# IX. North Korea's military nuclear capabilities

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The Democratic People's Republic of Korea (DPRK, or North Korea) maintains an active but highly opaque nuclear weapon programme. Estimates of the size of North Korea's nuclear arsenal vary considerably. They are based primarily on calculations of the amount of plutonium that North Korea may have separated from the spent fuel produced by its 5-megawatt-electric (MW(e)) graphite-moderated research reactor at Yongbyon and assumptions about North Korean weapon design and fabrication skills.[1] The estimate here is that North Korea has up to eight rudimentary nuclear weapons, assuming that each uses 5 kilogrammes of weapon-grade plutonium.[2]

On 12 February 2013 North Korea announced that it had carried out its third underground nuclear test explosion, at the Punggye-ri test site in the north-east of the country (see section XI below). According to the announcement, the test had 'diversified' North Korea's nuclear deterrent by using a smaller and lighter nuclear device with greater explosive force than those used in the test explosions conducted in 2006 and 2009.[3] This claim could not be independently verified.[4] The development of a miniaturized device would mark an important technological advance by North Korea towards building a warhead compact and light enough to fit on a long-range ballistic missile. (The missiles capable of carrying such a warhead are described below.)

In 2013 North Korea initiated a major effort to refurbish and modernize its plutonium production capabilities. On 3 April the North Korean General Department of Atomic Energy announced that it intended to 'readjust' and restart the facilities at Yongbyon, including the disabled 5-MW(e) reactor.[5] In December two non-governmental experts assessed, based on commercial satellite imagery, that North Korea appeared to have begun producing fuel rods for the recently restarted reactor at Yongbyon following

[1] Albright, D. and Waldron, C., *North Korea's Estimated Stocks of Plutonium and Weapon-grade Uranium* (Institute for Science and International Security: Washington, DC, 16 Aug. 2012).

[2] For detail about this estimate see Kile, S. N., 'North Korea's military nuclear capabilities', *SIPRI Yearbook 2013*, p. 324.

[3] Korean Central News Agency (KCNA), 'KCNA report on successful 3rd underground nuclear test', 12 Feb. 2013. The KCNA is North Korea's state news agency; its statements are available on the website of the Korean News Service in Tokyo, <http://www.kcna.co.jp/>.

[4] Broad, W. J., 'A secretive country gives experts few clues to judge its nuclear program', *New York Times*, 12 Feb. 2013.

[5] Korean Central News Agency (KCNA), 'DPRK to adjust uses of existing nuclear facilities', 2 Apr. 2013.

extensive renovation work.[6] The reactor was estimated to be capable of producing approximately 6 kg of plutonium per year.[7]

There has been considerable speculation that North Korea is seeking to build nuclear weapons using highly enriched uranium (HEU) as the fissile material and may have obtained clandestine design assistance for an HEU-based weapon from Pakistani nuclear engineer, Abdul Qadeer Khan.[8] By producing HEU for nuclear weapons, North Korea could potentially overcome the constraints posed by its limited stock of weapon-grade plutonium. There has also been speculation that North Korea may attempt to build a fusion-boosted fission device or possibly even a thermonuclear weapon, which would require the use of both HEU and plutonium in the bomb design.[9] North Korea is known to have a uranium-enrichment programme, including a centrifuge enrichment plant at Yongbyon that is ostensibly for civilian purposes. However, it remains unclear whether North Korea has produced HEU for military purposes. The airborne radionuclide samples that were collected after the February 2013 test explosion were inconclusive in determining whether the nuclear device had used HEU as the fissile material, rather than plutonium, which North Korea was believed to have used in its two previous tests (see section XI).[10]

## Ballistic missiles

The main goal of North Korea's nuclear weapon programme is widely believed to be to develop a nuclear warhead that can be delivered by a long-range missile. However, there is neither public evidence that North Korea has developed a sufficiently compact nuclear warhead for this purpose nor, despite its ambitious ballistic missile programme, a missile re-entry vehicle to carry it. In 2013 the US Director of National Intelligence, James R. Clapper, reaffirmed that the prevailing view in the US intelligence com-

[6] Hansen, N., 'Major development: reactor fuel fabrication facilities identified at Yongbyon nuclear complex', 38 North, US–Korea Institute, Johns Hopkins University, 23 Dec. 2013, <http://38north.org/2013/12/yongbyon122313/>.

[7] Hansen, N. and Lewis, J., 'North Korea restarting its 5 MW reactor', 38 North, US–Korea Institute, Johns Hopkins University, 11 Sep. 2013, <http://38north.org/2013/09/yongbyon091113/>.

[8] Hecker, S. S., 'What to expect from a North Korean nuclear test?', *Foreign Policy*, 4 Feb. 2013. See also United Nations, Security Council, Report of the Panel of Experts established pursuant to resolution 1874 (2009), 11 May 2012, annex to S/2012/422, 14 June 2012, para. 26.

[9] Lewis, J., 'Setting expectations for a DPRK test', Arms Control Wonk, 29 Jan. 2013, <http://lewis.armscontrolwonk.com/archive/6200/setting-expectations-for-a-dprk-test#more-3155>; and Makino, Y., 'N. Korea likely to test fusion-boosted fission bomb able to reach U.S.', Asia and Japan Watch, *Asahi Shimbun*, 25 Jan. 2013, <http://ajw.asahi.com/article/asia/korean_peninsula/AJ201301250058>.

[10] Schneidmiller, C., 'Possible North Korea nuke test emissions identified', Global Security Newswire, 23 Apr. 2013, <http://www.nti.org/gsn/article/possible-north-korea-nuke-test-emissions-identified/>.

munity was that North Korea had 'not yet demonstrated the full range of capabilities necessary for a nuclear armed missile'.[11]

North Korea's ballistic missile arsenal is known to include nine types of indigenously produced guided ballistic missile, which are believed to be derived from older Soviet missile designs and from technologies that were reverse engineered by North Korea.[12] North Korea is frequently cited in the open-source literature as possessing a total of 800–1000 ballistic missiles of all types, but these estimates are highly uncertain.[13] Considerable uncertainty also exists about the reliability and operational readiness of North Korea's ballistic missile force. Compared with the missile programmes of other countries, North Korea has carried out only a small number of test and training launches of its indigenously produced missiles before declaring them to be operational.[14]

Assuming that North Korea does develop a compact nuclear warhead, some observers assess that the size, range and operational status of the Nodong make it the missile system most likely to be given the nuclear delivery role (see table 6.10).[15] Other candidates include the Musudan (also designated BM-25), the Hwasong-13 (designated KN-08) and the Taepodong-2.[16]

The Nodong is a road-mobile, single-stage, medium-range ballistic missile (MRBM) with an estimated maximum range of 1000–1250 kilometres.[17] North Korea flight tested the missile first in 1993 and again in 2006 and 2009. The most recent test took place on 26 March 2014, when the Strategic Rocket Force Command of the Korean People's Army (North

[11] Clapper, J. R., US Director of National Intelligence, 'DNI Statement on North Korea's nuclear capability', Press statement, 11 Apr. 2013, <http://www.dni.gov/index.php/newsroom/press-releases/191-press-releases-2013/839-dni-statement-on-north-korea-snuclearcapability>; and Shanker, T., Sanger, D. E. and Schmitt, E., 'Pentagon finds nuclear strides by North Korea', *New York Times*, 11 Apr. 2013.

[12] These include 4 shorter-range missiles, Hwasong-5 (designated Scud B by NATO), Hwasong-6 (Scud C), Hwasong-7 (Scud D) and Toksa (designated KN-02 by the USA) missiles, and 5 longer-range missiles, Nodong, Musudan, Hwasong-13, Taepodong-1 and Taepodong-2. For a detailed history of North Korea's missile programme see Pollack, J. D., *No Exit: North Korea, Nuclear Weapons and International Security* (Routledge: Abingdon, 2011); and Bermudez, J. S., *A History of Ballistic Missile Development in the DPRK*, Occasional Paper no. 2 (Monterey Institute of International Studies, Center for Nonproliferation Studies: Monterey, CA, 1999).

[13] Schiller, M., *Characterizing the North Korean Nuclear Missile Threat* (Rand Corporation: Santa Monica, CA, 2012), p. xv.

[14] Schiller (note 13), pp. 11–13, 34–36.

[15] See e.g. Fitzpatrick, M., 'North Korea nuclear test on hold?', Shangri-La Voices, International Institute for Strategic Studies, 27 May 2014, <http://www.iiss.org/en/shangri-la voices/blogsections/2014-363a/north-korea-nuclear-test-on-hold-8fec>.

[16] For a comprehensive technical analysis of North Korea's ballistic missile programme see Schiller (note 13). See also Fitzpatrick, M. (ed.), *North Korean Security Challenges: A Net Assessment* (International Institute for Strategic Studies: London, July 2011), pp. 129–160.

[17] Fitzpatrick (note 16), pp. 134–35.

**Table 6.10.** North Korean forces with potential nuclear capability, January 2014

There is no public evidence that North Korea has developed and tested a re-entry vehicle that is intended to carry a nuclear warhead on a ballistic missile. This table lists ballistic missiles that could potentially have this role.

| Type | Range (km) | Payload (kg) | Status |
|---|---|---|---|
| Nodong | 1 250 | 750–1 000 | Fewer than 50 launchers;[a] first deployed in 1990; most recent test launch on 26 Mar. 2014 |
| Musudan (BM-25) | >3 000 | ~1 000 | Under development; no test-launch yet |
| Hwasong-13 (KN-08) | >5 500 | .. | Under development; no test-launch yet |
| Taepodong-2 | >5 500 | .. | Under development; failed test-launch in 2006; 3-stage space launch vehicle variant, the Unha-3, placed satellite in orbit in Dec. 2012 |

[a] The total missile inventory may be larger than the number of launchers, which can be reused to fire additional missiles.

*Sources*: US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat* (NASIC: Wright-Patterson Air Force Base, OH, May 2013); *Jane's Strategic Weapon Systems*, various issues; 'Nuclear notebook', *Bulletin of the Atomic Scientists*, various issues; and authors' estimates.

Korea's army) launched two Nodong missiles from mobile launchers that travelled 650 km before falling into the Sea of Japan.[18]

The Musudan (also designated BM-25) missile is reported to be a road-mobile, single-stage, intermediate-range ballistic missile (IRBM). Most analyses in the open-source literature have concluded that its design is based on the Russian R-27 (SS-N-6) submarine-launched ballistic missile (SLBM). The Musudan was first presented during a military parade in 2010.[19] The missile has never been tested and is not believed to be operationally deployed.

The Hwasong-13 was first presented by North Korea as a road-mobile missile with intercontinental range during a military parade in April 2012. Little is publicly known about the missile, which has not yet been flight tested. According to Clapper, North Korea has taken 'initial steps' towards deploying the Hwasong-13.[20] However, some non-governmental analysts have argued that the missiles displayed during military parades in 2012 and

[18] 'N.Korea fires two ballistic missiles', Yonhap News Agency, 26 Mar. 2014, <http://english.yonhapnews.co.kr/national/2014/03/26/65/0301000000AEN20140326000500315F.html>.

[19] Lewis, J., 'Origins of the Musudan IRBM', Arms Control Wonk, 11 June 2012, <http://lewis.armscontrolwonk.com/archive/5337/origins-of-the-musudan-irbm>.

[20] Clapper, J. R., US Director of National Intelligence, 'Worldwide threat assessment of the US intelligence community', Statement for the record, US Senate, Select Committee on Intelligence, 29 Jan. 2014, <http://www.dni.gov/index.php/newsroom/testimonies/203-congressional-testimonies-2014/1005-statement-for-the-record-worldwide-threat-assessment-of-the-us-intelligence-community>, p. 6.

2013 were only mock-ups since they contained a number of design anomalies that called into question whether the system actually existed.[21]

The Taepodong-2 is believed to be a two- or three-stage ballistic missile with anticipated intercontinental range, although the estimates of this vary considerably. The initial test-launch in 2006 failed, as did two subsequent attempts, using space launch vehicle variants, in 2009 (the Unha-2 variant) and in April 2012 (the Unha-3 variant).[22] North Korea successfully placed into orbit a satellite using a Unha-3 rocket in December 2012.[23] Despite the successful application of three-stage separation technology demonstrated by the satellite launch, analysts have noted that North Korea has never demonstrated the guidance and re-entry capabilities required for a long-range ballistic missile.[24]

[21] Richardson, D., 'North Korea has taken steps towards KN-08 deployment', *Jane's Missiles and Rockets*, 7 Feb. 2014; and Schiller, M. and Schmucker, R. H., 'The assumed KN-08 technology', Arms Control Wonk, 26 Apr. 2012, <http://lewis.armscontrolwonk.com/archive/5205/addendum-on-kn08>.

[22] Postol, T. A., 'A post-launch examination of the Unha-2', *Bulletin of the Atomic Scientists*, 29 June 2009, <http://thebulletin.org/post-launch-examination-unha-2>. It is unclear whether the Unha-2 launched in 2009 and the Taepodong-2 of 2006 were the same type of rocket.

[23] Richardson, D., 'Unha-3 was largely of North Korean manufacture', *Jane's Missiles and Rockets*, Mar. 2013, pp. 4–6; and Wright, D., 'Markus Schiller's analysis of North Korea's Unha-3 launcher', All Things Nuclear, Union of Concerned Scientists, 22 Feb. 2013, <http://allthingsnuclear.org/markus-schillers-analysis-of-north-koreas-unha-3-launcher/>.

[24] Elleman, M., 'Prelude to an ICBM? Putting North Korea's Unha-3 launch into context', *Arms Control Today*, vol. 43, no. 2 (Mar. 2013).