

NORTH KOREA'S NUCLEAR AND MISSILE PROGRAMS

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NORTH KOREA'S NUCLEAR AND MISSILE PROGRAMS

EXECUTIVE SUMMARY

This background report examines what is known about the North Korean nuclear and missile programs in mid-2009. It is based on open source literature, interviews and unpublished documents made available to Crisis Group. Companion reports, published simultaneously, address the appropriate policy response of the international community to recent nuclear and missile developments and assess the DPRK's chemical and biological weapons capabilities.¹

Prior to the 1980s, North Korea had a clear military advantage over South Korea, but the balance of conventional forces has turned against Pyongyang, especially after the end of the Cold War. During the famine of the mid-1990s, the North Korean leadership increasingly relied on the military to manage government affairs and it introduced a "military first" policy in 1998 to coincide with Kim Jong-il's official rise to power. Since economic woes have made it impossible to compete with neighbours in conventional forces, Pyongyang has had a strong incentive to retain and expand its asymmetric capabilities.

North Korea's nuclear and missile arsenal is already of worrying size. Pyongyang possibly has deployed over 600 short-range Scud variants that can strike South Korea, and as many as 320 medium-range Nodong missiles that can strike Japan. Long-range missiles with the potential to hit the continental U.S. are still under development. It probably has somewhere between six and twelve nuclear weapons, or at least explosive devices. Experts are divided as to whether weaponisation technology has advanced far enough for any of these to be now useable as warheads: for this purpose weapons have to be small enough to be mounted on missiles and durable enough to withstand the rigours of flight. Even if they are not at this stage now, each year and each test bring that moment closer.

While North Korean military doctrine still emphasises offensive tactics, the nuclear weapons are of little use except for deterrence, which is reflected in the posture of deployments and in the command and control structure. Nevertheless, misperception, miscalculation, escalation or a change in military strategy could conceivably lead to their deliberate, accidental or unauthorised use. The risk of an accidental nuclear explosion cannot be ignored, given uncertainty about the sophistication of the North's technology and its known generally poor safety standards.

Moreover, Pyongyang has sold missiles, missile components and technology to several countries and has been cooperating with Iran to develop long-range missiles and space launch vehicles. Its missile program has been an important source of hard currency and a symbol of national power that the leadership exploits for internal political control.

For all these reasons, the denuclearisation of the Korean Peninsula and the halting of the North's ballistic missile program remain crucial policy priorities for neighbours, as well as the wider international community that continues to be acutely concerned about the proliferation implications. Whatever the motives that have driven its development, the elimination of North Korea's nuclear and missile arsenal will require considerable planning and resources.

Diplomatic efforts should focus on the nuclear issue now, but progress on this front would create opportunities to address Pyongyang's other weapons of mass destruction (WMD), including a large chemical weapons stockpile and possible biological weapons, which must be eliminated before a stable and permanent peace can be established in North East Asia.

Seoul/Brussels, 18 June 2009

¹ Crisis Group Asia Report N°169, *North Korea: Getting Back to Talks*, 18 June 2009; Crisis Group Asia Report N°167, *North Korea's Chemical and Biological Weapons Programs*, 18 June 2009.

NORTH KOREA'S NUCLEAR AND MISSILE PROGRAMS

I. INTRODUCTION

North Korea has tested two nuclear explosive devices, the first in 2006 and the latest on 25 May 2009. Efforts to end its nuclear weapons program have stalled over verification and disarmament, with the North refusing to take key steps to open up its program to scrutiny.² Despite making some slow headway, the Six-Party Talks, which bring together the U.S., the two Koreas, Japan, China and Russia, have not been able to get Pyongyang to give up its weapons.³ North Korea maintains that it needs the weapons to protect itself against attack by the U.S. That is certainly one possible motivation; others may include a need to give its powerful military what it wants, promote national unity as its economy continues its stagnation, and internal succession dynamics (with Kim Jong-il reportedly informing North Korean institutions and organisations about his decision to identify as his heir his third son, Kim Jong-un, immediately after the May nuclear test.⁴

² See Crisis Group Report, *North Korea: Getting Back to Talks*, op. cit. For further related analysis, see Crisis Group Asia Briefing N°91, *North Korea's Missile Launch: The Risk of Overreaction*, 31 March 2009 (from which much of Section III of this report in particular is drawn); Crisis Group Asia Briefing N°62, *After the North Korea Nuclear Breakthrough: Compliance or Confrontation?*, 30 April 2007; Crisis Group Asia Briefing N°56, *North Korea's Nuclear Test: The Fallout*, 13 November 2006; Crisis Group Asia Briefing N°52, *After North Korea's Missile Launch: Are the Nuclear Talks Dead?*, 9 August 2006; Crisis Group Asia Report N°87 *North Korea: Where Next for the Nuclear Talks?*, 15 November 2004; and Crisis Group Asia Report N°61, *North Korea: A Phased Negotiation Strategy*, 1 August 2003.

³ On 19 September 2005, representatives from the six parties signed a "Statement of Principles", whereby the DPRK agreed to abandon "all of its nuclear programs" in exchange for negative security assurances and positive inducements from the other parties. Subsequent agreements included details on actions and responsibilities for implementation of the "Statement of Principles", which encompassed the disablement and eventual dismantlement of North Korea's nuclear facilities.

⁴ A frequent foreign visitor to the DPRK told Crisis Group that during 25-28 May 2009 North Korean officials in Pyongyang informed him of the succession plans for the

Not much is known about the weapons themselves. A key concern is whether North Korea has mastered the technology to put a weapon on a ballistic missile. This is a complex process that involves building a small and durable weapon that can withstand the rigours of flight. Some intelligence agencies believe that it has such weapons; others are more sceptical. Certainly the trade and technology transfers in nuclear and missile technology make it likely that North Korea has made some headway in building a useable weapon.

Pyongyang also has a major missile program. It most recently tested a long-range missile that it claimed was a satellite launch. No satellite was ever tracked orbiting the earth, so the test probably failed, although it would have provided useful information to rocket engineers. North Korea has sold missiles to other countries, particularly in the Middle East, and may be transferring the technology behind them. As its economy struggles, missiles may become even more important as a source of hard currency.

This background report examines what is known about the North Korean nuclear and missile programs as of mid-2009. A companion policy report, published simultaneously, addresses the appropriate policy response by the international community, and in particular the U.S. in the context of the Six-Party Talks framework. Another Crisis Group background report, also published simultaneously, examines the country's chemical and biological programs.⁵ All countries keep their weapons programs secret, but in North Korea almost everything

first time. DPRK officials reportedly said they are worried and hope the transition does not have to be implemented in the coming weeks or months. South Korea's National Intelligence Service confirmed the succession plans on 1 June 2009. Crisis Group interview, Seoul, 29 May 2009; "Spy agency confirms N.K. leader's third son as successor", Yonhap News Agency, 2 June 2009; Kim So-hyun, "Kim Jong-un named next 'Dear Leader'", *The Korea Herald*, 3 June 2009. For a more detailed discussion of the possible motivations for North Korea's nuclear program and recent tests, see Crisis Group Report, *North Korea: Getting Back to Talks*, op. cit.

⁵ Crisis Group Report, *North Korea: Getting Back to Talks*, op. cit.; Crisis Group Report, *North Korea's Chemical and Biological Weapons Programs*, op. cit.

is secret. Intelligence agencies that monitor the DPRK⁶ have a record of exaggeration and even at times dissembling; they also want to protect their methods and sources. Any work on North Korea is thus hindered by multiple problems of verification. These reports draw mostly on publicly available material, but Crisis Group has also seen some confidential government documents and conducted extensive interviews to check assertions from other sources.

II. BACKGROUND AND KEY ISSUES

A. DPRK AND DETERRENCE

Since 2002, Pyongyang has repeatedly declared its right to “counter the U.S. nuclear threat” with “a strong physical deterrent, a nuclear deterrent and nuclear weapons”.⁷ Initially, statements vaguely referred to a “physical deterrent or nuclear deterrent”, but on 10 February 2005, the foreign ministry declared Pyongyang had “manufactured nukes and was compelled to bolster its nuclear weapons arsenal”.⁸ Ultimately, the foreign ministry announced on 3 October 2006 that North Korea would “conduct a nuclear test to bolster its nuclear deterrent”, before actually conducting the test six days later.⁹ Subsequently, North Korean officials and media have boasted of the country’s nuclear achievement. On 25 May 2009, officials announced a second test.

On 10 December 2008, the (North) Korean Central News Agency (KCNA) reported that “the United States had officially recognised North Korea as a nuclear weapons state for the first time”.¹⁰ The DPRK’s official news agency cited a report by the U.S. Joint Forces Command that included North Korea, along with China, India, Pakistan and Russia, as nuclear powers on the rim of Asia.¹¹ Just as North Korean media were congratulating the DPRK’s “new status”, U.S. Secretary of Defense Robert Gates published an article in *Foreign Affairs* asserting that “North Korea has built several bombs”.¹²

⁷For example, “KCNA urges U.S. to have right option for peace”, KCNA, 4 November 2002; “Rodong Sinmun on DPRK’s legitimate right to self-defence”, KCNA, 20 December 2002; “Statement of FM spokesman blasts UNSC’s discussion of Korean nuclear issue”, KCNA, 6 April 2003; “U.S. urged not to fault DPRK’s self-defensive measure”, KCNA, 11 May 2003; “DPRK to put spurs to increasing its nuclear deterrent force for self-defence”, KCNA, 18 June 2003; “DPRK foreign ministry on six-way talks”, KCNA 30 August 2003; “SPA approves measures taken by foreign ministry as regards nuclear issue”, KCNA, 3 September 2003; “DPRK to steadily increase its nuclear deterrent force”, KCNA, 9 September 2003.

⁸“DPRK FM on its stand to suspend its participation in six-party talks for indefinite period”, KCNA, 10 February 2005.

⁹“DPRK foreign ministry clarifies stand on new measure to bolster war deterrent”, KCNA, 3 October 2006; “DPRK successfully conducts underground nuclear test”, KCNA, 9 October 2006.

¹⁰“U.S. recognizes DPRK as nuclear weapons state”, KCNA, 10 December 2008.

¹¹“The Joint Operating Environment 2008”, U.S. Joint Forces Command, 25 November 2008.

¹²Robert M. Gates, “A Balanced Strategy”, *Foreign Affairs*, January/February 2009.

⁶Democratic People’s Republic of Korea.

The two references attracted significant media attention in the Republic of Korea (ROK, South Korea). Defence Minister Lee Sang-hee declared that the North would never be recognised as a permanent nuclear weapons state, and Foreign Minister Yu Myung-hwan said it was a mistake to classify it as a nuclear power.¹³ However, the *Rodong Sinmun*, official daily of the (North) Korean Workers' Party, declared "the U.S. announcement [and recognition] that the DPRK is a nuclear weapons state reflects the stark reality".¹⁴ Pyongyang's apparent nuclear status was reiterated in January 2009, when a U.S. Department of Defense task force report was released declaring that "North Korea, India and Pakistan have acquired both nuclear weapons and missile delivery systems".¹⁵ These reports reflect military assessments and planning, but they have implications beyond internal military policymaking.

Pyongyang's claim that it has been recognised as a nuclear power has ramifications across three broad dimensions: international security and defence planning; international law, politics and diplomacy; and domestic politics in North East Asia.¹⁶ In the realm of international security and defence planning, national policymakers must prepare for the actual military capabilities of potential enemies, and it is prudent to anticipate worst-case scenarios. U.S. military officials consider North Korea a "nuclear weapons state" because they must plan for various contingencies and possible military operations.

North Korean media have been quick to publicise one-sentence references in U.S. military publications because the DPRK has been working to acquire a "nuclear deterrent" for decades. Although its media, publications and government officials do not elaborate on their concept of deterrence, basically it requires the capability to inflict unacceptable damage on an adversary. However, deterrence is only robust and credible if your enemy believes you have the ability to strike back. In other words, if Pyongyang's military adversaries believe the North Korean military can retaliate with nuclear

warheads, they almost certainly will be deterred from attacking North Korea.

While U.S. military planners must deal with the country's actual capabilities, the U.S. Defense Department announcements have been controversial because of fears that military assessments will result in political and diplomatic recognition of a nuclear DPRK. Pyongyang seeks political and diplomatic recognition because the regime believes it would gain international prestige and privileged treatment as an equal by the major powers.

For example, the foreign ministry asserted that since "the DPRK has become a full-fledged nuclear weapons state, the Six-Party Talks should be disarmament talks, where the participating countries negotiate the issue on an equal footing".¹⁷ Clearly, this would exclude Japan and South Korea – non-nuclear weapons states – and establish a special status for North Korea to engage with the nuclear powers. Moreover, the DPRK claims its nuclear status serves the security interests of North East Asia and that it is a "responsible nuclear weapons state that would not transfer its nukes".¹⁸ As Pyongyang announced its withdrawal from the Six-Party Talks in April 2009, the foreign ministry declared that the country's "military first politics would maintain peace and stability on the Korean Peninsula since the talks had failed".¹⁹

North Korea's nuclear weapons status is completely unacceptable in terms of international law and diplomacy. While the DPRK argues it is no longer bound by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) since withdrawing from it in January 2003, it is illegal to divert previously safeguarded materials and to use previously safeguarded facilities for the production of nuclear weapons. If any state or international agency were to recognise North Korea as a nuclear weapons state, this would be a dangerous signal to other NPT members that may be considering a nuclear breakout.

Therefore, diplomats refuse to grant North Korea this status and to use the term "nuclear weapons" when referencing Pyongyang's nuclear capabilities. Ambassador Kim Sook, former head of the South Korean delegation to the Six-Party Talks, told Crisis Group that "the South Korean government position is not differ-

¹³ Jung Sung-ki, "N. Korea is not nuclear power: Pentagon", *The Korea Times*, 10 December 2008; "李국방 '北, 영원히 핵보유국 인정 안돼'" ["Defence Minister Lee, 'North cannot be recognised permanently as a nuclear weapons state'"], *The JoongAng Ilbo*, 11 December 2008.

¹⁴ "Lee Myung Bak group's black-hearted intention and perverted view on fellow countrymen flayed", KCNA, 23 December 2008.

¹⁵ "Report of the Secretary of Defense Task Force on DoD Nuclear Weapons Management", 18 December 2008 (released to the public on 12 January 2009).

¹⁶ These three dimensions are not completely discrete, and some issues, such as non-proliferation, fall into all three categories.

¹⁷ "DPRK foreign ministry spokesman on denuclearisation of Korea", KCNA, 31 March 2005.

¹⁸ "Annual Security Outlook 2007", ASEAN Regional Forum, 2007, pp. 34-35.

¹⁹ "DPRK foreign ministry vehemently refutes UNSC's 'presidential statement'", KCNA, 14 April 2009.

ent from that of the United States”, and that “we don’t see anything different from what Secretary Gates and the U.S. Joint Operations Command Centre have said”. Furthermore, Kim said, “we believe North Korea has reached the stage where they have produced five to eight nuclear explosive devices – we like to say ‘nuclear explosive devices’ as opposed to ‘weapons’”. When told this implies North Korea possesses nuclear weapons, since it makes little sense to dedicate plutonium and components to devices that cannot be delivered to targets, Kim replied: “We don’t know if they have weapons”.²⁰

North Korea’s society and polity, nevertheless, already embrace the country’s nuclear weapons status, which provides tremendous political benefits to Kim Jong-il and the ruling Korean Workers’ Party. The symbolic and prestige value of nuclear weapons within the North should not be underestimated. Nuclear weapons and ballistic missiles are important symbols of the “military first” policy and state promotion of science and technology to address a number of national objectives, including economic recovery, a strong national defence, food and energy security and national unification. If Pyongyang were to abandon its nuclear status abruptly, most North Koreans would perceive it as rejecting an important pillar of Kim’s national strategy.

Domestic politics in South Korea and Japan could also be affected by North Korea’s nuclear weapons status. Both countries have advanced nuclear power industries and technologies, and South Korea had a nuclear weapons program in the 1970s. Although for legal, political, economic and diplomatic reasons, Tokyo and Seoul now are very unlikely to develop nuclear weapons, the recognition or acceptance of a nuclear North Korea would almost certainly increase public demands for a nuclear response. Support for such a step has little public support in Japan, but a majority of South Koreans has consistently believed that their country should acquire nuclear weapons, even before the North conducted its nuclear tests.²¹ Although South Korea can probably live with a limited and ambiguous North Korean nuclear capability, any shift in Japan’s nuclear status would almost certainly trigger a South Korean nuclear breakout.

²⁰ Crisis Group interview, Ambassador Kim Sook, former special representative for Korean Peninsula Peace and Security Affairs, Seoul, 13 January 2009.

²¹ “South Korean opinion polls: majority favors nuclear weapons; 1980s generation question U.S. ties”, *WMD Insights*, December 2005/January 2006, at www.wmdinsights.com/11/EA1_SouthKoreanOpinion.htm.

B. DPRK MILITARY DOCTRINE

Nominally, the DPRK “conducts all activities under the leadership of the Korean Workers’ Party (KWP)”.²² Although the party is supposed to exert command and control of the Korean People’s Army (KPA), the military has gained power and influence in state affairs under the leadership of Kim Jong-il since the mid-1990s.²³

The KPA has been strongly influenced by Soviet military doctrine, Mao Zedong’s concepts of guerrilla tactics and “people’s war”, the anti-Japanese guerrilla experience of Kim Il-sung and his partisans in the 1930s and 1940s and the devastation and stalemate of the Korean War (1950-1953).²⁴ Two main political objectives drive military planning and doctrine: survival of the state and the Kim family regime, and Korean unification on DPRK terms. Although the DPRK has experienced a generational change in its leadership, the memory of U.S. intervention in 1950 is still pervasive among policymakers. Moreover, North Korean military planners are aware of recent advancements in U.S. military technologies and have studied cases of U.S. military intervention, concluding that “possession of powerful military capabilities is the only way to deter U.S. aggression”.²⁵

More recently, North Korea’s military doctrine has been affected by Kim Jong-il’s “military first politics”,²⁶ which was introduced to coincide with a September 1998 constitutional revision that formalised the country’s dynastic succession. North Korean media describes the policy as Kim’s upgrade of his father’s *chuch’e* ideology.²⁷ Following the elder Kim’s death in 1994, the country faced extraordinary economic deprivation and a famine that killed hundreds of thousands.²⁸ With the capacity of the state and the party in steep decline,

²² DPRK Constitution, Chapter 1, Article 11.

²³ Kim Chol U, *Army-Centred Politics of Kim Jong Il* (Pyongyang, 2002).

²⁴ James M. Minnich, *The North Korean People’s Army: Origins and Current Tactics* (Annapolis, 2005).

²⁵ Kim Chol U, *op. cit.*

²⁶ The military first policy is known as *sŏn’gun chŏngch’i* (先軍政治).

²⁷ “WPK exploits will be everlasting, says Rodong Sinmun”, KCNA, 4 October 2005. *Chuch’e* (主體, “self-reliance”) is sometimes transliterated as *Juche*.

²⁸ DPRK officials have acknowledged 220,000 famine-related deaths, but other estimates range as high as 3.5 million. The actual number is probably somewhere between 600,000 and one million. Stephan Haggard and Marcus Noland, *Famine in North Korea* (New York, 2007), pp. 72-76.

Kim Jong-il increasingly turned to the military to manage state affairs.²⁹

The state invokes “military first politics” (commonly known as “*songun*” or “*songun* politics” in North Korea’s English-language publications) to reassure the military that it will get a first cut at scarce resources and to keep the population focused on external threats. In exchange for its privileged position, the military is expected to contribute to development and set an example for citizens as the country works hard to emerge from economic backwardness.³⁰ Kim Jong-il reportedly views “military first politics” as the “saviour for our style of socialism”, and many North Koreans apparently believe it is necessary because the country is “standing alone in the face of imperialist aggression from the United States”.³¹

The state also uses the military and *songun* politics to indoctrinate the population, especially those too young to have experienced the Japanese colonial period or the Korean War. Despite claims that the country is resolute in its revolutionary ideology, the collapse of socialism in the former Soviet Union and Eastern Europe was more than just an economic shock. The government allocates tremendous resources to indoctrination and monitoring citizens’ loyalty to the Kim family regime. The KPA is the largest mass organisation and ideally positioned to disseminate political propaganda to young people who might be questioning the legitimacy of the government.

Foreign analysts debate whether a shift in the conventional military balance against North Korea has forced the DPRK political leadership to rely on its asymmetric military capabilities for deterrence, national survival and maintaining the status quo, or if Pyongyang remains wedded to “completing the revolution in the South” and with force if necessary or possible.³² According to its by-laws, the Korean Workers’ Party is committed to “achieving a complete socialist victory in the northern half of the republic and to completing a people’s

revolution to liberate all Korean people throughout the nation”.³³ Pyongyang nominally is committed to unifying Korea, but DPRK leaders are preoccupied with the survival of the state and the Kim family regime; therefore, they are not likely to launch an unprovoked war that they would lose.

Nevertheless, the KPA’s war-fighting doctrine is based on two main objectives: achieving a swift victory through overwhelming offensive attacks and deterring the U.S. from intervening effectively.³⁴ North Korea almost certainly would have to use its ballistic missiles and possibly its chemical or nuclear weapons to achieve these objectives, but with no guarantee of success. North Korean media often cite Washington’s 2002 Nuclear Posture Review, U.S. economic sanctions, U.S.-ROK combined military exercises and former U.S. President George W. Bush’s “axis of evil” reference in his 2002 state of the union address, in addition to other activities and statements, as evidence that Washington has a “hostile policy aimed at strangling the DPRK”. In May 2009, state media began to describe the Obama administration as continuing the “hostile policy” of its predecessor but “in a more cunning manner”.³⁵

Given North Korea’s weakness and threat perceptions, its leaders probably feel they have no choice but to strengthen the country’s military capabilities, but their conventional options are limited. They acknowledge the North cannot compete with Washington in an arms race, so DPRK military planners believe they must have asymmetric capabilities for deterrence.³⁶

Pyongyang consistently says Washington might invade the DPRK at any moment. Although outsiders usually view these claims as nothing but paranoia or absurd bluster, North Koreans apparently believe the DPRK is an innocent victim that somehow has become the target of Washington’s wrath. They view their formidable military capabilities as all that prevents a U.S. attack, even a nuclear one. Very few North Koreans

²⁹ *Sŏn’gun chŏngch’i* first appeared in North Korean media in December 1997, but the DPRK government claims that 1995 marks the beginning of “military first politics”. 북한개요 2004 [North Korea Summary 2004], ROK unification ministry, December 2003, pp. 35-38.

³⁰ Crisis Group interviews, Pyongyang, April 2007.

³¹ Ibid; Kim Chol U, op. cit.; and 윤명현 [Yun Myŏng-hyŏn], *우리 식 사회주의: 100문 100답* [Our Style Socialism: 100 Questions and Answers] (Pyongyang, 2004).

³² Homer T. Hodge, “North Korea’s Military Strategy”, *Parameters*, vol. 33, no. 1 (spring 2003), pp. 68-81; Andrew Scobell and John M. Sanford, *North Korea’s Military Threat: Pyongyang’s Conventional Forces, Weapons of Mass Destruction, and Ballistic Missiles* (Carlisle, 2007).

³³ 조선로동당 규약 [Korean Workers’ Party Bylaws], in 북한개요 2004 [North Korea Summary 2004], op. cit., pp. 504-529.

³⁴ Joseph S. Bermudez, Jr., *The Armed Forces of North Korea* (New York, 2001); 장명순 [Chang Myŏng-sun], *북한군사연구* [North Korean Military Research] (Seoul, 1999); and “North Korean Smart Book”, U.S. Forces Korea, Camp Garry Owen, 2001, pp. 4-9.

³⁵ “U.S. wrong policy toward DPRK rebutted”, KCNA, 7 May 2009; “Spokesman for DPRK foreign ministry blasts U.S. invariable hostile policy towards it”, KCNA, 8 May 2009; “U.S. moves to work out new strategy towards DPRK under fire”, KCNA 19 May 2009.

³⁶ Kim Chol U, op. cit.

have the opportunity to meet foreigners, but those who do often ask: "Why does the United States threaten to attack our country with nuclear weapons? Why does the United States dislike Koreans so much?"³⁷ However, a former DPRK government official told Crisis Group that senior DPRK government and KWP officials do not believe the U.S. has any intention of attacking North Korea, but that DPRK media disseminate this message to help the regime maintain power and social control.³⁸

KPA personnel are taught that ROK and U.S. chemical weapons would be used in a war, even though Seoul and Washington are both parties to the Chemical Weapons Convention (CWC) and the Geneva Protocol, which prohibit the possession or use of such weapons.³⁹ North Korean media nevertheless cite this supposed threat as a justification for Pyongyang's nuclear arsenal.⁴⁰ While the country suffers from extreme shortages of food and consumer goods, the defence industry produces protective suits that must be replaced after every CW defence exercise. "Military first" means these factories and training centres do not experience the same shortages that are ubiquitous in the civilian economy.⁴¹ Despite the opportunity cost and hardship, civilians are forced to accept the allocation of resources to the military as "necessary to protect the people from foreign aggression".⁴²

³⁷ Crisis Group interviews, Pyongyang, April 2007; Crisis Group interview, Kaesŏng, DPRK, 24 June 2008.

³⁸ Crisis Group interview, former DPRK government official, Seoul, 2 December 2008.

³⁹ The CWC requires members to declare and destroy all CW stocks; the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous, or Other Gases, and of Bacteriological Methods of Warfare (Geneva Protocol) bans the use of chemical and biological weapons in war.

⁴⁰ "U.S. storage of chemical weapons blasted", KCNA, 15 June 2004.

⁴¹ Internal government memorandum made available to Crisis Group.

⁴² Crisis Group interviews, Pyongyang, April 2007.

III. BALLISTIC MISSILES

A. HISTORY OF THE PROGRAM

The DPRK leadership has sought ballistic missiles since at least the 1960s. By the 1970s, Pyongyang was seeking technology transfers and international cooperation to obtain missile production capability.⁴³ In the late 1970s and early 1980s, it was developing the Hwasŏng-5, a reverse-engineered version of the Soviet Scud-B (R-17).⁴⁴ Analysts disagree over the timing and source of North Korea's Scud-B samples, but most believe Egypt provided samples in the late 1970s.⁴⁵ Others are convinced the Soviet Union provided Scud-B through a licensing agreement or that Moscow delivered a sufficient number of missiles for an unauthorised reverse-engineering effort.⁴⁶ According to a senior ROK analyst, North Korea's initial Hwasŏng-5 production must have been under a licensing agreement, because it did not have the capability to reverse-engineer missiles in the early 1980s.⁴⁷

⁴³ Joseph S. Bermudez, Jr., "The North Korean 'Scud B' Program", *Jane's Soviet Intelligence Review*, May 1989, pp. 203-207; Joseph S. Bermudez, Jr., "A History of Ballistic Missile Development in the DPRK", Occasional Paper no. 2, Center for Nonproliferation Studies, November 1999, p. 3; Christopher F. Foss (ed.), *Jane's Armour and Artillery 1991-92* (Coulsdon, Surrey, 1991), p. 749; and Gordon Jacobs and Tim McCarthy, "China's Missile Sales – Few Changes for the Future", *Jane's Intelligence Review*, December 1992, p. 560.

⁴⁴ The North Korean name for the missile literally means "Mars" (火星).

⁴⁵ Joseph S. Bermudez, Jr., "Ballistic Ambitions Ascendant", *Jane's Defence Weekly*, 10 April 1993, pp. 20, 22; Bermudez, Jr., "A History", op. cit., p. 10; Hajime Ozu, *Missile 2000: Reference Guide to World Missile Systems* (Tokyo, 2000), p. 95; "Ballistic Missile Threat Evolves", *International Defense Review*, vol. 33, no. 10 (1 October 2000); "북한 미사일 문제관련 참고자료" ["Reference Material on the North Korean Missile Issue"], press release, ROK unification ministry, 3 November 2000, p. 1; 장준익 [Chang Chun-ik], *북한 핵-미사일 전쟁* [North Korea: Nuclear Missile War] (Seoul, 1999), pp. 249, 266; 이정훈 [Yi Chŏng-hun], "프로그램에서 대포동까지 북한의 미사일 게임" ["From the FROG to the Taepodong: North Korea's Missile Game"], *Shindonga*, August 1999, p. 202.

⁴⁶ Robert H. Schmucker, "3rd World Missile Development – A New Assessment Based on UNSCOM Field Experience and Data Evaluation", paper prepared for the twelfth Multinational Conference on Theatre Missile Defence, Edinburgh, Scotland, 1-4 June 1999; Jim Mann, "N. Korean missiles have Russian roots, explosive theory suggests", *The Los Angeles Times*, 6 September 2000.

⁴⁷ This ROK analyst asserted that North Korea received about 100 Scud-B missiles from the USSR in the late

The first North Korean Scud-B versions were flight tested in April 1984, but there were at least two failures.⁴⁸ Successful flight tests of the Scud-C (Hwasŏng-6) and Scud-B (Hwasŏng-5) were conducted in May 1986 and July 1986, respectively, and they were deployed and operational by 1988.⁴⁹ North Korea also exported about 100 Hwasŏng-5s to Iran in 1987-1988, which were fired against Iraq in the "War of the Cities". By the early 1990s, North Korea was developing the "Nodong", the Taepodong-1 (Paektusan-1), the Taepodong-2 (Unha-2 or Paektusan-2), and possibly the "Musudan" (a North Korean road-mobile version of the Soviet R-27/SS-N-6 "Serb" submarine-launched ballistic missile).⁵⁰

North Korea has successfully flight-tested the Hwasŏng-5/6 and the Nodong, but the single flight test of the Taepodong-1 (Paektusan-1) on 31 August 1998 was only partially successful; the third stage failed, apparently exploding before it could place a small satellite, "Kwangmyŏngsŏng-1", into low earth orbit. The Taepodong-1 program has since been terminated.⁵¹ The Taepodong-2 has been flight-tested twice. The first test failed after about 40 seconds of powered flight on 5 July 2006.⁵²

In 2008, the DPRK reportedly conducted at least one static engine test for the Taepodong-2, and a new long-range missile (space) launch facility was under construction at Tongch'ang-ri, Ch'ŏlsan-kun, North P'yŏng'an Province on the west coast.⁵³ According to ROK Defence Minister Lee Sang-hee, the North began build-

ing the facility in 2000 and had completed 80 per cent of the construction by late 2008.⁵⁴ In May 2009, construction was accelerating at the site, and analysts believe the facility could be finished by mid-year.⁵⁵ However, in January 2009 the North deployed a Taepodong-2 to its old launch facility on the east coast at Musudan-ri, North Hamgyŏng Province, and began flight test preparations.⁵⁶ On 24 February, the DPRK's Korean Committee of Space Technology announced that this was part of an effort to launch the Unha-2 (Taepodong-2) and place an experimental communications satellite, the "Kwangmyŏngsŏng-2", into earth orbit.⁵⁷

On 12 March, Pyongyang declared that it had acceded to the Outer Space Treaty and the Convention on Registration of Objects Launched into Outer Space.⁵⁸ It also notified the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) that it planned to launch the satellite during the period 4-8 April. Despite international pleas to cancel the launch, the Unha-2 was flight tested on 5 April 2009. The first and second stages performed well, but the third did not place the satellite into orbit, either failing to separate properly or suffering some other malfunction.⁵⁹ North Korean media asserted that the satellite

1970s. Crisis Group interview, Seoul, 30 October 2008. There are at least two open source reports of the former USSR supplying Scud missiles to the DPRK in the 1980s. See "'Soviet Base' in North Korea", *Jane's Defence Weekly*, 21 September 1985, p. 3; and *SIPRI Yearbook 1989: World Armaments and Disarmament* (Oxford, 1989), p. 256.

⁴⁸ Internal government memorandum made available to Crisis Group; Joseph S. Bermudez, Jr., "An Analysis of North Korean Ballistic Missile Testing", *Jane's Intelligence Review*, April 1995, pp. 184-185.

⁴⁹ Internal government memorandum made available to Crisis Group.

⁵⁰ For more details on DPRK missile development, see Daniel A. Pinkston, *The North Korean Ballistic Missile Program* (Carlisle, February 2008).

⁵¹ Crisis Group interview, Seoul, 7 January 2009.

⁵² Doug Richardson, "Transonic buffeting may have doomed Taepo Dong-2", *Jane's Missiles and Rockets*, 1 August 2006.

⁵³ Crisis Group interview, Seoul; "北, 새 미사일기지에서 로켓엔진 시험" ["North tests rocket engine at new missile base"], *The Chosun Ilbo*, 17 September 2008; 이하원 [Yi Ha-wŏn], "北 동창리에 새 미사일기지 건설" ["North building new missile base at Tongch'ang-ri"], *The Chosun Ilbo*, 12 September 2008.

⁵⁴ "S Korea: N Korea building base for bigger missiles", Associated Press, 4 November 2008; "North Korea building base for bigger missiles", Reuters, 4 November 2008.

⁵⁵ "Activity at N. Korean test sites intensifies", *The Chosun Ilbo*, 7 May 2009; Crisis Group interview, Seoul.

⁵⁶ Jin Dae-woong, "N.K. Missile at eastern launch site: source", *The Korea Herald*, 5 February 2009; Sam Kim, "N. Korea moving to launch long-range missile: source", Yonhap News Agency, 3 February 2009. Initially, intelligence analysts believed the missile was being transported to the new space launch facility at Tongch'ang-ri. Crisis Group interview, Seoul, 4 February 2009.

⁵⁷ "Preparations for launch of experimental communications satellite in full gear", KCNA, 24 February 2009.

⁵⁸ "KCNA report on DPRK's accession to International Space Treaty and Convention", KCNA, 12 March 2009; "N. Korea joins space treaty, convention - Russian ministry source", RIA Novosti, 12 March 2009. For background on some of the legal issues leading up to the launch, see Crisis Group Asia Briefing, *North Korea's Missile Launch*, op. cit. The full name of the treaty is the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and Other Celestial Bodies.

⁵⁹ Craig Covault, "North Korean rocket flew further than earlier thought", *Spaceflight Now*, 10 April 2009, <http://spaceflightnow.com/news/n0904/10northkorea/>; "2nd, 3rd stages of N. Korea rocket may have separated", Kyodo News, 10 April 2009 in Open Source Center (OSC) Document ID: JPP20090409969105.

did reach orbit, though no independent evidence supports the claim.⁶⁰

While the Taepodong-2 could potentially strike the western U.S., the system is not yet reliable and requires further development and testing. Critics assert that Pyongyang disguised a missile test as a satellite launch to deflect international sanctions, but the argument is mostly irrelevant given the dual-use attributes of the launch vehicle, and the legal issue surrounding the launch is inconclusive.⁶¹ The system could be configured as a space launch vehicle (SLV) or a long-range ballistic missile, but it has little direct military utility, since it must be launched from a stationary platform, and launch preparations are observable weeks in advance.⁶²

Nevertheless, the flight test provided valuable data for future missile development. Inter-Korean “space race” dynamics may also have motivated Pyongyang, which would have scored propaganda points if it had placed a satellite into orbit before South Korea, which is scheduled to make an attempt on 30 July 2009.⁶³ The ROK had not believed the North would be able to launch first.⁶⁴

After investing so much in the new space launch centre, it is unclear why Pyongyang decided to use the old site at Musudan-ri. There are a few possibilities:

- ❑ the new facility was not ready, but Pyongyang decided it must test the Taepodong-2 to meet technical development timelines;
- ❑ Pyongyang decided a test flight should coincide with domestic political events, such as the 8 March 2009 Supreme People’s Assembly elections and possible initiatives surrounding succession plans;

⁶⁰“NK: satellite in orbit after successful launch”, *The Korea Times*, 5 April 2009; “N. Korea claims satellite in orbit despite reports of failed launch”, Yonhap News Agency, 5 April 2009; “DPRK’s successful satellite launch hailed abroad”, KCNA, 13 April 2009.

⁶¹Crisis Group Briefing, *North Korea’s Missile Launch*, op. cit.

⁶²In previous launches, fuel and oxidiser were provided by tanker trucks, and at least two to three weeks were required to erect the missiles and fuel them for launching. However, North Korea reportedly has installed equipment at the Musudan-ri launch facility to fuel the missiles directly, which could partially conceal the launch preparations. “Intelligence: N. Korea to test new missile”, *The Donga Ilbo*, 2 October 2008; “北新형 미사일 시험발사 준비 징후” [“Signs that the North is preparing to launch a new missile”], *The Chosun Ilbo*, 2 October 2008.

⁶³Lee Joon-seung, “Gov’t approves launch of S. Korea’s first space rocket”, Yonhap News Agency, 2 June 2009.

⁶⁴Crisis Group interview, Seoul, 5 November 2008.

- ❑ Pyongyang felt an urgent need to send a political signal, especially to the new Obama administration;
- ❑ the Taepodong-2 was ready for another flight test, but Pyongyang lacked confidence in it and preferred that any accident take place at Musudan-ri rather than at the new facility; and
- ❑ Pyongyang wished to gage the international military and political reactions to the deployment at Musudan-ri, which is more provocative because of its proximity to Japan.

While North Korea had multiple possible motivations, its continued development and investment in new missile launch facilities indicate that the leadership is probably determined to develop long-range missiles and acquire a space launch capability. Once the Tongch’ang-ri space launch facility is completed, the leadership will have strong incentives to continue satellite launches and long-range missile development, unless technical barriers become insurmountable, or the benefits of restraint through a diplomatic settlement are seen as greater than the domestic costs of abandoning the missile and space programs. Reaching a diplomatic settlement is difficult because the DPRK leadership demands more compensation for renouncing what it considers the considerable domestic political value of those programs than what the international community is willing to pay.

B. INVENTORY

While U.S. policymakers tend to focus on efforts to acquire long-range missile capability, Pyongyang’s inventory of short-range and medium-range road-mobile ballistic missiles poses a more imminent threat. It may have deployed over 600 short-range Scud variants and possibly as many as 320 medium-range Nodong missiles.⁶⁵ The Musudan, another road-mobile, liquid-fuelled ballistic missile, has not been flight tested (at least in the North), but ROK intelligence believes it was deployed in 2007. It is believed to be nuclear-capable and could potentially strike Guam.⁶⁶ Iran is

⁶⁵Statement of General B.B. Bell, Commander, United States Forces Korea, before the House Armed Services Committee, 9 March 2006; Statement of General B.B. Bell, Commander, United States Forces Korea, before the Senate Armed Services Committee, 24 April 2007; internal government memorandum made available to Crisis Group.

⁶⁶Internal government memorandum made available to Crisis Group; Crisis Group interview. The Musudan design is based on the Soviet SS-N-6 submarine-launched ballistic missile (SLBM). Some analysts believe Iran has conducted at least one proxy flight test of the Musudan (Shahab-4 or Nodong-B) in Iran in January 2006. See Joseph S. Bermudez,

developing a version, but reportedly received it in “kit form from the DPRK”.⁶⁷ North Korea also has unveiled a new solid-fuelled short-range tactical missile, the “Toksa” (Viper) or KN-02, but it is unclear whether it has been deployed. It is a North Korean version of the Soviet/Russian Tochka (SS-21 Scarab) but has a range of only about 120km.⁶⁸ However, it is much more accurate than the North’s other missiles and could strike the Seoul-Inch’ŏn metropolitan area and possibly U.S. military bases in P’yŏngt’aek, south of Seoul.⁶⁹

North Korea’s ballistic missiles are stored underground and in war would be transported to launch sites that are little more than concrete slabs. Underground storage and mobility increase survivability and provide the option of surprise attack, but crews must erect and fuel the missiles as well as collect and input meteorological data prior to launch, which would create a small window of vulnerability to pre-emption.⁷⁰ Nevertheless,

“North Korea deploys new missiles”, *Jane’s Defence Weekly*, 4 August 2004; David C. Isby, “North Korea has deployed intermediate-range ballistic missiles”, *Jane’s Missiles and Rockets*, 1 September 2004; Daniel A. Pinkston, “North Korea displays ballistic missiles during military parade, some for first time”, *WMD Insights*, June 2007, at www.wmdinsights.com/I16/I16_EA1_NKDisplays.htm; Charles P. Vick, “The Operational Shahab-4/No-dong-B Flight Tested in Iran for Iran & North Korea Confirmed”, Federation of American Scientists, 10 April 2007, at www.globalsecurity.org/wmd/library/report/2006/cpvick-no-dong-b_2006.htm; “조승진 [Cho Sŭng-jin], “北개발 미사일 함정 발사용?/잠수함 작아 탑재 어려워” [“Is the North developing a submarine-launched missile? Difficult to carry on small submarines”], *Seoul Shinmun*, 5 August 2004; 최호원 [Ch’oi Ho-wŏn], “새로 배치된 북미사일 괌-하와이도 사정권에” [“New deployed missile can strike Guam and Hawaii”], *The Donga Ilbo*, 8 July 2004.

⁶⁷ Crisis Group interview, Seoul.

⁶⁸ The North Korean name of the missile is unknown, but South Korean officials reportedly do not like the American coined “Toksa”, probably because the name is too flashy and positive from their perspective, so American analysts use “KN-02” in discussions with ROK officials. Crisis Group interview, Seoul, 30 October 2008.

⁶⁹ P’yŏngt’aek is about 60km south of Seoul, and about 100-120km south of the DMZ. To strike P’yŏngt’aek, the Toksa would have to be launched just north of the DMZ, but it has never been deployed to this area. U.S. forces in Korea would view such a deployment as extremely provocative. Crisis Group interview, Seoul. For more on the KN-02, see Daniel A. Pinkston, “North Korea displays ballistic missiles”, op. cit.

⁷⁰ For details on the sequence of preparations for a Scud missile launch, see Steven J. Zaloga, *Scud Ballistic Missile and Launch Systems 1955-2005* (Oxford, 2006), pp. 21-23. The Soviets reportedly required about 90 minutes to prepare a missile for launch, but the Iraqi military reduced the time to less than 30 minutes after their experience in the “War of the Cities” with Iran. Tim Ripley, “Scud Hunting: Counter-force

it would be extremely difficult to execute pre-emptive strikes against the mobile missiles. The North’s rugged terrain, numerous underground facilities and sheer number of missiles make it virtually impossible to destroy the inventory with a conventional pre-emptive strike.⁷¹

In sum, North Korea has hundreds of ballistic missiles, along with a significant infrastructure and institutional arrangement to sustain its missile development program. It is nearly self-sufficient in ballistic missile production, but still relies upon some advanced foreign technologies and components, particularly for guidance systems. It has established foreign entities and front companies to acquire inputs, but export controls and denial strategies have made its international procurement efforts more difficult. Furthermore, Security Council Resolutions 1695, 1718 and 1874 require all UN member states to refrain from trading in North Korean missiles or related components and technologies.⁷²

C. FROM SIMPLE NUCLEAR DEVICES TO MISSILE WARHEADS

The detonation of a nuclear explosive device is a significant scientific achievement, but miniaturising such a device for assembly into a missile warhead or gravity bomb for aircraft delivery presents a number of difficult engineering problems. The exact details of North Korea’s weapon design and miniaturisation are unknown, but the foreign ministry announced on 10 February 2005 that the country possessed nuclear weapons.⁷³ North Korea subsequently demonstrated

Operations against Theatre Ballistic Missiles”, Bailrigg Memorandum 18, Centre for Defence and International Security Studies, Lancaster University, 1996, at www.cdiss.org/documents/uploaded/Scud%20Hunting%20%20BM%2018.pdf.

⁷¹ Despite a dedicated effort to suppress Iraqi Scuds during the Gulf War in 1991, coalition forces had extreme difficulties and were mostly unsuccessful. For an overview and analysis of recent discussions in Japan regarding a pre-emptive strike against DPRK missiles, see Daniel A. Pinkston and Kazutaka Sakurai, “Japan Debates Preparing for Future Preemptive Strikes against North Korea”, *The Korean Journal of Defense Analysis*, vol. 18, no. 4 (winter 2006), pp. 95-121.

⁷² “Security Council Condemns Democratic People’s Republic of Korea’s Missile Launches, Unanimously Adopting Resolution 1695 (2006)”, UN Security Council, department of public information, news and media division, 15 July 2006; also Security Council Resolutions 1718 (14 October 2006) and 1874 (12 June 2009).

⁷³ “Statement of DPRK government on its withdrawal from NPT”, KCNA, 10 January 2003; “DPRK FM on its stand to suspend its participation in six-party talks for indefinite period”, KCNA, 10 February 2005; and James Brooke and David E. Sanger, “North Koreans say they hold nuclear arms”, *The New York Times*, 11 February 2005.

its “nuclear deterrent” by exploding a small nuclear device on 9 October 2006 at the Mount Mant’ap test site near the village of Punggye-ri in North Hamgyŏng Province.⁷⁴ The yield was less than one kiloton of TNT, but the North reportedly informed China before the blast that the target yield was four kilotons.⁷⁵ In comparison, the yields of the atomic bombs dropped on Hiroshima and Nagasaki were about fifteen and twenty kilotons, the typical range for the first tests by other nations. While the cause of the low yield is unknown, speculation has centred on possible problems with the neutron generator or impurities that may have contaminated the plutonium.⁷⁶

The second nuclear test was at the same site on 25 May 2009. Initial estimates placed the yield at about two to eight kilotons, with about four likely.⁷⁷ The target yield is unknown, but if North Korea tested a similar device aiming for four kilotons as reportedly in 2006, the test can be termed a success. State media reported “the test helped satisfactorily settle the scientific and technological problems arising in further increasing the power of nuclear weapons and steadily developing nuclear technology”.⁷⁸ Some analysts argued the small yield indicated underdeveloped capabilities, but it could mean the North has been working within design parameters for a missile warhead all along and could be satisfied with a relatively low-yield weapon.⁷⁹

In the early 1990s, U.S. intelligence estimated that the DPRK probably had one or two nuclear bombs, but the North probably was unable to make the devices

small enough to be delivered on a ballistic missile. Press reports at the time asserted that Pyongyang had sought assistance, particularly from Russia, to design a nuclear warhead, but the extent of any technology transfers is unclear.⁸⁰ According to a Crisis Group source, a prominent defector claimed to have overheard in late 1991, while still in North Korea, that the DPRK had begun to “pay Russian scientists large sums of money earlier that year to achieve significant strides in nuclear development”. The same source has claimed that by the early 1990s the North had acquired and developed optical equipment for analysing nuclear explosive tests.⁸¹

In 1994, U.S. Naval Intelligence warned that Pyongyang would probably be able to arm its Nodong missiles with nuclear warheads by 2000 and possibly by 1995.⁸² ROK intelligence believes DPRK engineers were able to make significant progress in warhead miniaturisation between 1999 and 2001, and the national defence ministry now believes the North has warheads that can be mounted on ballistic missiles.⁸³ The U.S. Defense Intelligence Agency (DIA) concurs. In February 2004, its director, Vice Admiral Lowell E. Jacoby, told the U.S. Senate Select Committee on Intelligence: “We believe North Korea has nuclear warheads from plutonium produced prior to the 1994 Agreed Framework”.⁸⁴ Jacoby confirmed this view during Senate testimony in April 2005.⁸⁵

Defectors have made several claims – mostly unsubstantiated – regarding nuclear bombs or warheads. In 1994, Kang Myŏng-do, the son-in-law of former Prime Minister Kang Sŏng-san, claimed the North had five

⁷⁴ “DPRK foreign ministry clarifies stand on new measure to bolster war deterrent”, KCNA, 3 October 2006; “DPRK successfully conducts underground nuclear test”, KCNA, 9 October 2006.

⁷⁵ Siegfried S. Hecker, “Report on North Korean Nuclear Program”, Center for International Security and Cooperation, Stanford University, 15 November 2006.

⁷⁶ Mark Hibbs, “DPRK test shot highly inefficient, may be design flaw, experts say”, *Nucleonics Week*, vol. 47, no. 41, 12 October 2006.

⁷⁷ Jeffrey Park, “The North Korean nuclear test: what the seismic data says”, *The Bulletin of the Atomic Scientists*, 26 May 2009, <http://thebulletin.org/web-edition/features/the-north-korean-nuclear-test-what-the-seismic-data-says>; Thom Shanker and William J. Broad, “Seismic readings from North Korea blast appear to point to a small nuclear test”, *The New York Times*, 25 May 2009; Bill Gertz, “Inside the ring: North Korean test”, *The Washington Times*, 28 May 2009; Kim Su-jeong and Yoo Jee-ho, “Expert: North’s test not a surprise, more to come”, *The JoongAng Ilbo*, 1 June 2009, <http://joongangdaily.joins.com/article/view.asp?aid=2905533>.

⁷⁸ “KCNA report on one more successful underground nuclear test”, KCNA, 25 May 2009.

⁷⁹ Zhang Hui, “Revisiting North Korea’s Nuclear Test”, *China Security*, vol. 3, no. 3 (summer 2007), pp. 119 – 130.

⁸⁰ “북한행 러 과학자/핵탄제조 전문가/러 일간지 보도” [“North Korea bound Russian scientists/Nuclear warhead manufacturing specialists/Russian Daily Report”], *The Han’guk Ilbo*, 9 February 1993, p. 2.

⁸¹ High-speed optical cameras record the implosion of the high explosives package surrounding the fissile bomb core. Non-nuclear testing is required to insure the uniformity of the implosion and to test materials used for a tamper and neutron reflector. North Korea has conducted about 170 high explosive tests to verify and improve its bomb design. Internal memorandum made available to Crisis Group.

⁸² Barbara Starr, “No Dongs may be nuclear, warns USN”, *Jane’s Defence Weekly*, 18 June 1994.

⁸³ Crisis Group interview, Seoul, 3 November 2008.

⁸⁴ Vice Admiral Lowell E. Jacoby, director of the Defence Intelligence Agency, “Current and Projected National Security Threats to the United States”, statement for the record, Senate Armed Services Committee, 26 February 2004, p. 8.

⁸⁵ David S. Cloud and David E. Sanger, “Agency says North Korea able to mount warheads on missiles”, *The New York Times*, 28 April 2005.

nuclear bombs and was prepared to produce five more.⁸⁶ However, that is not credible, since the North lacked the plutonium for so many weapons, and it is extremely unlikely Kang would have had access to such sensitive information. “Kim Il-do”, who purportedly defected in May 2005 and had served in the Supreme People’s Assembly, claimed to have worked for the Second Economic Committee, responsible for munitions production. He said North Korean scientists fabricated at least one nuclear weapon with four kilograms of plutonium. He said the device weighed one ton, and scientists certified reliability to Kim Jong-il but remained concerned, so were working to reduce the mass to 500kg.⁸⁷ A Japanese weekly reported in August 2008 a defector’s claim to have seen a spherical nuclear device in Yŏngbyŏn in January 2001, but Japanese government analysts believe the report is not credible.⁸⁸

The notorious Pakistani scientist A. Q. Khan claimed he was taken to a facility in 1999 about one hour outside of Pyongyang and shown three nuclear devices.⁸⁹ He reportedly was only given brief access, and it is uncertain whether Khan, a metallurgist, had the expertise or the staff to examine the devices. However, a government source has concluded Khan was shown three Nodong nuclear warheads, each with a diameter of about 60cm.⁹⁰ U.S. and South Korean intelligence apparently disagree over the amount of plutonium required for North Korea’s bomb design, which ultimately determines the number of deployable warheads.⁹¹ DIA assumes the North’s bombs require three to four kilo-

grams of plutonium, while ROK intelligence believes each requires about six kilograms. Given North Korea’s probable weapons-grade plutonium stock of about 38.5kg, the range of potential weapons is six to twelve.⁹² The ROK government’s official position is that North Korea has “about five to eight nuclear explosive devices”, but it declines to give a precise number and refuses to call them nuclear weapons or warheads.⁹³

Theoretically, North Korea could use aircraft, a ship or even a vehicle to deliver a nuclear weapon, but these platforms are either vulnerable or unreliable.⁹⁴ Foreign military planners must have contingency plans for such delivery attempts, but they are very unlikely, especially given Pyongyang’s ballistic missile capabilities. Intelligence sources told Crisis Group they believe the DPRK has deployed nuclear warheads for Nodong missiles in the northern part of the country.⁹⁵ Another intelligence source confirmed that the Nodong is “the selected delivery system”.⁹⁶ The North’s ballistic missiles provide little military utility unless they are armed with nuclear warheads, so the Nodong is the most likely delivery platform given its range and relative reliability.⁹⁷

⁸⁶ James Sterngold, “Defector says North Korea has 5 A-bombs and may make more”, *The New York Times*, 28 July 1994.

⁸⁷ 송승호 [Song Sŭng-ho], “北韓 최고인민회의 대의원 韓國에 망명, 핵개발에 대한 중대 증언” [“North Korean Supreme People’s Assembly member defects to South Korea, gives grave testimony about nuclear development”], *Wŏlgan Chosun*, August 2005.

⁸⁸ Osamu Eya, *Flash*, 5 August 2008 edition, in “Japanese magazine cites DPRK defector on location of bomb”, Korea Open Source Digest, Saturday-Monday, 26-28 July 2008; Crisis Group email correspondence, Dr Satoru Miyamoto, Japan Institute of International Affairs, 29 July 2008.

⁸⁹ David E. Sanger, “Pakistani says he saw North Korean nuclear devices”, *The New York Times*, 13 April 2004; James A. Foley, “Khan shown North Korean nuclear weapons”, *Jane’s Intelligence Review*, 1 May 2004.

⁹⁰ Internal government memorandum made available to Crisis Group.

⁹¹ DPRK engineers may still be working to improve or verify bomb designs. They continued high-explosive implosion testing at the Yongdŏk-dong test site in the city of, Kusŏng, North P’yŏn’an Province, through late 2008, but these could also be for political purposes since the North knows the tests are visible to U.S. intelligence. Crisis Group interview, Seoul, 7 January 2009.

⁹² Internal government memorandum made available to Crisis Group.

⁹³ Crisis Group interview, Ambassador Kim Sook, Special Representative for Korean Peninsula Peace and Security Affairs, Seoul, 13 January 2009.

⁹⁴ North Korea’s only bomber, the obsolete H-5 (Il-28), is vulnerable to South Korean and Japanese air defences. Other fighter bombers in the inventory theoretically could deliver a nuclear bomb but would also be vulnerable. North Korea has no known submarine launch missile capability, but there have been reports of possible efforts to develop a ship-launched ballistic missile. These reports are unsubstantiated and any such North Korean systems or technologies are experimental and unproven. A device delivered by truck or in a shipping container would be vulnerable to interception. Crisis Group interview, Seoul, 7 January 2009; “Seoul claims North Korea is developing IRBM”, *Jane’s Missiles and Rockets*, 1 April 2007; “‘Rogue state’ has fired shipboard ballistic missile”, *Jane’s Missiles and Rockets*, 1 October 2001; David Miller, “Sea delivery: a rogue state’s third option”, *Jane’s Intelligence Review*, 1 May 1996.

⁹⁵ Internal government memorandum made available to Crisis Group.

⁹⁶ Crisis Group interview, Seoul, 7 January 2009.

⁹⁷ Ham Taek-yŏng and Sŏ Chae-jŏng calculated that the KPA would have to fire between 226 and 900 conventionally armed Scuds to destroy a single ROK Air Force air strip because of poor accuracy. A KN-02 (Toksa) with a circular error probability (CEP) of 200 metres or less could strike a South Korean command and control centre with a chemical weapon (CW) warhead but would not be effective because of ROK

D. COMMAND AND CONTROL OF NUCLEAR WEAPONS

The National Defence Commission (NDC) is the highest military authority in the DPRK. As its chairman, Kim Jong-il, “directs and commands all the armed forces”.⁹⁸ He has established firm control of the military, the party and the state and has no peers or apparent challengers. Although he reportedly has selected his third son as his successor, it is uncertain whether transition plans will transpire as intended.

During peacetime, the NDC and its chairman have ultimate control of military planning, arms production and procurement. The NDC delegates some responsibilities to the party and the Ministry of the People's Armed Forces but maintains tight control of weapons of mass destruction (WMD) and ballistic missile assets. Kim Jong-il holds extraordinary power as General Secretary of the KWP, as well as chairman of the NDC, which has the authority to declare war and issue orders for national mobilisation. In wartime, Kim would become Supreme Commander of the Korean People's Army (SCKPA).

Nominally, power is more decentralised in peacetime, but Kim maintains strict control via formal and informal networks throughout the military and party. Decentralisation otherwise keeps party and military organisations divided, forcing them to check each other and compete for access and rewards from him. Kim reportedly disdains meetings, preferring to bypass the formal institutional lines of authority and often delivering instructions directly to relevant secretaries.⁹⁹ He exerts tight control over nuclear assets and delivery systems and must authorise the use of any nuclear weapons. This very personal and centralised system could create instability and uncertainty if he suddenly were unable to lead.

In April 2009, the Supreme People's Assembly expanded the number of NDC members from eight to thirteen. New members included Kim Jong-il's brother-in-law, Chang Sŏng-t'aek, and Chu Kyu'ch'ang, who is believed

to be in charge of an independent entity with custody of North Korea's nuclear bombs (see below).¹⁰⁰ The expansion could be related to succession plans, since the additional members bring broader functional expertise that could be useful if for rule by committee in a post-Kim era. However, most NDC members are in their 70s or 80s, and predictions for the post Kim Jong-il are only speculative.

North Korea's nuclear bombs have not been transferred to the KPA, but Kim Jong-il apparently maintains control of them. This may be through the Second Economic Committee, which is responsible for the production of weapons and military equipment, including missiles and nuclear weapons. Since 2003, it has been headed by Paek Se-bong, who was appointed to the NDC in September 2003.¹⁰¹

However, there is a strong possibility Kim controls nuclear weapons through an independent but still unidentified institution under Chu Kyu-ch'ang.¹⁰² Kim demands secrecy and compartmentalisation, and since his management style emphasises direct personal control, he probably is unwilling to transfer nuclear custody to an agency with any other function.¹⁰³ Of course, he would have to be the formal head of such an agency, but his deputy could be Chu, who is believed to be in charge of the nuclear weapons development program.¹⁰⁴ Chu is 75 and chief of the first department in the munitions industry division under the KWP Central Committee. He played a prominent role in North Korea's missile and nuclear development in the 1990s and was in charge of the August 1998 attempted satellite launch and the 2009 launch.¹⁰⁵ From 1991 to 1998 he directed

CW defence capabilities. 함택영 및 서재정 [Ham Taek-yŏng and Sŏ Chae-jŏng], “북한의 군사력 및 남북한 군사력균형” [“North Korea's Military Power and the North-South Korean Military Balance”], in 함택영 [Ham Taek-yŏng] et al., *북한군사문제의 재조명* [Reflecting on North Korean Military Issues] (Seoul, 2006), pp. 391-398.

⁹⁸ DPRK Constitution, Chapter 6, Article 100, 102.

⁹⁹ Crisis Group interview, Seoul, 3 November 2008; internal government memorandum made available to Crisis Group.

¹⁰⁰ “DPRK radio lists leaders, members of DPRK NDC, SPA presidium, cabinet”, [North] Korean Central Broadcasting Station, in OSC Document ID: KPP20090410104002, 9 April 2009.

¹⁰¹ “北 군수전담 제2경제위원장은 백세봉 국방위원” [“Paek Se-bong, chairman of the North's Second Economic Committee in charge of munitions, also on the National Defence Commission”], Yonhap News Agency, 14 January 2008.

¹⁰² Crisis Group interview, Seoul; internal government memorandum made available to Crisis Group.

¹⁰³ Kim has been careful to prevent anyone from acquiring too much power lest they could potentially challenge the Kim family regime. Internal security and monitoring is very strict. ROK intelligence believes telephone calls of all senior officials are monitored, and video cameras have been installed in their offices and homes. Crisis Group interview, Seoul.

¹⁰⁴ Internal memorandum made available to Crisis Group; Crisis Group interview, Seoul, 3 November 2008.

¹⁰⁵ 고수석 [Ko Su-sŏk], “북한의 정보기술(IT) 담당기구와 컴퓨터.인터넷 현황” [“The Current Status of North Korea's IT Organisations, Computers and the Inter-

the Second Natural Science Academy, which conducts advanced weapons-related research and development. He was elected to the Supreme People's Assembly in 2003, six years before joining the NDC.¹⁰⁶

E. ARMING AND FIRING NUCLEAR MISSILES

For North Korea to use its nuclear weapons, the Supreme Commander of the Korean People's Army (SCKPA) must first issue the order to transfer custody of the nuclear warheads to the KPA. Kim Jong-il would direct Chu Kyu-ch'ang to have the weapons armed, which probably would take one or two days.¹⁰⁷ This delay indicates that the North has followed China's example of storing its bombs and missiles separately for safety purposes, but at the cost of less operational readiness. Furthermore, it means North Korea lacks sophisticated nuclear safety devices such as permissive action links (PALs) and environmental sensing devices (ESDs), which increases the likelihood of an accidental nuclear explosion if the weapons are placed on alert.

In the case of conventional military assets, the SCKPA issues directives to the chief of the general staff of the KPA, who issues operational orders in wartime. But this level is probably bypassed for nuclear weapons. Kim as SCKPA likely would issue direct orders to the Missile Guidance Bureau (MGB) to mate the warheads with the missiles and deploy to their launch sites. The MGB is an independent, corps-level unit directly under the general staff, headquartered in Sŏngch'ŏn-kun, South P'yŏng'an Province, on the outskirts of Pyongyang.¹⁰⁸

According to an intelligence source, nuclear weapons probably are stored at the following locations: Yongjŏng-dong, Namp'o City, South P'yŏng'an Province; near Kap'hyŏn-dong, Hŭich'ŏn City, Chagang Province;

and Kong'in-dong, Kanggye City, Chagang Province.¹⁰⁹ If A.Q. Khan travelled about one hour from Pyongyang to view North Korea's warheads, he possibly visited Yongjŏng-dong, Namp'o, which could be the location of a nuclear warhead assembly and testing facility. The Yongjŏng-dong facility is near the Chamjin Munitions Factory on the outskirts of Pyongyang, near Namp'o, which reportedly produces the Taepodong-2 and the Nodong.¹¹⁰

The proximity of the two facilities would make it easier for warhead designers and missile engineers to collaborate, but separate storage facilities would be better for safety and security. Once the devices were certified reliable in Namp'o, they could have been transferred to Kap'hyŏn-dong, Hŭich'ŏn City, and/or Kong'in-dong, Kanggye City. DPRK military planners might prefer to store the warheads at two locations to increase survivability during hostilities. Both cities are industrial centres linked to transport networks and near Nodong missile bases.

North Korean nuclear weapons would likely be launched from the MGB's Nodong missile division, headquartered in Yongnim-ŭp, Yongnim-kun, Chagang Province. There are three Nodong missile regiments in the division. The first is headquartered in Sino-ri, Unjŏn-kun, North P'yŏng'an Province (near the west coast, about 100km from the Chinese border); the second is headquartered in Yŏngjŏ-ri, Kimhyŏngjik-kun, Yanggang Province (in the centre of the country, about twenty kilometres from the Chinese border); the third is located along with the Nodong missile division in Yongnim-ŭp (in the centre of the country about 45-50km from Kanggye City, and about 50-60km from Hŭich'ŏn City).¹¹¹

net"], in 한국과학기술정보연구원 [Korea Institute of Science and Technology Information], *북한과학기술연구 [Research on North Korean Science and Technology]* (Seoul, 2003), pp. 39-52; "ROK daily names Chu Kyu-ch'ang as scientist behind DPRK's rocket development", *The Joong-gang Ilbo*, in OSC Document ID: KPP20090406021001, 6 April 2009.

¹⁰⁶ 최선영 [Ch'oe Sŏn-yŏng], "北 당 군수공업부 1부부장에 주규창 임명된 듯" [Chu Kyu-ch'ang appointed chief of the First Department in the Munitions Industry Division under the North's Party], *Yonhap News Agency*, 12 April 2001.

¹⁰⁷ Internal government memorandum made available to Crisis Group.

¹⁰⁸ Ibid; 정인환 [Chŏng In-hwan], "미사일 장사, 많이 남았습니까?" ["Is There Much Missile Business Left?"], *Hankryoreh 21*, no. 618, 13 July 2006.

¹⁰⁹ Internal government memorandum made available to Crisis Group. However, another intelligence source claimed the U.S. Central Intelligence Agency has "low confidence" in these exact locations because there are several underground facilities in the region, and the weapons could be stored in a number of nearby facilities. Crisis Group interview, Seoul, 7 January 2009.

¹¹⁰ 양정아 [Yang Chŏng-a], "대포동 2호 北 잠진 군수공장서 제조" ["Taepodong-2 manufactured at Chamjin munitions factory near Namp'o"], *The Daily NK*, 20 June 2006, at www.dailynk.com/korean/read.php?cataId=nk00100&num=23865; 이영종 [Yi Yŏng-jong], "남포서 만든 대포동 2호 위장막 씌워 발사장 이동" ["Taepodong-2 made in Namp'o and transported to launch site with camouflage cover"], *The Joong-gang Ilbo*, 20 June 2006, at http://article.joins.com/article/article.asp?Total_ID=2329379.

¹¹¹ Internal government memorandum made available to Crisis Group.

The second or third Nodong regiments would likely be tasked with launching nuclear missiles, because they are close to the suspected warhead storage sites and less susceptible to air or cruise missile attacks than the first regiment in Sino-ri. According to U.S. intelligence, there are indications North Korea has been building new Nodong bases near the Chinese border to take advantage of a reported 25-mile (40-km) buffer zone at that border that is “off limits to U.S. bombing”. But an analyst told Crisis Group Washington probably would shrink the zone significantly in case of war in Korea.¹¹² The North probably is constructing the bases to increase the credibility of its nuclear deterrent by improving missile survivability. In March 2008, the new chairman of the South’s joint chiefs of staff told the ROK National Assembly that the military is prepared to carry out pre-emptive strikes against DPRK nuclear facilities if necessary, but China would certainly react negatively to any such development.¹¹³

Another possibility, although unlikely, is that North Korea would use the untested Musudan as a delivery platform. Its advantage is that it could potentially strike Guam, but it cannot be viewed as reliable without flight testing. North Korea’s suspected nuclear weapons storage sites are also much closer to the second and third Nodong regiment bases. The Musudan missile division has three regiments and is headquartered in Yangdök-kun, South P’yöng’an Province, about 80km east of Pyongyang. The first regiment is believed to be in Pakch’on, Yullyun-kun, South Hwanghae Province, on the west coast, about 80km south west of Pyongyang. The second and third are on the east coast, probably at Chunghäung-ri, Hong’wön-kun, South Hamgyöng Province; and Sangnam-ri, Höch’ön-kun, South Hamgyöng Province.¹¹⁴ The distance and terrain between the warhead storage sites and the Musudan missile bases make the Musudan an unlikely delivery system at present, but that could change if the Musudan were tested, and warheads were redeployed closer to its bases.

Intentions are impossible to assess, but there seems to be little military utility for North Korea’s nuclear weapons other than deterrence, which Pyongyang repeatedly has stated is its objective. For many years prior to its nuclear breakout, the regime’s military efforts apparently focused on internal stability and deterrence against a pre-emptive U.S. attack. However, a major pillar of DPRK military strategy is to exclude or deter the U.S. from intervening on the Korean Peninsula. If it

were able to do so, an effort to overturn the status quo in North East Asia by threat or use of force would be more promising. Moreover, if U.S. alliance commitments in the region lost credibility, Japan and South Korea might be forced to take measures that could trigger the beginning of an arms race.

A “North Korean war plan” prepared in 2003 and obtained by a South Korean daily detailed mobilisation procedures in time of war. It was issued under Kim Jong-il’s signature as Central Military Commission (CMC) Chairman, when Kim had gone into seclusion after the U.S.-led coalition had begun its war in Iraq. The CMC chairman’s position was thought to have been vacant after the death of Kim Il-sung in 1994, and the commission was believed to have become inactive after the NDC became prominent in the 1990s. However, the plan was probably issued as a party document through KWP channels to reach civilians in case of war mobilisation. It was defensive in tone, not a plan for offensive strikes. There were no details for missile units other than to “strike enemy targets according to the instructions of the supreme headquarters”. It emphasised the need to report to “supreme headquarters” any detection of nuclear, chemical weapons or biological weapons having been used against the DPRK but did not explain how the DPRK, at the discretion of the SCKPA, would respond.¹¹⁵

F. MISSILES AND SCIENTIFIC NATIONALISM

Nuclear and ballistic missile technologies represent advanced scientific achievements that can be sources of nationalistic pride. Domestically, the North Korean government has promoted its nuclear and missile programs as strong pillars of national defence and prominent symbols of scientific nationalism. The programs are representative of the national effort to build a “strong and prosperous country” (*kangsöngdaeguk*) under Kim Jong-il. The term *kangsöngdaeguk* first appeared in August 1998 in reference to Kim having provided “on-the-spot guidance” in Chagang Province in February 1998 and is now established state doctrine.¹¹⁶

¹¹² Crisis Group interview, Seoul, 30 October 2008.

¹¹³ Kim Min-seok and Jung Ha-won, “North’s nukes on attack radar”, *The JoongAng Ilbo*, 27 March 2008.

¹¹⁴ Internal government memorandum made available to Crisis Group.

¹¹⁵ A ROK government source asserted the document is authentic. Crisis Group interview, Seoul. See “‘북전시사업세칙’ 입수/세부내용 어떻게 - 개전 24 시간내 당.군.민 총동원” [“Detailed North Korean war operation plans’ obtained: detailed contents on how to mobilise the party, military and people within 24 hours of war outbreak”], *The Kyunghyang Sinmun*, 5 January 2005; Jong-heon Lee, “Analysis: N. Korea’s war contingency plan”, United Press International, 5 January 2005.

¹¹⁶ The Korean term is 强盛大國. 북한개요 2004 [*North Korea Summary 2004*], op. cit., pp. 34-35.

It is no coincidence that it coincides with Kim's formal rise to power and the DPRK's attempt to place the "Kwangmyŏngsong-1" into low earth orbit with the Paektusan-1 on 31 August 1998.¹¹⁷ North Korean media have also glorified the "successful" launch of the "Kwangmyŏngsong-2" on 5 April 2009 as a clear indication of national power and development.¹¹⁸

"Building a *kangsŏngdaeguk*" focuses on four areas of desired national strength: ideology, politics, the military and the economy.¹¹⁹ The leadership apparently believes the country is strong ideologically and politically, because North Korean society has been indoctrinated for decades with the *chuch'e* ideology of Kim Il-sung.¹²⁰ The leadership acknowledges economic weakness, and policymakers and state media are accordingly focused on a national effort to become a "*kangsŏngdaeguk* in economics" by 15 April 2012, the 100-year anniversary of Kim Il-sung's birth. To achieve this, the DPRK emphasises military industries, apparently believing this will produce spillover benefits for the civilian economy.¹²¹

¹¹⁷ Paektusan (Mount Paektu) is the highest mountain in Korea. Located on the Chinese border, it is a national symbol for both Koreas. Kim Il-sung based his anti-Japanese insurgency around the mountain before fleeing to the Soviet Union in late 1940 or early 1941. North Korea denies Kim escaped to the Soviet Far East, but all North Koreans recognise the revolutionary symbolism of the mountain, and DPRK propaganda claims Kim Jong-il was born there, rather than near Khabarovsk in the USSR. According to DPRK propaganda, a "bright lode star" (*kwangmyŏngsŏng*) appeared over Mount Paektu the night Kim Jong-il was born, and all the people knew a new general had been born. In DPRK propaganda, the Paektusan-1 space launch vehicle and the "Kwangmyŏngsong-1" satellite symbolise the link between Kim Il-sung and Kim Jong-il.

¹¹⁸ "Kim Jong-Il observes launch of satellite Kwangmyŏngsong-2", KCNA, in OSC Document ID: KPP20090405971108, 6 April 2009; "Shall guarantee construction of economically powerful state with invincible gun barrel", KCNA, in OSC Document ID: KPP20090406051003, 6 April 2009; "Pride of a state that manufactures and launches artificial satellites", KCNA, in OSC Document ID: KPP20090406051001, 6 April 2009.

¹¹⁹ 강성종 [Kang Sŏng-jong], *북한의 강성대국 건설전략 [Study on the North Korean Strategy for Building a Strong and Prosperous Country]* (Seoul, 2004), pp. 100-107. The ROK unification ministry combines "ideology and politics" into the single dimension of ideology; see its *북한개요 2004 [North Korea Summary 2004]*, op. cit., pp. 34-35.

¹²⁰ "All people called upon to work hard to build rich and powerful nation", KCNA, 12 November 2006.

¹²¹ 윤명현 [Yun Myŏng-hyŏn], *우리 식 사회주의: 100문 100답 [Our Style Socialism: 100 Questions and Answers]* (Pyongyang, 2004).

The state promotes science and technology as necessary for economic recovery and development, and the media often displays images of nuclear and rocket technology as evidence of national power and wise leadership. The effort has probably paid off; the regime is still in power two decades after the collapse of socialism in Eastern Europe. Even defectors were impressed when the Paektusan-1 (Taepodong-1) was launched in 1998; many North Koreans believed the launch proved the nation had the technological prowess to defeat any adversary.¹²² As the state continues to promote science and technology as the key to economic recovery, missiles and nuclear technology will almost certainly remain prominent propaganda symbols unless peaceful scientific endeavours become available as substitutes.

G. MISSILE EXPORTS

North Korean ballistic missiles also pose global threats through proliferation. The DPRK has sought technology, components and materials from abroad since the inception of the missile development program, but the country also has become a prominent proliferator of missiles and missile technologies. Since the 1980s, Pyongyang has sold missile systems to Iran, Pakistan, Egypt, Libya, Syria and Yemen. It has acknowledged its missile sales, which it regards as its "sovereign right".¹²³ Exports of ballistic missiles, components and technology have accounted for a significant portion of North Korea's meagre hard currency earnings. It is extremely difficult to estimate the total export earnings, because Pyongyang and its customers have a strong incentive to conceal transactions.¹²⁴ According to a U.S. military source, the DPRK earned \$580 million in 2001, but this figure is almost certainly inflated.¹²⁵ The same figure has been cited as the total earned from missile exports for the period 1987-1992.¹²⁶ However,

¹²² Crisis Group interview, North Korean defector, Seoul, 10 October 2008.

¹²³ "U.S. accusations against DPRK rebuffed", KCNA, 24 December 2002; "Nobody can slander DPRK's missile policy – KCNA commentary", KCNA 16 June 1998.

¹²⁴ This incentive was strengthened with the passage of UN Security Council Resolution 1695 following the DPRK's July 2006 ballistic missile tests. Crisis Group Briefing, *After North Korea's Missile Launch*, op. cit.

¹²⁵ Stephan Haggard and Marcus Noland, "North Korea's External Economic Relations", The Peterson Institute for International Economics, working paper, Washington DC, August 2007.

¹²⁶ Yoshiharu Asano, "N. Korea missile exports earned 580 mil. dollars in '01", *The Yomiuri Shimbun*, 13 May 2003; Lim Yun-Suk, "US and N. Korea to hold talks on Pyongyang's missile exports", *Agence France-Presse*, 28 March 1999.

proceeds have almost certainly been in decline over the last decade.

Potential buyers have been dissuaded by direct political pressure and the Proliferation Security Initiative (PSI), a U.S.-inspired multilateral counter-proliferation effort that was established in part to intercept North Korean missile shipments. Furthermore, UN Security Council Resolutions 1695, 1718 and 1874 require all member states to refrain from ballistic missile transactions with the DPRK. Of course, these initiatives will not stop a few determined buyers, but they have made the risks and potential costs greater. Pyongyang has responded with more air shipments of missile systems and components, and is probably offering more technology transfers and licensing deals, which are harder to detect. However, declining sales denies North Korea economies of scale that would make the program more effective.

Cooperating with other countries to develop satellite launchers is another way for Pyongyang to circumvent sanctions. It reportedly provided technical assistance for Iran's 2 February 2009 satellite launch and received data from the event in return.¹²⁷ International cooperation offers an opportunity to pool resources and establish a division of labour to reduce costs. The development of satellite launchers provides a cover for ICBM development and generates domestic political benefits for the leadership.

IV. KEY RISKS

A. WEAPONS USE

There are several possible scenarios for the use of North Korean nuclear weapons or ballistic missiles in Korea or elsewhere. While mutual deterrence on the Korean Peninsula is robust, deterrence could fail; in the case of transfers to other states or non-state actors, the likelihood of use increases. North Korea also does not have advanced safety mechanisms to prevent the accidental or unauthorised use of its nuclear bombs. Moreover, South Korea's population density and Seoul's proximity to the demilitarised zone (DMZ) separating North and South make millions of civilians vulnerable to a conventional as well as a nuclear missile attack.

1. Attack: deliberate, accidental, unauthorised

While the literature stresses the offensive nature of DPRK military doctrine, it is difficult to imagine North Korea using its ballistic missiles or nuclear weapons in an unprovoked first strike. There is always the danger of accidental or unauthorised launches, but currently that is unlikely. The North's ballistic missiles are inaccurate and relatively insignificant as military weapons unless they are armed with WMD,¹²⁸ and most South Korean analysts believe they and the North's nuclear weapons can serve little purpose except deterrence or as bargaining chips with the U.S. in an effort to achieve broader foreign policy objectives.¹²⁹

A deliberate North Korean nuclear attack would be suicidal, so it is very unlikely except as a "doomsday weapon" in the event of imminent defeat in war. WMD assets are tightly controlled by Kim Jong-il, who by all accounts appears to be rational, with a strong instinct for personal survival. Kim's indicated successor and the current inner circle of nuclear custodians almost surely share these attributes, but this is not an absolute certainty. Furthermore, as noted above, North Korea does not have advanced nuclear safety devices such as permissive action links (PALs) and environmental sensing devices (ESDs) to prevent an unauthorised or accidental nuclear detonation or missile launch when systems are on high alert. Misperceptions or miscommunications could lead to accidental or unauthorised use

¹²⁷ "North Korea cooperates in Iran's satellite launch, secretly linked to development of long-range ballistic missiles", *Sankei Shimbun*, in OSC Document ID: JPP20090302038002, 2 March 2009.

¹²⁸ See Ham Taek-yŏng and Sŏ Chae-jŏng, *op. cit.*, on the poor accuracy of conventionally armed Scuds and related issues, fn 97 above.

¹²⁹ *Ibid*; Crisis Group interview, Ham Taek-yŏng (Hamm Taik-young), vice director, Institute for Far Eastern Studies, Seoul, 3 November 2008; and other Crisis Group interviews, Seoul, 30 October 2008.

of nuclear weapons if they are transferred to KPA commanders in the field.

2. Retaliation, escalation

The Korean Peninsula is one of the world's greatest potential military flashpoints. The DPRK has the fourth largest military in the world, with one million active duty personnel, but most of its hardware is obsolete.¹³⁰ Escalation and all-out war were avoided during periods of high tension and serious North Korean provocations in the 1960s, but there have been several close calls since the end of the Korean War.¹³¹ Misperception or miscalculation could lead to an escalation spiral. Deliberate or accidental incursions during a time of rising tensions can create incentives to strike first.

In particular, Pyongyang does not recognise the west sea boundary, the Northern Limit Line (NLL), extending from the Military Demarcation Line (MDL), which has seen two deadly battles over the last decade. In June 1999, the ROK navy sank a DPRK naval vessel, and in June 2002 the North did the same to a South Korean ship. In the 2002 skirmish, the South Korean military called off its pursuit of North Korean vessels after electronic intelligence indicated the North had turned on radars for onshore anti-ship missiles.¹³² If the ROK had launched a preemptive strike against the radar and missile sites to protect its ships, the situation could have escalated to full-scale war.

3. Internal use in a power struggle

Authoritarian states are plagued by succession problems, which are often resolved through violence, though some one-party states (such as the Soviet Union and

China) have institutionalised peaceful transition mechanisms. The DPRK's only power transfer was in July 1994, following the death of Kim Il-sung, when many analysts were surprised at the smooth transition to Kim Jong-il and the state's resiliency. Many ROK analysts believe Kim's "military first" policy has paved the way for another smooth transition, at least in the short run. However, if the next leader is unable to deliver economic recovery, internal pressures could create instability or trigger a military coup. Any military struggle for power could be violent, but most South Korean analysts believe the nuclear arsenal would remain secure, even in the case of regime collapse.¹³³

B. PROLIFERATION, SALES, TRANSFERS

The evidence surrounding DPRK-Syrian cooperation to construct a nuclear reactor at Dair al-Zor (Al Kibar), Syria seems very strong. According to the International Atomic Energy Agency (IAEA), construction began between April and August 2001, and many characteristics of the site are consistent with those of a nuclear reactor. The IAEA also discovered processed uranium in environmental samples that Syria claims must have come from depleted uranium munitions used by the Israeli Air Force when it bombed the facility on 6 September 2007.¹³⁴ The U.S. intelligence community is convinced a nuclear reactor was being constructed with North Korean assistance, and some intelligence analysts believe bilateral nuclear cooperation dates back to 1997.¹³⁵ An international procurement network that it reportedly maintained for the project also implicated North Korea.¹³⁶

North Korea's proliferation activities are well documented, especially regarding ballistic missiles to the Middle East and Pakistan. North Korean-made missiles were fired by Iran against Iraq in the 1980s, and further

¹³⁰ Andrew Scobell and John M. Sanford, *North Korea's Military Threat*, op. cit.; and Jae-Jung Suh, "Assessing the Military Balance in Korea", *Asian Perspective*, vol. 28, no. 4 (2004), pp. 63-88.

¹³¹ Notable examples include capture of the *USS Pueblo* (January 1968); the shooting down of a U.S. Air Force reconnaissance plane (April 1969); the axe murders of two U.S. Army personnel at Panmunjom's Joint Security Area in the DMZ (August 1976); the bombing and attempted assassination of former ROK President Chun Du-hwan in Burma (October 1982) that killed 21 people, including four ROK cabinet ministers; and the bombing of a Korean Air passenger aircraft in flight (November 1987).

¹³² Robert Whyman and David Watts, "Korean dispute ends in sea battle", *The Times* (London), 16 June 1999; "The Naval Clash on the Yellow Sea on 29 June 2002 between South and North Korea: The Situation and ROK's Position", ROK national defence ministry, 1 July 2002; Mark Magnier, "Koreans battle in Yellow Sea", *The Los Angeles Times*, 29 June 2002.

¹³³ Crisis Group interview, ROK General Kim Chae-ch'ang (rtd.), Seoul, 9 December 2008. A senior ROK analyst, however, said he believes chemical weapons are more likely to be used during an internal power struggle than in a conflict with the South. Crisis Group interview, Seoul, 30 October 2008; Crisis Group Report, *North Korea's Chemical and Biological Weapons*, op. cit.

¹³⁴ "Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic", report by the director general, 19 November 2008.

¹³⁵ David Albright and Paul Brannan, "The Al Kibar Reactor: Extraordinary Camouflage, Troubling Implications", Institute for Science and International Security Report, 12 May 2008; Bill Gertz and Sara A. Carter, "Intelligence on Syria delayed to avoid fight", *The Washington Times*, 25 April 2008.

¹³⁶ Robin Wright and Joby Warrick, "Purchases linked N. Korean to Syria", *The Washington Post*, 11 May 2008.

cooperation has enabled Iran to increase its missile capabilities. In February 2009, North Korea assisted Tehran with its first satellite launch, which has applications for long-range missile development in connection with Tehran's possible nuclear weapons program. Recipients of DPRK missiles pose direct security threats, and once they master the technology, can also transfer it to other states.

After North Korea conducted missile and nuclear tests in 2006, the UN Security Council adopted Resolutions 1695 and 1718, which inter alia, require all UN member states to refrain from supplying missile-related materials and technologies to the DPRK and proscribe the procurement of any North Korean missile-related materials and technologies. Resolution 1874, adopted unanimously on 12 June 2009, strengthens the sanctions regime and prohibits the procurement of any arms from the DPRK. Any party in a missile transaction with North Korea could thus be subject to sanctions. North Korea is also under unilateral U.S. sanctions for missile proliferation, but economic sanctions have not stopped determined buyers. In August 2008, at U.S. request, India reportedly denied permission for a North Korean aircraft to transit its airspace en route to Iran because the Air Koryo Ilyushin Il-62 was suspected of carrying illicit cargo, possibly missiles or missile-related components.¹³⁷ However, such an aircraft has the range to fly non-stop from Pyongyang to Tehran through Chinese and Pakistani airspace, a trip they were observed making "more than once" in 2008 after India turned back the Air Koryo plane.¹³⁸

C. ARMS RACES

DPRK nuclear and missile programs could trigger arms races in North East Asia or elsewhere by posing direct threats or undermining non-proliferation. Japan and South Korea, the countries most threatened by its arsenal, are non-nuclear weapon states, in full compliance with NPT obligations and IAEA safeguards, including the Additional Protocol. But both have extensive nuclear power industries and advanced nuclear technologies. Japan enriches uranium for reactor fuel and reprocesses spent fuel. Any diversion of its nuclear materials would be observable, and Tokyo depends on foreign uranium, so is vulnerable to a supply suspension. Nuclear breakout would be very costly for Seoul and Tokyo, politically and economically, but the technical barriers to

building a bomb are relatively low. South Korea is constrained by bilateral nuclear cooperation agreements and the 1992 "Joint Declaration on the Denuclearisation of the Korean Peninsula", which prohibit uranium enrichment or spent fuel reprocessing. Its natural uranium deposits are scarce, so Seoul also is dependent upon foreign reactor fuel supplies.

Japan and South Korea have forsworn nuclear weapons, relying instead upon conventional forces and credible U.S. alliances, and would face a number of political, diplomatic and legal obstacles to nuclear breakout. But a nuclear arms race in North East Asia, though very unlikely, could occur if there were a collapse of the non-proliferation regime and a restructuring of regional security architecture that undermined their security. However, North Korean proliferation to other regions, particularly the Middle East and South Asia, can trigger or exacerbate arms races in areas that are already insecure.

¹³⁷ The flight returned to Yangon, Burma, where it had stopped en route to Iran. Jay Solomon, Krishna Pokharel and Peter Wonacott, "North Korean plane was grounded at U.S. request", *The Wall Street Journal*, 1 November 2008.

¹³⁸ Crisis Group interview, Seoul, 7 January 2009.

V. POSSIBLE RESPONSES

This section sketches the different possible mechanisms and approaches notionally available to the international community in responding to North Korea's nuclear and missile programs, without attempting a detailed evaluation of each. Crisis Group's recommended approach for dealing with the immediate issues raised by the recent nuclear test is spelt out in the policy report published simultaneously with this background paper.¹³⁹

A. NON-PROLIFERATION, COUNTER-PROLIFERATION AND EXPORT CONTROLS

1. Non-proliferation and counter-proliferation

Non-proliferation efforts are necessary but not sufficient for managing the North Korean nuclear threat. They require cooperation among national governments, international organisations and the private sector. The discovery of the A.Q. Khan nuclear smuggling network and numerous other cases of WMD-related trafficking has led to the establishment of counter-proliferation mechanisms. In particular, the U.S.-initiated PSI, founded in 2003, is aimed at interdicting WMD shipments before they reach countries of concerns or terrorist groups. It began as a coalition of eleven countries but now includes 95, after South Korea announced its intention to join the day following Pyongyang's second nuclear test. A set of principles was adopted in September 2003, but there is no treaty, central authority or secretariat to manage the coalition. Members rely on existing domestic and international laws to intercept dangerous cargoes. The effort has some successes but requires excellent intelligence and coordination. The PSI alone is not a perfect solution to proliferation, but it raises the costs and difficulties for proliferators.¹⁴⁰

2. Export controls

After India conducted its first nuclear test in 1974, the Nuclear Suppliers Group (NSG) was established to control or deny sensitive nuclear components and technologies. It now has 45 members and establishes guidelines

meant to ensure that nuclear materials and technologies are not exported for military purposes.¹⁴¹ Other export control mechanisms include the Missile Technology Control Regime (MTCR), the Australia Group, and the Wassenaar Arrangement.¹⁴² While export controls have made it more difficult and costly to acquire illicit materials and technologies, it is hard to monitor the large volume of international trade, and proliferators have been creative in circumventing export controls. UN Security Council Resolution 1540 (2004) requires all member states to take "effective measures to prevent the transfer of WMD and their delivery systems to non-state actors", including accounting; physical security; border security and law enforcement against smuggling; and effective export and trans-shipment controls. It also calls on states to adopt, strengthen and comply with relevant multilateral treaties.¹⁴³

Member states' resources and commitments are often insufficient, however, and Resolution 1540 has not been universally implemented.¹⁴⁴ It established a committee that reports to the Security Council on implementation and to which member states were required to submit an initial report by October 2004. As of July 2008, 37 countries – of which the DPRK is the only one possessing WMD – had failed to do so.¹⁴⁵ While Pyongyang has not denounced or rejected the resolution, it has not taken any initiative to implement it. The 1540 Committee includes the DPRK in its communications and has prepared a checklist for implementation.¹⁴⁶ The UN can also provide technical assistance to member states that request it.

¹⁴¹ For information on the NSG, see www.nuclearsuppliersgroup.org.

¹⁴² The Australia Group was established in 1985 to restrict the supply of chemical and biological weapon agents and materials. The Wassenaar Arrangement, established in 1995, targets conventional arms and dual-use technologies. See their websites, www.australiagroup.net/en/index.html; and www.wassenaar.org.

¹⁴³ Security Council Resolution 1540, 28 April 2004, available at http://www.un.org/Docs/sc/unsc_resolutions04.html.

¹⁴⁴ Peter Crail, "Implementing UN Security Council Resolution 1540: A Risk-Based Approach", *The Nonproliferation Review*, vol. 13, no. 2 (July 2006), pp. 355-399; Wade Boese, "Implications of UN Security Council Resolution 1540", presentation to the Institute of Nuclear Materials Management panel discussion, Arms Control Association, 15 March 2005.

¹⁴⁵ Report of the Committee established pursuant to Security Council Resolution 1540 (2004), UN S/2008/493, 8 July 2008, at www.un.org/sc/1540/committeereports.shtml.

¹⁴⁶ The 1540 Committee was preparing to deliver the checklist to DPRK authorities in the summer of 2008. The DPRK has the authority to release it to the public or keep it confidential. Crisis Group email correspondence, committee member, 20 June 2008.

¹³⁹ Crisis Group Report, *North Korea: Getting Back to Talks*, op. cit.

¹⁴⁰ For more on the PSI, see "The Proliferation Security Initiative (PSI) at a Glance", Arms Control Association, fact sheet, October 2007; Wade Boese, "Interdiction Initiative Successes Assessed", *Arms Control Today*, July/August 2008; "Proliferation Security Initiative", The James Martin Center for Nonproliferation Studies, Inventory of International Nonproliferation Organizations and Regimes, <http://cns.miis.edu/inventory/pdfs/psi.pdf>.

Export control systems require national legislation, human resources and cooperation between the private and public sectors, as well as international cooperation. North Korea has no experience in this area, and it will take years to put together an export control regime if it decides to reform and abandon its WMD programs.¹⁴⁷ The Kaesŏng Industrial Complex (KIC), an inter-Korean joint economic project in North Korea just five kilometres north of the DMZ, offers a test case for the application of export controls in the DPRK. According to South Korea's "Inter-Korea Exchange and Cooperation Act", ROK firms must receive approval from the unification minister before sending any strategic items into the KIC.

In December 2004, the KIC established export control rules and a committee that reviews and monitors compliance for KIC firms, which are required to submit compliance documents to it every October.¹⁴⁸ Prior to investing in the KIC, firms must receive approval from the unification ministry, which delegates the export control review to the Korea Strategic Trade Institute (KOSTI), a semi-private industry association that works with the government and firms on export control compliance and submits the results to the ministry for final approval.¹⁴⁹ One firm's application for the pilot phase of the project was rejected because it exceeded certain machine tool specifications.¹⁵⁰

B. MISSILE DEFENCE

Missile defence (MD) systems have been deployed in North East Asia but are insufficient to intercept a full-scale North Korean missile attack. The technology is expensive and unproven. It offers no defence against North Korea's artillery, and the offence has the advantage in a missile arms race because it is cheaper to build more missiles to overwhelm defences than it is to develop more defences. Limited missile defence is mostly to protect military assets and offers little or no protection to civilian populations.

Japan feels most threatened by North Korea's nuclear capabilities and believes missile defence offers the only real countermeasure. Although systems are unproven and imperfect, distance and geography make it technologically feasible to intercept North Korean missiles, and the Japanese constitution, domestic laws and national defence policies proscribe the use of offensive military force. Aegis destroyers patrolling near North Korea theoretically could intercept missiles in their boost phase or in mid-flight, though decisions to engage would need to be made very rapidly. Patriot missile batteries would have a shot in the terminal phase as the Nodongs approached their targets, but again the systems are not flawless.¹⁵¹

Japanese politicians and media have discussed preemptive strikes against North Korean ballistic missiles, but this would require actionable intelligence that would be nearly impossible to obtain, and the Japanese military does not have the capability to strike DPRK missile facilities.¹⁵² The rhetoric is aimed at a domestic audience and does not represent a real policy option at this time. However, while missile defence is insufficient to protect Japan completely from DPRK missile strikes, Pyongyang is deterred by U.S. counter-strike capabilities and extended deterrence through the U.S.-Japan alliance. Japan consequently will continue missile defence cooperation with the U.S. and expand deployments of MD systems.¹⁵³

Missile defence is more problematic for South Korea. It provides no protection against North Korean artillery rounds and it would be very expensive to maintain enough interceptors to protect against Pyongyang's complete missile inventory. Proximity makes it difficult to shoot down all incoming missiles. Extensive missile defence deployments, especially if ROK systems were to become deeply integrated with a U.S.-Japan-South Korea regional network, would alienate China, which Seoul cannot afford to do. Beijing would especially object to any system that could nullify its own missile deterrent against the U.S. or be extended to protect Taiwan. U.S. Forces Korea have deployed Patriot

¹⁴⁷ Crisis Group interview, Shim Soung-kun, president, Korea Strategic Trade Institute (KOSTI), Seoul, 25 June 2008.

¹⁴⁸ *개성공단 5년 [Kaesŏng Industrial Complex: 5 Years]*, ROK unification ministry, December 2007, pp. 120-121.

¹⁴⁹ In the case of conventional weapons or sensitive items, the ROK implements an inter-agency review that can include the national defence, knowledge economy, education, science and technology and other relevant ministries as warranted. However, none of these items is even considered for KIC or inter-Korean trade.

¹⁵⁰ Crisis Group interview, Shim Soung-kun, president, Korea Strategic Trade Institute (KOSTI), Seoul, 25 June 2008.

¹⁵¹ For a short overview of Japan's missile defence systems and plans, see "Japanese Ballistic Missile Defense", The Claremont Institute, http://www.missilethreat.com/missiledefensesystems/id.30/system_detail.asp.

¹⁵² Daniel A. Pinkston and Kazutaka Sakurai, "Japan Debates Preparing for Future Preemptive Strikes against North Korea", *The Korean Journal of Defense Analysis*, vol. 18, no. 4 (winter 2006), pp. 95-121.

¹⁵³ Masako Toki, "Under Fukuda, Japan Accelerates Ballistic Missile Defense Cooperation with the United States", *WMD Insights*, February 2008, at www.wmdinsights.com/I22/I22_EA5_JapanAcceleratesBMD.htm.

systems to protect their bases, but they offer no real protection to South Korea's major cities.

Seoul is introducing the Korean Air and Missile Defence (KAMD) network, scheduled to come online in 2010 and become fully operational in 2012. It includes Aegis destroyer ship-launched interceptors and modified PAC-2 Patriot systems acquired from Germany in early 2009.¹⁵⁴ The ROK wants a limited capability to intercept North Korean missiles, but the military does not wish to become part of a U.S.-led global MD network.¹⁵⁵ Despite U.S. requests, Seoul is reluctant to participate in a system that would be expensive and could involve it in global geopolitical tensions it would rather avoid.¹⁵⁶ While the Lee Myung-bak administration is more receptive to missile defence than its predecessor, it wants to maintain independence and control of its own assets.¹⁵⁷

C. DETERRENCE AND COUNTER-STRIKE CAPABILITIES

Deterrence and credible precision strike capabilities will be indispensable until the DPRK abandons its nuclear weapons and ballistic missiles. The U.S. military plays a prominent role in deterring North Korea through its bilateral alliances with Seoul and Tokyo. In 1978, the U.S. and South Korea established the Combined Forces Command (CFC) to integrate their forces on the Korean Peninsula under a U.S. four-star general and a four-star ROK deputy commander in time of war.¹⁵⁸ The CFC is scheduled to be disbanded in April 2012, when Seoul regains wartime operational control of its military, which many analysts believe could undermine the credibility of the alliance.¹⁵⁹

In a war, the North Korean Air Force would be no match for its U.S. and ROK counterparts, who would be able to gain air superiority and deliver counter-strikes against DPRK targets. The U.S. could also deploy additional air assets from other bases in the Pacific. It periodically rotates advanced strike aircraft to the Pacific theatre during military exercises or at times of increased tensions in Korea to signal it is prepared to fulfil its alliance commitments if necessary.¹⁶⁰

Since the end of the Korean War, the majority of U.S. ground forces have been located near the DMZ to serve as a "tripwire" in case of a North Korean attack. The stationing of U.S. troops at several small installations was considered to have a deterrent effect on Pyongyang, because it ensured that the U.S. would become involved in any fighting. However, in recent years the Pentagon has come increasingly to view these troops as vulnerable hostages who reduce its military options, and as part of its force transformation policy, U.S. ground elements are being moved further south, to get them beyond North Korean artillery range and reduce the American footprint.¹⁶¹

The U.S. Army has deployed artillery and Army Tactical Missile Systems (ATACMS) with the Second Infantry Division near the DMZ, which has drawn North Korean criticism.¹⁶² In 2002, South Korea became the first country to purchase ATACMS missiles from the U.S.¹⁶³ The ROK has also developed and deployed the Hyönmu, an upgraded version of the U.S. Nike-Hercules. Its range is only about 180km, but the South has produced its own highly accurate land-attack cruise missiles that can strike targets throughout the North. In October 2006, Seoul established an integrated missile command under the ROK Army to manage counter-strike forces.¹⁶⁴

¹⁵⁴ Jung Sung-ki, "Seoul takes over 1st batch of German Patriot missiles", *The Korea Times*, 28 November 2008; Jung Sung-ki, "Seoul begins deploying Patriot missile interceptors", *The Korea Times*, 16 September 2008.

¹⁵⁵ Jung Sung-ki, "S. Korea opposes joining U.S. missile defense system", *The Korea Times*, 3 January 2008; "S Korea to develop homegrown missile defense system", Agence France-Presse, 21 December 2006.

¹⁵⁶ Jung Sung-ki, "US urges Seoul to bolster missile defense", *The Korea Times*, 4 April 2008.

¹⁵⁷ Jung Sung-ki, "USFK chief urges Seoul to join US BMD", *The Korea Times*, 25 February 2009.

¹⁵⁸ "Combined Forces Command: Mission of the ROK/US Combined Forces Command", United States Forces Korea, www.usfk.mil/usfk/cfc.aspx.

¹⁵⁹ "Combined forces command marks 30th anniversary", *The Chosun Ilbo*, 7 November 2008; "South Korea to reclaim wartime OPCON in April 2012", *The Hankyoreh*, 23 February 2007.

¹⁶⁰ Jung Sung-ki, "U.S. deploys stealth bombers to Guam", *The Korea Times*, 1 March 2009; "Stealth bombers could form part of joint exercise", *The Chosun Ilbo*, 5 March 2009.

¹⁶¹ Chang-hee Nam, "Relocating the U.S. Forces in South Korea: Strained Alliance, Emerging Partnership in the Changing Defense Posture" *Asian Survey*, vol. 46, no. 4 (July/August 2006), pp. 615–631; Todd Lopez, "Transformation in Korea", *Army.mil/news*, 29 July 2008.

¹⁶² "6th Battalion, 37th Field Artillery", U.S. Army Second Infantry Division website, www.2id.korea.army.mil/organization/units/fires/6-37fa/; "U.S. moves to deploy new type missiles in South Korea assailed", KCNA, 2 April 2005; "Memorandum of the DPRK government exposing arms buildup of U.S. and S. Korea", KCNA, 13 September 1997.

¹⁶³ "Briefs - Korea buys ATACMS Block IA", *Jane's International Defence Review*, 18 January 2002.

¹⁶⁴ Daniel A. Pinkston, "South Korea tests 1,000 kilometer-range cruise missile and develops 1,500 kilometer-range

Non-proliferation, counter-proliferation, deterrence and containment policies all have to be maintained as insurance against the failure of diplomacy to resolve the North Korean nuclear issue. The military option is unthinkable unless there is clear foreknowledge that the DPRK is about to initiate unprovoked military operations against its neighbours. This is very unlikely since, it would be observable and suicidal for the DPRK. Nevertheless, the international community must be prepared for all contingencies.

D. EMERGENCY RESPONSE PLANNING

Mutual deterrence is robust on the Korean peninsula, but deterrence could fail. North Korean WMD is more likely to be used in an inadvertent conflict escalation along the DMZ or near the NLL in the Yellow Sea, but ROK emergency response agencies must be prepared for any scenario. South Korea has conducted civil defence exercises for decades, but civilians appear to be more complacent than in the Cold War era. Critics have argued that previous leaders exaggerated the North Korean military threat in order to instil fear and justify authoritarian rule.¹⁶⁵ On the other hand, conservatives argue that the government deliberately discounted or ignored the North Korean threat during ten years of liberal rule under former Presidents Kim Dae-jung and Roh Moo-hyun. However, the 11 September 2001 terrorist attacks in the U.S. and large natural disasters around the world have increased awareness of the need for emergency response planning.

South Korea adopted its “Basic Disaster and Safety Management Law” in March 2004 and established the National Emergency Management Agency (NEMA) in June the same year. That agency responds to natural disasters, is responsible for civil defence training and has signed cooperation agreements with the UN and the U.S. While a North Korean nuclear attack would

version”, *WMD Insights*, November 2006; and Daniel A. Pinkston, “South Korean response to North Korean July missile exercise includes unveiling of new cruise missile”, *WMD Insights*, October 2006.

¹⁶⁵ For example, in 1986 North Korea began constructing a large dam on a tributary to the Han River that runs through Seoul. President Chun Du-hwan and others asserted that the dam could be used as a weapon and unleash a flood on Seoul. South Korea began to build its own dam – the Peace Dam – south of the DMZ in 1987 to block any such attempt. Construction was suspended when it was half finished, but it was finally completed in 2005 at a cost of about \$429 million. Choe Sang-hun, “Peace dam still waits for the flood that never came”, *The New York Times*, 28 August 2007.

overwhelm it, preparedness could reduce the number of casualties and help survivors recover.¹⁶⁶

E. DIPLOMACY, ENGAGEMENT AND ARMS CONTROL

Numerous international institutions specialise in disarmament and confidence building. However, East Asia does not share Europe’s experience of deep multilateral institutionalism, particularly in regional security. Some mechanisms are universal and indispensable, such as the NPT, IAEA, the CWC and the Biological and Toxin Weapons Convention (BTWC). So far, however, these institutions have been insufficient for dealing with North Korean WMD, which has led to the proliferation of ad hoc instruments over the last two decades: the Agreed Framework; the Four-Party Talks; the Six-Party Talks; inter-Korean summits; inter-Korean ministerial meetings; inter-Korean military talks; and Track II dialogues. No single mechanism can resolve all outstanding issues surrounding North Korean WMD and regional security, so a patchwork of existing and new ones will be necessary if diplomacy is to succeed.

This report does not directly address North Korea’s chemical weapons and biological weapons programs, and the North Korean nuclear threat is the most urgent regional security issue. But if progress is made on rolling back Pyongyang’s nuclear ambitions, there could be an opportunity to construct a diplomatic solution for chemical weapons and the suspected biological weapons program. In certain circumstances, disarmament efforts in these areas might even build confidence that could stimulate progress in nuclear and missile disarmament.¹⁶⁷

1. Six-Party Talks

The Six-Party Talks were established in August 2003 to seek a diplomatic solution to the problem of North Korea’s nuclear weapons program. The six parties (China, the DPRK, Japan, the ROK, Russia and the U.S.) signed a “Statement of Principles” on 19 September 2005 whereby Pyongyang agreed to abandon that program in exchange for a package of security assurances and economic and political incentives. The process has been divided into three steps: a freeze, disablement and dismantlement. The disablement phase was nearly complete before North Korea announced its withdrawal from the talks in April 2009, but com-

¹⁶⁶ For more information on NEMA, see its website at: <http://eng.nema.go.kr/>.

¹⁶⁷ See Crisis Group Report, *North Korea’s Chemical and Biological Weapons Programs*, op. cit.

plete denuclearisation will take several years at best; sceptics doubt Pyongyang will ever abandon its nuclear ambitions.

The “Statement of Principles” was only a beginning. Subsequent agreements and protocols have been necessary for implementation, and future protocols will have to be negotiated to complete the disablement phase and begin the dismantlement phase if the talks resume. Given the complexities of the objectives, the six parties have formed five working groups to address the following issues: denuclearisation of the Korean peninsula; economic and energy cooperation; the establishment of a North East Asian Peace and Security mechanism; the normalisation of DPRK-U.S. relations; and the normalisation of DPRK-Japan relations.

With North Korea walking away from the Six-Party Talks, the most productive diplomatic way forward may be for the U.S. to seek high-level bilateral talks within that framework. This theme is developed in the Crisis Group Policy Report published simultaneously with this paper.¹⁶⁸

2. Missile Technology Control Regime/ Hague Code of Conduct

The Missile Technology Control Regime (MTCR) was established in 1987 to “limit the risks of proliferation of weapons of mass destruction (ie, nuclear, chemical and biological weapons) by controlling transfers of systems, components and technology related to WMD delivery systems (other than manned aircraft)”.¹⁶⁹ Except for the short-range Toksa tactical missile, North Korea’s ballistic missile arsenal exceeds the range and payload guidelines under the MTCR, so it would have to destroy hundreds of missiles if it were to join the regime.

The MTCR limits the range and payload of ballistic missiles to 300km with a 500-kg warhead (or any equivalent combination of range/payload trade-offs), and also maintains Category I and Category II export control lists. Category I items include:

complete rocket systems (ballistic missiles, space launch vehicles and sounding rockets) and unmanned air vehicle systems (including cruise missiles sys-

tems, target and reconnaissance drones) with capabilities exceeding a 300km/500kg range/payload threshold; production facilities for such systems; and major sub-systems including rocket stages, re-entry vehicles, rocket engines, guidance systems and warhead mechanisms.¹⁷⁰

Export denial is assumed for such items. Category II items include weapons, systems and dual-use items not included in Category I.

The regime does not prohibit peaceful space programs, including satellite launches, as long as the programs do not use Category I or II items that could be employed in the production of WMD delivery systems. MTCR members, therefore, must be cautious about transfers of space technology especially for space launch vehicles (SLVs) because they contain technology difficult to distinguish from what is used for ballistic missiles.¹⁷¹ A drawback of the MTCR is that it does not address the demand side for countries seeking access to outer space for peaceful use.

Bulgaria and Slovakia offer examples of potential problems in any efforts to eliminate DPRK missiles. The U.S. encouraged them in the late 1990s to destroy their SS-23 leftovers from the Soviet era, in accordance with the MTCR.¹⁷² Both claimed “financial, environmental and national security concerns as reasons they could not eliminate” the missiles even though they agreed that the missiles fell under Category I and so should be destroyed.¹⁷³ Unified Germany and the Czech Republic inherited SS-23s and destroyed them in the 1990s. Bulgaria began to destroy its SS-23s in July 2002, with technical and financial help from the U.S. State Department’s Non-Proliferation and Disar-

¹⁷⁰ “MTCR Guidelines and the Equipment, Software and Technology Annex”, at www.mtcr.info/english/guidelines.html.

¹⁷¹ Ibid.

¹⁷² The Soviet Union supplied SS-23 missiles to Bulgaria, Czechoslovakia and East Germany around the time it was negotiating and signing the Intermediate-Range Nuclear Forces Treaty (INF). After an investigation, the U.S. concluded that the transfers were not a technical treaty violation, and it was able to convince the countries to destroy the missiles. See “Case Study: SS-23 Missiles in Eastern Europe”, U.S. Department of State, Bureau of Verification, Compliance, and Implementation, 1 October 2005, at www.state.gov/t/vci/rls/prsr/57238.htm.

¹⁷³ “Bulgaria, Slovakia still hold SS 23s”, *Arms Control Today*, September 1997.

¹⁶⁸ Crisis Group Report, *North Korea: Getting Back to Talks*, op. cit.

¹⁶⁹ “The Missile Technology Control Regime at a Glance”, Arms Control Association, fact sheet, September 2004, www.armscontrol.org/factsheets/mtcr; “The Missile Technology Control Regime”, The James Martin Center for Nonproliferation Studies, at www.nti.org/e_research/official_docs/inventory/pdfs/mtcr.pdf.

mament Fund. U.S. observers verified in January 2004 that destruction was complete.¹⁷⁴

The Ukrainian case is another example that might have implications for the DPRK. Ukraine inherited advanced space and missile programs from the Soviet Union, and officials initially refused to abandon the missile program to join the MTCR.¹⁷⁵ In September 1993, Washington's policy on MTCR membership and space launches was clarified to allow new members to retain their SLV capabilities as long as they abandoned their offensive ballistic missiles.¹⁷⁶ The U.S. then began to offer incentives and guaranteed Ukraine a share of the space launch market based on a concrete percentage for its companies. Kiev retained its short-range Scud missiles after joining the MTCR, which the U.S. claimed did not interfere with its MTCR membership.¹⁷⁷

Destroying missiles and their components is difficult and dangerous, so North Korea will require assistance if it chooses to do so. Missiles contain many hazardous materials that must be handled carefully during disposal. In addition to the risks to the personnel who destroy the weapons, significant time and resources are required.¹⁷⁸

The Intermediate-Range Nuclear Forces Treaty (INF) offers a prominent example of peaceful missile destruction. The 1987 agreement between the Soviet Union and U.S. provided for the dismantlement of short- and medium-range land-based missiles, as well as inspections and monitoring to prevent violations, which would also be necessary in the North Korean case. Each type of missile under the INF required that specific steps be completed to ensure that components could never be reused or reconstructed. The treaty also prohibited disposal in areas that could result in environmental contamination or harm to the public. The cost of dismantling the missiles was high due to the extensive safety measures – one estimate is about \$70,000 per

missile.¹⁷⁹ Extrapolating this figure to the DPRK inventory could be misleading but suggests the process would be beyond the North's financial capabilities.

The International Code of Conduct against Ballistic Missile Proliferation (ICOC), now known as the Hague Code of Conduct (HCOG), was launched in November 2002 as a broad set of principles for transparency and confidence building measures. The guidelines call for restraint regarding missile proliferation and require states to provide annual reports on launches, prior notification of space launches and annual declarations of space launch and missile policies.¹⁸⁰ The HCOG is a supplement, not a substitute for the MTCR. However, it does not address the demand side issues neglected by that regime. The DPRK is not a member, but if Pyongyang agrees to convert its missile program to peaceful uses, it should join, and possibly engage as well with the ROK in a joint effort to pursue peaceful space applications.

3. G-8 Global Partnership

The G-8 Global Partnership against the Spread of Weapons and Materials of Mass Destruction (Global Partnership) was established in June 2002 at the G-8 Summit in Kananaskis, Canada, with the objective of raising \$20 billion over ten years to eliminate WMD threats through dismantlement and the employment of weapons scientists for peaceful purposes. The U.S. has pledged to provide at least \$10 billion of the funding, and other industrialised countries have joined the effort. Until now, efforts have focused on the former Soviet Union, but the partnership is looking to expand its work to WMD programs in other countries, including the DPRK.¹⁸¹ Canada has taken a strong interest in the initiative and could approach North Korea and propose participation as a way to help Pyongyang meet its obligations in the Six-Party process.

¹⁷⁴“Adherence to and Compliance with Arms Control, Non-proliferation, and Disarmament Agreements and Commitments”, U.S. Department of State, August 2005, p. 11.

¹⁷⁵Gary Bertsch and Victor Zaborisky, “Bringing Ukraine into the MTCR: can U.S. policy succeed?”, *Arms Control Today*, April 1997.

¹⁷⁶Dinshaw Mistry, “Beyond the MTCR: Building a Comprehensive Regime to Contain Ballistic Missile Proliferation”, *International Security*, vol. 27, no. 4 (spring 2003), pp. 119-149.

¹⁷⁷Ibid; Howard Diamond, “U.S., Ukraine sign nuclear accord, agree on MTCR accession”, *Arms Control Today*, March 1998.

¹⁷⁸Malcolm W. Browne, “Environmental risk seen in dismantling missiles”, *The New York Times*, 21 September 1987.

¹⁷⁹“The U.S. Nuclear Weapons Cost Study Project”, The Brookings Institution, August 1998.

¹⁸⁰“International Code of Conduct against Ballistic Missile Proliferation (ICOC)”, Arms Control Association; and “Adherence to and Compliance with Arms Control”, op. cit., pp. 102-103.

¹⁸¹“G-8 leaders agree to fund threat reduction programs”, *Arms Control Today*, July/August 2002; “Global Partnership against the Spread of Weapons and Materials of Mass Destruction (“10 Plus 10 over 10 Program”)”, The James Martin Center for Nonproliferation, Inventory of International Nonproliferation Organisations and Regimes, updated 19 October 2007, <http://cns.miis.edu/inventory/pdfs/g8.pdf>.

4. Missile disarmament and the peaceful use of outer space

Kim Jong-il has in the past offered to give up the missile program in exchange for satellite launch services. He pitched this first to Russian President Vladimir Putin in July 2000, then to U.S. Secretary of State Madeline Albright, when she visited Pyongyang in October 2000.¹⁸² Given the symbolic value of missiles and space launch vehicles, the DPRK is very unlikely to abandon its program unconditionally. The international community could provide data, satellite launch services, or opportunities to participate in other peaceful space programs as an alternative to the DPRK's current missile program, but this will take extended and difficult negotiations. A program similar to the Cooperative Threat Reduction (CTR) scheme would be appropriate to channel the North's missile resources into peaceful space exploration, possibly in collaboration with the South.¹⁸³ Significant political change will be required in Pyongyang before any arrangement could be implemented, but if it agrees to abandon its ballistic missile arsenal, the Six-Party process could propose a phased cooperative program for peaceful space uses:

- ❑ an ROK invitation for the DPRK to observe its 2009 satellite launch would be a relatively cost-free confidence building measure that could open talks on peaceful use of missile technology;
- ❑ regional dialogue on peaceful use of outer space could potentially be spun out of the Six-Party Talks, as all participants are involved in either space exploration or missile production. It could also include the European Space Agency;
- ❑ conversion to peaceful industry could be accomplished by subcontracting to North Korean industries in a way aimed at controlling the transfer of any dual use technology;
- ❑ provision of satellite data would be another cheap and easy confidence building measure that could help North Korea with land use, environmental reconstruction, mining, weather forecasting and disaster relief and transport planning;

- ❑ provision of satellite launch services would be attractive to the North because of its focus on a highly nationalistic scientific agenda, even though it would be more cost-effective to buy time on other satellites; and
- ❑ a DPRK astronaut might be sent to the International Space Station: astronauts from a wide array of countries have now gone into space, and recent space travel by Chinese Taikonauts illustrated the political importance of the missions.

5. Issue linkage, inter-Korean arms control and regional security mechanisms

The North Korean leadership will not abandon its nuclear arsenal if it lacks confidence and is insecure. Issue linkage and confidence building measures could construct a regional security mechanism whereby Pyongyang would be confident that nuclear weapons were no longer necessary. Critics argue this is impossible to achieve, but diplomatic efforts must be exhausted before other actions are taken. The DPRK regime is plagued by food, energy and economic insecurity, as well as a worsening of the conventional arms balance. The Six-Party Talks implicitly are committed to a strategy of issue linkage, but detailed arrangements and processes will have to be formulated in the dismantlement phase for denuclearisation to succeed.

The DPRK has resisted ROK requests for inter-Korean arms control, but it will have to change its position or it will be impossible to establish a regional peace mechanism, which is a goal of the Six-Party process. Cooperative and collective security for the region can only be established if the security concerns of all actors are addressed. The parties will either have to strike a grand bargain or start with small confidence-building steps and work up to eventual nuclear disarmament. Whichever path is taken, the comprehensive bargain must address North Korea's multidimensional insecurity, as well as conventional arms control and its chemical weapons and suspected biological weapons program. Pyongyang will try to hold on to its nuclear arsenal for as long as possible, so these other security issues should be addressed as soon as possible with an eye towards establishing leverage on the nuclear issue.

¹⁸² Madeleine Albright, remarks at National Press Club, 2 November 2000, at the Federation of American Scientists, www.fas.org/news/dprk/2000/dprk-001102zss.htm.

¹⁸³ Daniel A. Pinkston, "North and South Korean Space Development: Prospects for Cooperation and Conflict", *Astropolitics*, vol. 4, no. 2 (Summer 2006), pp. 207-227.

VI. CONCLUSION

North Korea's nuclear and ballistic missile programs pose serious international security threats that require immediate and sustained international attention. The nuclear threat is greater now that North Korea may well have developed useable nuclear warheads for its Nodong medium-range missiles. Kim Jong-il and a civilian institution maintain custody of the warheads, whose greatest utility is deterrence and national prestige to solidify internal regime control. However, the extreme centralisation of authority in North Korea raises concerns over the control of nuclear assets in case Kim Jong-il loses power or the regime collapses.

Pyongyang's missile arsenal, which is believed to include between approximately 355 and 685 short-range Scud variants, and possibly as many as 320 medium-range Nodongs, is a source of instability in North East Asia and other regions. North Korea also reportedly has deployed the Musudan, a new road-mobile missile that is nuclear capable and potentially could strike Guam. In the 1990s, the North was engaged in a diplomatic process with the U.S. aimed at the elimination of the missile program, but this was discontinued by the Bush administration. In addition to their military utility, missiles have been a symbol of national prestige and an important source of foreign exchange for Pyongyang, so it demands compensation before accept-

ing any restraints. While these demands are often viewed as "blackmail", some positive economic incentives will be necessary for the leadership to abandon its nuclear weapons and ballistic missiles. If progress is made on the nuclear issue, there could be opportunities to construct a cooperative diplomatic solution for missiles.

Serious diplomatic efforts must continue to address all North Korean WMD capabilities, but the international community must be prepared for a number of other contingencies, including a deliberate, accidental or unauthorised nuclear attack; nuclear retaliation following a conventional military clash and escalation; and arms races. Effective responses require planning and policy coordination among international agencies and national governments, as well as NGOs.

Every possible diplomatic effort must be made to achieve North Korean nuclear disarmament. Good faith negotiations at any level are a mechanism for finding solutions to critical international security problems and a device for testing the intentions of friends and adversaries. Hopefully, diplomacy will establish a WMD-free Korean peninsula, but to guard against the possibility of its failure, the international community must maintain robust deterrence and containment against the North Korean nuclear threat.

Seoul/Brussels, 18 June 2009

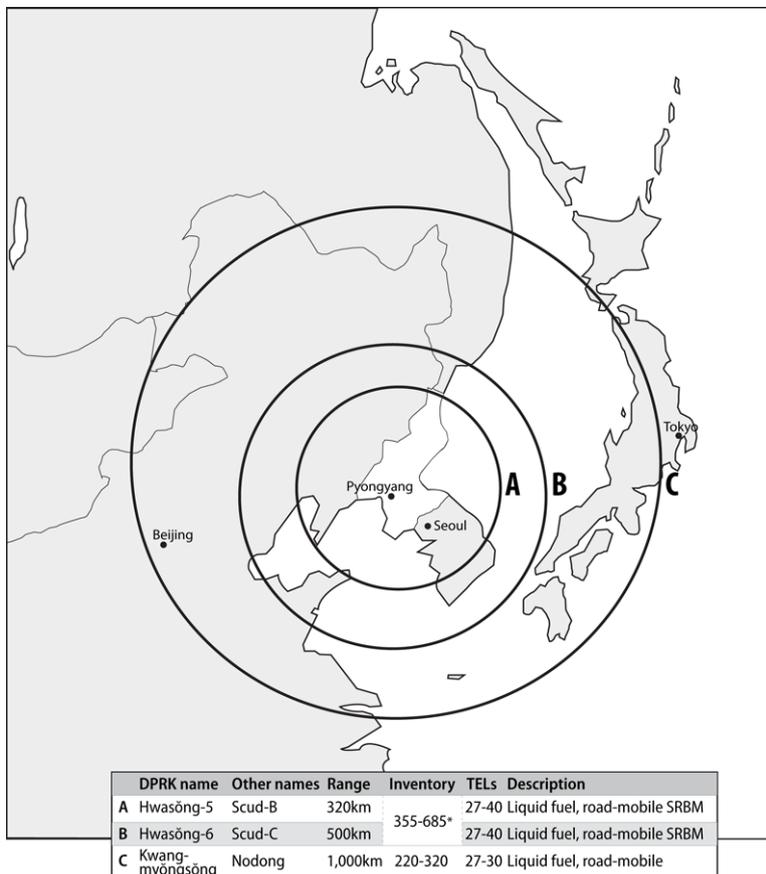
APPENDIX A

GLOSSARY OF ABBREVIATIONS AND TERMS

ATACMS	Army Tactical Missile Systems.	KOSTI	Korea Strategic Trade Institute, a semi-private industry association delegated by the ROK government to work with the government and firms on export control compliance.
BTWC	Biological and Toxin Weapons Convention, opened for signature in 1972 and entered into force in 1975. It prohibits the development, production, and use of biological and toxin weapons.	KPA	[North] Korean People's Army.
CEP	Circular error probable, the radius of a circle within which half of all ballistic missiles fired at a target are expected to fall.	KWP	[North] Korean Workers' Party.
CFC	Combined Forces Command, established in 1978 by the U.S. and South Korea to integrate their military forces under a U.S. four-star general and ROK four-star deputy commander in time of war. Scheduled to be disbanded in April 2012.	MCTR	Missile Technology Control Regime, established in 1987 to limit WMD proliferation by controlling transfers of technology, components and systems.
CWC	Chemical Weapons Convention, opened for signature in 1993 and entered into force in 1997. It bans the production and possession of chemical weapons.	MD	Missile defence.
DIA	(U.S.) Defense Intelligence Agency.	MDL	Military Demarcation Line, divides the two Koreas and represents the line of contact when the Korean War Armistice was signed on 27 July 1953.
DMZ	Demilitarised zone, four-km wide buffer zone dividing the two Koreas, with two km on each side of the Military Demarcation Line (MDL)	MGB	Missile Guidance Bureau, an independent corps-level unit directly under the general staff headquartered in Sŏngch'ŏn-kun, South P'yŏng'an Province, near Pyongyang. Would likely be tasked by SCKPA (Kim Jong-il) to mate warheads with missiles and deploy to launch sites.
DPRK	Democratic People's Republic of Korea.	MOU	[South Korean] unification ministry.
ESD	Environmental sensing device, designed to prevent the detonation of nuclear weapons unless the device senses the external effects of delivery, such as free-fall period, temperature, pressure, acceleration, etc., to a specific target.	NCDB	[North Korean] Nuclear and Chemical Defence Bureau, under the General Staff Department of the Ministry of the People's Armed Forces.
HCOC	The Hague Code of Conduct, formerly the ICOC (below), launched in November 2002 as a broad set of principles for transparency and confidence building measures, calls for restraint regarding missile proliferation and requires states to provide annual reports on launches, prior notification of space launches and annual declarations of space launch and missile policies.	NDC	National Defence Commission, highest military authority in the DPRK, chaired by the SCKPA, at present Kim Jong-il.
IAEA	International Atomic Energy Agency.	NEMA	[South Korean] National Emergency Management Agency, established in 2004 to respond to natural disasters; its civil defence division is responsible for training.
ICAO	International Civil Aviation Organisation.	NLL	Northern Limit Line, the west sea boundary extending from the Military Demarcation Line (MDL). It is not recognised by Pyongyang and has been the site of two deadly sea battles over the last decade.
ICBM	Inter-continental ballistic missile.	NPT	Treaty on the Non-Proliferation of Nuclear Weapons.
ICOC	International Code of Conduct against Ballistic Missile Proliferation, see HCOC above.	NSG	Nuclear Suppliers Group, established to control or deny sensitive nuclear components and technologies. It has 45 members and establishes guidelines to ensure that nuclear materials and technologies are not exported for military purposes.
IMO	International Maritime Organization.	PAL	Permissive action links, designed to prevent the unauthorised arming or detonation of nuclear weapons.
INF	Intermediate-Range Nuclear Forces Treaty, 1987 agreement between the Soviet Union and U.S. that provided for the dismantlement of short- and medium-range land-based missiles, as well as inspections and monitoring to prevent violations.	PSI	Proliferation Security Initiative, U.S.-inspired and founded in 2003 to interdict WMD shipments before they reach countries of concern or terrorist groups.
KAMD	Korean Air and Missile Defence, South Korean missile defence system scheduled to come on online in 2010 and become fully operational in 2012.	ROK	Republic of Korea.
KCNA	[North] Korean Central News Agency.	SCKPA	Supreme Commander of the Korean People's Army, at present Kim Jong-il.
KIC	Kaesŏng Industrial Complex, an inter-Korean joint economic project in North Korea five km north of the DMZ.	SLV	Space launch vehicle.
		WMD	Weapons of mass destruction.

APPENDIX B

NORTH KOREAN MISSILE RANGE: NORTH EAST ASIA



*The total number of Hwasong-5/6 missiles is 355-685, but the exact number of each system is unknown

APPENDIX C

NORTH KOREAN MISSILE RANGE: PACIFIC REGION



DPRK name	Other names	Range	Inventory	TEs	Description
A	Kwang-myŏngsŏng Nodong	1,000km	220-320	27-30	Liquid fuel, road-mobile
B	? Musudan; BM-25; (SS-N-6)	4,000km	20-30	22-27	Liquid fuel, road-mobile
C	Paektusan-2, Unha-2	Taepodong-2 6,700km	3-4 (?)	N/A	Liquid fuel, tower launched

APPENDIX D

NORTH KOREAN NUCLEAR WARHEAD AND MISSILE FACILITIES



APPENDIX E

DPRK MISSILES

DPRK name	Other names	Payload	Range	Inventory	Transporter-erector-launchers (TELs)	Description
?	Toksa (毒蛇)*; KN-02	485kg	120km	?	?	Solid fuel, road-mobile tactical missile
Hwasŏng-5 (火星-5)	Scud-B (R-17)	990kg	300km	355-685	27-40	Liquid fuel, road-mobile SRBM based on Scud-B
Hwasŏng-6 (火星-6)	Scud-C	770kg	500km			Liquid fuel, road-mobile SRBM based on Scud-C
Kwangmyŏngsong (光明星) (?)	Nodong* (蘆洞)	700kg	1,000km	220-320	27-30	Liquid fuel, road-mobile
Paektusan-1 (白頭山-1)	Taepodong-1* (大浦洞-1)		2,200km	?	N/A	Liquid fuel, tower launched; program terminated
Unha-2 (銀河-2)	Taepodong-2* (大浦洞-2); Paektusan-2 (白頭山-2)		6,700km+	?	N/A	Liquid fuel, tower launched
?	Musudan* (舞水端); BM-25; (SS-N-6)		3,000-4,000km	20-30	22-27	Liquid fuel, road mobile

* Toksa, Nodong, Taepodong, and Musudan were coined by U.S. intelligence. "Toksa" means "viper" but Nodong and Taepodong are old place names for administrative districts in Musudan-ri, North Hamgyŏng Province, the location of a missile test and launch facility.

APPENDIX F

ARMS CONTROL AND EXPORT CONTROL REGIMES

Technology	International Regime	Monitoring Secretariat	Export Control Regime	Remarks
Nuclear	NPT	IAEA	NSG, Zangger Committee	–
Missile	MTCR / ICOC	–	MTCR / ICOC	No secretariat enforcement
Chemical	CWC	OPCW	Australia Group	–
Biological	BTWC	–	Australia Group	Weak enforcement
Conventional Arms	CCWC / Wassenaar Arrangement	–	Wassenaar Arrangement	–

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Crisis Group's Senior Advisers are former Board Members who maintain an association with Crisis Group, and whose advice and support are called on from time to time (to the extent consistent with any other office they may be holding at the time).

Martti Ahtisaari

(Chairman Emeritus)

George Mitchell

(Chairman Emeritus)

Hushang Ansary

Ersin Arioğlu

Óscar Arias

Diego Arria

Zainab Bangura

Christoph Bertram

Alan Blinken

Jorge Castañeda

Eugene Chien

Victor Chu

Mong Joon Chung

Gianfranco Dell'Alba

Jacques Delors

Alain Destexhe

Mou-Shih Ding

Gernot Erler

Marika Fahlén

Stanley Fischer

Malcolm Fraser

I.K. Gujral

Max Jakobson

Todung Mulya Lubis

Allan J. MacEachen

Graça Machel

Barbara McDougall

Matthew McHugh

Nobuo Matsunaga

Miklós Németh

Timothy Ong

Olara Otunnu

Shimon Peres

Surin Pitsuwan

Cyril Ramaphosa

George Robertson

Michel Rocard

Volker Rühle

Mohamed Sahnoun

Salim A. Salim

Douglas Schoen

**Christian Schwarz-
Schilling**

Michael Sohlman

William O. Taylor

Leo Tindemans

Ed van Thijn

Simone Veil

Shirley Williams

Grigory Yavlinski

Uta Zapf