengthened the DPRK's survivability¹¹.

In this context, this article also proposes to overcome the biased assumption that North Korea would be gone soon, which has lasted over about three decades since the end of the cold War, and has spread out as a mainstream theory in North Korean Studies¹². In fact, about 28 years have passed since these assumptions emerged, and the predicted collapse of the DPRK has not occurred. Moreover, after the meeting between Kim Jong Un and D. Trump, the possibility of collapse seems far less likely, which means that these assumptions could just be hypothetical and need to be reassessed.

Furthermore, Crisis Studies can be academically strengthened by making public the features of cases where extremely asymmetric confrontations have taken place between the US and North Korea. In particular, Crisis Studies with nuclear weapons tend to lean on symmetric confrontations between fully fledged nuclear-armed states, such as the US-USSR or the U.S.- China relations both of which are in a status of mutually assured destruction (MAD), or more regional conflicts between relatively asymmetric actors like India-Pakistan relations.

Meanwhile, in attempting to build parity in the US-DPRK confrontations, we are faced with a situation where one side possesses perfectly reliable nuclear weapons proven through many nuclear tests and once used on Japan, in Hiroshima and Nagasaki, and the other has yet to become a fully established nuclear-armed state. Thus, this study will surely be a concrete step towards improving the quality and value of Crisis Studies with nuclear weapons. It could be beneficially applied to reassessing Nuclear Deterrence Theory, this article's analytical framework, as well.

8 VoA (May 18, 2019), "The Serious Drought captured by the US Weather Satellites as well", <https://www.yna.co.kr/view/AKR20190518021400504?section=nk/news/all>, accessed on May 19, 2019. Yohnap News (May 17, 2019), "The DPRK official mentioned 'its precipitation in the past five months is the worst recorded since 1917'", <https://www.yna.co.kr/view/AKR20190517046600504?section=nk/news/all>, accessed on May 18, 2019.

9 VoA (May 17, 2019), "North Korea imported more tobacco and fruits than food during the first quarter of 2019", <https://www.voakorea.com/a/4920614.html>, accessed on May 18, 2019.

10 *Ibid.*

11 I am going to study those other factors, such as decision- and policy-making processes in the domestic politics of both the US and DPRK, the US and UN-led economic sanctions and DPRK's economy, which may have influenced the DPRK's survivability, at another opportunity.

12 In reality, the Kim Young Sam and Lee Myung Bak administrations of South Korea, both of which individually experienced key events in the DPRK regime's governance, like the death of its leader, pushed forward with a plan, named Operation Chung-Mu, in preparation for the imminent collapse of the North Korean regime, while the US government mapped out OpPlan 5027 based on the prediction that North Korea would be gone soon.

2. Current Evaluations of the DRPK's Nuclear Weapons

In this chapter, firstly I will be reviewing the preceding works on both nuclear deterrence theory and North Korea's nuclear development, and secondly, verifying if the advancement of nuclear weapons in the KJU regime has brought about an increase in its survivability based on nuclear deterrence theory.

(1) Literature Review of Preceding Works

In 1946, a year after the bombing of Hiroshima and Nagasaki occurred, Bernard Brodie, a founder of the nuclear deterrence theory, mentioned “[T]he threat of retaliation does not have to be 100 percent certain; it is sufficient if there is a good chance of it. But that chance has to be evident. The prediction is more important than the fact”¹³, while predicting H-bombs and nuclear tests would become needed “with its emphasis on the punitive aspect of retaliation”¹⁴ in order to make certain that “the enemy will fear even the smallest number of bombs that might be sent in retaliation”¹⁵.

To ensure retaliation capability to prevent the rise of reciprocal fear of surprise attack¹⁶, he recommended multilateral possession of nuclear weapons and pointed out that the ability to fight back “after an atomic bomb attack will depend on the degree to which the armed forces have made themselves independent of the urban communities and their industries for supply and support”¹⁷. Afterward, he revealed the possession of ICBMs and SLBMs could clear the conditions shown above¹⁸.

In addition, he mentioned the circumstances where atomic bombs are not used are more plausible if both sides have the nuclear bomb in quantity from the beginning than if neither side has it at the outset or if only one side has it¹⁹, thereby protecting them from the occurrence of crisis instability²⁰. His thought was developed into the concept of MAD where the strategic stability between two nuclear states is confirmed if both sides can perceive the fear of nuclear retaliation from each other by deliberately getting themselves exposed to a nuclear second strike by abandoning the possession of weaponry based on the idea of deterrence by denial, such as a Missile Defense (MD) system²¹, which can be seen as a move that would enable the counterpart to conduct a nuclear first strike and facilitate an arms race.

13 Brodie, B., “Implications for Military Policy,” in B. Brodie, ed., *The Absolute Weapon: Atomic Power and World Order*, New York: Harcourt, Brace, 1946, p. 60.

14 Brodie, B., *Strategy in the Missile Age*, Princeton, 1959, p. 295.

15 Brodie, B., *Ibid.*, p. 295.

16 Schelling, T., *Strategy of the Conflict*, Harvard University, 1960, p. 207.

17 Brodie, B., *Ibid.*, p. 73.

18 Brodie, B., “The Development of Nuclear Strategy”, *International Security*, Vol. 2, No 4(Spring 1978), p. 68.

19 Brodie, B., *op. cit.*, p. 70.

20 Crisis stability can be defined as a situation where two nation-states do not perceive a surprise attack as an advantageous option to maximize their utilities. On the contrary, Crisis Instability emerges when they see a first attack as an incentive to escape from the fear of an opponent's surprise attack. Strategic stability traditionally contains crisis stability and arms-race stability.

21 Nuclear deterrence theorists yielded to the idea of non-first use and were confronted with nuclear defense theorists who saw deterrence by denial. For details, please refer to my articles: CHOI, Jung Hoon, “Analyzing North Korea's Declaration of Non-First Use of Nuclear Weapons from the Perspective of Nuclear Deterrence Theory”, *Quarterly Bulletin of Third World Studies Vol. 57, No. 1 (No. 423)*, Afro-Asian Institute of Japan, Jan. 2017, pp. 1-22 (written in Japanese).

The nuclear deterrence theory founded by Brodie has been updated by George Kennan, Glenn Snyder, Albert Wohlstetter, Thomas Shelling, Kenneth Waltz, Robert Jervis, Scott Sagan and so on, while it was institutionalized by the Strategic Arms Limitation Treaty (SALT) where the Anti-Ballistic Missile Treaty and the Interim Agreement on the Limitation of Strategic Offensive Arms were concluded between the US and the USSR in May 1972. Furthermore, it was applied not just to a maximal nuclear deterrence strategy, but also to a minimal one that nuclear actors, such as China, India and Pakistan, employed to deter their counterparts who possessed superior conventional forces, and this worked out in the past. For example, India used to think sixty nuclear weapons were enough to deter both Pakistan and China; Pakistan might need twenty bombs to deter India; China possessed twenty ICBMs with H-bombs to deter its enemies as of 2003²².

Considering the nuclear deterrence theorist's logic, the evaluation on North Korea's nuclear weapons is a key factor to verify the current level of its survivability from the terms of nuclear deterrence theory since that 'chance' of retaliation Brodie used to mention has to be evident through the advancement of nuclear weapons. In particular, it is vital for the DPRK's survival whether or not it has successfully developed ICBMs with thermonuclear warheads able to hit the US mainland in an invulnerable way by evading US preventive attacks. In other words, H-bomb-loaded ICBMs can become a game changer to reinforce the DPRK's survivability.

At present, evaluations of the DPRK's nuclear weapons have a tendency to reach a consensus that it has succeeded in developing nuclear weapons to a certain extent, especially that reports on nuclear-armed short and medium-range ballistic missiles are trustworthy. However, there have been slight differences in analyzing how sophisticated their ICBMs are, such as; whether or not they have fully obtained capability for reentry, i.e., whether ICBMs that are able to reach the US mainland have the technology to reenter the atmosphere intact; and how many nuclear weapons, including ICBMs, North Korea already possesses that are ready to deploy or are deployed.

The US Department of Defense (DoD) has admitted that the DPRK can develop a nuclear-armed ICBM that is capable of posing a direct threat to the United States, and that they passed a significant milestone on July 28, 2017, but the DoD has been skeptical about whether North Korea has fully acquired ICBM technologies, pointing out that "ICBMs are extremely complex systems that require multiple flight tests to identify and correct design or manufacturing defects. ICBM trajectories impart significant structural and thermal stresses on the reentry vehicle (RV), requiring repeated testing to ensure that the RV will survive and that the warhead will operate as designed²³."

By analyzing the crane used for the launching test last November, Jeffrey Lewis argued that the DPRK possessed the capability to strike US soil, and the remaining phase involves mounting a nuclear warhead on a long-range ICBM; nevertheless "it's a question of when, not if, Pyongyang will get there²⁴". Also, Scott Sagan admitted its ICBM can reach the US, while saying "North Korea no longer poses a nonproliferation problem; it poses a nuclear deterrence problem²⁵". Siegfried Hecker, however,

22 S. Sagan & K. Waltz, *The Spread of Nuclear Weapons*, W. W. Norton & Company, Inc., 2003, pp. 109-116.

23 Office of the Secretary of Defense, 2017, "Military and Security Development Involving the Democratic People's Republic of Korea 2017-A Report to Congress", p. 10.

24 R. Engel and Kennett Werner, "Open-source material offers hints on North Korea's missile capabilities", *CNBC* (Mar. 1, 2018), <https://www.nbcnews.com/news/north-korea/open-source-material-offers-hints-north-korea-s-missile-capabilities-n850246>, accessed on Aug. 20, 2018.

25 S. Sagan (Sept 10, 2018), "The Korean Missile Crisis-Why Deterrence Is Still the Best Option-", *Foreign Affairs*, <https://www.foreignaffairs.com/articles/north-korea/2017-09-10/korean-missile-crisis>, accessed on Dec. 2, 2018.

pointed out in the end of December 2017, the DPRK would need “at least two more years of tests²⁶” to perfect its ICBMs, although admitting its nuclear weapons could bring about a nuclear catastrophe.

As a matter of fact, the discussion above has not confronted whether North Korea has the capability to hit the US mainland or not, but whether their ICBMs mounted with nuclear warheads are fully ‘reliable’ or not. I would like to contribute to this discussion on the current status of North Korean nuclear capabilities and its effects, adding my original analysis on it afterward.

(2) The Process of Advanced Development

North Korean Nuclear development gained attention after the end of the Cold War when the CIA found it suspicious and, in 1992, reported it to the UN along with satellite pictures of the Nyongbyon nuclear facilities. Back then, the DPRK leader was Kim Jong Il, the father of Kim Jong Un. The Kim Jong Il regime finally declared its possession of nuclear weapons in 2004 as a result of the Iraq War in 2003, although the regime had not conducted any nuclear testing before 2006 to ensure strategic ambiguity. However, the development of the DPRK's nuclear weapons was accelerated in line with the embarkation of his son's regime.

How did the KJU regime make the significant political decision to push forward the further development of nuclear weapons beyond his father's legacy? First of all, the Fourth Conference of Representatives of the Workers' Party of Korea (WPK) was held on April 11, 2012 in order to elect Kim Jong Un as the leader of the party under the newly created title of First Secretary, and two days later, a revision of the Constitution was implemented in the Fifth Session of the 12th Supreme People's Assembly (SPA). In that revision, North Korea conspicuously defined itself as a nuclear-armed state in the preamble of its Constitution for the first time.

Next, it unanimously adopted the “Byungjin” (parallel development) policy of ‘economy and nuclear weapons’ during a plenary session of the Party Central Committee (PCC) on March 31, 2013, and a day later, the SPA passed the “law on consolidating the possession of nuclear weapons for self-defense of the state”, the so-called “April First Nuclearization Law”, which was a de-facto nuclear doctrine to indicate how the KJU regime would use nuclear weapons. After adopting this series of policies, the DPRK repeatedly emphasized the importance of the Byongjin policy in the 7th Congress of the WPK, the 2nd Plenary Session of the 7th WPK and the leader's New Year speech of 2018.

Then, what pragmatic progress did the Byongjin policy make in the advancement of nuclear weapons? I will measure it by two methods, namely by qualitative and quantitative approaches. When it comes to qualitative analysis, a meaningful event is already found on the same day when a revision of the Constitution declared it as a nuclear-possessing state. That is, a rocket named Unha-3 was launched with a satellite called Kwangmyongsong-3. On that day the launch failed, but eight months later the revised version, an Unha-3 unit-2 rocket, demonstrated a successful flight by getting a satellite into orbit.

What should be noted here is that the DPRK succeeded in launching a rocket from the newly constructed Sohae Space Center in Cholsan County, in North Pyongan Province at Tongchang-ri, that flew south for the first stage, and then launched a satellite it was carrying into a Sun-synchronous orbit after accordingly changing the trajectory at the third stage. This indicated that North Korean three-

26 S. Hecker (Dec. 4, 2017), “What We Really Know About North Korea's Nuclear Weapons-And What We Don't Yet Know for Sure-”, *Foreign Affairs*, <https://www.foreignaffairs.com/articles/north-korea/2017-12-04/what-we-really-know-about-north-koreas-nuclear-weapons>, accessed on Dec. 2, 2018.

staged rockets could deliver nuclear warheads to the US mainland through a south satellite orbit, which could evade the US early warning system.

This is not the first time this kind of nuclear attack has been conceived. For example, the Soviet planned nuclear attacks, called “FOBS (Fractional Orbital Bombardment System)”, using a satellite orbit, which was actually banned at the SALT2²⁷.

Therefore, the Unha-3 test was the first phenomenon from which the US could possibly have perceived the DPRK as an actual threat to its homeland security, bearing in mind that North Korea had conducted two nuclear tests, in 2006 and 2009, before the Unha-3 launch. Moreover, the danger of an Electromagnetic Pulse (EMP) attack²⁸, which would have a lethal effect on the US and its allies, could not be denied at that time because an EMP attack does not need the capability of re-entry and precise guidance technology for which the KJU regime had not carried out a pragmatic test at that time. To put it another way, the lift-off of Unha-3 can be viewed as a signal notifying the US of the start of the Byongjin policy.

Nonetheless, its potential to launch nuclear attacks where a nuclear warhead is delivered through an orbiting satellite and exploded at high altitude didn't mean that North Korea had already obtained adequate capability to deter the US, since it was still vulnerable to US preventive attacks. To mount a bulky nuclear warhead that was not entirely miniaturized by nuclear fusion technology, the Unha3-like rockets needed to be large, and their boost phase would be instantly detected by the US early warning system.

Put simply, if North Korea attempted to make a surprise attack on the US with the Unha-3, then its rocket would be destroyed by the US before it had even lifted off. For that reason, the successful lift-off of Unha-3 could not be a game changer that would force the US to perceive the DPRK as an imminent and immediate threat that the US had better deal with as soon as possible.

Therefore, the KJU regime continued with the advanced development of its nuclear weapons in order to create a ‘true game changer’, the key to which was thermonuclear weapons. Thermonuclear weapons with nuclear fusion were beneficial not only because they had more destructive warheads that could give the US a massive scare, but also because by using less uranium and plutonium, which are some of the heaviest atoms in space, they could miniaturize and reduce the size of nuclear warheads.

To open its H-bomb era, the DPRK conducted nuclear tests twice in 2016. The fourth nuclear test on January 2016 was officially stated as the first H-bomb test for North Korea, and many specialists including the US and South Korea admitted that some nuclear-fusion-related technology, such as a boost-type H-bomb structure using deuterium and tritium for a facilitator to get more effective fissile

27 Miroslav Gyürösi (Apr. 2012), “The Soviet Fractional Orbital Bombardment System Program”, <http://www.ousairpower.net/APA-Sov-FOBS-Program.html>, accessed on Nov. 18, 2018.

28 I defined an EMP attack here as a nuclear attack which explodes a nuclear device at a high altitude in order that EMPs created by the nuclear explosion paralyze the enemy's electrical and electronic systems. In detail, electric magnetic waves, such as gamma rays, are able to reach to much farther targets than other kinds of radiation that are lethal to those who are exposed to it, bringing about short-circuits of electrical and electronic systems even though they are located in more remote areas than radiation alone can affect. Additionally, a low-yield nuclear detonation can cause an EMP attack. In fact, EMPs occurred in the past nuclear tests of the US and the USSR in 1962 where they detonated nuclear warheads by satellites, and then a blackout was observed in Hawaii a thousand miles away from the exploding point. For more details, see, the US Government, DoD (May 9, 2017) and for more, the 21st Century Complete Guide to Electromagnetic Pulse-Nuclear Weapon Effects (NWE) and the Threat to the Electric Grid and Critical Infrastructure HEMP, EMI, Microwave Devices-, independently published.

process with more neutrons, may have been used for the test, although most of them denied the possibility that the test was a multi-phased one²⁹.

According to the Nuclear Weapons Institute of the DPRK, the following fifth test in September 2016, which recorded the highest scale of magnitude at that time, was a nuclear test where an actual nuclear warhead was detonated³⁰. We can understand from this test that the KJU regime had succeeded in developing standardized nuclear warheads employing nuclear fusion materials, whose mass is much lighter than fission ones, so the DPRK was now able to produce smaller, lighter and more powerful warheads, and in addition possesses both uranium and plutonium-type A-bombs.

On the other hand, along with developing more sophisticated nuclear warheads utilizing nuclear fusion-technology, the DPRK endeavored to upgrade its capacity for delivering these improved nuclear bombs as described above. The key was whether or not it could develop a delivery system which established more reliable re-entry technology and higher survivability.

There are three tracks for developing delivery devices: i. Orbital Bombardment System (OBS), ii. Submarine-launched Ballistic Missiles (SLBMs) System, iii. Intercontinental Ballistic Missiles (ICBMs) System. The KJU regime has simultaneously advanced these three in a step-by-step manner for strategic purposes.

For the first track, namely OBS, the DPRK launched a Kwanmyongsong-4 satellite by a Kwangmyongsong rocket, an upgraded version of the Unha-3, in February 2016, about a month after the fourth nuclear test. This launch, following the fourth nuclear test with thermonuclear-related technology, led to an increase in the reliability of OBS that would be able to realize EMP attacks.

For the second track, North Korea intended to acquire SLBMs to enhance the survivability of delivery devices. In August of 2016, a Pukkuksong-1, or KN-11, was approximately vertically launched and achieved a 500 km flight. In that test, two significant steps in improving its survivability were observed, i.e. solid fuel and cold-launch, which enabled the DPRK to preset ballistic missiles on portable launch pads by omitting the process of fueling just before launching that is preferable when employing liquid fuel³¹. The shorter the time taken to launch ballistic missiles is, the less is the possibility of being detected by an enemy's satellites and radars. Moreover, a solid fuel-powered ballistic missiles' structure is simpler than a liquid one, reducing the possibility of technical problems occurring during the launching process.

The further necessary step for completing the development of SLBMs is having more than a few submarines. If the KJU regime achieves this, it will be able to operate a nuclear weapons' system beneath the sea in a more secretive manner. In this way, it can be safely assumed according to satellite pictures that Simpo-class submarines, loadable with SLBMs, are under construction³².

29 Yonhap News (Jan. 8, 2016), "A specialist Hecker is anxious North Korea's nuclear test can lead to technological development and miniaturization (Korean)", <http://www.yonhapnews.co.kr/northkorea/2016/01/08/1801000000AKR20160108066700009.HTML>, accessed on Oct. 8, 2017; (Jan. 19, 2016), "Boost-typed nuclear fission technology would enable North Korea to weaponize its low-grade plutonium (Korean)", <http://www.yonhapnews.co.kr/northkorea/2016/01/19/1801000000AKR20160119111300009.HTML>, accessed on Oct. 8, 2017.

30 KCNA (Sept. 9, 2016), "DPRK Succeeds in Nuclear Warhead Explosion Test", <http://www.kcna.co.jp/item/2016/201609/news09/20160909-33ee.html>, accessed on Sept. 9, 2018.

31 Some tanks of liquid fuel with hypergolic propellant can be pre-readied in ballistic missiles. However, there were several severe accidents in cases using hypergolic propellant which is very toxic and corrosive.

32 J. Bermudez, Jr. (July 20, 2017), "Sinpo South Shipyard: Preparations for a New SLBM Test?", *38North*, <http://>

The Pukkuksong-1 spun off the Unit-2 (KN15), whose tests were conducted twice in February and May 2017. These spin-offs tend to be identified as middle-range ballistic missiles (MRBMs) that can be launched from land using a Transporter Erector Launcher (TEL). When analyzing videos of the test showing the warheads changing their own positions accordingly before reentering into the atmosphere, it was noticed that the test for the Pukkuksong-2 had succeeded in warhead separation and advanced re-entry-related technology.

When TELs, solid fuel and cold-launch for launching ballistic missiles are combined with the already existing underground facilities and roads located in the DPRK, it is safe to say that the level of invulnerability of North Korean ballistic missiles will be sharply raised³³.

Finally, we will examine the third track to developing ICBM-related technology. Development was accelerated in 2017 when, on the US Independence Day, July 4, 2017, the KJU regime finally took the plunge and tested a two-staged ICBM called Hwasong-14 (KN20), on the basis of the progress Hwasong-12 had made. The Academy of Defense Science of the DPRK stated that the ICBM test began at 9 am and resulted in a maximum altitude of 2802 km, a flying distance of 933 km, and a flight time of 39 minutes³⁴. All of the data exceeded that of the Hwasong-12 (KN-17) tested in May 2017. Its actual flying distance when not selecting a lofted trajectory has been disputed, yet in the big picture, all arguments basically reached the consensus that it could have flown over 6000 km, which is beyond the orthodox definition of an ICBM that should be able to fly over 5500-km according to SALT-2.

As for the re-entry of Hwasong-14, the Academy of Defense Science of the DPRK made public that the main purpose of the flight test on July 4 was to reaffirm re-entry technology, showing its specific data where the temperature of the warhead stayed within 24-45 degrees Celsius, while pointing out that the telemetry kept successfully transmitting data during the reentering period³⁵.

This statement made by the KJU regime was validated by the following test of a Hwasong-14 on July 28, which succeeded in demonstrating a more enhanced performance by reaching an altitude of approximately 3724.9 km, a distance of 998 km, and a flight time of 47 minutes, outstripping the previous test's results.

Particularly, in the second test of a Hwasong-14, the Japanese NHK news reported that a flashing object that appeared to be a mock warhead or its second stage was seen landing nearly vertically on the water, about 170 km west of the west coast of Hokkaido³⁶. If the flashing object remained nearly intact for a while after reentering the atmosphere, the DPRK might have made progress towards possessing suitable re-entry vehicles and guidance technology. The fact remains that North Korea successfully got either the mock warhead or its second stage to land on the sea in an area which was only approximately 170-km away from Japanese territory, despite the risk that the remains of the tested Hwasong-14 could have inadvertently hit Hokkaido soil, which might have resulted in a

www.38north.org/2017/07/sinpo072017/, accessed on July 21, 2017.

33 A picture of TEL located in an underground pathway was made public in a report about a celebration party for a successful flight of Hwasong-14.

34 KCNA (July 4, 2017), "Report of DPRK Academy of Defence Science", http://www.kcna.co.jp/item/2017/201707/news04/201707_04-21ee.html, accessed on Nov. 18, 2018.

35 KCNA (July 5, 2017), "Kim Jong Un Supervises Test-launch of Inter-continental Ballistic Rocket Hwasong-14", <http://www.kcna.co.jp/item/2017/201707/news05/20170705-01ee.html>, accessed on July 6, 2017.

36 NHK News (July 29, 2017), "NHK's cameras detected some flash (Japanese)", http://www3.nhk.or.jp/news/html/20170729/k100_11079571000.html, accessed on July 31, 2017.

retaliatory strike from Japan and its closest ally, the US, in the name of self-defense.

After the second Hwasong-14 test, the DPRK announced: “[T]he test-launch was aimed to finally confirm the overall technological specifications of the weapon system of a Hwasong-14 capable of carrying a large-sized heavy nuclear warhead, including its maximum range³⁷”, and confirmed “[T]he attitude control features of a heavy warhead in the mid-flight stage after the separation of the warhead were reconfirmed, and the accurate guidance and attitude control of the warhead was ensured upon atmospheric reentry at a launch angle steeper than the actual maximum range flying conditions”.

It indicates that North Korea thought the development of the ICBM Hwasong-14 was complete after confirming the capacity of its reentry technology through that test. Whether or not the KJU regime had actually established their reentry technology by the second Hwasong-14 test is however still disputable³⁸.

The KJU regime continued ICBM advancement to end the dispute around Hwasong-14. Hwasong-15 (KN-22), another ICBM having a much larger size than Hwasong-14, was launched at 2:48 am, on November 29, 2017. This two-stage ICBM was fitted with a new Gimbal engine using liquid propellant, and all its specifications were upgraded from the previous tests. It soared to 4475 km, the highest altitude ever, and flew a distance of 950 km with a flight time of 53 minutes, which indicates that North Korea aimed to conduct a more pragmatic drill that night.

Furthermore, this test launch used the 9-axis self-propelled launching vehicle whose mobility undoubtedly strengthened the survivability of ICBMs, and a round nose-cone whose shape differed from the Hwasong-14. The DPRK implied its ability to develop multi-reentry-vehicles (MRVs), while improving their accuracy as well.

As a result, North Korea's perception of its own ICBM system is demonstrated in the statement that “[T]he ICBM Hwasong-15 type weaponry system is an intercontinental ballistic rocket tipped with super-large heavy warhead which is capable of striking the whole mainland of the U.S.³⁹”. This means that, from the perspective of the KJU regime, the DPRK now possesses the capacity to attack the US mainland with a super-heavy nuclear warhead that seems to be able to contain MRVs. This perception is tightly linked with the new year address Kim Jong Un made on January 1, 2018, declaring “[T]he whole of its mainland is within the range of our nuclear strikes and the nuclear button is on my office desk all the time⁴⁰”.

This DPRK subjective view on the Hwasong-15 has been more or less shared by many nation states, mass media and specialists, acknowledging that, should it take a conventional angle for firing and use an around 400-km altitude to deliver its warheads, Hwasong-15, with an over 1000 kg

37 KCNA (July 29, 2017), “Kim Jong Un Guides Second Test-fire of ICBM Hwasong-14”, <http://www.kcna.co.jp/item/2017/201707/news29/20170729-04ee.html>, accessed on July 30, 2017.

38 There are discussions on how far Hwasong-14 can fly and how heavy a payload it can carry. M. Elleman (Nov. 29, 2018), “North Korea's Hwasong-14 ICBM: New Data Indicates Shorter Range Than Many Thought”, *38 North*, <https://www.38north.org/2018/11/melleman112918/>, accessed on Dec. 1, 2018; J. Lewis (Nov. 9, 2018), “DPRK RV Video Analysis”, <https://www.armscontrolwonk.com/archive/1206084/dprk-rv-video-analysis/>, accessed on Dec. 1, 2018.

39 KCNA (Nov. 29, 2017), “DPRK Gov't Statement on Successful Test-fire of New-Type ICBM”, accessed on Nov. 18, 2018.

40 KCNA (Jan. 1, 2018), “Kim Jong Un Makes New Year Address”, <http://www.kcna.co.jp/item/2018/201801/news01/20180101-22ee.html>, accessed on Oct. 5, 2018.

payload⁴¹, can probably fly over 13000 km, which is further than the 11000 km needed to reach Washington DC and New York City.

(3) Fortifying Existing Deterrence

Meanwhile, the KJU regime has not overlooked reinforcing its deterrence backed by conventional tactical weapons. In 2012, Kim Jong Un drew up a plan to develop a “new-type large-caliber multiple launch rocket system⁴²”. Four years later, a final test fire of the new-type large-caliber multiple launch rocket system (KN-09), upgraded from a 240 mm to 300-mm one which could reach targets within a range of about 200 km carrying a warhead approximately of 100-150 kg, was conducted under the guidance of Kim Jong Un himself. His purpose was “for estimating the might of a controlled ordnance rocket warhead for large-caliber multiple launch rocket systems of a new type to be deployed in the reserve artillery units of the Korean People's Army⁴³.”

This test also indicates that the conventional tactical deterrent, by which the Kim Jong Il was effectively able to put the fear into Seoul that it could have been totally burnt out if the second Korean War were to take place, has been keenly strengthened by his son, Kim Jong Un⁴⁴. What should be noted here is that Vladimir Putin, the current president of Russia, testified in 2017 that, during the summit held in 2001, Kim Jong Il had told him that the DPRK possessed A-bombs which were able to be simply delivered to Seoul by its rocket system⁴⁵. Those A-bomb-loadable rocket launchers that Kim Jong Il developed are what Kim Jong Un has advanced as such⁴⁶.

Eventually, Kim Jong Un clarified that the latest test of advanced tactical weapons, conducted in November 2018, was “the weapon system whose development Chairman Kim Jong Il had chosen personally and directed step by step with his special attention paid to it was born at last⁴⁷”.

In this way, Steve Bannon, the former chief strategist for the US President D. Trump, counted the North Korean conventional rocket system, deployed along the border between North and South Korea, as the main cause that ten million people in Seoul would die in the first 30 minutes of the possible conflict, so that “there’s no military solution⁴⁸” until the main cause is removed.

41 Its payload can be over 3,000kg according to the data of SS-19, whose capability is close to it and can deliver 3,355kg warhead containing six MIRVs.

42 Although rockets can typically be distinguished from missiles considering that the former do not have a precision-guided-function, while the North Korea’s rockets are actually precision-guided, this article still calls it the new large-caliber multiple “rocket” system because the official statement the Kim Jong Un regime published after the test fire conducted on March 4, 2016, named it as such.

43 KCNA(Mar. 4, 2016), “Kim Jong Un Guides Test-fire of New Multiple Launch Rocket System (Korean ver.)”, <http://www.kcna.co.jp/calendar/2016/03/03-04/2016-0304-009.html>, accessed on Oct. 18, 2018.

44 Also, an artillery drill, the largest ever, using rocket systems was implemented on April 25, 2017.

45 Sputnik (Oct. 4, 2017), “Kim Jong Il Revealed the Possession of an A-bomb in 2001, Said Putin (Japanese ver.)”, <https://jp.sputniknews.com/politics/201710044150323/>, accessed on Oct. 18, 2018.

46 Kim Jong Un implied after the final test fire that the development of a rocket system was one of the moves to strengthen its nuclear force in the same statement: “[T]he only way for defending the sovereignty of our nation and its right to existence under the present extreme situation is to bolster up nuclear forces both in quality and quantity and keep a balance of forces”.

47 KCNA (Nov. 16, 2018), “Supreme Leader Kim Jong Un Supervises Newly Developed Tactical Weapon Test”, <http://www.kcna.co.jp/item/2018/201811/news16/20181116-04ee.html>, accessed on Nov. 18, 2018. An atomic canon which was able to deliver a 350-kg nuclear warhead was tested by the US in 1953.

48 Robert Kuttner (August 16, 2017), “Steve Bannon, Unrepentant”, *The American Prospect*, <http://prospect.org/>

In parallel, the KJU regime conducted various forms of drills to steadily improve the quality of utilizing its ballistic missiles in more pragmatic situations. In September 2016 and March 2017, it fired several ballistic missiles simultaneously in each test, to confirm obtaining the capability for saturation attacks viewed as a countermeasure against MD. In March 2016 and April 2017, the test fires for detonating nuclear warheads at preset altitudes were observed so as to maximize the effect of not only a nuclear explosion, but also an EMP. In the context of being ready for an actual war, a Hwasong-14 was surprisingly fired from Mupyongri at midnight, a ploy which no one could have anticipated being used beforehand.

Following those tests, in May 2017, the KJU regime fired ballistic missiles with fin-actuation systems employing four fins that could change the trajectory in mid-flight, and could hit their target in accordance with radar guidance. In the same month, the DPRK made a public announcement that Pukkuksong-2 had been deployed and was under mass-production.

North Korea's efforts to develop a maneuverable reentry vehicle (MaRV) were observed in the missile (KN-23) tests conducted in May 2019 as well. Its solid-fueled, short-range missiles launched by TELs, showcased their equivalent capabilities to "Iskander", which is a cutting-edge SRBM deployed by Russia. During the tests one of them flew approximately 420km at an altitude 40-45 km and performed complicated maneuvers. This means the DPRK, was becoming more invulnerable to a US first strike, has successfully improved its retaliation capabilities since it can launch them in about 4-15 minutes and, with great probability, can evade South Korea's MD systems, KAMD and THAAD, which now focus only on coping with existing ballistic missiles with a typical trajectory. Moreover, the new short-range missiles are seen to be capable of carrying a 710-800 kg nuclear warhead and their range can be extended further when considering the history of missile development.

Additionally, the DPRK's capability to deter the US force located in the Asia Pacific operational theater was strengthened by the two test fires of Hwasong-12 in August and September of 2017. They were launched from TELs and accomplished a 3700 km flight, indicating that Hwasong-12 would be able to hit Guam in a pragmatic way based on its highly developed readiness and survivability⁴⁹. As this test was completed successfully, the DPRK declared Hwasong-12 had become battle-ready.

After the series of drills regarding warfare, the KJU regime made another breakthrough in the development of nuclear detonation technology. At 12:00 on September 3, 2017, the sixth nuclear test was accomplished with the largest magnitude seismic shock, M6.1-6.3, ever recorded. According to the statement issued by the Nuclear Weapons Institute of the DPRK, it tested a two-staged thermonuclear bomb to be inserted as the payload of an ICBM and its every process was successfully confirmed, while Kim Jong Un directly guided its test⁵⁰.

article/steve-bannon-unrepentant, accessed on Nov. 18, 2018. Also, in Oct. 2017, Hong Jun Pyo, Former Leader of Liberty Korea Party which is now the largest opposition party in ROK, said the US estimated that it would take about one week to devastate the North Korea's rocket system.

49 In the statements regarding Hwasong-12 drills in 2017, the DPRK said the main purpose was to reinforce its retaliation capability and confirm the command procedures when it comes to launching Hwasong-12, while Kim Jong Un revealed that "our final goal is to establish an equilibrium of real force with the U.S. and make the U.S. rulers dare not talk about a military option for the DPRK."

50 KCNA(Sept. 3, 2017), "DPRK Nuclear Weapons Institute on Successful Test of H-bomb for ICBM", <http://www.kcna.co.jp/item/2017/201709/news03/20170903-13ee.html>; "Kim Jong Un Gives Guidance to Nuclear Weaponization", <http://www.kcna.co.jp/item/2017/201709/news03/20170903-01ee.html>, accessed on Sept. 21, 2018

Whether it was a two-stage H-bomb or a boost-type one was disputed back then, yet it would likely have been the former, considering the five factors below. Firstly, North Korea possesses the A-bombs necessary for creating the extremely high pressure and high temperature of at least 40 million degrees Celsius that is a significant precondition for creating a nuclear fusion reaction, namely a D-T reaction.

Secondly, Lithium, which is also an indispensable component in producing tritium for facilitating D-T reactions⁵¹, can be mined from the DPRK's soil and North Korea has attained the skill to process lithium ore into lithium deuteride⁵². Thirdly, uranium ore, U235 and U238, which are used for the primary detonation device and tamper of thermonuclear weapons, is abundant in North Korea. Fourthly, in the pictures released by the DPRK just before its test was done, the design of the casing that would have been used seemed “gourd-like”, a very typical shape for a thermonuclear bomb casing.

Finally, the yield deduced by the magnitude of its seismic wave, achieved a magnitude of 160 - 300kt, which is quite a typical figure for thermonuclear tests⁵³. Moreover, if it was to be loaded onto new ICBMs, miniaturization by a nuclear fusion chain reaction is a more rational choice than developing a boosted fission weapon, using fusion materials for emitting more neutrons to facilitate a nuclear fission reaction, for which the possibilities of miniaturization are limited.

Another point here is that in the official statement on the sixth nuclear test, the DPRK clearly stated its H-bombs “can be detonated even at high altitudes for a super-powerful EMP attack according to strategic goals⁵⁴”, from which we can infer that it is no longer disputable whether North Korea has the intention to implement an EMP attack.

(4) Quantitative Analysis

Next, I will quantitatively analyze the advancement of the nuclear weapons under the KJU regime. From January 2012 to October 2018, for a period of six years and nine months, missile tests including satellite-mounted rockets and ballistic missiles were counted at least 86 times⁵⁵, which is approximately five times as many as those of the Kim Jong Il regime. Apart from sharply increasing the number of missile tests, the KJU regime has three new features in its delivery system development.

Firstly, its test sites have varied. Under the previous regime, only two sites, Kitteryong and Tonghae Satellite launching grounds were used, but the current regime has launched rockets and missiles from Gusong, Mupyongri, Pukchang, Nampo, and Pyongyang International Airport in addition to the two sites above. The diversification of missile test sites indicates that the KJU regime has been making every effort to diversify its delivery system, such as employing TELs and SLBMs, so

51 D-T reaction generates about 17Mev which is greater than a D-D reaction or nuclear fission ones.

52 North Korea used to sell lithium⁶ online. The UN, “Report of the Panel of Experts established pursuant to resolution 1874 (200- 9)”, <http://undocs.org/S/2017/150>, accessed on Oct. 9, 2018.

53 The latest analysis on how many kilotons the sixth nuclear test yielded was provided by a research group of Lamont-Doherty Earth Observatory of Columbia University. David P. Schaff, the project leader, said “Its magnitude (M6.3) was rather clearer than its nature: about 250 kilotons or about 17 times the size of the bomb that destroyed Hiroshima.” Also, it reveals that the 6th nuclear test created 80m-diameter cavity underground.

54 KCNA (Sept. 3, 2017), “Kim Jong Un Gives Guidance to Nuclear Weaponization”, http://www.kcna.co.jp/item/2017/201709/news_03/20170903-01ee.html, accessed on Sept. 21, 2018.

55 If we include the three-four short-range missiles the DPRK tested in May 2019, the number of missile tests conducted since 2012 has increased to about 89-90 times.

as to overcome its vulnerability. Moreover, the fact that test sites near Pyongyang were employed for ballistic missile tests while its leader was closely watching can be understood as a sign from North Korea that its delivery systems were fully trustworthy, since ballistic missiles have to contain very toxic materials for propellant and a failed launch test could have resulted in a severe incident.

Secondly, the types of missiles have varied. The former regime tested four kinds, such as Scud-C, Nodong, Tepodong, and Unha-rockets, whereas the KJU regime seems to have fired five types of Scuds, such as ER/B/B MaRv/C/C MaRV, and eight kinds of rockets and ballistic missiles, Hwasong 12/14/15, Musudan, Pukkungsong 1 and 2, Iskandar-like missiles and Unha rockets. The diversification of the types of missiles was most likely done to strengthen the survivability, while confirming how to use them in a more realistic way so that it would be possible to break an enemy's MD.

Finally, the range of missiles launched has been longer. As the 2017 New Year Speech pointed out that North Korea was at the final stage in its ICBM's development, the Kim Jong Un regime emphasized the development of ICBMs, and regarding the test results of Hwasong14-15 backed by achieving the revolutionary 3.18 engines, it has seemingly succeeded in the possession of ICBMs which are able to reach the US mainland, but which are not perfectly reliable yet.

As for nuclear detonations, the KJU regime has conducted four more nuclear tests in six years so far than the Kim Jong Il regime's two nuclear tests in about 17 years. Also, the yields of the third through sixth nuclear tests that the KJU regime conducted have shown a surge in comparison with those of the previous regime. For example, the yield of the second nuclear test was estimated at around 1kt, while the sixth nuclear test achieved a 160-300kt-sized seismic shockwave, which means its explosive power has become 150-300 times more powerful than that of the previous regime.

Another significant scientific piece of data on the North Korean nuclear weapons indicates how many nuclear weapons the DPRK possesses. The US intelligence agency reportedly tends to estimate that the number of nuclear weapons is 20 - 60 or more⁵⁶, and so does South Korea: Cho Myong Gyun, the ROK Unification Minister back then, stated in the Diet in 2018 that the ROK intelligence agency analyzes the DPRK possesses at least, 20, and at most, 60 nuclear weapons⁵⁷. Siegfried Hecker, who is a professor of Stanford University and personally witnessed the state-of-the-art centrifuges in Nyongbyon in 2010, estimates the number would be approximately 30 based on the experiences of his four visits to North Korea⁵⁸, while according to David Albright, the President of the Institute for Science and International Security (ISIS), "North Korea had about 14 - 33 nuclear weapons" at the end of 2017⁵⁹.

To sum up, the number of nuclear weapons stockpiled by the KJU regime seems to be not less than

56 D. Sangar (Mar. 9, 2018), "How Would U.S. Verify That North Korea Is Disarming?", *NY Times*, <https://www.nytimes.com/2018/03/09/us/politics/trump-north-korea-nuclear-missiles.html>, accessed on Oct. 5, 2018; E. Albert (June 6, 2018), "What Are North Korea's Military Capabilities?", *Foreign Affairs*, <https://www.cfr.org/background/north-koreas-military-capabilities>, accessed on Oct. 5, 2018.

57 Yonhap News (Oct. 1, 2018), "The South Korean Unification Minister Said North Korea would possess 20-60 nuclear weapons (Korean)", <https://headlines.yahoo.co.jp/hl?a=20181001-00000066-yonh-kr>, accessed on Oct. 2, 2018.

58 JTBC (Sept. 28, 2018), "US Nuclear Scientist, Hecker Mentioned it was a Surprise that North Korea Made a Decision on the Abandonment of Nyongbyon (in Korean)", <http://news.jtbc.joins.com/html/059/NB11702059.html>, accessed on Sept. 29, 2018.

59 D. Albright, "Understanding North Korea's Nuclear Weapon Capabilities", *ISIS*, <http://isis-online.org/isis-reports/detail/unders-tanding-north-koreas-nuclear-weapon-capabilities/>, accessed on Oct. 5, 2018.

30, and Kim Jong Un clearly ordered the mass-production of nuclear weapons on January 1, 2018⁶⁰.

(5) Perception Changes and Survivability in Terms of Nuclear Deterrence Theory

As has been shown above, the KJU regime has advanced its nuclear weapons arsenal by additionally conducting four nuclear tests, including a thermonuclear one, and about 90 missile tests, including an ICBM that can hit Washington DC and New York City, while continuing to strengthen its traditionally conventional deterrence.

In this way, some perception changes have been observed in both the Kim Jong Un and the Trump regimes. What is important here is that, in terms of the nuclear deterrence theory, the perception is more important than the fact. In other words, how the US perceives the DPRK's advanced nuclear weapons is more vital than its real capability, so that these perception changes can possibly have an influence on the deterrence relationship since the advancement of the nuclear weapons under the KJU regime has proven the "chance"⁶¹ that B. Brodie mentioned as well.

As for the DPRK's perception on its advancement of nuclear weapons, Kim Jong Un declared on the day Hwasong-15 was launched: "Now we have finally realized the great historic cause of completing the state's nuclear force, the cause of developing our rocket power"⁶². Furthermore, he stated on January 1, 2018 that "[B]y also conducting tests of various means of nuclear delivery and super-intense thermonuclear weapons, we have attained our general orientation and strategic goal with success"⁶³. He continued that its advanced nuclear weapons brought about "a powerful and reliable war deterrent", which the DPRK sees as able to thwart and counter "any nuclear threats from the United States, and they constitute a powerful deterrent that prevents it from starting an adventurous war. In no way would the United States dare to ignite a war against me and our country"⁶⁴.

Before the emergence of the self-perception that the DPRK had completed its nuclear force that could deter the US's military actions against it, the KJU regime clearly made every effort to create a higher nuclear deterrent that could build a de-facto 'nuclear equilibrium' with the US. For instance, the Foreign Ministry of the DPRK issued a public statement on September 13, 2017, containing the words "establishing a practical equilibrium with the US"⁶⁵. Also, its Foreign Minister Ri Yong Ho declared in an interview with Tass Russian News Agency that the DPRK was getting close to its final goal of building an equilibrium with the US by force⁶⁶. From the perspective of nuclear deterrence theory, this nuclear equilibrium could mean that North Korea would aim to establish MAD with the US.

However, the KJU regime immediately stopped carrying out further nuclear advancement, taking a moratorium on nuclear and missile tests since the Trump administration's perception changes had been observed. In the earlier phase, D. Trump took a warlike attitude to the Kim Jong Un regime,

60 KCNA (Jan. 1, 2018), "Kim Jong Un Makes New Year Address", <http://www.kcna.co.jp/item/2018/201801/news01/20180101-22ee.html>, accessed on Oct. 5, 2018.

61 Brodie, *Op.cit.*, p.60.

62 KCNA (Nov. 29, 2017), "DPRK Gov't Statement on Successful Test-fire of New-Type ICBM", <http://www.kcna.co.jp/item/2017/201711/news29/20171129-07ee.html>, accessed on Nov. 18, 2018.

63 KCNA, *Op.cit.*.

64 *Ibid.*

65 KCNA (Sept. 13, 2017), "DPRK FM Categorically Rejects Harshes-ever UNSC's "Resolution on Sanctions"", <http://www.kcna.co.jp/item/2017/201709/news13/20170913-03ee.html>, accessed on Nov. 18, 2018.

66 Reuters (Oct. 11, 2017), "Trump would trigger the war, says the DPRK Foreign Minister (Japanese)", <https://jp.reuters.com/article/northkorea-missiles-trump-1011-idJPKBN1CG2IK>, accessed on Oct. 12, 2017.

calling him a 'Little Rocket Man', and reportedly sought to realize a preventive attack, the so-called operation Bloody Nose, which involved pinpoint-bombing North Korea's nuclear-related facilities before its nuclear weapons were fully developed, according to *Fear* 'Woodward-2018'.

Nevertheless, after November 29, 2017, US president D. Trump determined to make a political about-face in line with the following CIA's altered evaluation on North Korea's ICBMs which foresaw that they would be perfected within several months⁶⁷. As for the CIA's modified evaluation, Mike Pompeo, the CIA Director back then and now Secretary of State, mentioned in an interview with the BBC in January 2018 that Kim Jong Un would possess the capability to deliver a nuclear weapon to the US in a matter of a handful of months⁶⁸. Furthermore, John Bolton, the current US National Security Advisor, visited London and House of Commons at the end of November 2017 to relay that, "CIA chiefs have told Donald Trump that he has a three-month window in which to act to halt the North's ICBM program, after which the North Koreans will have the capability to hit US cities, including Washington DC, with a nuclear payload."⁶⁹

Ahead of it, "I do agree in principal with the assessment that the North Koreans are moving quickly to develop an intercontinental ballistic missile capability⁷⁰" Paul Selva, the vice chairman of the U.S. Joint Chiefs of Staff, the second-highest ranking military officer in the US, told the Senate Armed Services Committee on July 11, 2017. This means the possibility that the North Korea's ICBMs would reach the US mainland was already perceived by US decision makers even after the first test of Hwasong14. Meanwhile, on October 9, 2017, US Army Chief of Staff Gen. Mark Milley, who participated in a "war planning⁷¹" meeting held in February of 2018 for a war with North Korea, and was appointed as the next chairman of the Joint Chiefs of Staff by D. Trump in December 2018,

67 H. McMaster, the former assistant to the President, D. Trump, for National Security Affairs, testified there was a policy change from war-oriented to diplomacy-oriented in the Trump administration back then, and if no policy change to have a summit with North Korea had happened, it would have gone to a war in an interview with *Asahi Shimbun* on June 1, 2019. Minemura Kenji (June 1, 2019), "Interview with the Former Security Advisor H. McMaster (in Japanese)", *Asahi Shimbun*, <https://www.asahi.com/articles/DA3S1403830-7.html>, accessed on June 1, 2019; "Q: How much of a possibility of military conflict was there in 2017 when U.S. bombers joined a military exercise over the Korean Peninsula? A: I do think that we were on a path that, if we were unable to alter it, that it was on a path to conflict.", Minemura Kenji (June 1, 2019), "INTERVIEW: Ex-Trump top adviser justifies hard-line stance toward N. Korea", *Asahi Shimbun*, <http://www.asahi.com/ajw/articles/AJ201905130014.html>, accessed on June 1, 2019

68 The Japan Times (Jan. 31, 2018), "North Korea may perfect an ICBM within months, U.S. general says", <https://www.japantimes-s.co.jp/news/2018/01/31/asia-pacific/not-yet-north-korea-soon-perfect-icbm-knows-spy-satellites-pass-u-s-general/#.W97XrO-6zIU>, accessed on Nov. 4, 2018.

69 Mark Seddon (Dec. 4 2017), "Have we got just three months to avert a US attack on North Korea?", *The Guardian*, <https://www.theguardian.com/commentisfree/2017/dec/04/three-months-avert-us-strike-north-korea-nuclear-missile-kim-jong-un>, accessed on Nov. 4, 2018.

70 R.Kheel (July 18, 2017), "General: North Korean missiles 'clearly' have range to reach US", *The Hill*, <http://thehill.com/policy/defense/342494-general-north-korea-missiles-clearly-have-range-but-not-accuracy-to-hit-us>, accessed on July 19, 2017.

71 After it finished, Defense Secretary James Mattis said a war with North Korea would be catastrophic. He and Gen. J. Dunford Jr., the chairman of the Joint Chiefs of Staff, argued forcefully for using diplomacy to address North Korea's nuclear program. Also, Gen. Milley stated that "the brutality of this will be beyond the experience of any living soldier". *The New York Times* (Feb. 28, 2018), "U.S. Banks on Diplomacy With North Korea, but Moves Ahead on Military Plans", <https://www.nytimes.com/2018/02/28/world/asia/us-north-korea-military-war-planning.html>, accessed on Dec. 12, 2018.

made it clear that when it comes to solving the challenges of North Korea's nuclear and missile programs there are “no risk-free options⁷²”.

In addition, Gina Haspel, the incumbent CIA Director, stated “2017 was a very difficult year where North Korea conducted an unprecedented level of testing; they conducted a major nuclear test they claimed it was a thermonuclear device; they conducted a unprecedented number of missile tests... around 24 including three ICBM tests. ...I will say that I do think that sitting here today in 2018 that we are in a better place than we were in 2017 because of the dialogue we have established between our leaders⁷³”. This is a clear signal that the CIA has seen Hawasong-14 and 15 as ICBMs capable of threatening US security, and believes the US has become safer than it was in 2017 through the dialogues between US and DPRK leaders.

Moreover, these US perception changes can be confirmed by the fact that, on May 30, 2017, the Trump administration determined to conduct a GMD(the Ground-based Midcourse Defense) drill in which the US shot down an ICBM-like target for the first time⁷⁴, and, in the same context, on July 20, 2017, the Hawaii Emergency Management Agency declared the start of an educational campaign in order to prepare for possible nuclear strikes from North Korea. These actions wouldn't have been put into practice without US perception changes.

After the US perception that North Korea would be able to attack the US mainland emerged, the US-DPRK intelligence-led negotiations began at approximately the end of 2017, the Inter-Korean relationship was dramatically improved since the Pyongchang Olympics in February 2018, and at last the historic summit between the US and DPRK, which had not occurred for over 70 years, was held in Singapore with South Korea's Moon Jae-in administration acting as an intercessor.

Advancing the talks based on both sides' perception changes about the advancement of the DPRK's nuclear weapons, the KJU regime officially declared the victory of the parallel policy and strategically determined instead to go for a new social economic growth-oriented policy at the April plenary meeting of the Central Committee of the WPK in 2018.

Meanwhile, the US-DPRK summit in Singapore was held and the US president and the DPRK chairman signed a joint statement in which the two leaders agreed on establishing new US-DPRK relations, building a lasting and stable peace regime, committing to denuclearization of the Korean Peninsula, and recovering POW/MIA remains. This is clearly the fruit of the US-DPRK leaders' perception changes. After the Singapore summit finished, D. Trump made public his perception change on North Korea, tweeting “[B]efore taking office people were assuming that we were going to war with North Korea. President Obama said that North Korea was our biggest and most dangerous problem. No longer - sleep well tonight!⁷⁵” and “Just landed - a long trip, but everybody can now feel much safer than the day I took office. There is no longer a Nuclear Threat from North Korea⁷⁶”, which

72 Ryan Browne (Oct. 10, 2017), “US Army chief: ‘No risk-free options’ on North Korea”, *CNN*, <https://www.cnn.com/2017/10/09/politics/north-korea-us-army-no-risk-free-options/index.html>, accessed on Dec. 12, 2018.

73 An So Yeong (Sept. 25, 2018), “CIA Director, ‘North Korea wouldn't give up its nukes easily’(Korean)”, <https://www.voakorea.com/a/4585323.html>, accessed on Dec. 1, 2018.

74 In March 2019, the US conducted the second GMD test, which was to evaluate the GMD system by using a two Ground-Based Interceptor (GBI) salvo shot doctrine against a realistic ICBM target. The MD test launching two GBIs nearly simultaneously is unprecedented in the US.

75 D. Trump tweets on June 12, 2018, <https://twitter.com/realDonaldTrump/status/1006839007492308992>, accessed on June 14, 2018.

76 D. Trump tweets on June 12, 2018, <https://twitter.com/realDonaldTrump/status/1006837823469735936>, accessed

also indicates that the US president's perception on the DPRK was changed from a military-oriented to a diplomacy-oriented one.

After the second summit in Hanoi, held in February 2019, where it was decided to keep negotiating, having not yet reached the conditions for issuing a Joint Statement, the current US president's perception of the DPRK as a direct and imminent threat to the US mainland so that talks with the DPRK can be viewed as a better choice than a war that would escalate to a nuclear disaster, has basically remained unchanged. Regarding the historic "Executive Order on Coordinating National Resilience to Electromagnetic Pulses"⁷⁷ signed by himself on March 26, 2019, he wouldn't have ordered it if he hadn't got the perception that the US mainland was already exposed to the great risk of an EMP attack that an ICBM and OBS can create, which is exactly what the DPRK mentioned in its official statement on the 6th nuclear test.

Likewise, at the administrative level, the US defense community's perception is consistent with Trump's. On April 1, 2019, the US Department of Defense released a paper that acknowledged North Korea had already demonstrated "its ability to strike the US homeland"⁷⁸ by its three ICBM tests. Gen. Terrence O'Shaughnessy, US Air Force Commander, testified in the Hearing of the Senate Armed Services Committee on April 3, 2019 that "North Korea's ICBM program turned the corner in 2017 when North Korea successfully flight-tested multiple ICBMs capable of ranging the continental United States and detonated a thermonuclear device, increasing the destructive yield of its weapons by a factor of ten. Following these successes, Kim Jong Un declared the completion of his nuclear ICBM research and development program, implying the production and deployment of these systems would soon follow"⁷⁹. Finally, Acting U.S. Defense Secretary Patrick Shanahan also mentioned "[W]e acknowledge that North Korea has neared a point where it could credibly strike regional allies, U.S. territory, and our forward-deployed forces. North Korea remains an extraordinary threat and requires continued vigilance" on June 1, 2019.

Furthermore, D. Trump's diplomacy-oriented attitude to North Korea seems to be holding firm, considering the disputed tweet making it public that he had ordered the withdrawal of additional sanctions the US Treasury imposed⁸⁰, in addition to making the decision to end the large-scale joint military exercises, commonly known as Foal Eagle and Key Resolve. Meanwhile, on April 13, D. Trump tweeted that "a third Summit would be good"⁸¹⁸².

on June 14, 2018.

77 The White House (Mar. 26, 2019), "Executive Order on Coordinating National Resilience to Electromagnetic Pulses", <https://www.whitehouse.gov/presidential-actions/executive-order-coordinating-national-resilience-electromagnetic-pulses/>, accessed on Mar. 27, 2019.

78 US Department of Defense, "US Nuclear Weapons: Claims and Responses", <https://media.defense.gov/2019/Apr/01/2002108036/-1/-1/1/U.S.-NUCLEAR-WEAPONS-CLAIMS-AND-RESPONSES.PDF>, accessed on April 3, 2019.

79 The US Senate, "STATEMENT OF GENERAL TERRENCE J. O'SHAUGHNESSY, UNITED STATES AIR FORCE COMMANDER", https://www.armed-services.senate.gov/imo/media/doc/OShaughnessy_04-03-19.pdf, accessed on April 4, 2019.

80 D. Trump tweets on Mar. 22, 2019, <https://twitter.com/realDonaldTrump/status/1109143448634966020>, accessed on Mar. 23, 2019. D. Trump confirmed this tweet during a press conference on Mar. 29, 2019.

81 D. Trump tweets on April 13, 2019, <https://twitter.com/realDonaldTrump/status/1117033379776667648>, accessed on April 15, 2019.

82 D. Trump reconfirmed his will to have another summit with KJU on June 6, 2019, saying "I look forward to seeing him in the appropriate time". Yonhap News (June. 6, 2019), "(LEAD) Trump disputes report of N.K. officials'

Considering these facts shown above, it is safe to say that the survivability of the KJU regime has been steadily improving up to the present, compared to its previous condition when its advanced nuclear weapons had yet to appear and no direct communications between the US-DPRK decision-makers through summits had occurred.

Firstly, in the view of nuclear-deterrence theorists, a US preventive attack can be seen as extremely hard to put into action. As Bannon pointed out, the US currently doesn't have any 100% prevention strategy that could disable the DPRK's large-caliber multiple launch rocket system, possibly nuclear-bomb-loaded, that could be used for attacking South Korea. Its short- and mid-range ballistic missiles, whose survivability has been sharply improved with TELs are another object of scrutiny for the US and its allies when mapping out a prevention plan⁸³.

Moreover, the risk that US soil would be attacked by the North Korea's ICBMs with H-bomb-loaded warheads has tended to force the US to take a risk-aversion policy now that, as pointed out by Pompeo and Bolton, the deadline when North Korea would perfect ICBMs capable of reaching the US mainland has passed.

In addition, the current US Ground-Based Midcourse Defense (GMD⁸⁴) is viewed to still be ineffective if over 12 ICBMs are simultaneously fired at the US mainland carrying H-bombs that could be detonated at various altitudes, several of which would probably be set off at an altitude of 150-400 km, a height suitable to evade the THAAD system and generate an EMP.

Thus, essentially, the US would lose its assets in the US mainland and its allies' territories when conducting its first strike on the KJU regime, which would be the beginning of the political and economic downfall of the US and, therefore, the power of China would relatively increase.

Both in the military and political senses, the possibility of a US preventative attack has clearly declined. In other words, the KJU regime has established, at least, a minimum deterrent to be able to deter a US preventative attack⁸⁵, which can also enhance crisis stability between the US and the DPRK⁸⁶.

Secondly, the US and the DPRK have been engaged in talks that can improve the DPRK's survivability as well. The KJU regime has undertaken a new policy that emphasizes its economic growth now that its nuclear development is completed, which signals the regime wishes to turn its nuclear force with its advanced nuclear weapons into a diplomatic card to negotiate with the US. Meanwhile, the Trump administration now also prefers 'Fully, Final, Verified Denuclearization'

execution", <https://en.yna.co.kr/view/AEN20190606000251315?section=search>, accessed on June 7, 2019.

83 When North Korea's retaliation is conducted through its military facilities underground, US preventive air-strikes wouldn't be enough to eliminate all the DPRK's force for retaliation. A. Denmark (Jan. 9, 2019), "The Myth of the Limited Strike on North Korea-Any U.S. Attack Would Risk a War", *Foreign Affairs*, <https://www.foreignaffairs.com/articles/north-korea/2018-01-09/myth-limited-strike-north-korea>, accessed on Dec. 2, 2018.

84 The US has currently deployed 44 GBIs in silos and the four interceptors are needed to shoot down an ICBM. The GMD can be enhanced by increasing its number and improving the capability of GBIs. Also, in May 2017, the first test where GMD shot down a ICBM-like target was conducted.

85 Before 1980, China had not deployed its ICBMs and SLBMs, but had succeeded in ICBM tests. However, China could deter the US by its minimum deterrence strategy where it ensured the minimum nuclear retaliation force that would survive when the US implemented preventative attacks, making use of asymmetric circumstances between them. Kanemura, H., 2003, *Ballistic Missile Defense*, Kayasyobou (Japanese), pp.55-63.

86 It would become ineffective if another military innovation that enables actors to make perfect surprise attack occurs

(FFVD) to waging war with the DPRK, and the talks have been progressing step by step after achieving the historic summit between Trump and Kim Jong Un.

In fact, during the period of keeping the talks alive, possibilities of both the US and the DPRK military actions against each other would greatly decrease, so that the KJU regime can survive. What is vital to understand here is, in retrospect, that these kinds of negotiations over denuclearization and arms control tend to go on longer than expected. Classic examples are the SALT, South African, and Ukrainian cases, all of which took about 15 years until the deals were entirely completed. So far, the US president D. Trump officially repeats that he doesn't mind if his deal with the DPRK becomes a long drawn out process now.

Furthermore, the direct talks between the US president and the DPRK chairman, both of whom have the power to decide to press their nuclear weapons' buttons, should help prevent the occurrence of misperceptions that tend to be the main reason for war breaking out contingently, so this is another condition to strengthen crisis stability.

3. Conclusion

Taking all these points into account, the advancement of nuclear weapons under the KJU regime, which has established minimum deterrence, has also resulted in augmenting crisis stability between the US and the DPRK through changing their perceptions of each other, thereby leading to the consolidation of survivability under the KJU regime from the view of nuclear deterrence theory.

Based on this conclusion, there are three implications. Firstly, advancing its nuclear weapons is a sign that the KJU regime has shifted from a passive security strategy to an active one. The DPRK security strategy had been viewed as a passive under the circumstances where it faced an extremely asymmetric military gap with the US. In a nutshell, the US preference for aiming to ensure the status-quo of the Korean Peninsula, rather than the DPRK's deterrent, was seen as the main reason that no war has occurred. Nevertheless, the KJU regime determined to go for a more active security strategy in order to escape from uncertain survivability, by advancing its nuclear weapons.

Considering its active security strategy, the KJU regime could rationally choose to upgrade its advanced nuclear weapons further, which might be done by conducting another nuclear test detonating a thermonuclear bomb in Pacific Ocean, if its denuclearization negotiations with the US remain deadlocked as has been the case since the second summit which amplified its distrust of the US. The possibilities of this scenario can already be inferred from Kim Jong Un's New Year Address pointing out the "New Path".

Secondly, this case study implies crisis stability may be achievable even in an asymmetric relationship with a huge conventional military gap between two nation-states. The possession of nuclear weapons by a nation-state, which has a relatively smaller scale of conventional forces than its counterpart, can possibly make up for the military gap in its conventional forces. Also, the research result infers that there would be room to theoretically revise Stability-Instability Paradox, a model of nuclear deterrence theory, by exploring ways to establish an updated model, such as Instability-Instability Paradox, while applying it to the US-DPRK relations.

Finally, the DPRK's consolidation of its survivability implies the bankruptcy of the assumption that North Korea would collapse soon. This assumption has been the mainstream in North Korean Studies for about 30 years since the end of the Cold War. In the current situation under the advancement of North Korea's nuclear weapons and the continuation of talks between the US and

DPRK's leaders, it does not appear that the KJU regime will collapse any time soon.

In other words, since North Korea has become a truly embedded problem for the world's peace and stability, the right direction for researchers to take would be to map out much longer-term studies and policies to deal with the nuclear armed DPRK, considering a negative peace is much better than a lose-lose nuclear war.

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