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## NORTH KOREA MISSILE: Past, Present and Future

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### Abstract

North Korea has launched a number of missile tests and developed different kinds of missiles. As you know, a ballistic missile can be used as a means for Weapons of Mass Destruction(WMD) by flying most of the flight time outside the atmosphere at high speeds. Due to its flight characteristic, it is difficult to estimate and predict the trajectory of the end-stage flight. In addition, there are technical difficulties in terms of defense. These ballistic missile threats are continuing to be developed since more than 25 countries are in possession of ballistic missiles, such as silos, transportable chemicals, biological or nuclear weapons. After the end of the Cold War, Third World states started to possess some forms of ballistic missiles. That has created a serious security threat, and in particular, the development of North Korean nuclear capabilities and WMD which are threats to Northeast Asian security. Moreover, the participation of Third World states in missile development and technology has been significantly increased. For instance, North Korea's rocket technology is reached at a certain level. And, in December 2012, the satellites of Taepodong-3, a 10,000-km-class ICBM rocket, were orbited. As a result, these threats have now become a global security threat, including to the United States and out of Northeast Asia. Through its experience in developing ballistic missiles over the last three decades, it is true that North Korea has technological limitations, such as reentry technology and miniaturization of nuclear warheads. North Korea conducted the fourth nuclear test with "test hydrogen" in January 2016 and conducted the sixth nuclear test with the "hydrogen bomb for intercontinental ballistic missile(ICBM)" in September 2017. In his 2018 New Year's Speech, Kim Jong Un announced the "historic accomplishment of completing our nuclear capabilities." In July and November of the same year, he "successfully" fired the ICBM tests. After all, Kim Jong Un declared "the achievement of the historical cause of the nation's nuclear armed forces and the achievement of the rocket-powered nation" to the world. In the context of this situation, we should analyze North Korea's ballistic missiles technological level and prospect in near future. Especially, since North Korea had tried to accomplish nuclear experiment and SLBM/ICBM launch, it is very important to evaluate North Korea's missiles technology and limitations and prospect North Korea's next action. In order to complement technological problems, North Korea has secured continuous technology both domestically and internationally. I will make an effort to analyze North Korean technological problems. Lastly, we prospect that North Korea will cease all nuclear and ICBM testing and open to dialogue with the modes of negotiation. However, at the same time, there are some contradictions that prospect it will continue to pursue nuclear and missile capabilities by buying more time. In this context, my report will briefly assess North Korea's military behavior.

**[Keywords]** Missile Technology, North Korea, Ballistic Missiles, Reentry Technology, Nuclear Warhead

### 1. Introduction

The security situation on the Korean Peninsula has changed rapidly after 2018 Pyeongchang

Winter Olympics. One the one hand, after a successful Olympics, more than a symbol of peace, two historical summits, the Inter-Korean summit and Trump-Kim summit, had taken placed. On the other side, there still are continued security

issues in Asia. For example, China has committed military modernization, deployed many DF missiles and strengthened space capability. And in Russia, Putin has declared nuclear missile test. Japan also has tried to become a military strong nation. Lastly, President Trump has demonstrated U.S. superpower in the world. In these situation, North Korean leader Kim Jong Un accomplished Inter-Korean meeting twice and also Trump-Kim meeting. For this report, I will describe development of North Korean missiles and technology. For instance, North Korea has launched missiles over years that could reach to the continental U.S. North Korea test-launched a Taepodong-1 in 1998 and Taepodong-2 missiles in 2006, 2009, in April and December 2012, and in February 2016 and 2017. Beginning 2012, North Korea released footages showing the ICBM-class KN-08 on three occasions and KN-14 on one occasion[1].

**Figure 1.** North Korea's missile-building facilities.



## 2. History of North Korea's Missiles Development

Such North Korean ballistic missiles development has long history of more than 30 years, beginning with the retrograde design of the Soviet-B of the former Soviet Union introduced by Egypt in 1981. The Taepodong-based long-range rocket has also been developed over the last 20 years despite its economic difficulties. In the 1990s, North Korea had acquired not only economic value, but also Western technology through technology connections that exported missiles and related parts to Third World states such as Iran, Pakistan and Syria.

However, since the pressures of the international community have centered on the United Nations in the mid-2000s, direct exports of finished products and parts have become difficult. Also, small-scales of indirect technical connections were being made through knowledge-based activities such as technical consultation. North Korea's ballistic missiles technology has developed through these activities at the stage where the most technologies are mature, with the exception of some technologies related to the 10,000 km class ICBM. Most of the components except for some parts were developed and used independently.

In this chapter, I will analyze on North Korean Missile Technology. North Korea has more than 800 ballistic missiles, including 600 Scud missiles that can be deployed throughout the country, and 200 working missiles. Additionally, North Korea has more than 150 solid-propelled short-range missiles KN-02 and FROG non-oil rockets. By possessing 100-120km of KN-02, North Korea can attack Osan and Pyeongtaek's USFK bases. And it has 600 Scud missiles that can be deployed throughout Korean Peninsula and most of Japan. It also can produce 7 to 9 Scud missiles and 1 to 3 working missiles per month. For KN-02, a solid-propelled short-range missile, and FROG non-oil rocket, North Korea has more than 150[2].

In particular, the indigene short range of 70 km in the Soviet Union shows the propulsion of the SS-21 Scarab or OTR-21 "Tochka," which is a short-range, road-mobile, solid propellant, and single warhead ballistic missile designed for battlefield deployment.

It was designed as a replacement for the Free Rocket Over Ground(FROG) missile series. Many reports suggest that it can be launched in either a ballistic or cruise missile mode. The ballistic mode provides an increased range and speed, but the cruise mode allows for stealth and higher accuracy. Two versions are confirmed to develop the 'Scarab A' and the 'Scarab B'(Tochka U).

After the beginning of ballistic missiles developments in the 1970s, North Korea produced and fielded Scud-B and C with ranges of 300km and 500km, respectively, in the mid-1980s. In the late 1990s, North Korea fielded the Nodong missile with a range of 1,300km, and later the

Scud-ER, which extended the range of scud missiles. In 2007, North Korea fielded the Musudan missiles with a minimum range of 3,000km without a test-launch. Through these successive additions to its missile inventory, North Korea had gained direct strike capabilities against ROK and the surrounding countries of the Korean Peninsula. As a part of efforts to develop a long-range ballistic missile capable of threatening the continental U.S., North Korea test-launched a Taepodong-1 in 1998, and Taepodong-2 missiles.

From 2012 North Korea released footages showing the ICBM-class KN-08 on three occasions and KN-14 on one occasion. To flaunt its various delivery capabilities, North Korea released images of various tests conducted since March 2016, including a simulated test of its warhead re-entry technology, solid-fuel rocket engine test, and a ground test of an ICBM engine. Between April and October 2016, North Korea conducted eight test-launches of Musudan missiles, of which only one was estimated to have been partially successful. North Korea is continuing with its development of SLBMs, releasing footages of test launches four times between May 2015 and August 2016. North Korea is expected to heavily invest in SLBMs at the regime level to prepare for additional test-launches and build submarine operation capabilities. The types of ballistic missiles currently in North Korea's inventory are shown in <Figure 2>.

Figure 2. North Korea's history of missile development.

	Scud-B	Scud-C	Nodong-A	Nodong-B
propellant	• Fuel TM-185 • Oxidizer AK271	• Fuel UDMH • Oxidizer IRFNA	• Fuel TM-185 • Oxidizer AK271	• Fuel UDMH • Oxidizer IRFNA
Clustering			4x Scud-B	
Guidance				
Separate stage			Separate Warhead	Separate Warhead
Range	Copy 280-300km Advanced 320-340km	500km	1,000-1,300km	3,000-4,000km
Reentry			Reentry Vehicle	Reentry Vehicle
Warhead	WMD head up On processing Nuclear	WMD head up On processing Nuclear	WMD head up On processing	WMD head up On processing
	Scud-B	Scud-C	Nodong-A	Nodong-B
propellant	• Fuel TM-185 • Oxidizer AK271	• Fuel UDMH • Oxidizer IRFNA	• Fuel TM-185 • Oxidizer AK271	• Fuel UDMH • Oxidizer IRFNA
Clustering			4x Scud-B	

What Explains North Korea's Solid Propellant Rocket Technology?[3] The structure of a solid propellant rocket is much simpler than that of a liquid propellant rocket, but the complexity of

the design grows exponentially with its size, requiring extensive testing and design iterations for development. It is entirely possible that Pyongyang has been working on solid propellant technology for more than a decade while simultaneously developing the indigenous Musudan liquid propellant engine. It is also possible that Pyongyang is concurrently developing the solid propellant Pukguksong-2 IRBM and solid propellant Pukguksong-3 ICBM. As such, it would not be surprising if the North also decides initially to pursue concurrent development of both solid and liquid propellant ICBMs <Figure 3>.

Figure 3. Projected evolution of solid propellant Pukguksong-2 IRBM.

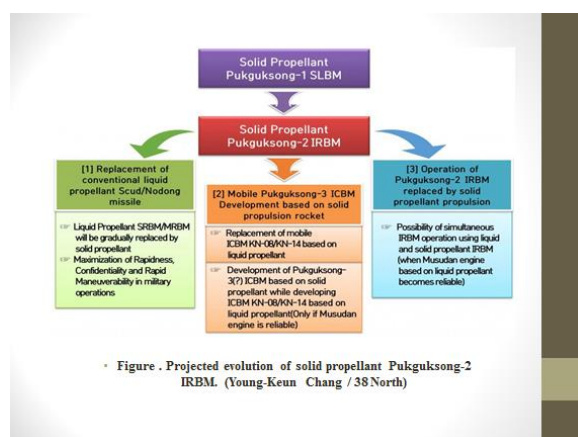
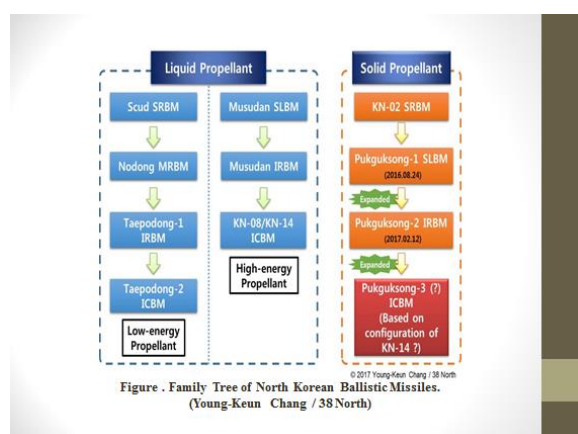


Figure 4. Family tree of North Korean ballistic missiles.



### 3. Limitations of North Korea Missile Technology and Prospect

However, the problems to be solved in order to weaponize the long range rocket of 10,000km class ICBM in the range are resumption of development and nuclear warhead miniaturization.

In the early 1990s with the assistance of Soviet Union, North Korea has secured high-grade aluminum alloys used in composite materials and fuselage, which have excellent heat-shielding ability, such as ceramic shielding, to prevent burning during re-entry.

With an analysis of the 1,000 to 1,300km of the working missiles, the 3,000 to 4,000km range of missiles(labor-B), and the long-range multi-stage launch of the rocket, it seems that technology has made considerable technological progress. Between 1990 and 1992, 30 to 50 experts from Russia and the Eastern bloc have visited North Korea in order to provide technological support for steric heat-resistant materials[4].

However, it is considered that complete re-solidification technology in the ICBM operating environment where high heat of 6,000 ~ 7,000° C is expected when re-entering the atmosphere with high speed is not yet secured[1]. Nuclear warhead miniaturization has also carried out two nuclear tests in 2006 and 2009 and is preparing for a more powerful 20-50kt third nuclear test. However, as it is known, if the explosive force is 6 to 7kt, a small warhead capable of being mounted on a ballistic missile has not yet been created.

North Korea has also not tested a nuclear warhead from a missile, either because it is simply not yet capable of doing so, or because of the uncertainties and dangers about the potential implications of such a test.

None of these advances means that North Korea has achieved its aspirational goals of a nuclear-armed missile to reach the United States. Both President Trump and President Moon Jae-in were not appeared to view this as a red line[6]. Though many Americans believe the missiles are intended principally to threaten and attack the United States, Kim's primary audiences are much closer to home. In order to do so, he must convince his elites and mass populace.

However, North Korea has yet to prove definitively that it possesses an intercontinental capability. Despite all of its missile tests and the obvious advancement of its nuclear weaponry, crucial tasks pertaining to the operational testing are far from completion. There is no evidence that North Korea has ever "mated" a warhead to a missile, and simulations and ground tests offer insufficient proof. As matters stand, additional missile tests will be required to demonstrate that North Korea has a reliable delivery vehicle with a prototype warhead able to survive reentry.

#### 4. Conclusion

Since two Inter-Korean summits and Trump-Kim summit held successfully, it seems that they brought peaceful and diplomatic solution to the Korean Peninsula problem. In order to last peace, the South and North Korea leaders should produce successful results and show cooperative posture in a sincere way. In addition, North Korea must eventually accomplish CVID that stands for "Complete, Verifiable and Irreversible Dismantlement."

North Korea has announced to halt their missiles and nuclear tests with a broad international welcome. The surprise announcement, relayed by North Korea's KCNA news agency, also said a test site would be shut down. In his statement, Kim Jong Un said it was no longer necessary to conduct missile tests because "nuclear weaponization" had been achieved. This echoes a previous statement made during a New Year address in which Mr. Kim declared his nuclear and ballistic missile programmes completed. The decision to halt missile tests is also aimed at pursuing economic growth, according to KCNA. Mr. Kim reportedly pledged to "concentrate all efforts" on developing a socialist economy.

President Trump has described this move as "good news" for the world, and President Moon also agreed saying it is a meaningful and peaceful progress. The EU said it was "positive", but called for complete denuclearization[5].

However, although Pyongyang said it would abolish its nuclear test sites, there is no indica-

tion it is planning to get rid of its existing weapons. With that in mind, we should continue to build peace and stable security situation on the Korean Peninsula, and further denuclearization of the Korean Peninsula.

## 5. Reference

### 5.1. Journal articles

[1] Kwon YS. Technical Analysis and Assessment of North Korean Ballistic Missiles. *Journal of National Defense Studies*, 56(1), 1-27 (2013).

### 5.2. Additional references

- [2] <http://lewis.armscontrolwonk.com> (2012).  
[3] Chang YK. A Paradigm Shift in North Korea's Ballistic Missile Development?. 38 North April 25 (2017).  
[4] <http://www.nti.org> (2008).  
[5] Jonathan D. Pollack. North Korea's Nuclear and Missile Programs: Strategies Directions and Prospects. Brookings January (2018).  
[6] BBC News North Korea Missile and Nuclear. Test Halt Hailed 21 April (2018).

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