



# North Korean Ballistic Missile Threat to the United States

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## Summary

This report reviews North Korea's ballistic missile program. In summer 2007, North Korea tested modern, short-range missiles. In July 2007, a Pentagon official said North Korea was about to deploy a new, advanced short-range missile, designated the KN-02, or Toksa (said to be a derivative of the former Soviet SS-21 missile). This report will be updated periodically. Additional information is provided by CRS Report RL33590, *North Korea's Nuclear Weapons Development and Diplomacy*, by Larry A. Niksch.

## The Taepo Dong Program

The North Korean Taepo Dong program traces its origins to the No Dong medium range ballistic missile<sup>1</sup> program of the late 1980s. In the early 1990s, North Korea initiated the development of two ballistic missile programs known to the West as Taepo Dong 1 and Taepo Dong 2.<sup>2</sup> The supposed design objectives for the Taepo Dong 1 system were to deliver a 1,000 to 1,500 kg warhead to a range of 1,500 to 2,500 km and for the Taepo Dong 2 to deliver the same warhead to a 4,000 to 8,000 km range.<sup>3</sup> Initial prototypes for both systems were probably manufactured in 1995 or 1996 with a possible initial production run for the Taepo Dong 1 initiated in early 1997 or 1998.<sup>4</sup> Analysts estimate that North Korea may have produced from one to ten Taepo Dong 1 and one or two Taepo Dong 2 prototypes by the end of 1999.<sup>5</sup> These missiles are not believed to be deployed.<sup>6</sup> North Korea is believed to have had extensive foreign assistance from China, Russia, Pakistan, and Iran throughout the program.<sup>7</sup> Very little was known about the actual program until the August 31, 1998 launch of a Taepo Dong 1 from the Musudan-ri Launch Facility in North Hamgyong Province, northeast coast of North Korea.<sup>8</sup>

The stated objective of this launch was to place North Korea's first satellite (Kwangmyongsong 1) into orbit. Initial U.S. intelligence reports postulated that the Taepo Dong 1 SLV was only a two stage rocket. The first stage fell into international waters 300 km east of Musudan-ri and the second stage flew over the Japanese island of Honshu and fell into the water 330 km away from the Japanese port of Hachinohe for a total distance of approximately 1,646 km.<sup>9</sup> Further analysis of radar tapes revealed that the Taepo Dong 1 had a small third solid propellant stage (presumably designed to place the satellite into orbit).<sup>10</sup> Debris from this third stage was believed to have impacted as far as 4,000 km from the launch point.<sup>11</sup> Some analysts believe that if the missile had functioned properly, the Taepo Dong 1 space launch vehicle (SLV) could have achieved a 3,800 to 5,900 km range.<sup>12</sup>

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<sup>1</sup> Ballistic missiles are classified by range as follows:

Short Range Ballistic Missiles (SRBMs) = 150 - 799 kms.

Medium Range Ballistic Missiles (MRBMs) = 800 - 2,399 kms.

Intermediate Range Ballistic Missiles (IRBMs) = 2,400 - 5,499 kms.

Intercontinental Range Ballistic Missiles (ICBMs) = 5,500 kms and greater.

<sup>2</sup> Joseph S. Bermudez, "A History of Ballistic Missile Development in the DPRK, Occasional Paper No. 2," Monterey Institute of International Studies Center for Nonproliferation Studies, 1999, p. 26.

<sup>3</sup> Joseph S. Bermudez, "North Korea's Long-Range Missiles," *Jane's Ballistic Missile Proliferation*, 2000, p. 5.

<sup>4</sup> Bermudez, Monterey Institute, p. 29.

<sup>5</sup> *Ibid.*

<sup>6</sup> Ballistic and Cruise Missile Threat, National Air and Space Intelligence Center, Wright-Patterson Air Force Base, Ohio. NASIC-1031-0985-06, March 2006, p. 10.

<sup>7</sup> *Ibid.*, pp 23 - 29.

<sup>8</sup> Bermudez, Janes, p. 6.

<sup>9</sup> Michael Dutra and Gaurav Kampani, "North Korea: A Second Taepo Dong Test?" Monterey Institute of International Studies, 1999, p. 2.

<sup>10</sup> *Ibid.*

<sup>11</sup> Bermudez, Janes, p. 6.

<sup>12</sup> Michael Dutra and Gaurav Kampani, p. 2.

## Potential Configurations and Ranges

In order to strike targets from North Korea, a North Korean missile would need to achieve the following ranges:<sup>13</sup>

Target	Washington, DC	Chicago	San Francisco	Seattle	Anchorage	Honolulu
Range (km)	10,700	10,000	8,600	7,900	5,600	7,100

Within possible range of the Taepo Dongs are U.S. military facilities in Guam (3,500 km), Okinawa, and Japan. The Taepo Dong 1 missile (as opposed to the SLV) is believed to be a two-stage missile that uses a No Dong missile derivative as its first stage and SCUD C derivative (called the Hwasong 6) as its second stage. In this configuration, it is estimated that it could deliver a 700 - 1,000 kg warhead to a range of 2,500 km,<sup>14</sup> which could put Japan and Okinawa within range. For the Taepo Dong 1 to achieve greater range its payload would have to be decreased. Some analysts speculate that a reduced-payload configuration could deliver a 200 kg warhead into the U.S. center and a 100 kg warhead to Washington D.C., albeit with poor accuracy.<sup>15</sup>

Until recently, the Taepo Dong 2 had not yet been flight tested. (It has also been called the Moksong 2 and the Pekdosan 2.) The Taepo Dong 2 is believed to be a two-stage missile about 35 meters long. The first stage has been said to bear close resemblance to the Chinese CSS-2 and CSS-3 first stage. The second stage is believed to be based on the No Dong missile. The two-stage variant is assessed a range potential of as much as 3,750 km with a 700 to 1,000 kg payload and, if a third stage were added, some believe that range could be extended to 4,000 to 4,300 km with a full payload.<sup>16</sup> Some analysts further believe that the Taepo Dong 2 could deliver a 700 to 1,000 kg payload as far as 6,700 km.<sup>17</sup> Pyongyang has yet to test the guidance system, and the missile is believed to be fairly inaccurate.<sup>18</sup> How it might be deployed (i.e., silo or transportable) also remains undetermined, although some have suggested it is a road mobile system. In order to achieve ranges capable of striking Hawaii and targets on the U.S. mainland, some analysts believe that the Taepo Dong 2's payload would need to be reduced to 200 - 300 kgs.<sup>19</sup> Some believe the Taepo Dong 2 may be exported to other countries in the future.<sup>20</sup>

In June 2006 the Taepo Dong 2 was observed being assembled and fueled at the Musudan-ri test site along the northeast coast of North Korea. At the time, some observers believed a test was imminent while others expressed caution because much technical uncertainty remained. On July 4, 2006 (at 4:12 p.m. EST), North Korea launched the Taepo Dong 2. The launch was preceded

<sup>13</sup> Bermudez, Janes, p. 8.

<sup>14</sup> Ibid., p. 5.

<sup>15</sup> Bermudez, Monterey Institute, p. 30.

<sup>16</sup> "Taepo Dong 2," *The Journal of the Federation of American Scientists*, 2002, the above discussion of the Taepo Dong 2 is found on p. 3.

<sup>17</sup> See North Korean Missile Could Bring U.S. into Range: Experts, Agence France-Presse, June 20, 2006, and Bermudez, Monterey Institute, p. 30.

<sup>18</sup> North Korea: An Impending Missile Launch?, Stratfor, June 16, 2006.

<sup>19</sup> Siegel, p. 5.

<sup>20</sup> Ballistic and Cruise Missile Threat, National Air and Space Intelligence center, p. 17.

by three shorter-range ballistic missile launches, and then followed by three more.<sup>21</sup> About 40 seconds into the flight, the Taepo Dong 2 apparently failed on its own during the first stage and fell into the Sea of Japan, according to USNORTHCOM (U.S. Northern Command). Causes for the failure were studied, but details have not been made public. Japanese sources reported some details of the missile launches, suggesting greater accuracy in their impact areas than other analyses.<sup>22</sup> The report also suggested greater Russian engineering support than indicated elsewhere. Some believe initial production of the Taepo Dong 2 may have started in 2005, and that perhaps 20 missiles were built in 2006.<sup>23</sup>

## North Korea's Military Spending<sup>24</sup>

Some experts voice concern over North Korea's level of military spending in relation to its missile program. North Korea reportedly spends as much as 40 percent of its gross domestic product (GDP) on the military.<sup>25</sup> In 2004, U.S. Forces Korea commander, General Leon J. LaPorte, reportedly stated that North Korea's military investments are primarily in their nuclear, biological, chemical and missile programs in order to gain an "asymmetrical" advantage over U.S. and South Korean forces.<sup>26</sup> General LaPorte reportedly emphasized his concern over missile development and North Korea's continued development of its nuclear weapons program that could eventually lead to "weaponizing their weapons-grade materials on missiles."<sup>27</sup>

North Korea's apparent willingness to devote such a large portion of its GDP to missiles and weapons of mass destruction could be cause for additional concern when viewed in the light of their alleged cooperation with other countries. Evidence suggests that North Korea has had extensive dealings with Iran, Pakistan, Russia, Syria, Yemen, and Libya on ballistic missiles and possibly even nuclear warheads.<sup>28</sup> One particular concern is that Chinese warhead designs, sold to Libya by Pakistani nuclear scientist Dr. A.Q. Khan, might also be in the hands of North Korea, which could help accelerate its efforts to develop long-ranged nuclear ballistic missiles.<sup>29</sup> Some suggest that North Korea's access to these countries' missile and WMD technologies might enable North Korea to advance its long-range nuclear ballistic missile program at a more accelerated rate without having to conduct extensive testing, particularly if they use proven missile designs from other countries.

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<sup>21</sup> The short-range test launches, some combination of SCUDs and No Dong missiles, occurred on July 4 (all EST) at 1) 2:32 p.m.; 2) 3:04 p.m.; 3) 3:59 p.m.; 4) 6:31 p.m.; 5) 7:12 p.m.; and 6) 4:15 a.m. (July 5, 2006).

<sup>22</sup> Japan: Analysis of Data on Landing Points of DPRK's 5 July Missile Launches, Yomiuri Weekly (Tokyo), Aug, 6, 2006, pp. 22-23.

<sup>23</sup> MissileThreat.com, [<http://www.missilethreat.com>]

<sup>24</sup> For a more detailed discussion of North Korea's economy see CRS Report RL32493, *The North Korean Economy: Leverage and Policy Analysis*, by Dick K. Nanto and Emma Chanlett-Avery.

<sup>25</sup> Bill Gertz, "North Korea Pumps Money into Military," *Washington Times*, August 3, 2004.

<sup>26</sup> Ibid.

<sup>27</sup> Ibid.

<sup>28</sup> See CRS Report RL30427, *Missile Survey: Ballistic and Cruise Missiles of Selected Foreign Countries*, by Andrew Feickert.

<sup>29</sup> Bill Gertz, Op. Cit.

## New Medium or Intermediate Range Missiles

Various reports indicate that North Korea is developing and deploying at least two new medium to intermediate range ballistic missile systems. It is not publicly known if North Korea is continuing development of a reported new version of its Taepo Dong ballistic missile,<sup>30</sup> the so-called Taepo Dong X, which could achieve intercontinental ranges. The two new medium to intermediate range missiles are believed to be based on the decommissioned Soviet R-27<sup>31</sup> submarine launched ballistic missile.<sup>32</sup>

The R-27, which was allegedly acquired from Russia in the 1990s and possibly enhanced with the help of Russian missile specialists, has been called an “excellent choice” on which to base a new missile system.<sup>33</sup> Its 40 year-old, liquid-fuelled technology is considered within the technological and industrial capabilities of North Korea and versions of its engines are already used in North Korean SCUDs and No Dongs. Perhaps the greatest advantage of this system is that the R-27 is a proven design meaning that North Korea may be able to develop and deploy these missiles without having to conduct extensive ground and flight tests.

### Land-Based Version <sup>34</sup>

The land-based version called Musadan or No Dong B is a medium to intermediate range ballistic missile with an estimated range of 2,500-3,200 km. The North Korean version of this missile is 12 m long—2.4m longer than the R-27—and, although smaller than the No Dong and Taepo Dong 1, has a greater range than these two missiles. This range puts most of East Asia within range, including U.S. military bases at Guam and Okinawa, although experts point out that the North Korean No Dong 2 missile could also reach Japan and Okinawa. Initial prototypes of the land-based version were reportedly first identified in 2000, and pre-production models and a new transporter-erector-launcher (TEL) were believed to have been completed by mid-2003.

The North Koreans reportedly began constructing two new missile bases to accommodate the Musadan/Non Dong B. One base is near Yangdok-gun and the other is at Sangnam-ni, previously reported as a No Dong and Taepo Dong base. North Korea has reportedly constructed administrative and maintenance facilities at these two sites as well as fortified underground tunnels for storing the missiles and TELs. By July 2004, experts reported that these new bases were from 70 to 80 percent completed.

### Sea-Based Version

The sea-based version of the R-27 is reportedly either a submarine or ship-mounted system with an estimated range of at least 2,500 km. Russian versions of the R-27 reportedly had both a single nuclear reentry vehicle as well as a version with three reentry vehicles, each with a 200 kiloton (KT) nuclear weapon. It is not known if North Korea possesses reentry vehicles for their versions

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<sup>30</sup> Bill Gertz, “North Korea to Display New Missiles,” *Washington Times*, September 9, 2003.

<sup>31</sup> The North Atlantic Treaty Organization (NATO) classification for the R-27 is the SS-N-6.

<sup>32</sup> Joseph S. Bermudez, “North Korea Deploys New Missiles,” *Jane’s Defense Weekly*, August 4, 2004.

<sup>33</sup> Information in this section comes from Joseph S. Bermudez, “North Korea Deploys New Missiles,” *Jane’s Defense Weekly*, August 4, 2004.

<sup>34</sup> *Ibid.*

of the R-27. There are indications that North Korea may be actively pursuing a sea-based ballistic missile capability, which could have potential security implications for the United States.

In September 1993, the Korean People's Navy (KPN) reportedly purchased 12 decommissioned Russian Foxtrot class and Golf-II class submarines for scrap metal from a Japanese company. The Golf-IIs, which are capable of carrying three SS-N-5 SLBMs, did not have their missiles or electronic firing systems when they were sold to the North Koreans, but they did allegedly retain significant missile launch sub-systems including launch tubes and stabilization systems. Some analysts believe that this technology, in conjunction with the R-27's well-understood design, gives North Korea the capability to develop either a submarine or ship-mounted ballistic missile. Many experts postulate that North Korea does not have the capability to develop a new SLBM on its own and that none of North Korea's other ballistic missiles are easily convertible to SLBMs.

North Korea apparently integrated the Golf-IIs missile stabilization and launch technology into a new class of conventionally powered ballistic missile submarines, possibly modified versions of Golf-IIs or Romeo class Russian submarines.<sup>35</sup> It is also possible, according to some observers, that North Korea might attempt to incorporate this launch technology into a merchant ship. It is not known if North Korea has sold or will sell this new system to other countries. Some analysts suggest that Iran might be an ideal candidate for such a system, as it has allegedly researched a sea-based ballistic missile capability in the past.

## **Security Implications**

DPRK systems potentially increase the missile threat to the United States. If the new missiles are indeed closely modified versions of the R-27, they are likely more accurate in relative terms and have greater range than other DPRK missiles. Some analysts believe that the sea-launched version could pose the greatest threat by threatening the continental United States. These experts suggest that a North Korean sea-launched missile capability could complicate intelligence collection efforts as well as present challenges for South Korean, Japanese, and U.S. ballistic missile defense systems. Others, however, are skeptical that North Korea can reach the continental United States with the new sea-based version. Anonymous U.S. government officials have reportedly stated that North Korea does not presently have a submarine that is capable of transporting a missile within striking distance of the continental United States.<sup>36</sup> These officials also expressed doubt that North Korea had intentions of developing a missile to hide inside a freighter to be used against targets in the United States.<sup>37</sup>

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<sup>35</sup> Ibid.

<sup>36</sup> Thom Shanker, "Korean Missile Said to Advance; U.S. is Unworried," *New York Times*, August 5, 2004.

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