

# CRS Report for Congress

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## North Korean Ballistic Missile Threat to the United States

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### Summary

This report updates earlier information concerning North Korea's ballistic missile development and that country's technological missile-launch capabilities. North Korea tested what it described as a Taepo Dong 1 space launch vehicle (SLV) in August of 1998 and has reportedly been developing a Taepo Dong 2 missile that may have sufficient range to strike certain areas of the United States. Recent press reports have speculated that North Korea has developed a new version of their Taepo Dong 2 missile as well as an unnamed intermediate range ballistic missile.<sup>1</sup> This report will be updated as events warrant. Additional information is provided by CRS Report RL30427, *Missile Survey: Ballistic and Cruise Missiles of Foreign Countries*, CRS Report RL30699, *Nuclear, Biological, and Chemical Weapons and Missiles: Status and Trends*, and CRS Issue Brief IB91141, *North Korea's Nuclear Weapons Program*.

### Background

The North Korean Taepo Dong program traces its origins to the No Dong medium range ballistic missile 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

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

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> North Korea is believed to have had extensive foreign assistance from China, Russia, Pakistan, and Iran throughout the Taepo Dong program.<sup>6</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 North Korea.<sup>7</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>8</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) that failed after separation from the second stage and fell into the sea with the satellite payload.<sup>9</sup> Debris from this third stage was believed to have impacted as far as 4,000 km from the launch point.<sup>10</sup> Some analysts believe that if this third stage had functioned properly, the Taepo Dong 1 space launch vehicle or SLV could have achieved a 3,800 to 5,900 km range.<sup>11</sup>

## Potential Configurations and Ranges

In order to strike targets from North Korea, the Taepo Dong missile would need to achieve the following ranges:<sup>12</sup>

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

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

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

<sup>5</sup> Ibid.

<sup>6</sup> Ibid., pp 23 - 29.

<sup>7</sup> Bermudez, Janes, p. 6.

<sup>8</sup> North Korea: A Second Taepo Dong Test?, Monterey Inst. of International Studies, 1999, p. 2.

<sup>9</sup> Ibid.

<sup>10</sup> Bermudez, Janes, p. 6.

<sup>11</sup> North Korea: A Second Taepo Dong Test?, p. 2.

<sup>12</sup> Bermudez, Janes, p. 8.

Within possible range of the Taepo Dong 1 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 which 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 can deliver a 700 - 1,000 kg warhead to a range of 2,500 km<sup>13</sup> which would 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>14</sup>

Unlike the Taepo Dong 1, the Taepo Dong 2 has never been flight tested. The Taepo Dong 2 is believed to be a two or three stage missile. The first stage has been said to bear close resemblance to the Chinese CSS-2 and CSS-3 first stage, but some evidence strongly suggests that the first stage uses four No Dong thrust chambers with a new turbo pump assembly. This turbo pump machinery is believed to have been developed jointly with Iran and China under technology sharing agreements from the mid-1990s. The second stage of the Taepo Dong 2 is believed to be based on the No Dong missile (the Taepo Dong 1's supposed first stage). The two-stage variant is assessed a range potential of approximately 3,750 km with a 700 to 1,000 kg payload and if a third stage were added (similar to the Taepo Dong 1 SLV) that range could be extended to 4,000 to 4,300 km with a full payload.<sup>15</sup> Some analysts believe that the Taepo Dong 2 could deliver a 700 to 1,000 kg payload as far as 6,700 km but with very poor accuracy.<sup>16</sup> 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>17</sup>

## A New Version of the Taepo Dong 2?

Prior to September 9, 2003 — the 55<sup>th</sup> anniversary of the founding of the Democratic People's Republic of Korea — U.S. and international press speculated that North Korea might display a new, longer-range version of the Taepo Dong 2 missile as well as an unnamed intermediate range missile during military parades held in Pyongyang. Despite this widespread speculation, no new military hardware, including ballistic missiles, was observed during the 90- minute parade.<sup>18</sup>

Unidentified Bush Administration officials, claiming to have access to intelligence reports, referred to the allegedly longer-range version of the Taepo Dong 2 as the "Taepo Dong X" and stated that intelligence analysts estimated that it would have greater range

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<sup>13</sup> Ibid., p. 5.

<sup>14</sup> Bermudez, Monterey Institute, p. 30.

<sup>15</sup> Taepo Dong 2, *Federation of American Scientists*, 2002, the above discussion of the Taepo Dong 2 is found on p. 3.

<sup>16</sup> Bermudez, Monterey Institute, p. 30.

<sup>17</sup> Siegel, p. 5.

<sup>18</sup> Parade Marks North Korean Anniversary, *CNN.com*, September 9, 2003.

and accuracy than previous versions of the Taepo Dong 2.<sup>19</sup> Another Administration official reportedly stated that the Taepo Dong X would have sufficient range to strike Hawaii, Alaska, California, or “most of the West Coast.”<sup>20</sup> In another press report, an Administration official who “asked not to be identified” estimated the Taepo Dong X’s range at 9,400 miles (15,040 kms) which, in theory, would enable the Taepo Dong X to strike virtually anywhere in the United States.<sup>21</sup>

According to unidentified U.S. intelligence officials, the Taepo Dong X is believed to be based on the former Soviet Navy SS-N-6 submarine launched ballistic missile that North Korea may have possibly obtained from Russia between 1992 and 1998.<sup>22</sup> According to this official, the Intelligence Community has “had hints of this for several years” but only within the last year were they able to confirm the Taepo Dong X’s existence and its use of SS-N-6 technology to improve its range and accuracy.<sup>23</sup> Officials stated that there was no indication that the Russian government had sanctioned missile sales to the North Korean government in “at least five years.”<sup>24</sup> An unnamed congressional source reportedly noted that the Russian Pacific Fleet, which deployed the SS-N-6, was “desperately disorganized and underfunded” during the period between 1992 and 1998, suggesting that North Korea might have obtained SS-N-6 technology from the Russian Navy or the missile’s designer, the Makeyev Design Bureau, without the knowledge or approval of the Russian government.<sup>25</sup>

It is possible that North Korea developed another version of the Taepo Dong 2 with relatively little advanced knowledge by U.S. intelligence agencies. The secretive nature of North Korea’s ballistic missile program is not without precedence - their August 1998 Taepo Dong 1 launch came with little warning. If North Korea has developed a “Taepo Dong X”, there are a number of factors that should be considered before assuming that some or all of the United States is now within range of this missile.

**Technical Considerations.** The Taepo Dong 2, which most analysts believe is a two or three stage missile with clustered No Dong engines in the first stage and a No Dong second stage, has never been flight tested.<sup>26</sup> Recent alleged intelligence reports are not clear if the Taepo Dong X consists of an untested Taepo Dong 2 mounted on top of the SS-N-6 or some other configuration. The SS-N-6, which entered service with the Soviet Navy in 1968, is assessed as having only a 3,000 km range (Mods 2 and 3) and an

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<sup>19</sup> North Korea to Display New Missiles, Bill Gertz, *Washington Times*, September 9, 2003.

<sup>20</sup> Ibid.

<sup>21</sup> Official Says North Korean Missile Could Target the U.S., George Gedda, *Associated Press Newswires*, September 11, 2003.

<sup>22</sup> N. Korea Working on Missile Accuracy, Sonny Efron, *Los Angeles Times*, September 12, 2003.

<sup>23</sup> Ibid.

<sup>24</sup> Ibid.

<sup>25</sup> Ibid.

<sup>26</sup> Taepo Dong 2, *Federation of American Scientists*, September 2003.

accuracy of 1,300 meters CEP.<sup>27</sup> Range estimates for the Taepo Dong 2 extend from 3,750 to 6,700 kms, with the higher estimate based on an added solid propellant third stage and reduced warhead weight<sup>28</sup>. If this is the case, it is unlikely that the overall range of the Taepo Dong 2/SS-N-6 configuration would be a simple additive function of the two missile's ranges as it appears to be portrayed in recent statements by Administration and intelligence officials. While there would likely be a notable increase in overall range, aerodynamic, structural, propulsion, and payload characteristics of this missile also have an effect on the overall range. No matter what the configuration, a series of successful flight tests would be the only way to accurately determine the maximum range of this missile. In addition, claims of increased accuracy, particularly over the extended ranges that are being claimed, can only be substantiated by a series of flight tests conducted out to the missile's maximum range.

Questions about nuclear warhead size and weight also bear further examination. At extended ranges, the Taepo Dong 2's warhead capacity was thought to be no more than a few hundred kilograms.<sup>29</sup> While some analysts believe that this is beyond North Korea's current technical capabilities, others point out that North Korea may have received assistance from Pakistan, which tested miniaturized and relatively sophisticated nuclear warhead designs for its missiles — weighing hundreds as opposed to thousands of kilograms — in 1998.<sup>30</sup> Even if North Korea has developed a miniaturized nuclear warhead for the Taepo Dong X, a reentry vehicle capable of withstanding the high temperatures and other stresses associated with nuclear weapons delivery at intercontinental ranges would also need to be developed or acquired from another country. It is possible that reentry vehicle technology developed for the SS-N-6 was also provided to North Korea along with the basic missile design technology.

## **New Intermediate Range Missile**

The South Korean press reported on September 8, 2003 that South Korean intelligence officials had identified what they believed were 10 new intermediate range ballistic missiles and five launch pads at North Korea's Mirim Aerodrome.<sup>31</sup> South Korean officials also suggested that this new missile had been under development since the early 1990s and could have a maximum range of 3,600 kms.<sup>32</sup> According to the report, Japanese, South Korean, and U.S. intelligence officials inferred from the shape of the missile that the new North Korean missiles were based on the Soviet-designed SS-N-6.<sup>33</sup> According to one U.S. press report, unnamed U.S. officials confirmed the accuracy of

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<sup>27</sup> Strategic Weapons Systems, Edited by Duncan Lennox, *Jane's*, Issue 38, July 2003, p. 604. CEP is defined as the radius of a circle centered at the target within which 50 % of all missiles aimed at the target would be expected to impact and is the standard for measuring accuracy for missiles and bombs.

<sup>28</sup> See p. 3 of March 25, 2003 version of this report.

<sup>29</sup> *Ibid.*

<sup>30</sup> Efron, p. 2.

<sup>31</sup> North Said to Deploy Longer Range Missiles, *Joong Ang Daily*, September 9, 2003.

<sup>32</sup> *Ibid.*

<sup>33</sup> *Ibid.*

South Korean press reports and further elaborated by stating that the unnamed intermediate range ballistic missile was road mobile<sup>34</sup>, making these missiles more difficult to locate and destroy. With the capability to accommodate a reentry vehicle weighing approximately 1,500 lbs (680 kgs)<sup>35</sup> a North Korean missile derived from the SS-N-6 could conceivably accommodate a heavier and less sophisticated nuclear weapon — the type which many experts believe North Korea is capable of producing.

While there appears to be some disagreement in the ranges for the SS-N-6 and the possible North Korean SS-N-6 variant (3,000 to 3,600 kilometers, depending on the source) a missile with a 2,500 kilometer range would enable North Korea to strike U.S. military forces in Japan and Okinawa and with a 3,500 kilometer range to strike Guam, a U.S. territory with a substantial U.S. military presence.<sup>36</sup> If this is the case, such a missile would represent a significant increase in North Korea's ability to deliver a heavier, first generation nuclear weapon at extended ranges.

## Considerations for Congress

Some analysts suggest that Congress should seek further clarification of these potentially new developments in North Korea's ballistic missile program. Some suggested points of clarification include:

- ! The configuration of the Taepo Dong X — is it a Taepo Dong 1 or 2 mounted on a SS-N-6 or a total redesign of the Taepo Dong 2 incorporating SS-N-6 propulsion, guidance, and other missile subsystems? Given the various missile configurations, what are the estimated payload capacities and maximum ranges?
- ! The estimated earliest date that these missiles could be flight tested and/or operationally deployed.
- ! Whether North Korean engineering advances in staging, guidance, reentry vehicles, and nuclear weapon safing, arming, fuzing, and firing<sup>37</sup> technologies have advanced to the point where North Korea could reliably deliver a nuclear weapon at intercontinental ranges with a Taepo Dong X. Is North Korea receiving foreign assistance in these technology areas?
- ! The capabilities of the reported SS-N-6-based intermediate range ballistic missile. If equipped with nuclear warheads, what threat does this pose to Guam and other U.S. interests within its range?

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<sup>34</sup> North Korea to Display New Missiles, Gertz, p. 1.

<sup>35</sup> R-27/SS-N-6 SERB, *Federation of American Scientists*, July 13, 2000, p. 1.

<sup>36</sup> North Korea's Long-Range Missiles, Joseph S. Bermudez, p. 5.

<sup>37</sup> The safing system ensures that the weapon does not detonate prematurely. The arming system readies the weapon for detonation. The fuzing system determines where in the flight the weapon will detonate. The firing system actually delivers the electrical signal to the weapon detonator.