THROUGH THE LOOKING GLASS: CHINESE OPEN SOURCE ASSESSMENTS OF NORTH KOREA'S BALLISTIC MISSILE CAPABILITIES

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ABSTRACT

North Korea's ballistic missile program has long been a concern for the United States, South Korea, and Japan. Foreign researchers have increasingly leveraged advanced open source intelligence technology and cooperated across countries to track the North's developments over the last 25 years. But one country has been left out – China. Are there open source Chinese analyses of DPRK ballistic missiles, do they align with U.S. assessments, and is there anything for other researchers to gain from reading these analyses? This report examines Chinese assessments of North Korean ballistic missile capabilities between 1998 and 2017. We find that Chinese analysts have paid growing attention to the North's missile capabilities but are still not as attentive as Western observers, from whom they draw most of their information and analytic insights. Chinese analyses broadly mirror Western experts' conclusions about the state of North Korea's missile capabilities, most notably that North Korea has a functional, if not fully perfected, intercontinental-range ballistic missile (ICBM) that can reach the United States with a nuclear weapon. However, there is little original Chinese analysis that would enhance foreign experts' preexisting understanding of DPRK missiles.

INTRODUCTION AND BACKGROUND

Since becoming the leader of the Democratic People's Republic of Korea (DPRK) in 2011, Kim Jong-un conducted four nuclear tests and 84 ballistic missile tests through the end of 2017, far surpassing his father's totals. Most dramatically, these included a test of the Hwasong-15 intercontinental-range ballistic missile (ICBM) in November 2017, which the U.S. government assesses can reach all of the United States.[1] These tests demonstrated considerable progress, if not complete success, toward realizing the Kim family's long-term vow to credibly threaten the U.S. homeland.

Considerable effort has been expended by foreign governments and researchers to analyze the North's missile program over the last 25 years. Beyond U.S. government assessments relayed publicly through Department of Defense (DoD) reports and testimony to Congress, a small but robust analytic community tracking North Korea's missile capabilities has formed to take advantage of open source intelligence resources. This includes using the North's own Korean Central News Agency (KCNA) images and footage, commercial satellite imagery, as well as other sources to assess DPRK missile design, test performance, and real-world capabilities.[2] Perhaps most well-known of these is the website 38North, hosted by the Stimson Center, and the Center for Non-Proliferation Studies (CNS). Analysts from other countries occasionally contribute research, including those from South Korea (ROK), Japan, Germany, and Israel.

One country notably absent from this conversation is the People's Republic of China (PRC). Despite the often overlooked fact that the North's advancing missile capabilities can target all of China, Beijing has not released any official analyses focused on North Korea's missiles. Is there anything to be gained from reading unofficial Chinese assessments of DPRK ballistic missiles?[3] What aspects of North Korea's missile program do Chinese analysts pay most attention to, and what sources do they rely on to observe, process, and analyze DPRK missiles? Does China's proximity and closer scientific cooperation with DPRK scientists make for better

analysis than those observing from afar?[4] If so, how do Chinese analysts view North Korea's ballistic missile program and what are their threat perceptions of these capabilities?

Given the concern U.S. officials have expressed over the North's ability to target the homeland, Chinese observers' equipoise in the face of a potentially greater threat seems puzzling. To be sure, the view of North Korea as seen from Beijing is starkly different from that of Washington. Despite China's frustrations with Kim Jong-un's behavior, Chinese analyses of North Korea evince little concern over the North's potential threat to China. Indeed, China's temporary uptick in sanctions pressure on Pyongyang in 2017 was almost certainly due more to alarm at the possibility of U.S. military action against a country on China's border than to the fact that North Korea was developing capabilities it might one day turn against China.[5]

Beijing's apparent reluctance to confront North Korea over its nuclear program has been explained many times and many ways: the lack of perceived threat, the value of North Korea as a buffer or for leverage, or even the utility of having Pyongyang as a convenient distraction or threat to the United States.[6] Yet, one possible explanation remains unexplored – that the Chinese government simply does not find the DPRK missile threat credible at the technical level. This report tests this hypothesis while also reviewing the Chinese open source technical analytic community and exploring whether U.S. analysts stand to gain from monitoring public Chinese assessments of global military developments.

Geopolitical Background

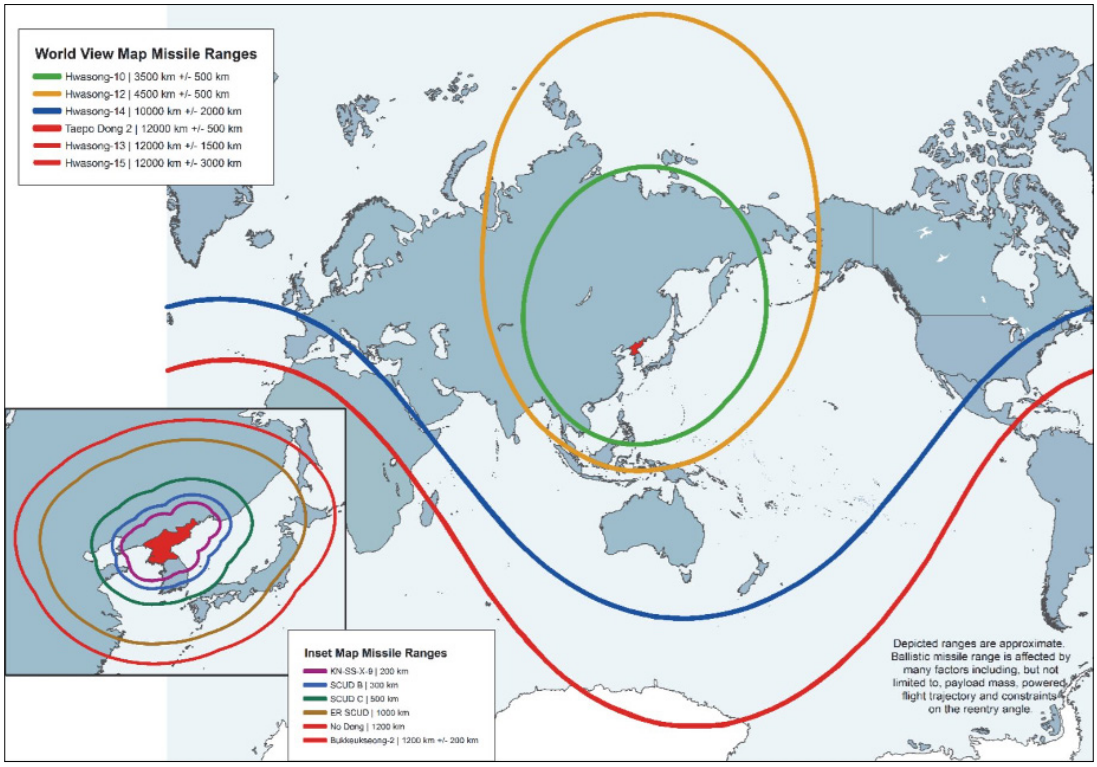
At first glance, China has many reasons to pay attention to DPRK missile developments. Beijing sits just minutes' worth of flight time away, were the Strategic Force of the Korean People's Army (KPA) to launch any of its estimated "several hundred short- and medium-range ballistic missiles (SRBMs and MRBMs)" toward the Chinese capital from any of an estimated 13-20 launch sites.[7] Diplomatically, prior to an improvement in relations in mid-2018, ties between the neighbors "reached their lowest level in decades" as the DPRK's missile and WMD testing programs spiked in 2016-2017.[8] DPRK leaders have been quite clear in private that China is one of the regime's greatest enemies. On his deathbed, Kim Jong Il reportedly told his son to "never forget that China is the country that has bullied Korea the most in history," who in turn reportedly cursed Chinese Chairman Xi Jinping, asserting that "Japan is a hundred year enemy but China is a thousand year enemy," and blamed the North's economic difficulties on China's "betrayal."[9] China has occasionally given North Korea cause to regard it with hostility, including when it cut off oil shipments briefly in 2003 and again in 2017. Indeed, for a paranoid Kim regime, there are even rumors that Jang Song Thaek's demise traces to his offer to Beijing to overthrow Kim.[10]

In this light, at least some foreign analysts have interpreted a few of the DPRK's missile tests as targeted at China. One U.S. scholar believes the March 2017 SCUD-ER tests, conducted after China agreed to extend UN sanctions to DPRK coal exports, may have been intended as a warning signal to China, noting that the 1,000 kilometer (km) range does not cover an obvious target for U.S. bases in South Korea or Japan, but could cover many of China's major industrialized coastal cities, even as far as Shanghai.[11] Similarly, the May 2017 Pukguksong-2 MBRM test was interpreted by one Japanese analyst as targeted at China, citing images of China's northeast in the KCNA footage of the launch, as well as rumors that a senior DPRK official said, "Our new ballistic missile can strike anywhere in China."[12] Are there Chinese analysts who interpret these tests as similarly threatening to the PRC?

Many would argue this DPRK threat on a technical level is attenuated by a reduced threat perception by Beijing. China has maintained the façade of friendship with North Korea under their 1961 Treaty of Alliance and Friendship; it also serves as the North's main provider of energy, foreign aid, and diplomatic cover. At their January 2019 meeting, Xi remarked on the "strong vitality of the China-DPRK friendship" and Kim commented that "DPRK-China relations last year were elevated to a new height."[13]

Yet, analysts of Chinese foreign and security policy have long characterized China as "the high church of realpolitik," purportedly unmoved by assessments of intent, and indifferent to the importance of history, to values, to the logic of images, or to common identity.[14] Instead, Beijing is seen as focused squarely and solely on making clear-eyed, cold-blooded assessments of capabilities and the threats that these might pose. If that is the case, then what explains why China might be so seemingly indifferent to this potential threat? In the past, some Western analysts have suspected North Korea of bluffing about the number and capabilities of its missile force.[15] Does China discount one or more aspects of North Korea's technical capabilities?

Figure 1. Assessed DPRK Missile Ranges



Source: *2019 Missile Defense Review* (Arlington, VA: US Department of Defense, January 2019): 41.

Approach and Methodology

To explore these questions, we first provide a baseline assessment of the North's missile arsenal derived from U.S. government and independent open sources. Next, we draw on 40 articles from leading Chinese journals to describe Chinese assessments of DPRK ballistic missiles. Our data set includes early Chinese analyses around 2000, the evolution of Chinese monitoring from 2009-2016, and current assessments of DPRK capabilities through the North's last long-range missile test in November 2017. We supplemented these sources with 10 interviews of subject matter experts from the United States, China, Japan, South Korea, Germany, and Russia, and also conducted a roundtable with U.S. specialists in March 2019.

This paper focuses on the most respected Chinese sources available, especially articles published either by personnel from the military and defense industry and/or in journals run by those organizations. Such journals include *Winged Missiles* [飞航导弹], published by a research institute under the state-owned China Aerospace Science and Industry Corporation (CASIC, 中国航天科工集团有限公司), and *Missiles and Space Vehicles* [导弹与航天运载技术], similarly published by a research institute under the state-owned China Aerospace Science and Technology Corporation (CASC, 中国航天科技集团公司). We have endeavored to paint a comprehensive picture of the literature, though this is necessarily an incomplete list of all possible sources. As part of the analysis, we have reconstructed and compared a Chinese database of DPRK missile tests against tracking efforts by Western analysts, represented by the CNS database hosted by the Nuclear Threat Initiative (NTI), as well as mainstream Western assessments from the U.S. government, 38North, and other sources.

U.S. ASSESSMENTS OF NORTH KOREAN BALLISTIC MISSILE CAPABILITIES

The U.S. government and independent researchers alike assert that North Korea is developing an increasingly credible ballistic missile force with the capability to strike the U.S. homeland as well as closer targets in Asia, especially South Korea and Japan. According to testimony to the U.S. Congress in March 2018 by the Director of the Defense Intelligence Agency, Lieutenant General Robert Ashley, the November 2017 test of the Hwasong-15 ICBM "demonstrated a capability to reach the United States" and the Pukguksong-2 MRBM solid-propellent missile represented a "[significant] advancement... because solid-propellant missiles can be prepared for launch more rapidly than liquid-propellant systems."[16] Independent researchers provide more specifics based on open source information, asserting the "Hwasong-14 could deliver a

North Korean nuclear weapon to Seattle assuming an overall RV [re-entry vehicle] mass of about 500 [kilograms, kg], of which the nuclear bomb contributes roughly 300kg," while the "Hwasong-15 can deliver a 1,000kg payload to any point on the U.S. mainland."[17]

While U.S. concern over DPRK missile capabilities dates back to the 1990s, when intelligence assessments projected a functional ICBM by 2010, these concerns have been amplified by the rapid pace of testing under Kim Jong-un.[18] In turn, the level of research into North Korean ballistic missile capabilities has increased within the United States, because of both greater availability of open source resources, and greater interest and funding for research related to critical national security issues. Western analysts view North Korea's ICBM program as only part of an increasingly diverse portfolio of ballistic missiles. As the 2017 DoD report on North Korean military capabilities notes, "North Korea has also made progress with solid-propellant technologies, submarine-launched ballistic missiles, and probably has an interest in countermeasures against U.S. and allied missile defenses."[19]

At the same time, foreign analysts also highlight several shortcomings Pyongyang has yet to overcome.[20] One such area is North Korea's capability to develop and field a reentry vehicle (RV) that can survive the heat of reentry to the Earth's atmosphere. However, according to a November 2018 report on the Hwasong-15's flight, such doubt "may not be justified," in part because "an RV that failed on a lofted trajectory might nonetheless survive on a minimum energy trajectory," meaning the November test is not an applicable criterion by which to judge the DPRK's RV capability.[21] Another criterion is the lack of flight testing for the Hwasong series of IRBM and ICBMs, leading researchers to question their operational reliability. This has led some researchers to assess that the North is on the cusp of an operational ICBM, which is a slightly less firm conclusion about the North's capabilities than official U.S. government assessments.[22] Overall, however, Western analysts neither dismiss the North's ability to overcome these capabilities in time, nor discount the possibility that a DPRK ICBM might reach the U.S. homeland if fired.

CHINESE ASSESSMENTS OF NORTH KOREAN BALLISTIC MISSILES

Like their U.S. counterparts, Chinese analysts also track and assess North Korean ballistic missiles, but are less attentive and publish little original analysis, instead largely drawing upon (and in many cases, plagiarizing) Western analyses. This section tracks the evolution of Chinese writings from the first Taepodong test in 1998 through the road-mobile KN-14 and KN-15 tests in 2017. Chinese analyses broadly mirror Western experts' conclusions about the state of North Korea's ballistic missile capabilities, most notably that North Korea has a functional, if not fully perfected, ICBM that can reach the United States with a nuclear weapon.

It is important to begin by providing the Chinese military's definitions for ballistic missile ranges, which are generally used in the articles surveyed here. The 2011 PLA dictionary categorizes missiles as SRBMs [近程导弹] for ranges under 1,000km; MRBMs [中程导弹] for ranges between 1,000 and 5,000km; IRBMs [中远程导弹] for missiles with ranges between 1,500 and 5,500km; "long-range" [远程导弹] for missiles capable of traveling 5,000 to 8,000km; and ICBMs [洲际导弹] for 8,000+km missiles.[23] This is similar to, but not the same as, the standard Western formulation of SRBMs under 1,000km; MRBMs from 1,000-3,000km; IRBMs from 3,000-5,500km; and ICBM above 5,500+km. However, the more important data are the stated ranges and operational status of the missiles, which are analyzed below.

Early Analysis (1998-2000)

Open-source Chinese analysis of North Korean missiles was kickstarted by the North's first Taepodong [大浦洞] test in August 1998. Early articles mostly focused on the North's capabilities and the KPA's ballistic missile development trajectory, based largely on published U.S. intelligence community assessments following the first Korean nuclear crisis in 1993.[24]

The first article, published in December 1998 in *Aerospace China*, concluded that the test demonstrated North Korea had the "technical capability to independently develop a medium-range ballistic missile with a range over 1,600km" that could reach Japan and carry a nuclear or chemical weapons warhead.[25] The author, Jiang Yuping [蒋宇平], worked for what is now the China Aerospace Academy of Systems Science and Engineering (CAASSE, 中国航天系统科学与工程研究院), which is a subsidiary of CASC as the 12th Academy (航天第十二研究院)and publishes the journal.[26] In his assessment, Jiang relayed DPRK claims from KCNA about the missile's performance and successful satellite launch, while also noting U.S. analysts' skepticism of such claims. Offering his own assessment, Jiang argued, "the successful launch of the multi-stage missile or vehicle demonstrates North Korea has accumulated bountiful experience in the design, development and manufacturing of ballistic missiles…[and] mastered the manufacturing technology for MRBMs." The article provides a succinct history of the North's missile program, tracing its origins from the acquisitions of the FROG-5 and FROG-7 from the Soviet Union in 1969. He assessed that North Korea would not deploy the Taepodong-1 before 2000. This analysis aligned with prevailing Western analysis, and appears to be drawn from the unclassified briefing of the November 1995 U.S. National Intelligence Estimate (NIE) report to Congress[27] and 1997 Congressional testimony, while also containing missile diagrams by Charles Vick (although these were used without attribution).[28] Jiang's colleagues published another article the next month that viewed the Taepodong test as a successful demonstration of the North's solid fuel technology and multi-stage missiles, but noted "structural issues" due to the missile's thickness and predicted challenges for improved performance.[29]

Table 1. Early Chinese Assessment of DPRK Ballistic Missile Force			
Missile	**Range (km)**	**Warhead (kg)**	**Earliest Deployment (Year)**
Scud-A	300	1,000	1984
Scud-B	300	1,000	1981
Hwasong-5	320-340	1,000	1985
Hwasong-6 (Scud-C)	500	700-800	1989
Nodong-1	1,000-1,300	800-1,000	1997
Taepodong-1	1,700-2,200	700-1,000	2000-2004
Taepodong-2	2,000-3,500	700-1,000	2000-2004

Source: Jiang, "Overview of Development of North Korea's Missiles and Satellites."

A third article, by Gao Qian [高倩], a scholar at Civil Aviation University, similarly mirrored Western data to review the 1998 test and North Korea's contemporary missile capabilities and development plans.[30] The article places the North's missiles in the context of the Soviet and Iraqi programs, arguing North Korea was making slower progress than Iraq at developing a missile with a longer range than the SCUD-C [飞毛腿] and that the North was likely using the Soviet's 1950s approach to the SLBM program, tying four SCUD-B engines together. Gao argued the revised 1995 US NIE of the Taepodong-2's range – upgraded to a 6,000km range that could hit Alaska or Hawaii, would be feasible if North Korea used more advanced fuel.[31]

Overall, these early articles reflect a basic understanding of DPRK missile capabilities in the late 1990s largely in line with, and drawn from, mainstream Western analyses. The small number of articles by a limited pool of authors, however, reveals there was no specific cohort of Chinese defense analysts publicly tracking DPRK missile capabilities. The authors surveyed here wrote single articles on DPRK missiles amidst their larger body of work on other foreign missile activity – largely that of the United States and Russia – and do not appear to have been paying exclusive, consistent attention to North Korean missile developments.

Monitoring DPRK Missile Tests (2006-2016)

Chinese analysts' coverage of DPRK ballistic missile developments ebbed during the 2000s but picked up again with the renewed emphasis on missile advances under Kim Jong-un. This is evident in one important series of articles that provides a baseline for understanding how much attention the Chinese technical community pays toward North Korea. Since at least 2000, staff from the Beijing Aerospace Long March Scientific and Technical Information Institute (STII, 北京航天长征科技信息研究所)have produced several different reports that document worldwide missile launches over the preceding year, published by their in-house journal *Missiles and Space Vehicles.*[32] STII is better known as CASC's 1st Academy's 19th Research Institute ["航天一院十九所], meaning it is a subsidiary of the China Academy of Launch Vehicle Technology (CALT) [中国运载火箭技术研究院], which itself is a subsidiary of CASC as the First Academy [航天第一研究院]. Researchers at STII are responsible for "monitoring and researching aerospace-related technical intelligence, strategic intelligence, arms control policy and the arms sale market," and that includes tracking the progress of other countries' missile programs around the world.[33] However, it is also important to place this research on DPRK ballistic missiles in perspective relative to related research on other space-faring nations. Of the 326 articles published by staff from STII through December 2019, only 23 mention North Korea, compared with 219 articles mentioning the United States, 134 mentioning Russia, 104 mentioning Japan, 66 mentioning India, and 61 mentioning France.[34] Clearly, North Korea is not a high priority for this group.

The early years of this series purposefully overlook North Korea's missile program. The clearest example is the exclusion of the North's first test of its Unha [银河] space launch vehicle (SLV) in July 2006, which was covered in the Chinese media and marked the first time China voted in favor of United Nations sanctions against the North.[35] However, neither the STII 2006 annual review or a similar article in *Aerospace China* mentions it.[36] Needless to say, as researchers observing global missile developments, it would have been impossible to miss the DPRK test, so its exclusion from the report that covers the United States, Russia, Europe, Japan, Ukraine and India is notable. Suggesting this omission was not a definitional problem – ballistic missile vs. SLV –the 2009 STII annual review, written by some of the same authors, included the 2009 Unha test and explicitly asserts it provided technical support for the North's larger ballistic missile ambitions.[37]

More detailed analyses of the DPRK's ballistic missile developments were undertaken between 2014-2016, with a new annual series, *Review of World Ballistic Missile Developments.* The initial 2014 report provided the first Chinese count of North Korea's ballistic missile inventory and deployment locations (see Table 2).[38] The numbers appear to be original Chinese estimates, since they provide specific missile counts, whereas the U.S. government estimates DPRK missile launchers, and the numbers cannot be traced to any specific Western report.[39] The report asserts the North's Scuds are

"mostly deployed in North Hwanghae Province County and […] in Kangwon Province," while the Nodong [劳动 or 芦洞] and KN-02 are "deployed in North Hwanghae Province, Chagang Province, and […] in Kangwon Province," and the Taepodong-1 is operationally deployed while the Taepodong-2's deployment status is unknown. This generally reflects Western assessments that North Korea deploys its short-range missiles closer to the DMZ and deploys its longer-range missiles in the northern part of the country, though the KN-02's slotting with the Nodong appears an odd choice, since the KN-02 is a SRBM and thus would seem more likely to be deployed with the Scuds.[40] Much of the specific deployment information was already compiled and published in *Nonproliferation Review* in 1994.[41]

The 2015-2017 reports demonstrate the STII team did independently track DPRK missile tests, albeit far less accurately and still as a low priority (see Table 3).[42] For example, the 2016 report claims the May 2015 SLBM test was launched from a submarine, whereas Western analysts believe that photos indicate it was still launched from a submerged platform; the report also ignores the failed December 2015 test containing doctored photos.[43] With hindsight, the report reviewing 2016 accurately predicted North Korea would continue improving its IRBMs in 2017, with a focus on pursuing multiple platforms and survivability.[44]

Table 2. Comparison of US and Chinese Assessments of DPRK Missiles

Missile	Chinese Count (Missiles)	US DOD Count (Launchers)
KN-02	92	Fewer than 100
Scud-A	500-600	
Scud-B		
Scud-C		
Scud-ER	n/a	
Nodong-1	142	Fewer than 50
Nodong-2	276	
Taepodong-1	15	n/a
Taepodong-2	5	Unknown
IRBM	n/a	Fewer than 50
Hwasong-13 (KN-08)	n/a	At least 6

Source: Chinese data from 2014 Chinese report. US data from 2013 DOD report and 2013 NASIC report, which have the same numbers, for contemporary snapshot.
Note: Chinese numbers have generally remained unchanged over 2014-2017, except for an adjustment of KN-02 down to 88 missiles in 2016. NASIC and DOD counts have also stayed the same, and do not list the Scud-A and Taepodong-1 missiles.

Table 3. Comparison of Chinese vs. US Databases on DPRK Missile Testing		
Year	**Chinese Count**	**US Count**
2013	**Total: 8**	**Total: 6**
2014	Improved KN-02: 0-4 Scud: 6-10 Scud-C or ER: 2 KN-10: 2 KN-09: 3 Nodong: some **Total: 18**	KN-02: 4 Scud-B: 4 Scud-C: 9 Nodong: 2 **Total: 19**
2015	KN-02: 5 Scud: 2 KN-11: 3 KN-06: 2 **Total: 14**	KN-02: 10 Scud-C: 2 Pukguksong-1: 3 **Total: 15**
2016	KN-02: 9 Scud: 3 Nodong: 2 Musudan: 7 KN-11: 3 SLV: 1 **Total: 25**	Scud-C: 4 Scud-ER: 3 Nodong: 5 Musudan: 8 Unha-3: 1 KN-11: 3 **Total: 24**
2017	Pukguksong-2: 5 Hwasong-12: 4 Hwasong-14: 2 Hwasong-15: 1 Three unnamed failures **Total: 12**	Pukguksong-2: 2 Hwasong-12: 6 Hwasong-14: 2 Hwasong-15: 1 **Total: 11**
2019	KN-02: 5 KN-23: 6 Pukguksong-3: 1 **Total: 12**	KN-23: 8 KN-24: 4 KN-25: 9 Pukguksong-3: 1 **Total: 22**

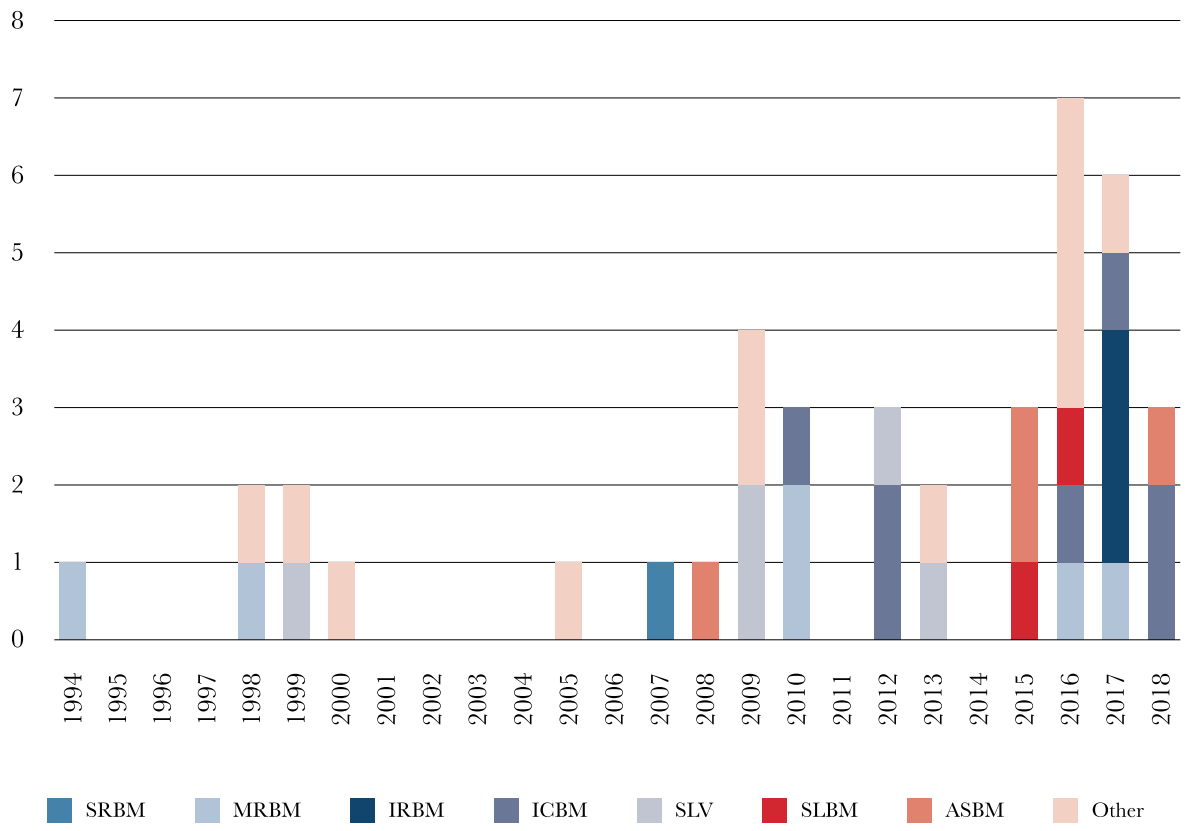
Source: Chinese data from 2014-2016 ballistic missile reports, the 2017 combined report, December 2017 Zhang Ying article, and Zhang Ying [张莹] and Zhang Huayu [张铧予], "Analysis of Northeast Asia Missile Equipment Capabilities" ["东北亚导弹武器装备能力分析"], *Winged Missiles* [飞航导弹], January 2020. US data from CNS/NTI database.

Assessing Current DPRK Missile Capabilities (2017-2018)

Despite this relative increase in effort from 2009-2016, when Kim Jong-un made his big push to accelerate ICBM testing in 2017, there was no concomitant increase in the number or quality of analyses by Chinese experts. A review of key journals found only two serious articles on the Hwasong-15 – a surprise given that DPRK missile testing drove the crisis with the United States that so concerned China and led to China-DPRK relations bottoming out in late 2017. Overall, Chinese analysts agreed with Western analysis that the Hwasong-15 demonstrated a significant step in the North's capability to strike the United States, but were more skeptical than American experts about its operational utility.

The two serious Chinese articles characterized the Hwasong-15 [火星-15] test as a breakthrough for North Korea but were restrained in their assessment of its implications.[45] The first article, by Zhang Ying, said the 2017 IRBM and ICBM testing "showed the world" North Korea's determination to possess a strategic nuclear weapon and develop multiple platforms.[46] The second article, by the pseudonymous Shen Jijian (神机箭), similarly describes the Hwasong-15 as the North's "first real ICBM" and an "engineering miracle" after the North walked its own development path.[47] Zhang asserts the Hwasong missile family achieved "fast progress" over 2016 and 2017 and showed the North was "strengthening the deterrent capability of its long-range missiles and ICBMs" and "improving the IRBMs' survivability and reliability."[48]

Figure 2. Chinese Articles About DPRK Missiles, By Type



Source: Authors' count of CNKI data in prominent journals. Other includes articles covering all DPRK missiles and other missile-related analysis (RV, fuel type, etc).

Zhang describes the Hwasong-15 test as "demonstrating that all parameters of the Hwasong-15 missile system meet the design requirements, and can guarantee the reliability in combat environments for the strategic weapon system's mission." That includes "verifying the accuracy of the mid-course attitude control and speed correction, the correctness of the vector control for the high-power engine and the high-ratio thrust engine, and the correctness of the corresponding guidance parameters, and the operational reliability of the newly-developed 9-axis self-propelled launcher's mobility and lifting capacity as well as the launch system." Citing 38North, Zhang states that with a conservative estimate the Hwasong-15 can deliver a 1,000kg payload to the U.S. mainland, representing a "large improvement."[49]

Despite this confidence in the missile's performance, overall Zhang does not see the Hwasong-15 as a credible imminent threat. Zhang argues North Korea's warheads can go only about 3,000km because of their heatshield performance.[50] By contrast, Shen appears to have more faith in the missile since the author argues that if foreign experts are correct in claiming the new nose cone design is a payload fairing (intended to protect the payload during launch), instead of what Shen assumes was a heat shield, then this would lead one to believe the fairing would include some decoys to make interception harder and improve the warhead's penetration survivability.[51] Although some U.S. researchers have mentioned this possibility, they are less certain about the use of decoys, at least in the near term.[52]

Looking ahead, Zhang asserts the Pukguksong-2 MRBM is the most promising DPRK platform for deterrence.[53] The article explains that because North Korea mostly hides its missiles in tunnels, and the Pukguksong-2 can be launched immediately after leaving the tunnel, it is the model closest to actual operational utility of all DPRK missiles. Although the article treats the missile as still in development, this argument is in contrast with Western skepticism over its reliability due to a lack of sufficient flight tests.[54] In contrast, Zhang argues that while the North's missiles with ranges over 6,000km (the Taepodong-2, KN-08, Hwasong-14 and Hwasong-15) can strike the U.S. West Coast, Hawaii, and Alaska, they are still not ready for operational deployment due to technical issues.

Zhang also expresses more faith in the future of the KN-08 and Musudan [舞水端] than Western analysts, even though they are still not operational.[55] Zhang believes the Musudan still needs more testing because its "reliability and combat

capability is relatively low" and thus assesses it remains a ways off from operational deployment, while asserting that the KN-08 has value only as a "symbolic deterrent." Yet, the article assumes the Musudan, Taepodong-2 and KN-08 will be part of North Korea's arsenal over the next 10 years, in comparison with most Western experts who assume North Korea has practically abandoned those missiles for the Hwasong series.[56] This greater expectation of the KN-08 and Musudan may reflect a Chinese assumption that the North will not abandon any platforms and that the KPA has a lower bar for emergency or even operational readiness than some Western experts assume.

The skepticism about operational deployment of ICBMs extends even to the DPRK's most tested, and thus likely most reliable, ballistic missiles. Zhang appears to doubt the North has successfully miniaturized a nuclear warhead, since he or she provides the range for the Hwasong-12 based on heavier payloads (1.2-2 tons), giving it a reduced range. Indeed, Zhang argues Pyongyang will now focus on developing a miniaturized warhead for longer-range missiles, but also asserts that North Korea already has the designs for a MRBM warhead. This makes it seem as if Zhang is downplaying the missile's range out of diplomatic sensitivities. Furthermore, Zhang argues the Taepodong series shows the "initial steps" toward mastering multi-stage missiles but the guidance, warhead, structure, and reentry technology all need work. The article states that the North's missiles with ranges under 2,000km – Nodong-1, Nodong-2, and Taepodong-1 – can cover all of Japan (including U.S. bases in Okinawa), as well as Russia's Far East and China's Northeast. Yet Zhang cautions that although the systems are already deployed and the North has some production capacity, they are not sufficiently flight tested, and as a result the "combat performance, reliability and operational utility" of these weapons is "relatively low." Of the North's missiles with ranges between 2,000-4,000km – the Musudan, Pukguksong-1, Pukguksong-2 and Hwasong-12 – the Musudan is described as being some ways from operational deployment, but the Pukguksong-2 and Hwasong-12 have a "relatively satisfactory rate of launch success." Zhang appears to implicitly but strongly believe the Pukguksong-2 and Hwasong-12 are the North's most credible, and thus formidable, threat.[57]

Looking forward, Zhang predicts North Korea will stick with liquid-fueled engines because the technology is more mature, reflecting a belief in Pyongyang's desire for reliable capabilities. Shen believes the North still has to do a real full-range test of its ICBMs to achieve full confidence in its capabilities, since the lofted tests can give insight only into engine performance but not the necessary attitude adjustments. Shen asserts the reason Kim has not ordered such a test is because the DPRK can't do long-distance control of the missile's full range and lacks survey ships to monitor its end of flight. Zhang assumes North Korea is interested in MIRV technology, which is different from most U.S. assessments predicting that MIRV-ing remains a long-term goal beyond North Korea's current capabilities.[58]

TAKING STOCK OF CHINESE ASSESSMENTS

What can Western researchers gain from a review of these Chinese technical assessments of DPRK ballistic missiles? Unfortunately, Chinese analysts rarely produce new analysis that would add to foreign understanding of DPRK missiles, and even when seemingly original assessments are made, such as a Chinese count of DPRK missiles, the lack of research methodology reduces its analytic value. Instead, little nuances in these writings can shed light on broader thinking within the Chinese defense community on the geostrategic implications of DPRK missile developments. Chinese analysts tend to downplay the threat posed by DPRK missiles and take a disinterested stance on matters of concern for the rest of the world, such as DPRK proliferation, chemical and biological weapon capabilities, and the risks these pose for regional security. The energy dedicated to tracking DPRK missile development does, however, illustrate China's strategic attention to Korean security issues as high-priority concern for regional security, and sheds some light on policy inputs within the Chinese system.

China Does Have a Research Community For Foreign Technical Assessments…

The main analysts we identified are mostly affiliated with either the defense industry or military, reflecting a largely insular community that lacks private (non-government) expertise like in the United States. This group still represents only a small fraction of a larger community of researchers who focus on the missile capabilities of more important countries, such as the United States, and analysts who look beyond missiles even for DPRK-related military capabilities, including ships and submarines, drones and cyber capabilities. However, these articles are generally not much more detailed than the missile articles reviewed above.

The researcher most focused on DPRK missiles was Zhang Ying (张莹), a defense industry researcher at STII. He or she shifted from writing 11 out of 13 articles between 2009-2014 on India and Russia to writing all their individual articles on Korea in 2016 and 2017. Other analysts who wrote on DPRK missiles consistently include Chinese military researcher Zhang Xiangguo (张相国) of Unit 61683 – which may be either the Contingency Response Office or the Targeting Control Center under the Operations Department Joint Command Operations Bureau – and Chinese military researchers Li Mei (李梅) and Dai Yanli (戴艳丽) of Unit 96658 Subunit 207, which is the PLA Rocket Force's (PLARF) equipment research unit.[59] We also know there are more, and perhaps even better informed, analysts within the Chinese military, since they occasionally engage with visiting Western counterparts. One Western expert, who has engaged with Chinese military analysts working on North Korea not surveyed here, reported finding them knowledgeable and informed on the topic.[60] Although North Korea is not always the highest priority for these authors, it is clear that the transmission belt of analysis can speed up when necessary – the two main articles on the Hwasong-15, for example, were published one month and three months after its test.

Despite this small cadre of experts, it is difficult to discern distinct Chinese schools of thought about DPRK missile capabilities. One natural dividing line would potentially be how Chinese researchers assess the credibility of DPRK missiles. As noted above, Zhang Ying and others who closely track DPRK missiles, generally accept Western assessments of Pyongyang's new suite of long-range Hwasong missiles as a credible threat to strike the United States. However, other Chinese researchers focus more on legacy platforms as more credible capabilities and downplay the newer Hwasong missiles. While this could represent a separate school of thought, this legacy focus instead appears to illustrate that knowledge of DPRK missiles does not extend evenly throughout the Chinese defense community. This uneven expertise is evident in two articles by PLA authors that convey outdated and incorrect analysis in late 2017 as North Korea had already tested its Hwasong-12 IRBM and Hwasong-14 ICBM. Researchers from the Northwest Institute of Nuclear Technology [西北核技术研究所], affiliated with the PLA, and researchers from an unknown PLA unit, both focused on the Taepodong and Musudan as the core of North Korea's missile arsenal, understating the ranges and using odd missile names.[61] These inconsistencies suggest that instead of different schools of thought, there are differing levels of expertise.

The authors who are missing are just as interesting. The PLA's interest in the DPRK is unsurprising, but it is noteworthy that no authors from the Northern Theater Command, the theater responsible for Korea contingencies, have written on the topic. This suggests they are restricted to contributing to classified internal assessments within the Chinese military. One key author we were unable to identify with more detail is the Shen Jijian pseudonym. Since other authors with sensitive affiliations wrote on the topic, it is noteworthy that this "Shen" sought to keep his or her identity secret. Our best guess is that Shen is a member of PLA intelligence and was authorized to publish this piece in order improve the community's quality of discussion on DPRK missiles. There appear to be no truly civilian Chinese researchers performing Western-quality open source technical analysis for public consumption, likely because there is no similar training available outside the Chinese government, it is a sensitive topic, and the structure of the Chinese policy community doesn't incentivize it. Similarly, there is little quality research done on DPRK nuclear weapons advances on a technical level, likely because of the sensitivity of the subject.[62]

But There is Little Value Add for Western Researchers…

The biggest shortcoming is the lack of original technical analysis of DPRK missiles. There appears to be no publicly available, original Chinese modeling for the missiles' flight performance, perhaps explaining their reliance on foreign assessments. This represents a general avoidance of leveraging DPRK open source information. Instead, the analyses only use or reference KCNA images or video when plagiarizing from Western analyses. This may be explained by Shen's stated skepticism that the images would be accurate enough for flight performance projections, but more likely reflects a lack of effort.[63] This plagiarism is fairly consistent throughout Chinese analyses, dating back to the 1990s.[64] They also avoid using the commercial satellite imagery that is now popular with Western experts, a choice that appears deliberate in light of Li Mei's use of Google Maps to examine THAAD deployments in South Korea.[65]

Many, if not all, of the detailed graphics contained in Chinese analyses can be traced to Western sources, suggesting a lack of Chinese effort to verify these assessments independently, at least in the public domain. For example, a May 2016 article by Li Mei that focused on the recently unveiled KN-14 simply plagiarized a 38North analysis in its entirety, including the range projections and missile model diagrams (though the images were expertly overlaid with Chinese to disguise their origins).[66] Li's article is really little more than a translation, though this also provides an opportunity to understand what specifically is too taboo for Chinese technical articles. The most notable censorship, in which the Chinese version diverges from its otherwise very faithful translation, is the exclusion of references to China, including omitting that the TELs North Korea used to transport, erect, and launch the missile were from China (merely noting that they were "imported"), and ignoring an argument that North Korea's likely development path to a miniaturized warhead will be based on original Chinese designs passed to Pakistan, then on to Libya. Yet the article retained a joke about the North's poor performance implying the missiles may "fall back on North Korean soil," indicating the omissions are intentional censorship. Overall, the Chinese technical analysts surveyed here evidently read some Western sources (38North and UCS) but use them rather sporadically and unsystematically, and notably overlook other prominent platforms such as Arms Control Wonk, NK News and The Diplomat (even as they cite Wikipedia).[67]

Looking beyond the limited technical value of these articles, future studies by foreign analysts can expand the scope to look at how the PLA evaluates the broader military balance on the Korean Peninsula and its evolving assessment of the risks of war in Korea. A more ambitious study could also attempt to find evidence of PLA planning for defending against DPRK missile attacks, such as articles in PLA air defense journals. Understanding Chinese views of military capabilities involved in a Korea contingency and when that might occur are important to better engage China on Korean contingency planning and ongoing security issues.

Chinese Researchers Quietly Understand Foreign Role in DPRK Missile Program

Chinese analysts also appear to recognize the role of foreign assistance in North Korea's missile program but downplay this (or ignore it out of diplomatic sensitivity) compared to Western analyses. The frankest discussions come in the first

round of articles, which argue that the North's slow progress on the Nodong-1 after 1992 reflected Russia's decision to end technical assistance and that finding a replacement source of foreign assistance would be "indispensable" to overcoming looming technical challenges.[68]

More to the point, discussion of China's assistance to the North's missile program is virtually nonexistent and likely taboo. Then-Secretary of Defense Leon Panetta told Congress in April 2012 that "clearly there has been assistance" from China for the North's missile programs, but that he "[didn't] know the exact extent of it" and could not discuss it further for its sensitivity.[69] The most specific case of Chinese inputs into the North's missile program made public so far is the export of commercial logging vehicles that the DPRK turned into TELs for the KN-08.[70] Chinese analysts rarely acknowledge this; one article that touched on the issue simply stated that they were acquired through "special channels."[71] One PLARF analyst did admit China's role but commented that since the Chinese vehicle was only turned into a TEL after it was exported from China, would it be similarly fair to criticize the United States if the CPU for the computers used in North Korea's launch control center were found to be from Intel?[72] Beyond this, the PLA is also evidently invested in rebutting further accusations of Chinese assistance, since in September 2016 one PLA commentator responded to ROK media reports on Western speculation that China assisted with the North's SLBM program.[73] Chinese authors (with the exception of Gao's 2000 article) do not use China's own development path as a benchmark for evaluating North Korea's progress, as this too was censored from the 38North KN-14 translation.[74] This reticence to acknowledge China's role in the North's program is clearly political and highlights that these Chinese analysts are inherently constrained in at least some aspects of their analysis, limiting the value of their research for others.

Hints of Original Analysis Do Exist…

Despite relying heavily on Western analyses, Chinese analysts do occasionally conduct some original analysis. As noted above, research staff from STII appear to conduct their own tracking of DPRK test launches and have produced their own estimates of DPRK missile stocks. One area in which Chinese researchers appear to have focused more original work is the Musudan's use of lattice fins for stabilization, which were added after the first four failed Musudan tests in 2016 and led to improved performance. While U.S. experts did note the addition of lattice fins, they were generally considered a small example of DPRK innovation to solve the problem of stabilizing the first stage.[75] By contrast, an article by a PLA analyst provides a much more in-depth analysis of the Musudan's new fins as a way to speak to the broader benefits of such technology.[76] The article notes that North Korea likely acquired the technology through its purchase of the KN-02/Toksa [托克萨] from Syria, but it was the first in the world to use eight fins, since the Soviet SS-20, R-77 AAM and even the U.S. MOAB use only four fins.

First, the author asserts the addition of the fins on the Musudan was a "major improvement" to "improve the stability of its early flight and overcome the missile's own problems through external aerodynamic control" and assumes that the fins are used in conjunction with an "internal hydraulic linkage mechanism" to two internal maneuverable engines.[77] It explains that as the Musudan's fuel box was extended to increase the range, this meant that after the fuel was consumed the missile's center of mass would deviate, and that the missile's design did not allow for immediate correction through vector control, which led to structural vibration and ultimately the missile breaking up and exploding.

Second, the article notes the similar use on the Pukguksong-1 [北极星] SLBM, explaining that the fins help control the missile's attitude during the high speeds of the boost phase, a problem likely caused by the engine's serious ablation (evident in the March 2016 engine test photos), which can't be solved with maneuverable engines since it is solid-fuel.[78] The author links the appearance of the grid fins on the Musudan and Pukguksong-1, explaining that since they are both based on the Soviet SS-N-6 they likely faced similar problems, even though the SLBM was eventually converted to a solid fuel engine. Western analysts, to our knowledge, did not make these analytic points about the Musudan and Pukguksong-1, suggesting this is original Chinese analysis.[79]

…And Reveal Insights into Chinese Thinking on Geopolitical Implications

Chinese analysts appear to believe sanctions have had a more substantial impact on the North's missile program than most Western analysts believe. Li Mei's translation of the 38North KN-14 article emphasizes the role of sanctions, adding that the original article's stated worst-case projection of 2023 would occur under "severe international sanctions" and even arguing North Korea "may lose access" to its TELs "under long-term sanctions."[80] Another PLA analyst argued in 2016 that sanctions would likely force the North to turn the Unha-3 SLV into an ICBM due to the increased costs for rocket technology, and appeared to implicitly link sanctions to the North's pace of testing, arguing that sanctions delayed testing for the Musudan until even after it was deployed operationally in the field.[81] Sanctions were even listed by PLARF analysts as a reason for the North's development of the hydrogen bomb as a way to overcome imprecise missile targeting, since sanctions have limited the North's access to the "high-precision guidance technology and parts manufacturing" that are necessary for more accurate long-range missiles.[82] Yet, these articles still miss important aspects of the Western conversation – for example, that North Korea appears content to acquire working, but not cutting-edge, technology, making sanctions enforcement more difficult.

Additionally, Chinese articles generally do not focus on North Korea's proliferation of missile technology, especially not in a negative light. The early burst of articles following

the North's 1998 Taepodong test relays in dispassionate terms actions that were alarming to Washington. Gao's 2000 article, for example, frames the Nodong's poor accuracy as limiting its value to being a "terror weapon" with nuclear or VX nerve gas payloads.[83] It also merely notes in passing that the Nodong-2's 1,500km range is not only "politically significant" for striking Tokyo but also useful for putting Israel within range of Iran and Libya "since these two countries may buy the Nodong-2 missile," adding that the 1993 Nodong test may have been for an Iranian delegation. Even earlier, Jiang's 1998 article assessed North Korea as likely to be producing 4-8 Scuds per month and selling them to Iran, Syria, and other countries.[84] Neither author remarked on the implications of such technology proliferation for Middle East security. A similar article from 2004 analyzing Libya's WMD program traces North Korea's role in its missile program without any concern.[85] There is not much current focus on DPRK-Iran cooperation, but Zhang's 2017 article notes that North Korea's Nodong-2, based on unattributed reports, may have incorporated "warhead technology" from Iran's Shehab-3 missile to add four small engines to the warhead to control reentry, making it more accurate.[86] Even when North Korea's proliferation of missile technology would logically threaten China, such criticism remains notable only in its absence. For example, a 2014 article on Vietnam's missile capabilities notes that Vietnam imported Scud missiles from North Korea, but ignores the fact that such weapons could be used against China in a South China Sea conflict.[87]

At least some analysts, however, do understand the second-order consequences of Pyongyang's actions for China's security. One 2016 *Winged Missile* article by PLA authors on the North's fourth nuclear test takes a stronger rhetorical stance against the DPRK's test than the Chinese government, stating that North Korea's test "severely violates international norms," "severely impacts the security and stability of Northeast Asia" and presents a "serious danger for breaking fragile [regional] stability."[88] Even more clearly, it describes South Korea as the biggest "victim" from the North's nuclear test and says the ROK people cannot accept the North's "nuclear terrorist threats." It also warns that Seoul and Tokyo may use the North as excuses to develop their own nuclear weapons and for Japan to become a "normal" country, which would worsen regional security. Zhang Ying's 2017 article also illustrates that these analysts are not narrowly focused on the missiles, but are also familiar with general DPRK government issues and regional dynamics: it asserts that "the frequent testing, from a political perspective, can strengthen Kim Jong-un's power internally, and externally, through testing four new IRBM and ICBM models successfully, has fully revealed North Korea's long-range missile capability, and accomplishes the goal of testing the new U.S. administration's policy and attitude toward North Korea, and propagandizes that international sanctions on North Korea are 'useless.'"[89] Nevertheless, these are rare mentions of geopolitical analysis.

The Korean Peninsula is a Major Security Concern for China…

The continued, if niche, attention to DPRK missiles over the years by Chinese defense researchers reflects a priority for Korea-related issues. Korean Peninsula security issues are clearly a key concern for China, which Andrew Scobell and Mark Cozad described as within China's "second ring of insecurity," the "band or buffer within which Beijing seeks to maintain stable and sympathetic—or at least neutral—regimes and deny presence or access to the military forces of external powers."[90] This is evident diplomatically, in Beijing's unprecedented effort to host the Six Party Talks in the 2000s – a level of diplomatic commitment to a third-party problem still unmatched a decade-plus later.[91] It is also evident in the PLA's decision to create the Northern TC in 2015, which is focused almost exclusively on Korea contingencies.[92] China's concern is primarily about the threat of a U.S.-initiated war against North Korea on its borders, with its immediate risks of DPRK collapse and increased U.S. military presence near China, along with the second-order consequences of spillover of nuclear contamination and refugees.[93]

This context helps frame the role of these articles. Fundamentally, China has an interest in monitoring all global military developments, especially those in its region and those most likely to be employed in a conflict. North Korea's missiles fit both of these motivations, as these articles likely help provide a technical baseline for the broader Chinese analytic community that works on Northeast Asian regional security and nonproliferation issues. They are likely used as open source reference materials for those without access to classified Chinese assessments, which is why they include translations of Western articles and are not cited in other Chinese articles. This way the broader Chinese defense community can keep track of DPRK missiles, especially to understand the technical capabilities that might risk provoking a war with the United States.

But China Generally Overlooks DPRK Threat to China

Beyond the threat of U.S. military actions against Pyongyang, Beijing worries far less about any DPRK actions against China. Beijing's concern, insofar as it exists, is much more likely centered on North Korea's missile capabilities than any other conventional capabilities, since its missile are realistically the only way Pyongyang could strike Beijing with any confidence and surprise. By comparison, the KPA's ground forces are arrayed overwhelmingly toward the DMZ with limited mobility, its navy is split between both sides of the Peninsula, and its air force flies Soviet relics dating to the late Cold War era at best.[94]

This lack of concern about the prospect of North Korea's missiles being used to target China is common across Chinese analyses. Chinese analysts do not focus on the missiles that

pose the greatest threat to China – the Scud and Nodong – but instead focus on the newest and biggest missiles that threaten the United States. Additionally, there is almost no mention in public of the possibility that North Korea could use its missiles to strike China, in part because Chinese analysts avoid addressing the most obvious time China might become a target for the North – Chinese intervention during a DPRK contingency. This is a case in which the exception proves the rule – the only authoritative analyst to mention China as a possible target for DPRK missiles was Zhang Ying.[95] Yet even then, Zhang appears to shape his or her analysis to fit political realities, noting only that the Nodong-1, Nodong-2 and Taepodong-1 could strike China's northeast. In reality, it is unclear how well these missiles would actually perform on the lofted trajectory needed to reach such a close target. Were the Nodong to be fired on a more normal trajectory, it would reach as far as Beijing and Shanghai with the conservative range estimate Zhang provides. The Taepodong's 2,000km range means it can almost reach Hong Kong and Chengdu from the Sohae launch pad, covering the vast majority of the Chinese population. This clearly downplays the reach of DPRK missiles below their acknowledged ranges and capabilities.

Chinese analysts do acknowledge the DPRK threat to China in private with Western counterparts, but this discussion is rarely public.[96] One expression of this concern is evident in an article by PLA Air Force (PLAAF) researchers in February 2019, which addresses global missile capabilities and the threat they pose to China.[97] For North Korea, its missiles were assessed as capable but only somewhat threatening to China – the same as Russia.[98] This ranked it behind countries that are both capable and "the most threatening" – the United States and India.[99] Illustrating Beijing's threat perceptions, however, is the fact that Japan's missile capabilities were described as "potential" but still very threatening. This lack of serious concern challenges the notion that Beijing practices a pure form of realpolitik, with foreign policy behavior and underlying threat perceptions attenuated to at least some degree by political relations, evident here for its approach to DPRK missiles.

Beyond assessing DPRK intent against China, Pyongyang's poor track record of missile testing further raises the possibility of an unintentional mishap, such as DPRK aircraft reportedly crash landing in China or DPRK missile failures bringing IRBMs down into nearby towns.[100] In the course of this study, when we asked one Chinese scholar if China was concerned about the possibility that a DPRK missile could unintentionally land on Chinese territory during a testing accident, the scholar demurred. He acknowledged that was a risk, but said China never worried about an intentional DPRK attack, and if such an accident did occur, "Beijing would yell at Pyongyang for a short period of time, then everything would return to normal."[101]

The relative lack of attention to DPRK missiles when compared with Japanese or U.S. missile capabilities is almost certainly a reflection of China's threat perception. Yet, Beijing still dedicates more resources to watching DPRK missiles for all these reasons than other "rogue regimes" do that might invite U.S. use of force, such as Iran, since researchers at STII wrote fewer articles on Iranian missiles over the same period of time than on DPRK missiles.[102] An interesting middle ground, however, is Russia, as STII researchers have written more articles addressing Russian missiles than any country besides the United States. This is likely motivated partly by a lingering threat perception of Moscow, despite warming ties since the fall of the Soviet Union, as well as by China's desire to simply monitor and understand global military developments.

Ultimately, these Chinese writings strongly suggest the Chinese government views DPRK missile capabilities as credible. Indeed, one possible indication China has hedged against the possibility of a DPRK attack is the reported deployment of S-400 air defense systems in Shandong, coincidentally located across from the Korean Peninsula.[103]

This Research Community Likely Provides Only Indirect Policy Inputs

The articles surveyed here appear to play an important role in providing a technical baseline for the broader Chinese analytic community that works on Northeast Asian regional security and nonproliferation issues. They are likely used as open source reference materials for those without access to classified Chinese assessments and reflect a concerted and long-term commitment of resources to monitoring foreign military developments, even third-party (U.S.) views of them.[104] These articles help inform broader discussion and feed foreign information into the otherwise fairly closed system, which is why they include translations of Western articles and are not cited in other Chinese articles. The journals are not widely influential since they do not publish on policy issues, but can be understood to represent leading views within the technical community.

However, these researchers and their analysis are unlikely to provide direct policy inputs into the Chinese system. The specific input and feedback loop between academic research and policy decision-making in China is difficult to assess, even more so when it comes to the Chinese military and defense community. Beyond researchers already within the system, such as those at STII, academics at Chinese universities can also impact the policy process.[105] This impact can come in many forms, including research projects funded by government grants, advisory roles for decision-making bodies, and personal relationships with decision-makers, especially former students. Their expertise can range from Korean security issues, to DPRK economy, to DPRK society, to Korea's place in U.S.-China relations, and all of this expertise is important for a comprehensive understanding of China-DPRK relations.

Indeed, there is a cottage industry of self-proclaimed experts who lend their analysis to more popular and mainstream magazines that are much more tabloids for military enthusiasts than venues for serious analysis, such as *Tank and Armoured Vehicle*. Chen Youlong is the most prolific analyst on DPRK missiles, authoring nine articles out of the 23 articles explicitly focused on the topic in 2017 and 2018 alone.[106] His lack of deep expertise on North Korea is evident in the fact that he has written 39 articles in the journal on other topics, including Canadian armored vehicles, the U.S. XS-1 space plane, and Turkey's new MRAP. This is compared to Chinese military-affiliated experts who work for the organizations producing Chinese missiles and who write exclusively on missile capabilities. Perhaps even more clearly, he wrote about the reported Ukrainian origins of the newest DPRK engines but misstated the name of the engines in question.[107] Yet, the impact of these types of analysts should not be overlooked as a driver in the overall public conversation about DPRK missiles, since Chen has over 1.8 million followers on China's version of Twitter, Sina Weibo.[108]

CONCLUSIONS

This report finds that open-source Chinese analysts do indeed monitor and publish on DPRK missiles but offer little to enhance existing Western research. The writings examined above suggest a growing interest in DPRK military affairs, reflecting the North's evolving capabilities, greater Chinese concern over the risk of U.S.-initiated conflict on the Peninsula, and broader trends of greater Chinese attention to foreign militaries around the world. The vast majority of Chinese analyses are drawn from Western sources, though some unique assessments do exist. Our survey demonstrates this specific community was able to accurately track DPRK missile advances, since Chinese analyses broadly align with Western conclusions from a technical standpoint, namely that North Korea has a functional, if not fully reliable, ICBM that can reach the United States with a nuclear weapon. At the very least, these articles serve to transfer some of the best Western analysis into China, hopefully providing a basis for better discussion on DPRK-related issues between Washington and Beijing.

Where Chinese and Western experts diverge is in their assessments of the operational viability of these systems, a point that gets to the heart of the questions posed by this report. To an American eye, open source Chinese analysts view the North through rose-colored glasses, tracking the advancing capabilities the North fields while refusing to acknowledge the devasting possibility that a North Korea armed with nuclear weapons and IRBMs threatens Asia just as much as – if not more than – its ICBMs threaten the United States. From Beijing's perspective, by contrast, U.S. analysts adopt a worse-case scenario approach that overlooks clear and perhaps daunting challenges made more severe by international sanctions.

The conclusion we draw from our review of Chinese assessments of North Korean ballistic missiles is that the PRC's foreign policy worldview, its domestic political system, and the political limits it places on information circulation, do not permit China-based specialists to produce systematic, original analyses that are responsive to the shifting threat that the Korean People's Army's advancing delivery vehicles for weapons of mass destruction could plausibly pose to the Chinese homeland. In order to find technical analysis of North Korea, foreign analysts should look to other sources than Chinese researchers.

What can be learned through this study is that Chinese analysts do not view the DPRK through a purely realist lens (or at least cannot publicly admit to doing so). This conclusion leads to at least three modifications for the existing realpolitik interpretation of Chinese foreign policy.

First, it is possible that Chinese analysts' threat perceptions are attenuated by the comfort of a superficial friendship with North Korea or the calculation that the regime is too dependent on China to bite the hand that feeds it. This would reflect a common Chinese assumption that Kim Jong-un is rational, and since a DPRK strike on China would be an irrational act in any circumstance other than a PRC invasion of the DPRK during a breakdown in Kim family control, this is, thus, not a concern.

Second, it is possible that Chinese analysts conceal their sense of concern about North Korean capabilities out of deference for the DPRK's perceived broader utility in China's geopolitical competition with the United States. This is also related to a possible sense of strategic empathy Chinese analysts may feel for North Korea, a country sometimes portrayed in Chinese propaganda as a poor and isolated yet proud nation staring down the militarily powerful American imperialists.[109]

Third, domestic political sensitivities, especially the desire to avoid feeding the impression that the Chinese Communist Party has supported the creation of a force that might pose a direct threat to the Chinese homeland, may limit the extent to which Chinese analysts can openly discuss uncomfortable realities such as China's vulnerability to North Korean capabilities and Beijing's past support to Pyongyang's weapons and missile programs. Such information is certainly considered sensitive and much of it would probably be classified within the Chinese system, making it dangerous or impossible for any PRC-based author to comment on or speculate about such subjects.

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[109] The authors thank Phil Saunders for this point.

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