

REDUCING THE RISK OF NUCLEAR WEAPON USE IN NORTHEAST ASIA

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# **NUCLEAR WEAPONS AND DELIVERY SYSTEMS THAT MIGHT BE IMPLICATED IN NUCLEAR USE INVOLVING THE KOREAN PENINSULA**

MATT KORDA

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# NUCLEAR WEAPONS AND DELIVERY SYSTEMS THAT MIGHT BE IMPLICATED IN NUCLEAR USE INVOLVING THE KOREAN PENINSULA

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## ABSTRACT

It is highly unlikely that the Democratic People's Republic of Korea (DPRK) would intentionally launch nuclear weapons in the absence of an existential threat to the continued survival of the state and its political leadership. However, in the event of such a scenario—for example, the prospect of an imminent US invasion or regime change operation—it is possible that the DPRK would use some of its estimated forty to fifty nuclear weapons in an attempt to forestall US action. In that case, the DPRK could use its short- and medium-range ballistic missiles early in a conflict to strike political and military targets in the Republic of Korea (ROK) and Japan, it and could potentially use its intermediate-range and intercontinental ballistic missiles to strike US military targets on Guam and Hawaii. The DPRK could also hold some nuclear weapons in reserve to strike the continental United States with intercontinental ballistic missiles, in the event that its initial nuclear strikes did not prevent an existentially threatening conventional invasion of the DPRK. First nuclear strikes by the United States (and its

allies), or by China or Russia, may also be unlikely in the absence of an overwhelming provocation, but the nuclear weapons and launch systems available to these states are also considered.

Keywords: DPRK, Nuclear Weapons, Delivery Systems, Nuclear-use Case, Korean Peninsula, United States

## THE DPRK'S NUCLEAR WEAPONS AND DELIVERY SYSTEMS

Due to the international community's distinct lack of external visibility into the nuclear weapons program of the Democratic People's Republic of Korea (DPRK), formulating an accurate open-source assessment of the country's nuclear capability is fraught with uncertainty. As a result, this paper relies upon publicly available information and satellite imagery relating to the DPRK's fissile material production, nuclear posture, and delivery vehicle development, and uses multiple sources of data whenever possible to corroborate each point.

### Warhead estimates

Given the uncertainties relating to the DPRK's fissile material production—and its uranium enrichment operations in particular—it is difficult to assess the nature of the DPRK's fissile material stockpile. It is also unclear whether the DPRK is prioritizing the development and production of higher-yield thermonuclear weapons or lower-yield fission-only or boosted single stage weapons. The configuration of the weapons would significantly change the amount of fissile material needed for each design. If the DPRK committed most of its fissile material towards thermonuclear weapons production, open-source estimates suggest the country could have sufficient fissile material to produce approximately ten to twenty nuclear weapons.<sup>1</sup> If the DPRK committed most of its fissile material towards single-stage fission weapons instead, then open-source estimates—including those made by the author of this paper—suggest the country could have sufficient fissile material to produce approximately

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<sup>1</sup> Vitaly Fedchenko and Robert Kelley, "New methodology offers estimates for North Korean thermonuclear stockpile," *Janes Intelligence Review* (September 2020), pp. 44-49, <https://www.janes.com/new-methodology-offers-estimates-for-north-korean-thermonuclear-stockpile>

forty to fifty nuclear weapons.<sup>2</sup> This falls within the range offered by a July 2020 US Army study, which stated that “[e]stimates for North Korean nuclear weapons range from 20–60 bombs, with the capability to produce 6 new devices each year.”<sup>3</sup> It is also possible that the DPRK has actually assembled only a small number of those weapons as it continues to iterate on the designs of its nuclear devices.

## Warhead yields

The yields of the DPRK’s nuclear weapons are unknown; however, it is clear from reviewing the data from the country’s six nuclear tests that the DPRK is now able to produce nuclear devices with yields in the range of thermonuclear warheads. Although the DPRK’s first few nuclear tests only produced very small yields, subsequent tests produced yields of approximately five to fifteen kilotons, and its most recent nuclear test—in September 2017—apparently produced a yield of well over one hundred kilotons.<sup>4</sup> It remains unclear whether any of these weapons were themselves thermonuclear, or whether some may have been single-stage fission devices “boosted” with tritium.

## Delivery systems

Over the past decade, the DPRK has developed a highly diverse ballistic missile force, including missiles in all major range categories.

The DPRK operates several types of liquid-fuel Scud missiles. These missiles, known as the Hwasong-5 and Hwasong-6, are believed to have ranges of 300 kilometers and 500 kilometers, respectively.<sup>5</sup> The DPRK is currently modernizing both types of older missiles by equipping them with maneuverable reentry vehicles specifically designed to evade regional defense systems.<sup>6</sup>

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<sup>2</sup> Hans M. Kristensen and Matt Korda, “North Korean nuclear weapons, 2021,” *Bulletin of Atomic Scientists* 77:4 (21 July 2021), pp. 222–236, DOI: 10.1080/00963402.2021.1940803

<sup>3</sup> Department of the Army, ‘North Korean Tactics’, ATP 7-100.2, July 2020, p. 1-11, <https://irp.fas.org/doddir/army/atp7-100-2.pdf>

<sup>4</sup> Ankit Panda, “US Intelligence: North Korea’s Sixth Test Was a 140 Kiloton ‘Advanced Nuclear’ Device,” *The Diplomat* (6 September 2017), <https://thediplomat.com/2017/09/us-intelligence-north-koreas-sixth-test-was-a-140-kiloton-advanced-nuclear-device/>

<sup>5</sup> National Air and Space Intelligence Center, “Ballistic and Cruise Missile Threat,” *Department of Defense* (2020), p. 21, [https://media.defense.gov/2021/Jan/11/2002563190/-1/-1/1/2020%20BALLISTIC%20AND%20CRUISE%20MISSILE%20THREAT\\_FINAL\\_2OCT\\_REDUCEDFILE.PDF](https://media.defense.gov/2021/Jan/11/2002563190/-1/-1/1/2020%20BALLISTIC%20AND%20CRUISE%20MISSILE%20THREAT_FINAL_2OCT_REDUCEDFILE.PDF)

<sup>6</sup> Ankit Panda, “Introducing the KN21, North Korea’s New Take on Its Oldest Ballistic Missile,” *The Diplomat* (14 September 2017), <https://thediplomat.com/2017/09/introducing-the-kg21-north-koreas-new-take-on-its-oldest-ballistic-missile/>

In recent years, it appears the DPRK has prioritized the development of several new types of solid-fuel short-range ballistic missiles (SRBMs)—including the KN23, KN24, and KN25—which have collectively been tested more than thirty times since the beginning of 2019.<sup>7</sup> These missiles appear to bear several similarities to conventional American and Russian missiles, such as the ATACM or Iskander SRBM. It is possible, however, that one or more of these new solid-fuel missiles could eventually be operationalized to deliver nuclear weapons. In January 2021, DPRK Chairman Kim Jong Un announced that the DPRK was in the process of developing “smaller and lighter” tactical nuclear warheads, which could potentially be assigned to these new SRBMs.<sup>8</sup> Additionally, the DPRK claims that some variants of the new SRBMs will be capable of carrying 2.5-ton warheads, which could allow Pyongyang to couple them with heavier nuclear warheads.<sup>9</sup> The DPRK is currently conducting a sophisticated testing program for these missiles involving night tests and salvo launches, focusing on reducing the time intervals between rapid missile launches.<sup>10</sup>

Given their shorter ranges, the DPRK’s SRBMs are likely to be deployed within the narrow mountain valleys of the country’s “Tactical” ballistic missile belt extending across North Kwanghae and Kangwon provinces—approximately 50 kilometers to 90 kilometers north of the demilitarized zone (DMZ). According to the Center for Strategic and International Studies’ Beyond Parallel program, “The locations chosen for these bases are far enough forward to provide coverage of critical facilities in the northern two-thirds of South Korea, yet far enough from the DMZ to be beyond the range of South Korean and U.S. long-range artillery.”<sup>11</sup>

At this stage of the DPRK’s nuclear program, the country’s nuclear weapons would most likely be operationalized for delivery by medium-range ballistic missiles (MRBMs). The DPRK has developed three types of MRBMs, all of which are currently assumed to be operational. These systems are likely to be deployed in the

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<sup>7</sup> James Martin Center for Nonproliferation Studies, “The CNS North Korea Missile Test Database,” *Nuclear Threat Initiative* (31 March 2021), <https://www.nti.org/analysis/articles/cns-north-korea-missile-test-database/>; The KN25 was designated by DPRK media as a “super-large multiple rocket launcher;” however, US Forces Korea designated it as an SRBM due to its size and speed, which are much greater than those of typical multiple rocket launch systems.

<sup>8</sup> “On Report Made by Supreme Leader Kim Jong Un at Eighth Party Congress of WPK,” *National Committee on North Korea* (9 January 2021), [https://www.ncnk.org/resources/publications/kju\\_8th\\_party\\_congress\\_speech\\_summary.pdf/file\\_view](https://www.ncnk.org/resources/publications/kju_8th_party_congress_speech_summary.pdf/file_view)

<sup>9</sup> Oh Seok-min, “New KN-23 ballistic missile to boost N. Korea’s tactical nuclear capabilities: experts,” *Yonhap News Agency* (26 March 2021), <https://en.yna.co.kr/view/AEN20210326006800325>

<sup>10</sup> Joseph Dempsey, “Assessment of the March 9 KN-25 Test Launch,” *38 North* (10 March 2020), <https://www.38north.org/2020/03/jdempsey031020/>

<sup>11</sup> Joseph Bermudez, Victor Cha, and Lisa Collins, “Undeclared North Korea: Missile Operating Bases Revealed,” *Center for Strategic and International Studies* (12 November 2018), <https://beyondparallel.csis.org/north-koreas-undeclared-missile-operating-bases/>



“Operational” ballistic missile belt in South Pyongan and South Hamgyong provinces—approximately 90 kilometers to 150 kilometers north of the DMZ.<sup>12</sup>

The Hwasong-7 (designated by the US Department of Defense as “Nodong”) is a single-stage, liquid-fuel MRBM carried on a five-axle transporter erector launcher. The National Air and Space Intelligence Center estimates that the DPRK currently possesses fewer than 100 Hwasong-7 launchers.<sup>13</sup> The missile, which was first test-flown in 1993, exists in two versions (Mod 1 and Mod 2) and has an estimated range of 1,200 kilometres or more. The Hwasong-7 is among the DPRK’s oldest operational ballistic missile systems and is assumed to have very poor accuracy relative to the country’s more modern systems. It is therefore likely that the Hwasong-7 would be used in a countervalue nuclear strike role against cities or other political targets, rather than targeting adversarial military systems as part of a damage limitation or counterforce role.<sup>14</sup>

The Hwasong-9 (designated by the US Department of Defense as “KN04” or “Scud ER” [extended range]) is a single-stage, liquid-fuel, road-mobile MRBM launched from a four-axle transporter erector launcher. The Hwasong-9 is occasionally classified as a short-range ballistic missile; however, in a triple test launch of the system on 5 September 2016, the missiles apparently flew to a range of approximately 1,000 kilometres, which is considered the lower end of the range to be classified as an MRBM.<sup>15</sup>

The Pukguksong-2 (designated by the US Department of Defense as “KN15”) is a two-stage, solid-fuel MRBM carried in a canister on a road-mobile caterpillar-type transporter erector launcher. The missile appears to be a modification of the submarine-launched Pukguksong-1 missile (designated by the US Department of Defense as “KN11”). The first two flight tests in 2017 demonstrated a range of up to

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<sup>12</sup> Ibid.

<sup>13</sup> National Air and Space Intelligence Center, “Ballistic and Cruise Missile Threat,” *Department of Defense* (2020), p. 25.

<sup>14</sup> James Martin Center for Nonproliferation Studies, “CNS Special Report on North Korean Ballistic Missile Capabilities,” *Nautilus Institute* (22 March 2006), <https://nautilus.org/wp-content/uploads/2011/12/0623.pdf>; David Albright, “North Korean Miniaturization,” *38 North* (13 February 2013), <https://www.38north.org/2013/02/albright021313/>; Center for Strategic and International Studies, “Hwasong-7 (Nodong 1),” *CSIS Missile Defense Project* (15 June 2018), <https://missilethreat.csis.org/missile/no-dong/>

<sup>15</sup> National Air and Space Intelligence Center, “Ballistic and Cruise Missile Threat,” *Department of Defense* (2020), p. 25; James Martin Center for Nonproliferation Studies, “The CNS North Korea Missile Test Database,” *Nuclear Threat Initiative* (31 March 2021).

1,200 kilometers, which matches the National Air and Space Intelligence Center's range estimate of 1,000 kilometers or more.<sup>16</sup>

With ranges of approximately 1,000 to 1,200 kilometres, the DPRK's MRBMs would all be limited to holding targets at risk in and around the Korean Peninsula, including Seoul, Tokyo, and other important political and military targets. In recent years, the DPRK has also been developing the capability to hold US targets at risk—including both regional targets like Guam, where strategic US military bases are located, as well as targets within the continental United States—through the production of intermediate-range and intercontinental ballistic missiles. These missiles would likely be deployed in the “Strategic” ballistic missile belt stretching across North Pyongan, Chagang, Ryanggang, and the northern section of South Hamgyong—more than 150 kilometers north of the DMZ.<sup>17</sup>

The DPRK currently has two intermediate-range liquid-fuel ballistic missiles (IRBMs) in its inventory—the Hwasong-10 (Musudan) and the Hwasong-12 (KN17). The Hwasong-10 has an estimated range of more than 3,000 kilometers, but it suffered several consecutive test failures in 2016, calling its reliability into question.<sup>18</sup> The National Air and Space Intelligence Center estimates that the DPRK has fewer than 50 Hwasong-10 launchers in its inventory; however, given the system's unreliability, it is likely that the Hwasong-10 may have been replaced by the newer Hwasong-12 as the DPRK's primary intermediate-range ballistic missile.<sup>19</sup> The Hwasong-12 has a range of approximately 4,500 kilometres, meaning that it could target Andersen Air Force Base on Guam—a strategic air base that occasionally hosts US heavy bombers and would function as a critical way station for fighter planes and aerial tankers during wartime. It is unknown, however, whether the Hwasong-12 has actually been deployed; the missile has failed at least three of its six test launches, although the most recent three tests in the series resulted in successful launches.<sup>20</sup>

The DPRK has publicly shown five types of intercontinental ballistic missiles: the Taepo Dong-2, the Hwasong-13 (KN08), the Hwasong-14 (KN20), the Hwasong-15 (KN22), and the Hwasong-17 (KN28).

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<sup>16</sup> National Air and Space Intelligence Center, “Ballistic and Cruise Missile Threat,” *Department of Defense* (2020), p. 25; James Martin Center for Nonproliferation Studies, “The CNS North Korea Missile Test Database,” *Nuclear Threat Initiative* (31 March 2021).

<sup>17</sup> Bermudez, Cha, and Collins, “Undeclared North Korea: Missile Operating Bases Revealed,” *Center for Strategic and International Studies* (12 November 2018).

<sup>18</sup> James Martin Center for Nonproliferation Studies, “The CNS North Korea Missile Test Database,” *Nuclear Threat Initiative* (31 March 2021).

<sup>19</sup> National Air and Space Intelligence Center, “Ballistic and Cruise Missile Threat,” *Department of Defense* (2020), p. 25.

<sup>20</sup> James Martin Center for Nonproliferation Studies, “The CNS North Korea Missile Test Database,” *Nuclear Threat Initiative* (31 March 2021).

The Taepo Dong-2 is a three-stage, liquid-fuel rocket that is believed to be a derivative of the Unha-3 space launch vehicle. The National Air and Space Intelligence Center's 2020 report most recently lists the system as a "space launch vehicle."<sup>21</sup> Although the Taepo Dong-2 may have once functioned as an early ICBM prototype, the DPRK's recent development of newer, more sophisticated long-range systems suggests that the Taepo Dong is not currently an operational military system and is unlikely to become one in the future.

The Hwasong-13 is a three-stage, liquid-fuel ICBM first displayed during a military parade in 2012. In 2013, an Air Force Global Strike Command briefing listed the system as an ICBM that the DPRK "could field in [the] next [five] years." Unlike the DPRK's newer ICBMs, however, the Hwasong-13 has never been flight tested and has not featured in any recent military parades.<sup>22</sup> As a result, it is unlikely that the Hwasong-13 is currently an operational military system, and it is unlikely to become one in the future.

The Hwasong-14, first displayed and tested in 2017, was the DPRK's first military ICBM to be test-launched. In total, it has been successfully tested-launched twice on lofted trajectories. Likely sharing a first stage with the Hwasong-12 IRBM, the two-stage, liquid-fuel Hwasong-14 is believed to have a range exceeding 10,000 kilometers, depending on the weight of the accompanying warhead. This could potentially bring US cities on the West Coast, including Los Angeles and Seattle, within striking distance.<sup>23</sup> It is unclear whether the Hwasong-14 is currently an operational military system; its conspicuous absence at the DPRK's most recent military parade that featured ICBMs—in October 2020—could indicate that the DPRK intends to place more emphasis on its newer, longer-range ICBMs moving forward.<sup>24</sup>

The Hwasong-15, first test-launched on a lofted trajectory in November 2017, is a two-stage, liquid-fuel missile with an even longer range than the Hwasong-14. The National Air and Space Intelligence Center lists the range of the Hwasong-15 to be more than 12,000 kilometers, which would bring most of the continental United

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<sup>21</sup> National Air and Space Intelligence Center, "Ballistic and Cruise Missile Threat," *Department of Defense* (2020), p. 5.

<sup>22</sup> Lt. Gen. James M. Kowalski, "Air Force Global Strike Command," *Air Force Global Strike Command* (7 May 2013), slide 5, <https://programs.fas.org/ssp/nukes/nuclearweapons/AFGSC-CommandBrief-May2013.pdf>

<sup>23</sup> David Wright, "North Korean ICBM Appears Able to Reach Major US Cities," *Union of Concerned Scientists* (28 July 2017), <https://allthingsnuclear.org/dwright/new-north-korean-icbm/>; National Air and Space Intelligence Center, "Ballistic and Cruise Missile Threat," *Department of Defense* (2020), p. 27; Michael Elleman, "North Korea's Hwasong-14 ICBM: New Data Indicates Shorter Range Than Many Thought," *38 North* (29 November 2018), <https://www.38north.org/2018/11/melleman112918/>

<sup>24</sup> NK News, "North Korea Military Parade 2020—Livestream & Analysis," *YouTube* (10 October 2020), <https://www.nknews.org/2020/10/watch-free-livestream-of-north-koreas-military-parade-with-expert-commentary/>

States within range. Heavier nuclear payloads, however, could potentially decrease the missile's range.<sup>25</sup> Although it is unclear whether or not the Hwasong-15 is currently operational, four units were displayed during the DPRK's October 2020 military parade, and one was on display at the DPRK's October 2021 Defense Development Exhibition, indicating that the system is still a current focus for the nation's missile program.<sup>26</sup>

At its October 2020 military parade, the DPRK unveiled its largest ICBM to date—a liquid-fuel missile that appears to be designated the Hwasong-17.<sup>27</sup> It was also displayed on a transporter erector launcher (TEL) at the DPRK's October 2021 Defense Development Exhibition.<sup>28</sup> According to the “UN Panel of Experts” on the DPRK, the Hwasong-17 will likely be able to deliver a payload of approximately 1,700 kilograms to a range of approximately 14,000 kilometers eastward and 10,500 kilometers westward.<sup>29</sup> Given the missile's significant increase in size relative to the DPRK's other ICBMs, it is possible that the missile could be designed to carry either a large warhead or a smaller number of multiple reentry vehicles (either MRVs or MIRVs—multiple independently targetable reentry vehicles) with penetration aids to targets in the continental United States.<sup>30</sup> However, developing these complex capabilities would require the DPRK to conduct a sophisticated testing program, so it is highly unlikely that the system will be deployed in the near future, if it is indeed designed to carry countermeasures or multiple reentry vehicles.<sup>31</sup> As of December 2021 it has not been tested.

The operational status of any of the DPRK's ICBMs is highly uncertain, partially because it remains unclear whether the DPRK has managed to develop a functioning

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<sup>25</sup> National Air and Space Intelligence Center, “Ballistic and Cruise Missile Threat,” *Department of Defense* (2020), p. 29.

<sup>26</sup> NK News, “North Korea Military Parade 2020—Livestream & Analysis,” *YouTube* (10 October 2020); Colin Zwirko (@ColinZwirko), “It's got everything. Hwasong-16, 15, 14, and that new ‘hypersonic missile’? A portrait of Kim Jong Un sitting in military uniform with Pak Jong Chon at his shoulder too,” Twitter (11 October 2021), <https://twitter.com/ColinZwirko/status/1447710669713776644>

<sup>27</sup> Ibid; Ankit Panda, (@nktpnd), “Real good catch by @ColinZwirko: North Korea's very large road-mobile ICBM seen at the end of the October 2020 is the \*Hwasong-17\*, NOT Hwasong-16 (KN28 to USIC).” Twitter (12 October 2021), <https://twitter.com/nktpnd/status/1448073861363290124?s=20>

<sup>28</sup> Colin Zwirko (@ColinZwirko), Twitter (11 October 2021).

<sup>29</sup> United Nations Security Council, Report S/2021/211, 21-01647 (4 March 2021), Annex 10, [https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/s\\_2021\\_211.pdf](https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/s_2021_211.pdf)

<sup>30</sup> David La Boon (@DavidLaBoon), “Using the Lawn as a Ref, ~24m Width. That'll Put the Diam at ~2.5m Confirming Your Suspicion.” Tweet (10 October 2020), <https://twitter.com/DavidLaBoon/status/1314989032602968064>; Jeffrey Lewis (@ArmsControlWonk), “My Work, for Better or Worse.” Tweet (13 October 2020), <https://twitter.com/ArmsControlWonk/status/1316071900552990720>

<sup>31</sup> Michael Elleman, “Does Size Matter? North Korea's Newest ICBM,” *38 North* (21 October 2020), <https://www.38north.org/2020/10/melleman102120/>

reentry vehicle capable of protecting a nuclear warhead during violent reentry through the atmosphere. As of December 2021, it has not yet publicly demonstrated such a capability, nor has it demonstrated the capability to achieve warhead miniaturization, warhead activation, remote targeting, and terminal stage guidance—all of which would be necessary to achieve a high degree of confidence in a successful nuclear detonation. External experts, however, have suggested that there are no significant technical barriers that prevent the DPRK from eventually developing these capabilities, and it is clear that the DPRK is currently working towards perfecting them.

In addition to land-based ballistic missiles, the DPRK is also developing a suite of submarine-launched ballistic missiles known as Pukguksong (“Polaris”), that could be ultimately intended to carry nuclear weapons.

The Pukguksong-1 (KN11) is a two-stage, solid-fuel missile with an estimated range of more than 1,000 kilometers. The system has been successful in three of its six test-launches; however, the DPRK’s development of newer Pukguksong SLBMs could suggest that this early missile was intended as a technology demonstrator and has since been superseded by more advanced missiles.<sup>32</sup>

The more advanced Pukguksong-3 SLBM was first successfully test-launched from a submerged barge in October 2019, and it could have a maximum range between 1,900 kilometers and 2,500 kilometers.<sup>33</sup> During the October 2020 military parade, The DPRK unveiled its even newer Pukguksong-4 SLBM, which is wider than the Pukguksong-1 and potentially shorter than the Pukguksong-3.<sup>34</sup> According to the UN Panel of Experts, the Pukguksong-4 could have a maximum range between 3,500 kilometers and 5,400 kilometers for payloads of 1,300 kilograms and 650 kilograms, respectively.<sup>35</sup>

At the DPRK’s subsequent military parade in January 2021, the DPRK displayed its most recent iteration of the Pukguksong missile family: the Pukguksong-5 SLBM. The missile is roughly the same length as the Pukguksong-3, with a more elongated shroud.<sup>36</sup> The larger missile diameters and shrouds seen in the later iterations could

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<sup>32</sup> James Martin Center for Nonproliferation Studies, “The CNS North Korea Missile Test Database,” *Nuclear Threat Initiative* (31 March 2021).

<sup>33</sup> David Wright, “North Korea’s Latest Missile Test,” *Union of Concerned Scientists* (1 October 2019), <https://allthingsnuclear.org/dwright/north-koreas-latest-missile-test/>; United Nations Security Council, Report S/2021/211, 21-01647 (4 March 2021), Annex 11.

<sup>34</sup> NK News, “North Korea Military Parade 2020—Livestream & Analysis,” *YouTube* (10 October 2020).

<sup>35</sup> United Nations Security Council, Report S/2021/211, 21-01647 (4 March 2021), Annex 11.

<sup>36</sup> Michael Elleman, “North Korea’s Newest Submarine-Launched Ballistic Missile, Same as the Old One?” *38 North* (15 January 2021), <https://www.38north.org/2021/01/north-koreas-newest-submarine-launched-ballistic-missile-same-as-the-old-one/>; H.I. Sutton, “New North Korean Submarine-



indicate that these missiles might be designed to eventually carry MIRVs or penetration aids to overcome regional missile defenses; however, the development of these capabilities would require a sophisticated testing program. To reduce the overall weight of the missiles, the DPRK's SLBMs appear to use wound filament casings made of composite fibers; this would serve to make the airframes lighter and more efficient, thus improving their range.<sup>37</sup>

In October 2021, the DPRK unveiled a “new type” of smaller SLBM with an unknown designation at its Defense Development Exhibition.<sup>38</sup> The missile appears to bear similar characteristics to the DPRK's newer short-range ballistic missile designs.<sup>39</sup> The same missile was reportedly test-launched one week later to an approximate range of 590 kilometers.<sup>40</sup>

Although the National Air and Space Intelligence Center's 2020 report suggests that none of the DPRK's SLBMs have been deployed, they are likely to eventually be deployed on the DPRK's new class of Sinpo ballistic missile submarine.<sup>41</sup> The DPRK currently has a single ballistic missile submarine, the Gorae (Sinpo-B)—whose official name is 8.24 *Yongung*—which features a single launch tube for conducting test launches of the DPRK's earliest SLBM, the Pukguksong-1.<sup>42</sup> In July 2019, DPRK state media displayed its new Sinpo-C class submarine, which is expected to have at least three launch tubes; this suggests that it is likely intended for operational use.<sup>43</sup> The

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Launched Ballistic Missile,” *Covert Shores* (15 January 2021), <http://www.hisutton.com/North-Korean-Navy-SLBM-Pukguksong-5.html>

<sup>37</sup> United Nations Security Council, Report S/2021/211, 21-01647 (4 March 2021), Annex 11; Michael Duitsman (@DuitsyWasHere), “1/ Ability to make wound-filament solid rocket casings would be very significant for North Korea's solid fuel ballistic missile program.” Tweet (20 April 2017), <https://twitter.com/DuitsyWasHere/status/855222408092844032>

<sup>38</sup> Tianran Xu, “Brief on the Defence Development Exhibition of the Democratic People's Republic of Korea,” *Open Nuclear Network* (18 October 2021), <https://oneearthfuture.org/file/2622/download?token=OSeaZusF>

<sup>39</sup> Tianran Xu, “Brief on the 19 October 2021 Submarine-Launched Ballistic Missile Test of the Democratic People's Republic of Korea,” *Open Nuclear Network* (21 October 2021), <https://oneearthfuture.org/file/2627/download?token=XmEUw6TF>

<sup>40</sup> KCNA, “Academy of Defence Science Succeeds in Test-Launch of New-type SLBM” (20 October 2021), <https://kcnawatch.org/newstream/1634724068-15952614/academy-of-defence-science-succeeds-in-test-launch-of-new-type-slbm/>

<sup>41</sup> National Air and Space Intelligence Center, “Ballistic and Cruise Missile Threat,” *Department of Defense* (2020), p. 33.

<sup>42</sup> H. I. Sutton, “Analysis—Sinpo Class Ballistic Missile Sub,” *Covert Shores* (27 August 2016), <http://www.hisutton.com/Analysis%20-%20Sinpo%20Class%20Ballistic%20Missile%20Sub.html>; KCNA, “Academy of Defence Science Succeeds in Test-Launch of New-type SLBM” (20 October 2021), <https://kcnawatch.org/newstream/1634724068-15952614/academy-of-defence-science-succeeds-in-test-launch-of-new-type-slbm/>

<sup>43</sup> Choe Sang-Hun, “Kim Jong-un Inspects New Submarine That Could Increase Range of Missiles,” *New York Times* (22 July 2019), <https://www.nytimes.com/2019/07/22/world/asia/north-korea-kim-jong-un-submarine.html>; Joseph Dempsey and Dave Schmerler, “Two Halls Enter—One Sub Leaves,”

Sinpo-C is a modification of a Chinese-built Soviet-era *Romeo*-class submarine.<sup>44</sup> The UN Panel of Experts estimates that given the size of the new Sinpo-C and the expansion of the Sinpo South shipyard, three submarines could potentially be built concurrently.<sup>45</sup>

The expansion of the DPRK's ballistic missile submarine program could provide Pyongyang with the ability to further diversify its nuclear arsenal, thus offering a more credible retaliatory strike guarantee. On the one hand, this development could potentially help stabilize nuclear tensions on the Korean Peninsula, as a potential adversary could be more averse to conducting a first strike because of the uncertainty in disabling the DPRK's nuclear deterrent. On the other hand, however, the DPRK's noisy diesel-electric ballistic missile submarines could potentially be vulnerable to adversarial anti-submarine warfare maneuvers and technologies. This vulnerability could potentially create a destabilizing situation for nuclear use if the DPRK's ballistic missile submarine felt threatened while on deterrence patrol.

In September 2021, the DPRK tested a new land-attack cruise missile to a range of 1,500 kilometers. Although Pyongyang has other cruise missiles in its arsenal, this is the first system that has been explicitly designated to be a "strategic cruise missile," implying a connection to the DPRK's nuclear weapons program.<sup>46</sup> Given that this system is designed to circumvent radars or missile defense systems, it could offer the DPRK a new and unique capability to attack regional targets.

Also in September 2021, the DPRK tested a new missile called the Hwasong-8, which appeared to include a hypersonic glide vehicle carried by a Hwasong-12 booster. The missile was subsequently displayed on its TEL during the October 2021 Defense Development Exhibition.<sup>47</sup> The photo released from the launch showed that the

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*Arms Control Wonk Blog* (17 June 2021), <https://www.armscontrolwonk.com/archive/1212081/two-halls-enter-one-sub-leaves/>; Oliver Hotham, "New North Korean submarine capable of carrying three SLBMs: South Korean MND," *NK News* (31 July 2019), <<https://www.nknews.org/2019/07/new-north-korean-submarine-capable-of-carrying-three-slbms-south-korean-mnd/>

<sup>44</sup> Tianran Xu, "Ballistic Missile Submarines and Submarine-Launched Ballistic Missiles of the Democratic People's Republic of Korea," *Open Nuclear Network* (16 April 2021), <https://oneearthfuture.org/research-analysis/ballistic-missile-submarines-and-submarine-launched-ballistic-missiles-democratic>

<sup>45</sup> United Nations Security Council, Report S/2020/151, 20-02046 (2 March 2020), Annex 60, <https://undocs.org/en/S/2020/151>

<sup>46</sup> Min Joo Kim, "North Korea says it has tested a new long-range cruise missile," *Washington Post* (13 September 2021), [https://www.washingtonpost.com/world/north-korea-says-it-has-tested-a-new-long-range-cruise-missile/2021/09/12/2118e3ea-1432-11ec-b976-f4a43b740aeb\\_story.html](https://www.washingtonpost.com/world/north-korea-says-it-has-tested-a-new-long-range-cruise-missile/2021/09/12/2118e3ea-1432-11ec-b976-f4a43b740aeb_story.html)

<sup>47</sup> Tianran Xu, "Brief on the Defence Development Exhibition of the Democratic People's Republic of Korea," *Open Nuclear Network* (18 October 2021), <https://oneearthfuture.org/file/2622/download?token=OSaZusF>

missile cleared the launch tube, but it is not clear from the text whether it was a completely successful flight.

## Fuel types: solid versus liquid

The DPRK increasingly appears to be prioritizing the development of solid-fuel missiles, particularly for its short- and medium-range ballistic missile systems. While liquid-fuel missiles are more efficient and can be throttled by slowing the chemical reaction between the fuel and oxidizer as needed, solid-fuel missiles have several distinct military advantages over liquid-fuel ones. In particular, solid propellant is safer and not as corrosive as liquid propellant, requires less maintenance, and can safely handle off-road transportation conditions.<sup>48</sup> Additionally, solid-fuel missiles are pre-cast and therefore do not require a lengthy fueling process prior to launch. This means that in a wartime scenario, solid-fuel missiles can simply be rolled out of their hiding places and launched within minutes; in contrast, liquid-fuel missiles could be vulnerable to a pre-emptive strike during their prolonged fueling process. This vulnerability could be exacerbated by the presence of support vehicles and fuel trucks that would not be necessary for solid-fuel missiles and make liquid-fuel missiles easier to spot via aerial reconnaissance or synthetic aperture radar.

Currently, the DPRK's only solid-fuel missiles that could potentially be assigned a nuclear strike role in the future are the KN23, KN24, and KN25 SRBMs, as well as the Pukguksong-1 (KN11) SLBM, Pukguksong-2 (KN15) MRBM, and the newer, developmental Pukguksong-3, Pukguksong-4, and Pukguksong-5 SLBMs. It is probable, however, that the DPRK aspires to develop a solid-fuel IRBM and/or ICBM that can strike targets in Guam and/or the continental United States.

In September 2021, DPRK state media reported that the Hwasong-8 was the first DPRK missile to use a "fuel ampoule," which involves placing pre-fueled liquid-fueled missiles in temperature-controlled canisters to facilitate faster launches.<sup>49</sup> According to the press release, the DPRK plans to transition all liquid-fueled missiles into ampoules.<sup>50</sup>

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<sup>48</sup> John Schilling, "A Solid but Incremental Improvement in North Korea's Missiles," *38 North* (29 March 2026), <https://www.38north.org/2016/03/jschilling032916/>

<sup>49</sup> KCNA, 'Hypersonic Missile Newly Developed by Academy of Defence Science Test-fired' (30 September 2021), <https://kcnawatch.org/newstream/1632978090-364336107/hypersonic-missile-newly-developed-by-academy-of-defence-science-test-fired/>; Xu, T. 'Brief on the Defence Development Exhibition of the Democratic People's Republic of Korea', *Open Nuclear Network*, 18 Oct. 2021, <https://oneearthfuture.org/file/2622/download?token=OSeaZusF>

<sup>50</sup> KCNA, 'Hypersonic Missile Newly Developed by Academy of Defence Science Test-fired' (30 September 2021).



## Launch systems

The DPRK's ability to operate large numbers of heavy long-range missiles could depend on its ability to procure or indigenously produce launchers for those same missiles. The DPRK previously sourced its heavy launchers from Soviet and Chinese companies that produced specialty vehicles and chassis for civilian and military applications.<sup>51</sup> The DPRK appears to have acquired several demilitarized Russian and Belarusian TELs for use with the Musudan and other longer-range missiles in the early 2000s.<sup>52</sup> When sourcing vehicles from China, the eight-axle WS51200 was marketed as a lumber hauler, and the apparent intended end-user when the vehicle was purchased was the DPRK Ministry of Forestry. Converted WS51200 vehicles were, however, subsequently displayed at an April 2012 military parade carrying Hwasong-13 ICBMs.<sup>53</sup> The UN Panel of Experts suggests that at least six of these heavy launchers have been transferred to the DPRK, and they have appeared at several subsequent military parades and during missile test launches.<sup>54</sup> It also appears that at least one of these vehicles was indigenously modified to add a ninth axle to support the November 2017 launch of the Hwasong-15 ICBM.<sup>55</sup> No more than six converted WS51200 launchers have appeared at any one time, so it is possible the DPRK only maintains a total of six such launchers.

Given the rigid sanctions regime under which the country operates, it is clear that the DPRK is working towards developing an indigenous heavy launcher production capability for its longer-range missiles. In late 2017 and early 2018, Kim Jong Un visited several factories with ties to the “production of Korean-style heavy-duty vehicles,” according to DPRK state media, including the March 16 Factory, the Kumsong Tractor Factory, the Amnokgang Tire Factory, the Sungri Motor Complex, and the Pyongyang Trolley Bus Factory.<sup>56</sup>

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<sup>51</sup> Melissa Hanham, “North Korea's Procurement Network Strikes Again: Examining How Chinese Missile Hardware Ended Up in Pyongyang,” *Nuclear Threat Initiative* (31 July 2012), <https://www.nti.org/analysis/articles/north-koreas-procurement-network-strikes-again-examining-how-chinese-missile-hardware-ended-pyongyang/>

<sup>52</sup> Markus Schiller, “Characterizing the North Korean Nuclear Missile Threat,” *RAND Corporation* (2012), [https://www.rand.org/content/dam/rand/pubs/technical\\_reports/2012/RAND\\_TR1268.pdf](https://www.rand.org/content/dam/rand/pubs/technical_reports/2012/RAND_TR1268.pdf)

<sup>53</sup> It is unclear whether these Hwasong-13 missiles displayed at the parade were mockups; however, the missiles' assignment to the newly-imported WS51200 vehicles clearly indicate that the vehicles had been converted to fulfill a military function.

<sup>54</sup> United Nations Security Council, Report S/2021/211, 21-01647 (4 March 2021), Annex 10; United Nations Security Council, Report S/2013/337, 13-33174 (11 June 2013), paras. 52-58, [https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/s\\_2013\\_337.pdf](https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/s_2013_337.pdf)

<sup>55</sup> United Nations Security Council, Report S/2021/211, 21-01647 (4 March 2021), Annex 10.

<sup>56</sup> Ankit Panda, “What to Watch For at North Korea's Upcoming Military Parade,” *The Diplomat* (4 February 2018), <https://thediplomat.com/2018/02/what-to-watch-for-at-north-koreas-upcoming-military-parade/>

Indigenously producing heavy launchers is a highly challenging prospect, however. The chassis and steering systems are complicated to produce and the DPRK would also have to develop powerful engines and transmissions. The DPRK would also have to create a complex computer program that properly aligns the vehicles' axles and allows them to safely respond to off-road terrain challenges.<sup>57</sup>

Despite these technological and logistical challenges, it appears that the DPRK is having some success with its indigenous production of heavy launchers for its missiles. In 2017, the DPRK first test launched its new solid-fuel Pukguksong-2 MRBM from an indigenously-produced road-mobile caterpillar-type transporter erector launcher. This tracked system could allow the Pukguksong-2 to be launched from hidden, off-road sites, compared to the DPRK's other missiles, which use wheeled launchers and thus require paved or relatively smooth roads—a rarity in the country's mountainous terrain. According to the UN Panel of Experts, the DPRK has also developed caterpillar launchers for some of its newer SRBM systems, including the KN23, KN24, and KN25.<sup>58</sup>

Additionally, in October 2020 the DPRK displayed a new eleven-axle transporter erector launcher for its new Hwasong-17 ICBM. It is certainly possible that the DPRK has continued to import vehicle components for the system despite enhanced sanctions enforcements. The UN Panel of Experts, however, suggested the vehicle itself was manufactured in the DPRK.<sup>59</sup> If this is the case, it would represent a significant accomplishment for the country's heavy launcher production capabilities. If the DPRK now has the ability to mass produce heavy launchers for its ICBMs, there would be significantly fewer constraints on the number of long-range missiles that the DPRK would be able to operate.

At the same time, these types of heavy, wheeled launchers would be limited to traveling on high-grade roads and would likely be used to carry the DPRK's newer liquid-fuel ICBMs; this means that the launcher would also have to travel in a convoy with fuel trucks, support vehicles, and possibly a loading crane—all of which would make it significantly easier for adversarial reconnaissance to spot the systems well in advance of launch. This could raise the possibility of a US or South Korean pre-emptive strike on a missile convoy during times of heightened tensions.

In September 2021, the DPRK conducted its first test launch of ballistic missiles from a train. The DPRK's "Railway Mobile Missile Regiment" was created at the Eighth Party Congress in January 2021, and DPRK officials stated that the successful test

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<sup>57</sup> Melissa Hanham, Matthew Frank, Xu Tianran, and Katsuhisa Furukawa, "North Korea's New ICBM and Transport Truck," *Datayo* (16 October 2020),

<https://datayo.org/p/stories/9cyjM94n9UXNErs/north-koreas-new-icbm-and-transport-truck>

<sup>58</sup> United Nations Security Council, Report S/2021/211, 21-01647 (4 March 2021), Annex 12.

<sup>59</sup> Ibid, Annex 10.

could lead to the expansion of the regiment into a full brigade.<sup>60</sup> The tested missiles appeared to be KN23 SRBMs that reportedly flew to a range of 800 kilometers; however, it is possible that the DPRK could eventually load its rail launchers with longer-range missiles specifically designed to carry nuclear weapons. Given that the DPRK has an extensive cross-country rail network that frequently travels through mountains, these new rail launchers will likely pose additional targeting challenges for US/ROK military planners.<sup>61</sup>

## NUCLEAR DOCTRINE AND NUCLEAR USE

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It is highly unlikely that the DPRK would intentionally launch nuclear weapons in the absence of an immediate existential threat to the continued survival of the state and its political leadership. In the event of such a scenario—for example, the prospect of an imminent US invasion or regime change operation—it is possible that the DPRK would use its nuclear weapons in an attempt to forestall US/ROK action.

For decades, the DPRK has been relatively transparent about its nuclear weapons policy and has made several complementary statements and signals laying out its nuclear doctrine in the event that deterrence fails. In 1997, a former North Korean official in the Ministry of Foreign Affairs testified before the US Senate that “as early as 1965, Kim Il-sung had said that North Korea should develop rockets and missiles to hit U.S. forces inside Japan. And regarding the U.S. forces inside South Korea [...] it is a well-known fact that North Korea will use short-range missiles and other missiles and rockets in order to have casualties of somewhere between 10,000 to 20,000, and even more casualties in the side of U.S. forces in order to have anti-war sentiments to rise inside the United States and cause the withdrawal of U.S. forces in the time of war.”<sup>62</sup>

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<sup>60</sup> Voice of Korea, “Secretary Pak Jong Chon guides launching drill of Railway Mobile Missile Regiment for inspection,” via *KCNA Watch* (16 September 2021), <https://kcnawatch.org/newstream/1631739672-562011738/secretary-pak-jong-chon-guides-launching-drill-of-railway-mobile-missile-regiment-for-inspection/>

<sup>61</sup> Colin Zwirko, “North Korea tested new train-launched ballistic missile system: state media,” *NK News* (15 September 2021), <https://www.nknews.org/2021/09/north-korea-tested-new-train-launched-ballistic-missile-system-kcna/>

<sup>62</sup> Young-Hwan Ko, “North Korean Missile Proliferation,” Testimony before the Subcommittee on International Security, Proliferation and Federation Services (21 October 1997), <https://www.govinfo.gov/content/pkg/CHRG-105shrg44649/html/CHRG-105shrg44649.htm>

The 2013 “Law on Consolidating the Position of Nuclear Weapons State”—one of the most recent official documents pertaining to the DPRK’s nuclear doctrine, suggests a similar goal, noting that the DPRK’s nuclear arsenal would only be used “to repel invasion or attack from a hostile nuclear weapons state and make retaliatory strikes.”<sup>63</sup> This doctrine bears significant similarities to Pakistan’s nuclear doctrine, which emphasizes using tactical nuclear weapons at the outset of a conflict to repel a superior Indian conventional invasion force.<sup>64</sup> The DPRK’s apparent aspirational development of “tactical” nuclear weapons could appear to strengthen its emphasis on a potential “pre-emptive attack” nuclear strategy.<sup>65</sup>

Occasionally, the DPRK has explicitly mentioned or signaled which targets it intends to hit in the event of imminent invasion. A 2016 statement by the Supreme Command of the Korean People’s Army stated that the country would first target the ROK’s Blue House, then “the U.S. imperialist aggressor forces’ bases for invading the DPRK in the Asia-Pacific region and the U.S. mainland,” in that order.<sup>66</sup> The statement does not explicitly mention nuclear use; however, it is strongly implied that nuclear weapons would be used for at least the second wave of attacks against targets related to the US/ROK’s conventional invasion force. More recently, the January 2021 8th Party Congress report noted the goal of “making a preemptive and retaliatory nuclear strike by further raising the rate of precision good enough to strike and annihilate any strategic targets within a range of 15,000 kilometres with pinpoint accuracy.”<sup>67</sup> In this context, nuclear use could be intended to “decouple” US military support from its regional allies in the Asia-Pacific region, in the event that deterrence fails.

Using DPRK sources, in 2017 European Council on Foreign Relations analysts Léonie Allard, Mathieu Duchâtel, and François Godement assembled a dataset of possible targets for a nuclear strike by the DPRK.<sup>68</sup> Their dataset can be divided into four

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<sup>63</sup> Korean Central News Agency, “Law on Consolidating Position of Nuclear Weapons State Adopted,” *Korea News Service* (1 April 2013), available via GlobalSecurity.org:

<https://www.globalsecurity.org/wmd/library/news/dprk/2013/dprk-130401-kcna01.htm>

<sup>64</sup> Lt. Gen. (Ret.) Khalid Kidwai, “Deterrence, Nuclear Weapons and Arms Control,” Keynote Address, “Workshop on South Asian Strategic Stability,” *International Institute for Strategic Studies and Centre for International Strategic Studies* (6 February 2020),

[https://www.youtube.com/watch?v=bInVdvk39e0&ab\\_channel=TheInternationalInstituteforStrategicStudies](https://www.youtube.com/watch?v=bInVdvk39e0&ab_channel=TheInternationalInstituteforStrategicStudies)

<sup>65</sup> On Report Made by Supreme Leader Kim Jong Un at Eighth Party Congress of WPK,” *National Committee on North Korea* (9 January 2021).

<sup>66</sup> Korean Central News Agency, “Crucial Statement of KPA Supreme Command,” *Korea News Service* (23 February 2016), available via GlobalSecurity.org:

<https://www.globalsecurity.org/wmd/library/news/dprk/2016/dprk-160223-kcna01.htm>

<sup>67</sup> On Report Made by Supreme Leader Kim Jong Un at Eighth Party Congress of WPK,” *National Committee on North Korea* (9 January 2021).

<sup>68</sup> Léonie Allard, Mathieu Duchâtel, and François Godement, “Pre-empting defeat: In search of North Korea’s nuclear doctrine,” *European Council On Foreign Relations* (22 November 2017), [https://ecfr.eu/publication/pre\\_empting\\_defeat\\_in\\_search\\_of\\_north\\_koreas\\_nuclear\\_doctrine/](https://ecfr.eu/publication/pre_empting_defeat_in_search_of_north_koreas_nuclear_doctrine/)

broad target locations—the ROK, Japan, the broader Asia-Pacific region, and the continental United States—each of which could potentially be targeted with different nuclear delivery systems launched from different ballistic missile “belts” within the DPRK.

Potential targets in the ROK would likely include government and political infrastructure in Seoul, as well as the city’s surrounding US military bases like Camp Humphreys and Osan Air Base. Additionally, the DPRK would likely seek to strike slightly longer-range targets on the Korean Peninsula, such as Kunsan Air Base and the strategic port at Busan, the latter of which would be particularly crucial to a US conventional invasion of the DPRK.

The DPRK could theoretically target Seoul with conventional artillery; however, Pyongyang would need to use longer-range ballistic missiles—potentially carrying nuclear weapons—to target US military infrastructure immediately south of the capital. These warheads would likely be carried by the DPRK’s Scud family of liquid-fuel SRBMs, including the Hwasong-5, Hwasong-6, and/or their modernized variants equipped with maneuverable reentry vehicles, respectively known as KN21 and KN18. It is also possible that the DPRK’s newer solid-fuel SRBMs—including the KN23, KN24, and KN25—could eventually be tasked with a nuclear delivery role targeting US military facilities south of Seoul.

To target the strategic port at Busan, the DPRK would likely use slightly longer-range missiles equipped with nuclear weapons, potentially its Hwasong-7, Hwasong-9, or Pukguksong-2 MRBMs launched from its “Operational” ballistic missile belt, or perhaps its new land-attack cruise missile (LACM). In July 2016, the DPRK explicitly practiced striking the port of Busan using a Hwasong-7 MRBM that travelled approximately 600 kilometers, implying that this missile would be used in that particular strike scenario.<sup>69</sup>

The DPRK’s MRBMs—or potentially its new LACM—would also likely be used to strike targets in Japan, which could include several US military bases in Tokyo, in addition to the two US air bases on Okinawa and Iwakuni Marine Corps Air Station near Hiroshima. In March 2017, the DPRK launched four Hwasong-9 MRBMs to a range of approximately 1,000 kilometers in a probable simulated strike on the base at Iwakuni.<sup>70</sup>

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<sup>69</sup> “North Korean says missile test simulated strike on South,” *BBC* (20 July 2016), <https://www.bbc.com/news/world-asia-36842560>

<sup>70</sup> Jesse Johnson, “North Korean missile drill simulated targeting Iwakuni base, analysis shows,” *Japan Times* (8 March 2017), <https://www.japantimes.co.jp/news/2017/03/08/national/north-korean-missile-drill-simulated-targeting-iwakuni-base-analysis-shows/>

Potential targets in the broader Asia-Pacific region could include Andersen Air Force Base on Guam—a strategic forward operating base in the Western Pacific that often services US heavy bombers—as well as the headquarters of US Indo-Pacific Command in Hawaii. In 2013, Kim Jong Un specifically named Guam and Hawaii among the targets for the “strategic rockets of the Korean People’s Army,” and explicitly included Hawaii in an infamous photo of the DPRK’s “U.S. Mainland Strike Plan.”<sup>71</sup>

In order to target Guam—located approximately 3,500 kilometers southeast of the DPRK—the DPRK would likely use Hwasong-12 IRBMs equipped with nuclear weapons. The Hwasong-10, the DPRK’s older IRBM, is also capable of targeting Guam, but that missile system’s test record is highly lacking, and the missile may not have the range to reach the island with a heavy nuclear warhead. It is also possible that the DPRK could use its family of Pukguksong SLBMs to reach regional targets in the Asia-Pacific region.

To target Hawaii with nuclear weapons—requiring a flight of approximately 7,500 kilometers from the DPRK—Pyongyang would have to turn to its ICBMs, either the Hwasong-14, the Hwasong-15, or the developmental Hwasong-17. Given that the Hwasong-15 and Hwasong-17 ICBMs are the only ICBMs that would likely be able to target the entirety of the continental United States, it is possible that the DPRK would use Hwasong-14 ICBMs to target Hawaii, while reserving its longer-range ICBMs for political and military targets in the continental United States, including Washington DC, US Strategic Command at Offutt Air Force Base, Air Force Global Strike Command headquarters at Barksdale Air Force Base, and the Pacific Fleet’s home port of San Diego.

## THE POTENTIAL FOR US NUCLEAR USE

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As with the DPRK, it is unlikely that the United States would initiate a nuclear war on the Korean Peninsula unless the United States believed that the DPRK was about to launch its own nuclear weapons. In the event of such a case, it is possible that the United States would initiate a nuclear strike plan under OPLAN 5015, which reportedly calls for preemptive strikes on the DPRK’s military and political

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<sup>71</sup> Korean Central News Agency, “Kim Jong Un Convenes Meeting and Orders Strategic Rockets “To be on stand-by,” *Korea News Service* (28 March 2013), available via North Korea Leadership Watch: <https://nkleadershipwatch.wordpress.com/2013/03/28/kim-jong-un-convenes-meeting-and-orders-strategic-rockets-to-be-on-stand-by/>; James Pearson, “North Korean Photo Reveals ‘U.S. Mainland Strike Plan,’” *NK News* (29 March 2013), <https://www.nknews.org/2013/03/breaking-north-korean-photo-reveals-u-s-mainland-strike-plan/>



infrastructure. In 2020, journalist Bob Woodward's book *Rage*—which included exclusive interviews with then-Secretary of Defense James Mattis—suggested that a US response to a DPRK attack could include the use of 80 nuclear weapons for a “decapitation strike.”<sup>72</sup>

These nuclear weapons could potentially be carried by Trident submarines deployed in the region. Eight of the United States' fourteen Ohio-class ballistic missile submarines operate in the Pacific theater, although only a small number of those are thought to be on “hard alert” in their designated patrol areas, meaning they could launch ballistic missiles within minutes. The remainder could be brought to hard alert status in a matter of hours or days.<sup>73</sup>

Each submarine can carry up to twenty Trident II D5 submarine-launched ballistic missiles, with each missile normally carrying an average of four or five warheads—for an average load-out approximately ninety warheads per submarine. Each submarine can carry three different warhead types: the 90-kiloton enhanced W76-1, the 8-kiloton “low-yield” W76-2, and the 455-kiloton W88. The payload of the different missiles on a submarine are thought to vary significantly to provide maximum targeting flexibility, but all deployed submarines are thought carry the same combination.<sup>74</sup>

The United States could also delivery nuclear weapons using heavy bombers either permanently based in the United States or temporarily stationed at Guam's Andersen Air Force Base. The B-52H Stratofortress is capable of launching up to twenty variable-yield W80-1 warheads from air-launched cruise missiles, and the B-2A Spirit can carry up to 16 B61-7, B61-11, and B83-1 gravity bombs, which can collectively produce yields between ten and 1,200 kilotons.<sup>75</sup>

Upon publication of Woodward's book, South Korean officials immediately challenged the claim that US nuclear weapons could be used on the Korean Peninsula, explicitly noting that “the use of a nuclear weapon is not [included] in our operational plan (OPLAN) and using military force is impossible without South Korea's consent.”<sup>76</sup> This would suggest that a US decapitation strike on the DPRK could be entirely conventional in nature.

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<sup>72</sup> Thomas Newdick, “Yes, The United States Did Draw Up A Plan To Drop 80 Nuclear Weapons On North Korea,” *The Drive* (18 September 2020), <https://www.thedrive.com/the-war-zone/36519/yes-the-united-states-did-draw-up-a-plan-to-drop-80-nuclear-weapons-on-north-korea>

<sup>73</sup> Hans M. Kristensen and Matt Korda, “United States nuclear weapons, 2021,” *Bulletin of Atomic Scientists* 77:1 (26 January 2021), pp. 43-63, DOI: 10.1080/00963402.2020.1859865

<sup>74</sup> Ibid.

<sup>75</sup> Ibid.

<sup>76</sup> Chad O'Carroll, “US reviewed plans to use nuclear weapons on North Korea, strike leadership,” *NK News* (14 September 2020), <https://www.nknews.org/2020/09/us-reviewed-plans-to-use-nuclear-weapons-on-north-korea-strike-leadership/>

# NUCLEAR WEAPONS OF RUSSIA AND CHINA

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It is possible that the regional nuclear weapons of Russia or China could be implicated in the event that a conflict on a Korean Peninsula dramatically spun out of control. Roughly half of Russia's twelve operational ballistic missile submarines (SSBNs) are thought to be operating in the Pacific theater. These SSBNs are armed with SS-N-23 M1 Sineva and SS-N-32 Bulava SLBMs—which are capable of launching four and six 100-kiloton multiple independently targetable re-entry vehicles, respectively. Russia's sixty to seventy Tu-160 and Tu-95MS strategic bombers can also carry between twelve and sixteen high-yield nuclear air-launched cruise missiles.<sup>77</sup>

Given the high yields of Russia's strategic weapons, it is perhaps more likely that Russia could choose to use its significant arsenal of non-strategic nuclear weapons on the Korean Peninsula. The Russian Air Force has roughly 500 non-strategic nuclear weapons assigned for delivery by Tu-22 M3 (Backfire) intermediate-range bombers, Su-24 M (Fencer-D) fighter-bombers, the new Su-34 (Fullback) fighter bomber, and the MiG-31 K. All of these aircraft can deliver nuclear gravity bombs, and Russia has also developed a new long-range dual-capable air-launched ballistic missile known as the Kh47 M2 Kinzhal, which could potentially be used against targets on both land and sea.<sup>78</sup>

Although the majority of China's shorter-range missile systems are designed for use with conventional munitions, the People's Liberation Army Rocket Force (PLARF) operates several types of dual-capable regional systems that could be used to deliver nuclear weapons on the Korean Peninsula. Open-source estimates suggest that China has approximately forty launchers for the nuclear DF-21A/E MRBM, and approximately 100 launchers for the dual-capable DF-26 IRBM. It is likely, however, that only a fraction of those DF-26 systems—perhaps only twenty—serve in a regional nuclear strike role. Both systems would be capable of targeting anywhere on the Korean Peninsula, and the 4,000 kilometer-range of the DF-26 would also allow it to strike Guam. China is also currently deploying its new hypersonic glide vehicle-equipped DF-17 MRBM to southeast China, which US officials describe as a “strategic nuclear system.” This system is likely intended for a conflict scenario involving Taiwan but could be operationalized for the Korean Peninsula as well.<sup>79</sup>

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<sup>77</sup> Hans M. Kristensen and Matt Korda, “Russian nuclear weapons, 2021,” *Bulletin of Atomic Scientists* 77:2 (18 March 2021), pp. 90-108, DOI: 10.1080/00963402.2021.1885869.

<sup>78</sup> Ibid.


<sup>79</sup> Hans M. Kristensen and Matt Korda, “Chinese nuclear weapons, 2020,” *Bulletin of Atomic Scientists* 76:6 (10 December 2020), pp. 443-457, DOI: 10.1080/00963402.2020.1846432.



China also operates six Jin-class (Type 094) nuclear-powered ballistic missile submarines, each of which can carry up to 12 single-warhead JL-2 SLBMs. With a range of approximately 7,200 kilometers, these missiles could reach Alaska, Guam, Hawaii, Russia, and India from waters near China.<sup>80</sup>

## CONCLUSION

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Over the coming years, the DPRK will likely continue to strengthen its nuclear deterrent through two distinct tracks. The first track could potentially include an explicit demonstration of the country's ability to target the continental United States with a strategic nuclear warhead. The second track will likely involve a further diversification of the country's nuclear arsenal by developing and deploying new types of delivery systems capable of delivering tactical nuclear warheads to regional targets. The completion of both goals to Kim Jong Un's satisfaction would ultimately strengthen the DPRK's public nuclear doctrine, which seeks to use nuclear weapons only "to repel invasion or attack from a hostile nuclear weapons state and make retaliatory strikes."<sup>81</sup> Dedicated open-source research will be needed to analyze the DPRK's progress on both tracks, particularly given the fact that DPRK media sources can often be subject to manipulation or exaggeration. 

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<sup>80</sup> Ibid.

<sup>81</sup> Korean Central News Agency, "Law on Consolidating Position of Nuclear Weapons State Adopted," *Korea News Service* (1 April 2013).