The Evolving Military Balance in the Korean Peninsula and Northeast Asia

VOLUME III
Missile, DPRK and ROK Nuclear Forces, and External Nuclear Forces

AUTHORS
Anthony H. Cordesman and Ashley Hess

A Report of the CSIS Burke Chair in Strategy
June 2013
About CSIS—50th Anniversary Year

For 50 years, the Center for Strategic and International Studies (CSIS) has developed solutions to the world’s greatest policy challenges. As we celebrate this milestone, CSIS scholars are developing strategic insights and bipartisan policy solutions to help decisionmakers chart a course toward a better world.

CSIS is a nonprofit organization headquartered in Washington, D.C. The Center’s 220 full-time staff and large network of affiliated scholars conduct research and analysis and develop policy initiatives that look into the future and anticipate change.

Founded at the height of the Cold War by David M. Abshire and Admiral Arleigh Burke, CSIS was dedicated to finding ways to sustain American prominence and prosperity as a force for good in the world. Since 1962, CSIS has become one of the world’s preeminent international institutions focused on defense and security; regional stability; and transnational challenges ranging from energy and climate to global health and economic integration.

Former U.S. senator Sam Nunn has chaired the CSIS Board of Trustees since 1999. Former deputy secretary of defense John J. Hamre became the Center’s president and chief executive officer in April 2000.

CSIS does not take specific policy positions; accordingly, all views expressed herein should be understood to be solely those of the author(s).

© 2013 by the Center for Strategic and International Studies. All rights reserved.

Library of Congress Cataloging-in-Publication Data
CIP information available on request.

ISBN: 978-1-4422-2519-0 (pb); 978-1-4422-2520-6 (eBook)
Table of Contents

EXECUTIVE SUMMARY ........................................................................................................ VII

THE MISSILE WARFARE BALANCE .................................................................................. VII

THE NUCLEAR AND CBRN BALANCE ................................................................. IX

THE ROLE OF CHINESE, US, AND OTHER OUTSIDE MISSILE AND NUCLEAR FORCES ................................................. X

THE BALANCE OF US AND CHINESE MISSILE AND PRECISION STRIKE FORCES ........................................... XII

THE BALANCE OF WEAPONS OF MASS EFFECTIVENESS AND “OFFENSIVE” VS. “DEFENSIVE” WEAPONS .......... XV

THE BROADER BALANCE OF US AND CHINESE STRATEGIC AND THEATER NUCLEAR FORCES ...................... XVI

US POLICY OPTIONS .............................................................................................. XVI

VII. KOREAN MISSILE FORCES ....................................................................................... 1

OVERVIEW OF DPRK MISSILE DEVELOPMENTS ........................................................................... 1

Arsenal and Capabilities ........................................................................................................... 1

DPRK MISSILE PROGRAMS ............................................................................................. 8

The Hwasong and Toksa Programs ......................................................................................... 8

The Nodong ............................................................................................................................ 10

The Taepodong Program ......................................................................................................... 11

The Musudan .......................................................................................................................... 18

The KN-08 .............................................................................................................................. 19

DPRK MISSILE FACILITIES ............................................................................................ 22

DPRK AIR DEFENSE AND COUNTER-SPACE CAPABILITIES .................................................. 25

ROK MISSILE DEVELOPMENT ........................................................................................ 26

The Early Program – The NHK Program ................................................................................. 26

The 2001 MTCR and the Hyunmu-3 Cruise Missile .................................................................. 27

Further Missile Limitation Agreement Revisions .................................................................. 28

ROK MISSILE DEFENSE AND SPACE ............................................................................. 29

Missile Defense ..................................................................................................................... 30

Space ...................................................................................................................................... 32

CONCLUSIONS .................................................................................................................. 32

VIII. KOREAN WMD FORCES ......................................................................................... 36

DPRK CHEMICAL AND BIOLOGICAL DEVELOPMENTS .................................................. 37

DPRK CHEMICAL WEAPONS ......................................................................................... 38

Western Estimates of DPRK Stockpiles and Capacity ............................................................ 39

Korean Estimates of DPRK Stockpiles and Capacity ............................................................. 41

Guesstimates of Key Locations ............................................................................................. 42

DPRK BIOLOGICAL WEAPONS ..................................................................................... 48

Capabilities ................................................................................................................................. 48

Facilities ...................................................................................................................................... 50

DPRK NUCLEAR DEVELOPMENTS .................................................................................. 54

Motivations for Acquisition .................................................................................................. 54

Assessments of Capabilities: Plutonium and Uranium .......................................................... 55

Nuclear Weapons and Warhead Developments .................................................................... 58

Moves Toward Sanctions ....................................................................................................... 73

Key Current Issues, Weapons Design, and Further Tensions ............................................... 77

ROK and US Response ......................................................................................................... 83

Japanese Response ............................................................................................................... 85

Russian and Chinese Response ............................................................................................ 86

Further DPRK-ROK-US Tensions ......................................................................................... 87
Halting Operations at the ROK-DPRK Joint Industrial Complex at Kaesong ........................................... 89
De-escalation ........................................................................................................................................ 92
DPRK Facilities ..................................................................................................................................... 95
ROK CHEMICAL DEVELOPMENTS ................................................................................................. 102
ROK BIOLOGICAL DEVELOPMENTS .............................................................................................. 102
ROK NUCLEAR DEVELOPMENTS ..................................................................................................... 103
Initial Weapons Research ..................................................................................................................... 103
Reprocessing and Enrichment Activities ............................................................................................. 104
2010-2013 and the ROK Nuclear Development Debate ..................................................................... 105
Civilian Facilities and the 123 Agreement ............................................................................................ 107

IX. THE BROADER BALANCE OF MISSILE, WMD, AND STRATEGIC FORCES ................................................................. 114
CHINA’S EVOLVING FORCE MIX AND STRATEGY ........................................................................... 114
Growing Chinese Deterrent and A2AD Capabilities ............................................................ 116
CHINESE CONVENTIONAL MISSILE CAPABILITIES ........................................................................ 119
CHINESE NUCLEAR-ARMED MISSILES .......................................................................................... 125
Chinese Missile Defense Capabilities ............................................................................................. 132
Chinese Counterspace Capabilities ................................................................................................. 133
Space ............................................................................................................................................... 134
US MISSILE FORCES .......................................................................................................................... 138
Missile Defense and Space ................................................................................................................ 140
Space .............................................................................................................................................. 142
NUCLEAR FORCES ............................................................................................................................ 143
CHINESE NUCLEAR FORCES ......................................................................................................... 148
Chinese and US Views of China’s Nuclear Forces ............................................................................. 148
Chinese Biological and Chemical Weapons ...................................................................................... 153
Role of Chinese Special Forces and Tunnel Facilities ...................................................................... 153
US NUCLEAR FORCES ....................................................................................................................... 153
Nuclear Forces .................................................................................................................................... 154
US Theater Nuclear Forces ................................................................................................................ 155
Other US Nuclear-Related Programs ............................................................................................... 158
SM-3 IIB ........................................................................................................................................... 158
JAPAN .................................................................................................................................................. 159
Missile Defense ................................................................................................................................... 159
Space ............................................................................................................................................... 161
RUSSIA ............................................................................................................................................... 164
Missile Capabilities ............................................................................................................................ 165
Missile Defense ................................................................................................................................. 165
Biological and Chemical Weapons ..................................................................................................... 166

ABOUT THE AUTHORS ....................................................................................................................... 167
List of Figures

Figure VII.1: DPRK Ballistic Missile Arsenal ................................................................. 6
Figure VII.2: ROK Ministry of National Defense Estimates of DPRK Missile Range ............ 7
Figure VII.3: Japanese Ministry of Defense Estimates of DPRK Missile Range ..................... 7
Figure VII.4: US Estimates of Primary North Korean Medium- and Long-Range Missiles ........ 20
Figure VII.5: Estimates of DPRK Hwasong and Nodong Missile Range – Northeast Asia .... 21
Figure VII.6: DPRK Missile Launches through 2009 .......................................................... 22
Figure VII.7: Possible Locations of DPRK Nuclear Warhead and Missile Facilities .................. 25
Figure VIII.1: DPRK Possible CW Agents ..................................................................... 40
Figure VIII.2: Defector Reports on the DPRK CW Program (as of 2004) ......................... 45
Figure VIII.3: Map of Possible DPRK Chemical Facilities ................................................. 46
Figure VIII.4: Major DPRK Civilian Chemical Production Facilities (as of 2004) ............... 47
Figure VIII.5: Possible DPRK Biological Agents .............................................................. 49
Figure VIII.6: Civilian DPRK Biological Facilities ............................................................. 51
Figure VIII.7: Map of Possible DPRK Civilian Biological Facilities ..................................... 53
Figure VIII.8: Estimates of DPRK Plutonium Production (as of 2006) ............................... 58
Figure VIII.9: Major Progress in the Six Party Talks ............................................................ 67
Figure VIII.10: Key Agreements in the Six Party Talks ......................................................... 68
Figure VIII.11: Known Disablement Steps at Yongbyon (as of January 2013) ..................... 70
Figure VIII.12: Inter-Korean Transportation Corridors ....................................................... 94
Figure VIII.13: South Korean Positive Perceptions of National Security (Present and Future), March 2013 ............................................................................................................ 94
Figure VIII.14: North Korean Nuclear Power Reactor Projects (as of January 2011) ......... 98
Figure VIII.15: List of Major North Korean Nuclear Sites .................................................... 99
Figure VIII.16: Map of Major North Korean Nuclear Sites .................................................. 100
Figure VIII.17: Map of Possible DPRK Nuclear, Biological, Missile, and Chemical Sites .... 101
Figure VIII.18: Nuclear Power Reactors Operating in the ROK .......................................... 112
Figure VIII.19: ROK Nuclear Power Reactors Under Construction or Planned .................... 113
Figure IX.1: Chinese Missile Forces, 2010-2012 ............................................................... 122
Figure IX.2: Range of Chinese Precision Strike Capabilities – Part One (US 2013 Estimate) .. 123
Figure IX.2: Range of Chinese Precision Strike Capabilities – Part Two (US 2012 Estimate) .. 124
Figure IX.3: Chinese Ballistic Missile Ranges – Part One (2012 Japanese Estimate) .......... 129
Figure IX.3: Chinese Ballistic Missile Ranges – Part Two (2013 US Estimate) .................... 130
Figure IX.3: Chinese Ballistic Missile Ranges – Part Three (2012 US Estimate) ............................. 131
Figure IX.4: US and Asian Nuclear Capable Forces ........................................................................ 144
Figure IX.5: Comparative Estimate of Global Holdings of Nuclear Weapons .............................. 147
Figure IX.6: Timeline of Japanese Missile Defense Development ................................................ 163
Figure IX.7: Japanese Ballistic Missile Defense Systems .............................................................. 164
Executive Summary

The tensions between the Koreas – and the potential involvement of the People’s Republic of China (China or PRC), Japan, Russia, and the United States of America (US) at both the political and military levels – create a nearly open-ended spectrum of possible conflicts. These range from posturing and threats – “wars of intimidation” – to major conventional conflict on the Korean Peninsula to intervention by outside power like the US and China to the extreme of nuclear conflict.

There are powerful deterrents to such conflicts. The Republic of Korea (ROK or South Korea) has emerged as major economic power, and one that is important to the economies of the US, Japan, and China – as well as to the world. The Democratic People’s Republic of Korea (DPRK or North Korea) is one of the world’s most heavily militarized states, but it is still a relatively small military power by US and Chinese standards. It remains vulnerable to US aid, missile power, and precision strike capability, and runs a serious risk of being isolated if it provokes or escalates a conflict without Chinese support.

The fact remains, however, that no one can dismiss the risk of a serious clash or war. This is particularly true if one considers the number of times that war has resulted from unpredictable incidents and patterns of escalation. The historical reality is that the likelihood of less-probable forms of war actually occurring has been consistently higher than what seemed in peacetime to be the most probable contingencies and the patterns of escalation that seemed most likely from the viewpoint of a “rational bargainer.”

This report is part of a three volume series that assesses the balance of forces that shape the stability and security of the Korean Peninsula in the full range of conflicts that could occur in the region. It focuses on the forces of the ROK and DPRK, but looks at outside powers as well. It also addresses the complex and constantly shifting mix of conventional, asymmetric, and CBRN (chemical, biological, radiological, and nuclear) capabilities that shape the balance.

Such an assessment is critical to shaping a strategy that can deter and defend against North Korea as well as for negotiations and planning responses to a variety of potential situations on the Peninsula. At the same time, the assessment shows there is no one way of assessing the Korean military balance that can be used for policy planning, strategic assessments, or arms control negotiations. The unclassified information available is often too uncertain, national perceptions differ too much, and different combinations of forces may be relevant in different situations.

The Missile Warfare Balance

Assessing and counting weapons and the missile delivery systems that can affect the Korean balance is as challenging as dealing with any other aspect of the balance, and again highlights the reality that there is no meaningful separation of “conventional” and “asymmetric” forces even at the highest levels of warfare.

This aspect of the balance is current dominated by DPRK missile forces, although the ROK is extending the range and size of its missile forces, US cruise missiles can play a major role
in an exchange, outside strategic missile forces play a role in deterrence and any extreme form of conflict, and missile defenses are beginning to alter the balance.

The DPRK’s ambitious missile programs are still largely in development and their capabilities are impossible to predict until the nature of their nuclear warheads is known and there have been enough tests of the DPRK’s longer-range missiles to provide a clear picture of their performance.

The DPRK’s longer-range *Nodong* (also known as the *Rodong*) Medium-Range Ballistic Missile (MRBM; 700-1,500 kg warhead and 1,000-1,500 km range) is still developmental and would require large numbers of additional, full-range tests to become a mature program. The Japanese Defense White Paper for 2012 reports that Japan believes tests were limited to a possible launch into the Sea of Japan in late May 1993, a mix of *Scud* and *Nodong* launches in July 2006, and a mix of launches that might have involved some *Nodongs* in July 2009.

Some experts feel that the DPRK’s larger *Taepodong*-1 MRBM (1,000-1,500 kg warhead and 1,500-2,500 km range) has never been launched, except as a Space Launch Vehicle (SLV). The Japanese Defense White Paper for 2010 reports one successful launch occurring on August 31, 1998.

Similarly, some experts believe the *Taepodong*-2 Inter-Continental Ballistic Missile (ICBM) (500-1,500 kg warhead and 4,500-8,000 km range) has never been launched, except as a SLV. The Japanese Defense White Paper for 2012 reports one failed launch in July 2006, and a second failed launch on April 5, 2009, when the DPRK fired a missile that is likely to have been a modified *Taepodong*-2 into the sea at a range over 3,000 kilometers. The DPRK claimed to be using the carrier rocket, called the *Unha*-2, to put a satellite into space.

In April 2012, the DPRK tested the *Unha*-3 in an attempt to put another satellite into space; this test failed after approximately 80 seconds. On December 12, 2012, the DPRK attempted a further launch of the *Unha*-3, successfully putting a satellite into orbit. However, many scientists doubt that the satellite is operational, though it may remain in orbit for years. The success of this missile test means that this rocket could potentially deliver a nuclear payload after slight modifications.

Furthermore, on April 15, 2012, the DPRK displayed six new missiles, known as KN-08s, in a military parade; they are likely to be mock-ups and not operational. They were displayed on trucks of Chinese origin, leading to speculation that China had, under UN Security Council Resolution 1718 sanctions, illegally sold such technology to the DPRK.

Another system, the DPRK’s *Musudan* Intermediate-Range Ballistic Missile (IRBM) (650-1,000 kg warhead and 2,500-3,200 km range), may be a copy or modification of the Russian R-27/BM-25 series. It may have been launched at very short ranges for test purposes but is not believed to be operational. These uncertainties make it impossible to estimate any of these missiles’ reliability and accuracy, or whether the DPRK has anything approaching some form of terminal guidance technology.

Recently, the ROK has deployed a series of cruise missiles, the maximum range of which is 1500 km – capable of reaching as far as Beijing and Tokyo. In addition to their cruise missile program, the ROK has successfully launched a series of communication satellites in the last
decade; while it does not possess a known ballistic missile program, it likely possesses the know-how to produce a ballistic missile.

In 1975, the ROK successfully reverse-engineered the US *Nike Hercules* surface-to-air missile (SAM) system, which could also be used in a surface-to-surface capacity. Named the NHK-1 (also known as the Paekkom-1, Baekkom-1, and Hyunmu-1), it had a range of only 150 km (93 miles). Development of the NHK-1 continued into the late 1970s with a successful test in September 1978.

Under pressure from the US, the ROK agreed in 1979 to restrict its missile range to 180 km with a 500 kg max payload in return for US technical support for ROK missile systems. In 1983, the ROK developed the NHK-2, incorporating improved technology and a range of 180 km (112 miles), which could be easily extended to 250 km (155 miles).

The US backed the ROK’s joining of the Missile Technology Control Regime (MTCR) in March 2001, a regime that supersedes the 1979 US agreement. As a result, the ROK began focusing on the development of cruise missiles such as the *Hyunmu*-3 series, capable of delivering payloads below 500 kg to targets deep within the DPRK and beyond. Developed indigenously in the ROK, the *Hyunmu*-3 system is reportedly similar in structure and guidance technology to the US *Tomahawk* but with a shorter range.

The *Hyunmu*-3A deployed in 2006 with a range of 500 km and is capable of striking Pyongyang – but not the DPRK’s long-range missile sites, including the Musudan-ri site in North Hamgyeong Province, located more than 300 km from Seoul. In early 2009, the ROK deployed the *Hyunmu*-3B, an improvement of the 3A model, which has a range of 1000 km, capable of reaching as far as Beijing and Tokyo as well as hitting key targets throughout the DPRK.

The most advanced missile in the ROK arsenal is the *Hyunmu*-3C, which has supposedly just entered into the production phase. In July 2010, it was reported that the ROK had begun manufacturing the *Hyunmu*-3C with a range of up to 1,500 km (937 miles), capable of reaching parts of China, Japan, and Russia.

### The Nuclear and CBRN Balance

Nuclear forces are becoming a critical part of the Korean balance. The DPRK’s efforts to acquire nuclear weapons and long-range missiles have been the source of concern and negotiations for more than a decade.

The DPRK’s programs also cannot be separated from the impact of US and Chinese nuclear weapons on the balance, or the need to evaluate the impact of chemical, biological, and precision-guided weapons. Moreover, “defensive weapons” such as effective air and missile defenses offset at least part of the opposing side’s missile and WMD capabilities. There is often no easy distinction between “offensive” and “defensive” weapons.

It is also important to note that all these elements of the DPRK’s forces are rapidly evolving. It has conducted three low-yield nuclear tests and has effectively ended its past agreements to limit the production of nuclear materials and its missile tests. While unclassified estimates are to some extent sophisticated guesswork, Pyongyang may have obtained enough
plutonium from its power reactors to have 4 to 13 nuclear weapons, even allowing for the material used in its three tests.

Dr. Siegfried S. Hecker, a former director of the Los Alamos National Laboratory, reported that, on a November 2010 visit to the DPRK’s Yongbyon nuclear facility, he saw a small, sophisticated facility with some 2,000 centrifuges that were “P-2” advanced designs. Furthermore, North Korea publicly stated in April 2013 that it was going to refuel its 5 MWe reactor at Yongbyon and was also building a new 50-100 MWe at Yongbyon and a 200 MWe reactor at Taechon. Thus, the DPRK may have – or may soon have – significant stocks of enriched uranium as well as plutonium. At a minimum, this means that the DPRK’s future production of weapons-grade material is impossible to accurately forecast, and that both targeting and arms control are far more difficult because of the inability to predict how many dispersed centrifuge facilities Pyongyang may have.

The official view of the US intelligence community is that North Korea has not yet been successful in getting high yields from its fission devices. Its initial tests produced only very low yields. It seems clear that it does not have boosted or thermonuclear weapons production capabilities, but there is no way to predict when or if it might acquire these.

North Korea has started talking about nuclear strikes on the US long before it even has a credible capability to launch them and makes no secret of the threat it poses to its neighbors. It also clearly is set on a course where it will steadily deploy nuclear-armed missiles and aircraft with progressively longer ranges, higher yields, and more accuracy and reliability over time. It will exploit any failure to match these forces, and there is no clear way to estimate how a mature and survivable nuclear force would affect North Korean uses of force at lower levels or its perceptions of risk.

Similar uncertainties arise because of the inability to predict how sophisticated the DPRK’s weapons and warhead design capabilities are. US experts feel that Pyongyang has obtained some advanced missile warhead design data, a notion that was confirmed by the sale of some of these data by the A.Q. Khan network.

The DPRK’s focus on nuclear weapons and long-range missile programs raises important issues for the Korean balance per se as well as for the US in deterring or responding to the DPRK threat or reality of using nuclear weapons against the ROK. This threat, however, cannot be limited to the Korean peninsula. It already extends to Japan, including US bases, as well as Alaska and perhaps the Western continental US. Potential US reactions again raise the issue of what China’s response would be and whether a crisis could escalate to the point at which the US-Chinese strategic and nuclear balance became relevant – a threat that could force Japan to make hard choices of its own.

**The Role of Chinese, US, and Other Outside Missile and Nuclear Forces**

However, DPRK nuclear weapons programs are only part of a far wider range of important issues in assessing the Korean balance:

- The US and China are major nuclear powers with boosted and thermonuclear weapons. While neither is likely to use nuclear weapons, they have the capability, and, at a minimum, this
The DPRK has implosion fission weapons. Its numbers, weapons yields, and ability to create reliable bombs and missile warheads are uncertain, but it seems likely it either has warheads or is rapidly moving toward acquiring them. It almost certainly has programs to develop boosted and thermonuclear weapons, but their status is unknown.

It is important to think about the consequences of the DPRK going from a token or no serious nuclear force to even a limited capability to strike the US matched by a serious capability to strike at the ROK or Japan and develop enough weapons for a serious tactical or theater nuclear strike capability. There is no way to calculate the DPRK’s willingness to take nuclear risks and the fact its threats and strategic rhetoric are extreme does not mean its actions will be. The fact remains, however, that it is the only power that openly threatens nuclear war and whose strategic leadership is openly uncertain enough to raise serious questions about its judgment and restraint.

The ROK had a covert nuclear weapons program that it halted in 1975 after quiet negotiations with the US, although small-scale experiments continued sporadically through 2000. Though there is no way to know whether they have made advances in weapons design and cold testing more recently, the ROK’s experience, along with its extensive civilian nuclear power industry, gives it a significant nuclear breakout capability if it should reverse its decisions.

Japan is unlikely to have nuclear weapons programs in the near future, but has all of the technology and material necessary to rapidly acquire them and develop boosted and thermonuclear weapons. Japan currently has a stockpile of approximately 44 tons of plutonium, with nine of those tons, enough for more than 1,000 nuclear weapons, stored domestically.

The US and China have nuclear-armed aircraft and ICBMs, IRBMs, MRBMs, and SRBMs with boosted and thermonuclear weapons. The DPRK may have long-range tactical and theater missiles with implosion nuclear weapons.

The DPRK is a major chemical weapons state, and probably has advanced chemical warheads and bombs. China may have stocks of chemical weapons. There is no way to estimate the size, type, and lethality/effectiveness of their relative stockpiles, or doctrine and plans for using them. It should be noted, however, that relatively crude mustard gas weapons played a decisive role in area denial and disruption of Iranian forces in the final phase of the Iran-Iraq War in 1988, and that stocks of persistent nerve gas and so-called 4th generation chemical weapons are possible. Although the ROK neither confirms nor denies the existence of a CW program, it is suspected of maintaining a chemical weapons program and may have covert stocks of chemical weapons.

The DPRK is suspected to have a biological weapons program and may have stocks of such weapons. These could range from basic to genetically-modified types. China’s program is not discussed in unclassified official statements. It should be noted that China, Japan, the DPRK, the ROK, and the US all have advanced civil biological, food processing, chemical processing, and pharmaceutical facilities that can be adapted to both chemical and biological weapons development and production. All have significant capability for genetic engineering of biological weapons. All would have to develop advanced biological weapons for test purposes to conduct an effective biological defense program.

No public details are available on the efforts of any power to develop small or specialized chemical, biological, radiological, or nuclear weapons for covert delivery or potential transfer to non-state actors and third countries.

China and the DPRK have large numbers of conventionally-armed, long-range missiles capable of hitting targets in the ROK. The nature of their conventional warheads is not clear, and this is critical since conventional warheads have limited lethality, and terminal guidance is needed to provide the accuracy necessary to strike at high value, rather than broad area targets. China and the
DPRK may already have, and are certainly developing, ballistic and cruise missiles with some form of terminal guidance.

The range of uncertainties in this list raises two key issues for both strategic and force planning as well as for arms control. One is the “diversion effect”: the risk that nuclear controls can drive states even further toward advanced biological and chemical weapons. Advances in biotechnology have made control regimes virtually impossible as well as vastly increased the potential lethality of biological weapons to levels beyond that of even boosted and thermonuclear weapons.

The second is the so-called Nth weapon paradox. It may be possible to reduce a nation’s nuclear weapons, but it is probably impossible to be certain it does not retain at least a few. The problem for arms control is that the smaller the stockpile, the more it has to be used in ways that threaten critical targets like major population centers rather than a given military target. Arms reductions can easily escalate targeting.

The Balance of US and Chinese Missile and Precision Strike Forces

It is unclear that China and the US will ever directly confront each other in a conflict in the Koreas, but both countries are developing a mix of new conventional missile, precision strike, nuclear-armed missile, nuclear weapon, and space warfare capabilities that have a major impact on the balance in the Koreas, Northeast Asia, and the entire Pacific region.

The US has long been a power with extensive conventional precision-strike, space-based, and nuclear capabilities. China, however, is rapidly modernizing and expanding its capabilities in all these areas. Chinese military analysts publicly explore a wide range of innovative strategies designed to use missile and precision strike forces to deter or limit US military capabilities in the region, although many now are deployed in ways that focus on Taiwan. China already has conventionally-armed missiles with terminal guidance systems, and has improved such systems under development, including ballistic anti-ship missiles that pose a long-range strategic threat to US carrier task forces.

The US DoD put heavy emphasis on these “anti-access” and “area denial” (A2AD) capabilities – and their potential impact on US power projection capabilities in the Koreas and Northeast Asia – in its report on *Military and Security Developments Affecting the People’s Republic of China* for 2011 and for 2013.¹

The Second Artillery controls China’s nuclear and conventional ballistic missiles. It is developing and testing several new classes and variants of offensive missiles, forming additional missile units, upgrading older missile systems, and developing methods to counter ballistic missile defenses. (p. 5-6)

By December 2012, the Second Artillery’s inventory of short-range ballistic missiles (SRBM) deployed to units opposite Taiwan stood at more than 1,100. This number reflects the delivery of additional missiles and the fielding of new systems. To improve the lethality of this force, the PLA is also introducing new SRBM variants with improved ranges, accuracies, and payloads.

China is fielding a limited but growing number of conventionally armed, medium-range ballistic missiles, including the DF-21D anti-ship ballistic missile (ASBM). The DF-21D is based on a variant of the DF-21 (CSS-5) medium-range ballistic missile (MRBM) and gives the PLA the capability to attack large ships, including aircraft carriers, in the western Pacific Ocean. The DF-21D has a range exceeding 1,500 km and is armed with a maneuverable warhead. (p. 5-6)

The Second Artillery continues to modernize its nuclear forces by enhancing its silo-based intercontinental ballistic missiles (ICBMs) and adding more survivable mobile delivery systems. In recent years, the road-mobile, solid-propellant CSS-10 Mod 1 and CSS-10 Mod 2 (DF-31 and DF-31A) intercontinental-range ballistic missiles have entered service. The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach most locations within the continental United States. China may also be developing a new road-mobile ICBM, possibly capable of carrying a multiple independently targetable re-entry vehicle (MIRV). (p. 5-6)

**Land-Based Platforms.** China’s nuclear arsenal currently consists of approximately 50-75 ICBMs, including the silo-based CSS-4 (DF-5); the solid-fueled, road-mobile CSS-10 Mods 1 and 2 (DF-31 and DF-31A); and the more limited range CSS-3 (DF-4). This force is complemented by liquid-fueled CSS-2 intermediate-range ballistic missiles and road-mobile, solid-fueled CSS-5 (DF-21) MRBMs for regional deterrence missions. By 2015, China’s nuclear forces will include additional CSS-10 Mod 2 and enhanced CSS-4 ICBMs. (p. 31)

**Sea-Based Platforms.** China continues to produce the JIN-class SSBN, with three already delivered and as many as two more in various stages of construction. The JIN-class SSBNs will eventually carry the JL-2 submarine-launched ballistic missile with an estimated range of 7,400 km. The JIN-class and the JL-2 will give the PLA Navy its first long-range, sea-based nuclear capability. After a round of successful testing in 2012, the JL-2 appears ready to reach initial operational capability in 2013. JIN-class SSBNs based at Hainan Island in the South China Sea would then be able to conduct nuclear deterrence patrols. (p.31-32)

**PLA Underground Facilities**

China maintains a technologically advanced underground facility (UGF) program protecting all aspects of its military forces, including C2, logistics, missile, and naval forces. Given China’s NFU nuclear policy, China has assumed it may need to absorb an initial nuclear blow while ensuring leadership and strategic assets survive. (p. 31)

China determined it needed to update and expand its military UGF program in the mid to late 1980s. This modernization effort took on a renewed urgency following China’s observation of U.S. and NATO air operations in Operation Allied Force and of U.S. military capabilities during the 1991 Gulf War. A new emphasis on “winning hi-tech battles” in the future precipitated research into advanced tunneling and construction methods. These military campaigns convinced China it needed to build more survivable, deeply-buried facilities, resulting in the widespread UGF construction effort detected throughout China for the last decade. (p. 31)

**Future Efforts.** China is working on a range of technologies to attempt to counter U.S. and other countries’ ballistic missile defense systems, including maneuverable reentry vehicles (MaRVs), MIRVs, decoys, chaff, jamming, thermal shielding, and anti-satellite (ASAT) weapons. China’s official media also cite numerous Second Artillery training exercises featuring maneuver, camouflage, and launch operations under simulated combat conditions, which are intended to increase survivability. Together with the increased mobility and survivability of the new training enhancements strengthen China’s nuclear force and enhance its strategic strike capabilities. Further increases in the number of mobile ICBMs and the beginning of SSBN deterrence patrols will force the PLA to implement more sophisticated command and control systems and processes that safeguard the integrity of nuclear release authority for a larger, more dispersed force. (p. 32)

These developments show that China is acquiring the ability to project conventional missile power deep into the Pacific in ways that make the traditional discussion of “blue water”
navies steadily less relevant. The issue today is the overall mix of sea-air-missile-space capabilities and how they interact with both conventional forces and asymmetric forces, including new forms of conflict like cyberwarfare. One can only speculate on the pace of change that these shifts will trigger in US, Chinese, and other regional powers over the coming decades, but they already are a major new aspect of the balance.

Moreover, China’s emerging missile capabilities include both conventional and nuclear strike capabilities in ways that intersect even if China and the US never openly threaten to use nuclear forces. Chinese nuclear capabilities can deter or limit the US response to China’s use of conventionally armed missiles, and even a worst case escalation to the use of nuclear-armed missiles may still lead China to use conventionally-armed precision strike systems against US or politically-sensitive targets in ways intended to limit or shape the process of escalation.

The US, in contrast, does not discuss the use of missile warfare in Asia in detail in its unclassified military literature and has not made this a major part of its discussion of rebalancing its force in Asia. It is clear, however, that conventional and nuclear missile capabilities are as important to the US side of the sea-air-missile-space balance as they are to China and the Koreas, that they sharply affect the land balance in terms of joint warfare, and that the degree of future US and Chinese cooperation or competition will affect every aspect of the Korean, Northeast Asian, and Pacific balances.

The US has large numbers of precision-guided, long-range cruise missiles for air and sea launch, and precision-guided, long-range multiple rocket launchers. The ROK is also developing an advanced cruise missile program of its own, capable of accurately hitting targets in the North.

US stealth aircraft can deliver precision-guided weapons at standoff ranges from most Chinese and DPRK surface-to-air missiles with the exception of the S300/S400 series. China is developing long-range anti-ship ballistic missiles that can strike large surface ships like US carriers at long distances. These potentially are “weapons of mass effectiveness” that can be launched in devastating strikes against critical facilities and infrastructure without the use of WMD warheads.

Missile defenses add another dimension. The US, Japan, and the ROK have some ballistic missile defense capabilities and are working together to develop wide-area theater ballistic missile defense systems. China has the Russian S300/S400 series of advanced surface-to-air missile defenses and is almost certainly seeking more advanced missile defense capabilities. The DPRK lacks such capabilities but is almost certainly seeking them. The balance of air and missile defense capabilities plays a critical role in limiting the offensive capabilities of the opposite side and reducing the risk in using one’s own missiles. This makes air and missile defenses the equivalent of a major offensive weapon.

China, the US, the ROK, and possibly the DPRK all have advanced cyber warfare capabilities. China has some anti-satellite capability and possibly some form of EMP weapon. These too are potential “weapons of mass effectiveness” that can be used to launch devastating strikes against critical facilities and infrastructure without the use of WMD warheads.
South Korea has already strengthened its missile defense forces, as has the US, and it is creating new plans for deploying reinforcements. The new missile and nuclear tests that North Korea carried out in late 2012 and early 2013 have reinforced ROK, Japanese, and US interests in creating theater-wide missile defense systems, while the DPRK’s satellite launches raise the issue it might develop anti-satellite (ASAT) weapons as well as new IRBMs and ICBMs. Any use of ASAT weapons could also have a massive impact on US battle management and ISR systems.

The Balance of Weapons of Mass Effectiveness and “Offensive” vs. “Defensive” Weapons

Conventionally-armed, precision-guided weapons can also be used to threaten or attack critical targets. It is unclear how accurate the DPRK’s missiles are, whether Pyongyang has a real-world terminal guidance capability to use in combination with ballistic missiles, or whether the DPRK can develop such systems for cruise missiles. As long as the DPRK does not have such “smart” warheads, conventionally-armed missiles are largely terror weapons that can produce limited casualties and damage to targets as large as cities or military facilities as large as airfields.

Once the DPRK does have a real-world terminal guidance capability, however, such missiles may become “weapons of mass effectiveness” that can destroy high-value and critical infrastructure targets with conventional warheads. This could lead to new patterns of escalation in which the US and ROK use or threaten to use precision-guided air-to-surface, surface-to-surface, and cruise missiles to destroy critical DPRK targets in an effort to halt or deter a DPRK conventional attack.

The DPRK’s nuclear developments have already begun to provoke a South Korean response that may eventually lead to a renewal of the ROK’s nuclear program, as well. In October 2012, South Korea announced, in conjunction with the US, that it was extending the range of its missile systems.

South Korea has already strengthened its missile defense forces, as has the US, creating plans for deploying reinforcements. The new missile and nuclear tests that North Korea carried out in later 2012 and early 2013 have reinforced ROK, Japanese and US interests in creating theater-wide missile defense systems, while the DPRK’s satellite launches raise the issue it might develop anti-satellite (ASAT) weapons as well as new IRBMs and ICBMs. Any use of ASAT weapons could also have a massive impact on US battle management and ISR systems.

Moreover, the fact so many missile and precision air strike systems are being deployed has turned “defensive” weapons, such as ballistic missile defenses and surface-to-air missile forces, into “offensive” forces. The comparative ability to defend also equates to the ability to reduce the risk in escalating to offensive missile, air, and stealth attacks.
The Broader Balance of US and Chinese Strategic and Theater Nuclear Forces

There is no way to assess the exact probability that the US or China would make threats to use their nuclear weapons in a Korean conflict, or ever escalate to their actual use, but the probability they would even make explicit threats seems extremely low. Each side’s nuclear weapons have a deterrent impact in restraining the other’s behavior without such threats, and even raising the possibility of an actual nuclear exchange would threaten the stability of Asia, the global economy, and the US and Chinese economies in ways in which the end result could not be calculated. Both sides seem likely to calculate that moving beyond the tacit threat posed by the existence of the other’s nuclear forces and would almost certainly be so destructive as to be more costly than any strategic or military gains in a limited war could ever be worth.

It is also unclear that numbers of nuclear weapons and delivery systems would be meaningful unless events forced the US or China into a major nuclear engagement. The US might “win” in terms of the most strike and damage, but the US has a much smaller target base. Nevertheless, the US and China are major nuclear powers with boosted and thermonuclear weapons. While neither is likely to use nuclear weapons, they have that capability, and – at a minimum – their possession of nuclear weapons plays a major role in the balance of deterrence and in shaping the risks of asymmetric escalation.

Both China and the US have every strategic and economic reason to show restraint, negotiate, and avoid such worst cases. Cooperation will not be easy, but the following analyses make it all too clear that every effort needs to be made to avoid repeating the mistakes that drove the US and China into the Korean War and the “worst case” miscalculations that led to World War I and World War II. Even some Asian repetition of the Cold War, and even one limited to conventional air and missile combat, would be a costly tragedy of incredible proportions.

Nevertheless, any assessment of the balance in the Koreas and Northeast Asia must consider just how important it is to emphasize Chinese and US cooperation that will avoid any confrontation or conflict that could escalate to the use of such forces. It must also consider the potential impact that a DPRK-ROK use of missile and WMD forces could have on Chinese and US tension and escalation and the reality of the impact that US rebalancing and Chinese emphasis on sea-air-missile capabilities for A2AD can have under worst case conditions.

US Policy Options

The US needs to work closely with South Korea to help it strengthen its own forces and to provide a US presence and security guarantees that will help South Korea defend and deter against any foreseeable mix of North Korean asymmetric and conventional options.

The ROK has the economic and military strength to deal with most contingencies, but it benefits from US arms and technology transfers, and its military capabilities are greatly reinforced by US air and sea power and by the fact a US land presence is a powerful signal of
the level of US commitment to South Korea’s defense. The US can also provide assets like “stealth” strike capabilities, a wide range of intelligence and battle management assets that South Korea cannot develop on its own, and new theater missile defense assets like THAAD and the SM-3.

North Korea’s missile forces and growing nuclear capabilities provide a more difficult challenge. US options are also limited by the fact that North Korea has a powerful – if cautious and sometimes restraining – protector in China. It is far harder for the United States to talk about preventive strikes after the fact and in the face of Chinese desire to keep a buffer state between it and the US. US options are also affected by the fact that any deployment of US nuclear forces or extended deterrence that focuses on North Korea will be seen by China as a potential threat.

At the same time, the US faces the reality that the risks of a growing North Korean nuclear force – coupled to a large stock of chemically armed bombs and missiles and possible biological weapons – mean it cannot simply let a key ally like South Korea bear a one-sided threat or leave Japan in a position in which it, too, has no balancing force. While arms control options are not impossible, it is also all too clear that they offer even less chance of success than negotiations with Iran.

This leaves the US with a number of alternatives, none of which offer the prospect of lasting stability, but which the US might use to pressure both North Korea and China in ways that might lead the DPRK to limit or roll back its nuclear programs and nuclear capabilities as well as help the ROK deter and defend against North Korean missile and nuclear forces if restraint and negotiations fail:

- Turn to China and say the US will offer extended nuclear deterrence to Japan and South Korea unless China can persuade North Korea to halt and roll back its nuclear programs.

- Put pressure on China and North Korea, and aid South Korea, by formally offering South Korea a US guarantee of “extended deterrence”:
  - The most discrete extended deterrence option would be nuclear-armed submarine- or surface-launched cruise missiles backed with the deployment of conventionally-armed cruise or ballistic missiles with terminal guidance systems capable of point attacks on North Korea’s most valuable civil and military assets.
  - The most decisive extended deterrence options would be the equivalent of the combination of Pershing II and ground-launched cruise missiles that were land based, had US operating crews both deep inside South Korea and in or near its major cities, and had both nuclear and precision conventional warheads. North Korea would be faced with the inability to strike at key South Korean population centers without striking at US forces and still see mobile US nuclear-armed forces in reserve. It also could not use conventional warheads without facing a more accurate and reliable US strike force in return.

- Work with South Korea to create the same kind of layered defenses against missiles and rockets being developed in Israel, and use the South Korean model to help create layered defenses in the Gulf, allowing an indirect form of cooperation between Israel and the Gulf states without overt ties or relations.

- Quietly signal that the US no longer will pressure South Korea and Japan not to develop their own long-range missile and nuclear forces. The US does not have to support proliferation by either South Korea or Japan. Experts may argue the timing, but none argue over South Korean and Japanese
capability to building long-range missiles and nuclear weapons, and do so with minimal – if any – testing. In fact, South Korea would already have nuclear weapons if the US had not pressed South Korea to not go ahead.

The US can put pressure on both North Korea and China in ways that allow several years for negotiations simply by not seriously opposing the ROK in any way that would bind or sanction its ally. While Japan is far less likely to make a decision to go nuclear, particularly in the near term, the US could decide that the Missile Technology Control Regime had essentially outlived its usefulness – binding the US without binding China – and encourage Japan to create precision-strike conventional missiles as well as missile defenses.

This would confront both North Korea and China with the reality that once such a Japanese force was created, Japan could quickly arm them with nuclear weapons if it came under increasing DPRK or Chinese pressure. Such options would give the US, the ROK, and Japan growing leverage to pressure China to restrain North Korea as well as deter and contain the expansion of Chinese nuclear forces.

One way to put such pressure on China would be to start a dialogue that could be either official or think tank, including discussions of both missile defense and extended deterrence, and encourage the ROK and Japan to surface the nuclear option. If this succeeded in pushing China into far more decisive pressure on North Korea, there would be no need for either extended deterrence or ROK or Japanese nuclear forces.

Moreover, such options could be used to lever Chinese restraint in transferring missile technology to Iran. There also is no reason that the US, South Korea and Japan could not offer quid pro quos in terms of incentives for a DPRK roll back, including a formal agreement on all sides for a local “weapons of mass destruction free zone” and economic incentives to a more open North Korea.

At the same time, the US may have to tacitly encourage ROK and Japanese creation of at least precision-guided conventional missile forces – and possibly nuclear forces – as a local regional counterbalance to the Chinese nuclear effort. This is scarcely a desirable option, or one that can easily be kept stable, but North Korea is only part of the problem, and the US should not passively allow itself to be trapped into a Chinese-US nuclear relationship. It should be clear to China that it faces other potential nuclear powers if China’s nuclear forces grow too much and are even indirectly linked to Chinese pressure on maritime and island disputes in the Pacific.
VII. Korean Missile Forces

The two Koreas differ sharply in their political and military needs for missile forces. As Chapter 3 and 4 have explained, long-range artillery, rockets, and missiles help North Korea (Democratic People’s Republic of Korea or DPRK) threaten and deter South Korea (Republic of Korea or ROK) and the US, and to compensate for the weaknesses in DPRK airpower. As Chapter 8 will explain, they also provide a potential means to deliver the DPRK’s nuclear weapons and weapons of mass destruction.

Overview of DPRK Missile Developments

The DPRK gives high priority to the development of ballistic missiles for several reasons, including political and diplomatic considerations, as a means of earning foreign currency, and efforts to enhance DPRK military capabilities on a regional basis and shape the Korean military balance in its favor.

According to a US Forces Korea (USFK) report,\(^2\)

> [T]he North Korean regime continues its efforts to develop nuclear weapons and ballistic missile programs both as a means to ensure the regime’s survival and to manipulate the international community. The regime’s potential export of weapons of mass destruction material and technology poses a regional and global threat…. North Korea views its ballistic missile programs as a source of prestige, a strategic deterrent, a means of exerting regional influence, and a source of hard currency. North Korea continues to build and test missiles of increasing range, lethality and accuracy, thereby bolstering its inventory of missiles available for internal use or external sale. With as many as 800 missiles in its active inventory, it seems as though North Korea intends to increase its offensive capabilities. Missile sales further constitute a vital source of hard currency for the North Korean regime facilitating its continued irresponsible behavior and repression of its own people.

At the same time, missile tests are very expensive for the DPRK due to its limited technology and economic base. The ROK Ministry of Unification estimated that the two missile launches in 2012 cost a total of $1.3 billion – with the rockets themselves costing $600 million, launch site development costing $400 million, and other related facilities costing $300 million.\(^3\)

These funds could have bought 4.6 million tons of corn, enough to feed the DPRK for four or five years.\(^4\)

Arsenal and Capabilities

The DPRK has hundreds of ballistic missiles, along with a significant infrastructure and institutional arrangement to sustain its missile development program. As of May 2012, the DPRK had at least nine different types of guided ballistic missiles available or in development, with some offered for export to other countries; it is often reported in open

---


\(^3\) Ramy Inocencio, “North Korea’s rocket launches cost $1.3 billion,” CNN, December 12, 2012.

source material that the DPRK has operationally deployed 800-1000 missiles. The specifics of each missile will be discussed later in this chapter, but this section gives a brief overview of the DPRK’s capabilities.

After the short-range Hwasong-5 (a DPRK version of the Soviet Scud-B) was put into serial production in 1987, DPRK missile development accelerated at a remarkable pace. During a five-year period (1987–1992), the country began developing the Hwasong-6 (a DPRK version of the Soviet Scud-C), the medium-range Nodong, the long-range Taepodong-1 and Taepodong-2, and the Musudan (a road-mobile version of the Soviet R-27/SS-N-6 Serb submarine-launched ballistic missile).

North Korea has successfully flight tested the Hwasong-5/6 and the Nodong; however, the Taepodong-1 was only partially successful in a 1998 test and a variant of the Taepodong-2 was tested successfully in December 2012 as a space launch vehicle (Unha-3). Figure VII.1 provides a chart assessing the key characteristics of the DPRK’s various missiles.

Sources vary, but many agree that the DPRK possesses between 600–800 Hwasong-5/6s (Scud-B, -C, and -D) that can strike the ROK – though according to one 2006 source, only 100-150 of these were deployed and the rest were exported – and 200-300 Nodong missiles (with up to 50 corresponding TELs) that can strike as far as Japan. Long-range missiles, like the Taepodong-1/2, with the potential to hit the continental US and other international targets, are still under development.

It is possible that the DPRK possesses 20-30 Taepodong-I missiles and perhaps 5 Taepodong-IIs. All of these missiles, except the Scuds, could also potentially be equipped nuclear or chemical capabilities, though sources are far from agreement on this issue. One often-cited source also reports that up to 50 Musudan missiles are deployed (with 50 TELs), and that the KN-02 is already in use.

**How Capable are the DPRK’s Missiles?**

Markus Schiller has conducted an extensive study of DPRK missile developments and has estimated that the DPRK holds many fewer missiles, and with lower capacities, than is usually assumed. While the DPRK has space launch vehicles has booster that might launch a small warhead as far as the US, he concludes that an actual ICBM with re-entry capability is unlikely, as is the actual full development and deployment of the KN-08.

---

5 However, Schiller notes that in his research he has been unable to find the original source of these claims and doubts their authenticity; Markus Schiller, *Characterizing the North Korean Nuclear Missile Threat*, RAND, 2012, p. iii, xv, 38.


7 Ibid.


10 However, Schiller notes that in his research he has been unable to find the original source of these claims and doubts their authenticity; Markus Schiller, *Characterizing the North Korean Nuclear Missile Threat*, RAND, 2012, p. iii, xv, 38.

The Scud B is probably available in large numbers (perhaps hundreds), since the R-17 had a very high production rate and was produced for three decades, if not longer, and many decommissioned or mothballed R-17s existed in post-Soviet Russia. The system is combat proven. Its nominal range is 300 km with a 1 ton warhead. Its real accuracy is probably around 1 km (CEP). Launch procedures are complex, and only few well-trained crews are expected.

The Scud C is probably available in smaller numbers (perhaps 100). The system is likely combat proven. Its range is about 500 km with a 0.7 ton warhead. Its accuracy is worse than that of the Scud B. Launch procedures are analogous to those for the Scud B, and only few well-trained crews are expected.

The Scud D is probably available in small numbers (perhaps a few dozen). Its range is about 700 km with a 0.5 ton warhead. Its accuracy is worse than that of Scud C. Launch procedures are analogous to those for the Scud B, and only few well-trained crews are expected.

The Nodong is limited to a small number of a few dozen at best. Its range is about 900 km with a 1 ton warhead. Its accuracy is worse than that of the Scud B. Launch procedures are comparable with those for the Scud B, with additional time-consuming fueling procedures once the missile is in vertical position.

Other Taepodong I prototypes are unlikely to exist.

One or two more Taepodong II/Unha-2/-3 might exist. Launch procedures are lengthy and easily visible.

If available at all, the Musudan is only available in small numbers.

The situation of the KN-02 is hard to judge. It might be available in sufficient numbers. Its accuracy might be high. Its range with a 0.5 ton warhead is most likely limited to 70 km, but might reach 120 km, if the newer version of SS-21 found its way to North Korea.

Even assuming an operational deployment of 800-1000 missiles, the DPRK faces several capacity constraints:12

- Only a small number of launch crews can be well trained. Even assuming that the production quality of North Korean–produced missiles is high, or that North Korea’s missiles are all of Soviet design and production, the lack of crew training will result in moderate results at best, with handling failures and low accuracy.

- If missiles are produced in North Korea, they are not of excellent reliability and accuracy because of the lack of firing table creation and lot acceptance tests.

- The number of imported and well-tested Soviet missiles is limited and might be only a fraction of the total missile force.

Former USFK Commander Burwell B. Bell testified before the House Armed Services Committee in March 2007 that “North Korea is developing a new solid-propellant short-range ballistic missile… [I]n March 2006, North Korea successfully test-fired the missile. Once operational, the missile can be deployed more flexibly and rapidly than the existing system and North Korea will be able to launch the missile in a much shorter preparation period.”13 The short-range missile referred to appears to be the Toksa.

---

12 Ibid.
The DPRK is also making efforts to improve existing ballistic missiles such as the *Hwasong* and *Nodong*, including an attempt to extend their ranges.\(^{14}\) See *Figures VII.1 to VII.3* for more detailed comparisons of the missiles, their capabilities, and their likely ranges.

Most analysts believe that the DPRK is nearly self-sufficient in ballistic missile production but still relies upon some advanced foreign technologies and components, particularly for guidance systems. The country has an extensive machine tool sector; thus, the DPRK is probably self-sufficient in the fabrication of airframes, tanks, tubing, and other basic components.\(^{15}\) However, the DPRK’s rapid strides in the development of its ballistic missiles with only a limited number of test launches could mean that the country imported various materials and technologies from outside.\(^{16}\)

Officials in the Russian government have admitted that Russian missile experts and nuclear scientists were in North Korea in the 1990s providing support, but the officials claimed that these scientists and experts returned to Russia by 1998. During this time period, DPRK missile experts were also in Iran, where they reportedly showed skills and knowledge that were “very unimpressive.”\(^{17}\)

**Uncertainties**

There are as many uncertainties in predicting the nature of the DPRK’s missile programs as there are in making predictions about its nuclear program. The DPRK’s ambitious missile programs are still largely in development, and their capabilities are impossible to predict because there have not been enough tests of the DPRK’s longer-range missiles to provide a clear picture of their performance.

These uncertainties, along with the fact that the DPRK’s missile testing involves firing the missiles over the ocean – as opposed to any sort of independently verifiable target – make it impossible to estimate any of these missiles’ reliability and operational accuracy, or whether the DPRK has anything approaching some form of terminal guidance technology.\(^{18}\) Nevertheless, DPRK advancements in missile technology coupled with its nuclear ambitions do cause deep concern among ROK and Western sources. Former US Secretary of Defense Robert M. Gates warned in January 2010: \(^{19}\)

> With the DPRK’s continuing development of nuclear weapons and their development of intercontinental ballistic missiles, North Korea is becoming a direct threat to the United States, and we have to take that into account...I think that North Korea will have developed an intercontinental ballistic missile (within five years)... Not that they will have huge numbers or anything like that, but they will have—I believe they will have a very limited capability.

---

\(^{14}\) Ibid., p. 45.

\(^{15}\) Pinkston, *The North Korean Ballistic Missile Program*, p. 21.


\(^{17}\) Markus Schiller, *Characterizing the North Korean Nuclear Missile Threat*, RAND, 2012, p. 36.


It has been a puzzle to the international community that the DPRK has managed to create a ballistic missile program so effectively with only a few test launches. This has led many to believe that the DPRK imported materials, technologies, and designs.

While most analysts concur that the DPRK has reverse-engineered Soviet ballistic missiles, Markus Schiller of RAND argues that the DPRK’s ballistic missile program is too sophisticated and has been tested too few times – with too low of a failure rate for so few tests – to be indigenous. He believes that instead, North Korea either received missiles directly from the USSR/Russia or had an arrangement for licensed production. Schiller proposes that the DPRK has been conducting missile tests with Soviet/Russian missiles to appear highly capable, but has probably not tested indigenously produced or designed missiles.\footnote{Markus Schiller, \textit{Characterizing the North Korean Nuclear Missile Threat}, RAND, 2012.}
### Figure VII.1: DPRK Ballistic Missile Arsenal

<table>
<thead>
<tr>
<th>Classification</th>
<th>Range (km)</th>
<th>Payload (kg)</th>
<th>Operational Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hwasong-5</strong></td>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>[SRBM]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hwasong-6</strong></td>
<td>500</td>
<td>600</td>
<td>500</td>
</tr>
<tr>
<td>[SRBM]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nodong 1</strong></td>
<td>1300</td>
<td>1350-1600</td>
<td>1300</td>
</tr>
<tr>
<td>[MRBM]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Musudan (BM-25)</strong></td>
<td>3000</td>
<td>2500-4000</td>
<td>2500-4000</td>
</tr>
<tr>
<td>[IRBM]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Taepodong-1</strong></td>
<td>2500</td>
<td>2500</td>
<td>2000</td>
</tr>
<tr>
<td>[IRBM]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Taepodong-2</strong></td>
<td>6700</td>
<td>2-stage: 7000-7500</td>
<td>4000-8000</td>
</tr>
<tr>
<td>[ICBM]</td>
<td></td>
<td>3-stage: 10000-10500</td>
<td></td>
</tr>
<tr>
<td><strong>Toksa (KN-02)</strong></td>
<td>--</td>
<td>--</td>
<td>160</td>
</tr>
<tr>
<td>[SRBM]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: “ROK” represents ROK Ministry of National Defense data; “NTI” represents Nuclear Threat Initiative data; “MT.Com” represents data from MissileThreat.com.

Tactical Missiles (with a range less than 300 km) are under the Artillery Training Guidance Bureau, while Strategic Missiles (more than 300 km) are under the Strategic Rocket Forces Command.

Figure VII.2: ROK Ministry of National Defense Estimates of DPRK Missile Range


Figure VII.3: Japanese Ministry of Defense Estimates of DPRK Missile Range

DPRK Missile Programs

There are extensive reports available on some DPRK missiles, while much less is known about others – in particular, the DPRK’s potential ICBMs.

The Hwasong and Toksa Programs

The DPRK possesses a large SRBM stockpile primarily based on different versions of the Russian Scud missile that can easily strike targets within the ROK. They are domestically produced and have a maximum range of approximately 300-500 km, with the ability to carry a 1 ton warhead.\(^{21}\) Figures VII.2 to VII.6 show the capabilities of these missiles.

It would appear that the DPRK indigenously reverse-engineered and improved the Soviet Scud-B, perhaps receiving the missile as early as 1972, produced the DPRK-version with USSR assistance or even under license in DPRK factories, or acquired different missile production technologies from several different foreign sources, incorporating them into its indigenous missile program. The DPRK’s version is reported to have a slightly improved range and a slightly increased diameter, as well as use a different rocket fuel. At the very least, it appears that the DPRK had significant help from several foreign sources, including Egypt, China (People’s Republic of China or PRC), Russia, and Iran.\(^ {22}\)

The first North Korean “indigenously-modified Scud” was first reportedly tested in April 1982; the first confirmed flight tests of Scud-B (Soviet R-17) versions were in April and September 1984. Successful flight tests of the Scud-B (Hwasong-5) and Scud-C (Hwasong-6) – with a smaller payload (approximately 700 kg) and a longer range (500 km) – were conducted in May 1986 and July 1986 respectively, though it would appear that the first credible report of a successful Hwasong-6 flight test was in June 1990.\(^ {23}\) Both were subsequently deployed by 1988.

The DPRK also made its first sale to Iran of the Hwasong-5 during this same period – a $500 million agreement in 1987 reportedly included 90-100 Hwasong missiles and other military hardware exports to Iran (were the missiles were subsequently renamed Shehab-1). Furthermore, a 1985 agreement between the two countries led to DPRK assistance with the construction of a Hwasong-5 production plant, reportedly operational in 1988. DPRK assistance to Egypt also reportedly led to the establishment of a Scud-B production plant in 1987 and a Scud-C plant in 1990.\(^ {24}\)

A drawing found on a North Korean freighter in 1999 depicts an enlarged Scud, similar to a Scud-D, and also known as the Scud-ER and Hwasong-7. This missile has a range of

---


\(^{22}\) “North Korea Missile Capabilities,” Nuclear Threat Initiative, May 1, 2010; Markus Schiller, Characterizing the North Korean Nuclear Missile Threat, RAND, 2012, p. 24.


\(^{24}\) “North Korea Missile Capabilities,” Nuclear Threat Initiative, May 1, 2010.
approximately 700 km with what appears to be the same engine as the *Scud*-B and -C. Similar to the *Nodong*, the warhead is separable. The missile is reported to have been available in the DPRK since 2000.\(^{25}\)

Some estimates indicate that the DPRK’s SRBMs include some 600–800 regular and extended-range *Scud* missiles. According to additional estimates, Pyongyang may deploy its missiles in two belts, with 22–28 bases in the forward area and 12–15 in the rear area. The first is 50–90 km north of the DMZ, and the second 90–120 km north. A third belt may exist more than 175 km from the border.\(^ {26}\) These warheads are probably equipped with high-explosive munitions, though it is also possible they have been fitted with chemical and biological weapons – though most likely not nuclear, as the relative crudeness of the *Scud* design makes it unlikely that the DPRK would equip it with a nuclear warhead.\(^ {27}\)

The DPRK has recently been seeking ways to improve its *Scud* arsenal and has worked on developing new short-range missile platforms. A May 2009 CRS report stated that in 2006 the DPRK tested newer versions of “solid-fuel Scuds, which can be fired quickly, in contrast to liquid-fuel missiles.”\(^ {28}\) And based on interviews with ROK officials, the International Crisis Group reported that in 2008:

> North Korea also 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. However, it is much more accurate than the North’s other missiles and could strike the Seoul-Incheon metropolitan area and possibly US military bases in P’yŏngt’aek, south of Seoul.\(^ {29}\)

Initial production of the *Toksa*/KN-02, utilizing technology entirely different from that of the *Scud*, likely began in 2006. They were displayed during a military parade in April 2007 and probably entered service in 2008.\(^ {30}\) An ROK military source reported that “A North Korean military unit on drill test-fired two shots of short-range missiles, presumed to be KN-02 missiles, into the East Sea” in mid-March, 2013.\(^ {31}\)

---


\(^ {26}\) Bermudez, “Going Ballistic.”


\(^ {28}\) Niksch, *North Korea’s Nuclear Weapons Development and Diplomacy*.


The Nodong

The DPRK is thought to have started its development of a single-stage medium-range missile derived from the Soviet Scud, called the Nodong (also known as the Rodong, Scud-D, Scud Mod-D, Nodong-A, and Nodong-1), in the 1990s. It appears the Nodong was first developed and successfully flight tested in 1993 with an initial production of 18 missiles; the flight tests reportedly included Iranian and Pakistani observers.32

Pakistani officials also viewed the Nodong in 1992, while Iranian officials were also present at the 1998 Taepodong-1 test.33 Much of the information about the missile stems from a comparison with the Ghauri-II/Hatf-V missile of Pakistan and the Shahab-3 of Iran, which all seem to be related missile programs34 – and results from tests of these missiles appear to have been shared with the DPRK.

The Nodongs shown at an October 2010 parade in Pyongyang appear to be slightly different than the Pakistani Ghauri and Iranian Shahab-3, looking more like the Iranian Ghadr-1. However, the Nodongs in the 2010 parade were clearly mock-ups, not real. The actual Nodong missile configuration is unknown, at least in open source material, and as such there are no available reliable technical statements beyond those analyzing the Pakistani and Iranian versions of the missile.35

It is reported that Soviet/Russian engineers assisted in development of the missile and that Iran pledged $500 million to jointly develop missile capabilities. Also, there is evidence that 12-25 Nodong missiles were sold to Pakistan in the late 1990s in return for uranium enrichment technology/materials, though Pakistan claims to have developed the Ghauri missile indigenously and denies it imported any Nodongs.36

There are reports that Iran received 15-20 Nodongs, though both the DPRK and Iran deny this. It also seems that Iraq made a $10 million down payment on Nodong missiles in 2003 (before the US invasion), though the missiles were never delivered and the DPRK refused to provide a refund.37

The Nodong is a liquid-fuel propellant single-stage ballistic missile, assessed to have a range of about 1,300-1,600 km with a 1,000 kg payload38 – within reach of almost all of Japan (see Figures VII.2 to VII.5).39 Nodong missiles are road-mobile (able to be fired from a Transporter Erector Launcher, or TEL)40 and liquid-fueled, and are generally stored

33 Ibid.
37 Ibid.
38 Ibid.
underground and transported to sites that are little more than concrete slabs for launch. This makes it difficult to detect signs of preparation for a launch.\(^4^1\)

Its accuracy is low for a modern missile. It cannot be used to attack point targets with conventional warheads and would only be effective against large, soft targets like cities, airports, or harbors. It is uncertain what its single-round reliability is, and this would present problems in arming it with a nuclear warhead.\(^4^2\)

Some experts feel that DPRK nuclear weapons would likely be launched from the Nodong missile division headquarters in Yongnim-up, Yongnim-kun, Chagang Province. Some reports indicate there are three Nodong missile regiments in the division: The first is headquartered in Sino-ri, Unjon-kun, North Pyongan Province (near the west coast, about 100 km from the Chinese border); the second is headquartered in Yongjo-ri, Kimhyongjik-kun, Yanggang Province (in the center of the country, about 20 km from the Chinese border); the third is located along with the Nodong missile division in Yongnim-up (in the center of the country about 45–50 km from Kanggye City, and about 50–60 km from Huichon City).\(^4^3\)

Approximately 175-200 Nodong missiles are said to be deployed, but the program is still developmental and requires large numbers of additional, full-range tests to become a mature program. The Japanese Defense White Paper believes tests are limited to a possible launch into the Japan Sea in late May 1993, a mix of Scud and Nodong launches on July 5, 2006, and a mix of launches that might have involved some Nodonts from the Kittareryong district of the DPRK on July 4, 2009.\(^4^4\)

A Nodong was successfully used in the failed Taepodong-1 1998 test.\(^4^5\) No unclassified source, however, provides a clear picture of exactly what happened during these tests or how far the DPRK has progressed in bringing the system to the final development stage.

**The Taepodong Program**

The DPRK initiated the development of two ballistic missiles known to the West as Taepodong-1 (also known as the Scud Mod-E, Scud-X, Moksong-1, Paektusan-1, and Pekdosan-1) and Taepodong-2 (also called the Moksong-2 and Paektusan-2) in the late 1980s and early 1990s, respectively. The Taepodongs are not production missiles and have never been successfully tested as a weapons platform – both have only been tested as space launchers, not as ballistic missiles.\(^4^6\)

---

\(^{41}\) Pinkston, *The North Korean Ballistic Missile Program*, p. 47.


**Taepodong-1**

The *Taepodong-1* was the DPRK’s first multi-stage missile, proving that the DPRK had ICBM development and deployment technologies. The missile has an estimated range of approximately 1,800-2,000 km and is assumed to be a two- or three-stage, liquid fuel propellant ballistic missile with a *Nodong* used as its first stage and a *Scud (Hwasong-5 or -6)* as its second stage. The space launch vehicle (SLV) adds a solid third stage instead of a reentry vehicle. The *Taepodong-1* has been launched only as an SLV once in August 1998, but it was unsuccessful in delivering a satellite into orbit as a result of failure in its third stage (see Figure VII.6). 47

Following the test, the *Taepodong-1* program was apparently ended, indicating it may have been a transitory program for the development of the longer-range *Taepodong-2*. 48 The *Taepodong-2*, developed between 1987 and 1992, is a two- 49 or three-stage (the SLV version, the *Unha*) 50 missile with a new booster resembling the Chinese CSS-2 and CSS-3 first stage and a *Nodong* as its second stage. 51

The missile integrates more advanced technology and has a much greater range than previous DPRK missiles. It is currently North Korea’s only true ICBM. Range and payload estimates vary, and while the missile has very limited accuracy, it is thought to be targeted at major US population centers in both Alaska and Hawaii – perhaps even as far as California. 52

A 2009 CRS report stated, “The two-stage variant is assessed by some to have a range potential of as much as 3,750 km with a 700 to 1,000 kg payload and, if a third stage were added, some believe that range could be extended to 4,000 to 4,300 km. Some analysts further believe that the Taepodong-2 could deliver a 700 to 1000 kg payload as far as 6700 km.” 53

**Taepodong-2**

David Wright of the Union of Concerned Scientists has calculated that the *Taepodong-2*, used as a ballistic missile, could deliver a 500 kg payload as far as 9,000 km, putting San Francisco and all US cities along the Pacific coast to the north within range. 54 While this would be a significant increase in range over the DPRK’s current missiles, it does not represent, as Wright states, “a true intercontinental nuclear delivery capability since

---

49 Ibid., p. 18.
developing a first generation warhead and heat shield with a mass of 500 kg or less is likely to be a significant challenge for North Korea.\textsuperscript{55}

The NTI reports that estimates of range are generally from 6,000-15,000 km, with a two-stage version capable of 7,000-7,500 km and a three-stage variant capable of 10,000-10,500 km.\textsuperscript{56} The abilities of the \textit{Taepodong}-1 and \textit{Taepodong}-2 can be seen in \textbf{Figures VII.2 to VII.4}.

Like the \textit{Taepodong}-1, the \textit{Taepodong}-2 has never been launched with an active warhead, and it is not clear whether its missile engines have been used as an SLV. The Japanese Defense White Paper of 2010 reported that one failed launch occurred in July 2006 (crashing after forty seconds of flight).

Victor Cha of CSIS notes that this missile was one of seven missiles fired at the time, headed on an eastward trajectory – and some of the missile parts landed only 250 km (155 miles) from Vladivostok. Three of the other six missiles also landed in Russian waters, close to Nakhodka. After the launch, the head of Russia’s Strategic Rocket forces criticized the DPRK for testing missiles that did not have any mechanisms for automatic self-destruction in case they travelled off-course. Russia, though only 150 km (90 miles) from the test site, received little advance notice of the testing from the DPRK.\textsuperscript{57}

The DPRK undertook a second launch in April 2009 in which the DPRK fired a missile that was most likely a variant of the \textit{Taepodong}-2, the \textit{Unha}-2 SLV, at a range over 3,000 km (see \textbf{Figure VII.6}).\textsuperscript{58} Prior to the launch, the DPRK announced the test in advance, even informing the International Civil Aviation and International Maritime Organizations of its intentions, providing coordinates of expected stage falling areas.\textsuperscript{59}

The DPRK hailed the 2009 test as a major success – even bragging that the supposed satellite payload was now broadcasting patriotic music from space – but military and private experts said that the launch had failed due to either an unsuccessful separation of the second and third stages or because the third stage did not fire successfully, citing detailed tracking data that showed the missile and payload had fallen into the sea.\textsuperscript{60}

\textbf{Recent Taepodong launches}

The DPRK had announced on March 16, 2012 that it planned to undertake an “earth observation satellite” launch in April; within hours, China’s vice foreign minister and “summoned” the DPRK’s Chinese ambassador to express Chinese “concerns and worries.” Other Chinese attempts to dissuade the DPRK from undertaking a space launch failed,\textsuperscript{61} and

\begin{itemize}
  \item \textsuperscript{55} Ibid.
  \item \textsuperscript{56} “North Korea Missile Capabilities,” Nuclear Threat Initiative, May 1, 2010.
  \item \textsuperscript{57} Victor Cha, \textit{The Impossible State} (New York: Ecco, 2012), p. 363.
  \item \textsuperscript{58} See Bermudez, “Going Ballistic,” and Pinkston, \textit{The North Korean Ballistic Missile Program}, p. 43–35.
  \item \textsuperscript{59} “North Korea Missile Capabilities,” Nuclear Threat Initiative, May 1, 2010.
  \item \textsuperscript{61} Bonnie S Glaser and Brittany Billingsley, \textit{Reordering Chinese Priorities on the Korean Peninsula}, CSIS, November 2012, p. 10.
\end{itemize}
on April 13, 2012, coinciding with huge celebrations of the 100th anniversary of Kim Il-sung, the DPRK conducted a satellite launch of the Gwangmyongsong-3 using a variant of the Taepodong-2, the Unha-3 SLV. It appeared to have a slightly different third stage than the 2009 launch. The missile flew for over a minute before breaking into several pieces, with the first stage falling into the sea 102.5 miles west of Seoul and the remaining two stages failing.\(^{62}\)

Several days after the launch, China supported a UN Security Council presidential statement condemning the launch as a violation of previous Security Council resolutions and supporting further Security Council measures in the case of any further DPRK provocations. This is in contrast to China’s reaction to the 2009 SLV launch, when it emphasized the distinctions between a missile and a satellite and insisted that the DPRK had a right to the peaceful use of outer space.

Chinese leaders were in particular angry that the DPRK gave months of advance warning regarding the launch to the US, but had neglected to inform China. The PRC further supported the Security Council’s moves to freeze the assets of several DPRK firms involved in financing nuclear and missile programs, while also initiating preemptive measures to warn the DPRK not to try another missile test.\(^{63}\)

A further test was successfully undertaken on December 12, 2012, delivering the Gwangmyongsong-3 satellite into orbit. Preparations were visible in late November, and in early December the DPRK announced that it would launch a satellite mid-month, later announcing this would occur between December 10 and 22. While previously launch preparations had taken about eight weeks, the December 2012 launch took approximately 40 days to prepare. The rocket had three load-bearing stages, and wreckage from the first stage was recovered by the ROK Navy – including parts of the power plant, a propellant tank, and a second, smaller, and badly-damaged propellant tank.\(^{64}\) Although the DPRK claims otherwise, it also appears that the satellite is “tumbling in orbit” and thus is most likely dead.\(^{65}\)

Some ROK officials believe that for this launch, the DPRK may have used foreign scientists to assist in fixing some of the problems experienced in previous long-range missile tests, such as weak engine thrust. The DPRK may have used smuggled technology and/or rogue scientists from former Soviet republics like Ukraine. Iranian observers were invited to the launch.\(^{66}\)

**The Taepodong’s Potential Re-Entry Capabilities**

---


64 Jane’s Intelligence Review, “Watch this space – North Korea successfully launches Unha-3,” January 16, 2013.


Some experts assess that this missile could be used to deliver WMDs with only minor modifications to withstand the heat of re-entry.67 In support of this claim, there is a long-standing US National Intelligence Estimate that the DPRK could successfully test an ICBM by 2015.68 It should also be remembered that the DPRK has had re-entry technology for its other ballistic missiles for over 30 years.69 Of course, how accurate such a missile would be is an entirely different matter.

*Jane’s Intelligence Review* assess that the *Taepodong-2/Unha-3* would not be well-suited to weapons conversion, and more development would be necessary before the *Unha* SLV could be turned into a viable weapon system.70 The IISS also reported in 2011 that the DPRK would have to undertake “an extensive flight-test program that includes at least a dozen, if not two dozen, launches and extends over three to five years” – and such testing would be observable.71 Similarly, a RAND report in 2012 asserted that the *Unha-3/Taepodong-2* would be incapable of carrying a nuclear warhead at an intercontinental range; if the DPRK wants an ICBM, “they have to develop a new rocket, using different technology. This would take a very long time, require a lot of work, and cost a lot of money.”72

The long preparation time necessary prior to a launch – at least several days – would provide significant advance warning, and the DPRK likely does not have the capability to use underground silos, which would then be vulnerable to surveillance and attack. In addition, a launched SLV would only be able to carry one re-entry vehicle, and the required long burn time and the delayed deployment of potential countermeasures would allow the US or another country under attack to target and engage missile defense systems in order to shoot down the missile.73

Michael Ellerman, a senior fellow at the IISS, based on the trajectory of ballistic missile development in other countries, noted that space launches do not and cannot play a decisive role in the development of long-range missiles. Furthermore, it is plausible that the DPRK’s missile launches actually were legitimately satellite launches, as claimed by the DPRK. The trajectory of the rocket and actual placement of the satellite in orbit, along with the prelaunch notification to international safety organizations, points to the DPRK actually attempting to

---

70 *Jane’s Intelligence Review*, “Watch this space – North Korea successfully launches Unha-3,” January 16, 2013.
73 *Jane’s Intelligence Review*, “Watch this space – North Korea successfully launches Unha-3,” January 16, 2013.
conduct satellite launches. The 1998 Taepodong-1’s trajectory was also consistent with this conclusion, as were those of the 2009 Unha-2 and April 2012 Unha-3 launches.\textsuperscript{74}

Ellerman acknowledged that satellite launches and ICBMs are similar in many regards—powerful rocket engines, payload separation mechanisms, inertial navigation and guidance units, and lightweight and strong airframes. However, there are also important differences between the two systems. First, a ballistic missile needs to have re-entry capabilities that protect the payload from heat and structural stress, which require special materials to be used in the missile—and which need to be tested and validated under realistic conditions.\textsuperscript{75}

Secondly, operationally, space launches are prepared over a period of days or weeks, waiting for ideal weather and checking and verifying subsystems and components. The process can be delayed and restarted. However, ballistic missiles must be able to reliably be used in a variety of less-than-ideal circumstances, with very little warning or preparation. This requires a much more rigorous validation scheme and extensive testing than has taken place during DPRK SLV launches.\textsuperscript{76}

While testing SLVs does assist in developing experience and data that could help in ICBM development, Ellerman believes that this information is of only limited use. Many of the key requirements of a ballistic missile cannot be tested during satellite launches, and many tests would have to be undertaken before a missile could be confidently given combat-ready status. Often, in fact, ballistic missiles have been converted into SLVs (by the USSR, China, and the US), not the other way around.\textsuperscript{77}

At the same time, the DPRK could in theory use the Unha-3 as the basis for a missile, though an ICBM based on the Unha-3 would way over 90 tons, thus too large and unwieldy to be deployed on a mobile launch platform. The DPRK would have difficulties concealing a silo launch site, and due to the DPRK’s geography, any silo would be close enough to the coastline that advanced military powers—like the US—could destroy them preemptively. Therefore, according to Ellerman, it is more likely that the DPRK would design a new missile entirely—such as the mock-ups of the KN-08 displayed during a military parade in April 2012—than use an SLV as an ICBM. If the KN-08 used more energetic propellants, it could have an intercontinental range; but, without testing, it is unknown if that is even a possibility.\textsuperscript{78}

\textbf{US, ROK, Japanese, and UN Responses to DPRK Launches}

\textsuperscript{74} Michael Ellerman, “Prelude to an ICBM? Putting North Korea’s Unha-3 Launch Into Context,” \textit{Arms Control Today}, March 2013.
\textsuperscript{75} Ibid.
\textsuperscript{76} Ibid.
\textsuperscript{77} Ibid.
\textsuperscript{78} Ibid.
Prior to the DPRK’s launch of a space vehicle in December 2012, Japan, the US, and South Korea all mobilized ballistic missile defense (BMD) capabilities to both guard against the potential DPRK threat and display a show of force:79

Japan has both land- and sea-based defences and is continuing to develop its BMD capabilities. The Japan Maritime Self Defense Force has four Kongo-class destroyers, each equipped with the Aegis Ballistic Missile Defence System. The US-developed system includes the SPY-1 search radar with an estimated range of 1,000 km, and the SM-3 Block 1A mid-course interceptor. This provides upper tier BMD coverage for the whole of Japan, designed to intercept a ballistic missile after the boost phase and before re-entry. Three Kongo-class destroyers – the Kongo, Myoko, and Chokai – were deployed in the East China Sea around Okinawa and the Sea of Japan ahead of December’s launch. Providing lower tier, point defence are 16 Patriot batteries, which are equipped with PAC-3 interceptors with a range of 15 km that are capable of engaging short- and medium-range missiles. Detection capability is provided by four new J/FPS-5 Early Warning 3D AESA Radars, as well as seven older FPS-3 sites that have been upgraded for the BMD role.

The ROK has less of a BMD capacity than Japan. While South Korea does have three KDX-3 destroyers with the Aegis System deployed, able to detect and track missiles, the ships only have SM-2 missiles, and can thus only intercept low-altitude threats. The ROK also has 48 Patriot systems with PAC-2 missiles on land, but an October 2012 ROK study found that the missile has an interception rate of less than 40% against short- and medium-range ballistic missiles (PAC-3s have a 92% success rate). The ROK’s strongest missile defense assets are two Israeli-supplied Green Pine radars, allowing the ROK to detect and track incoming missiles. These will likely be an important part of any future ROK missile defense network.80

The ROK reportedly deployed two KDX-III Aegis-deployed destroyers to track the December 2012 launch, but remains generally dependent on the US for missile defense abilities. The US deployed a Ticonderoga-class cruiser (the USS Shiloh) and three Burke-class destroyers (the USS Fitzgerald, McCain, and Benfold) off the Korean Peninsula in response to the DPRK’s launch plans. All of these ships have the Aegis Combat System and SM-2 and/or SM-3 interceptor missiles. Overall, the US has a TPY-2 radar deployed in northern Japan, the Army’s Air Defense Artillery regiments have four PAC-3 batteries in the ROK and 12 in Japan, and the 7th Fleet has nine Aegis-equipped vessels based near Japan.81

In response to the December 2012 test, UN Security Council Resolution 2087 was passed on January 22, 2013, adding six North Korean entities to the sanctions list – and further upsetting the DPRK, leading to further regional tensions.

It is probable that the DPRK tested critical technologies during the recent launches, such as increasing the size of propulsion, separation of the multi-staged propulsion devices, and altitude control.82 The improvements made to the Taepodong-2 apparent in the 2009 and 2012 tests show that the DPRK likely has the ability to improve upon current programs as well as build a new generation of ballistic missiles capable of reaching targets in the continental US.

---

80 Ibid.
81 Ibid.
There are reports that the DPRK has developed a more accurate, longer-range intermediate ballistic missile called the **Musudan** (also known as the **Nodong-B**, BM-25, **Taepodong-X**, and **Mirim**). The single-stage **Musudan** appears to be based on the design of the Soviet R-27/SS-N-6 missile, an intermediate-range, liquid propellant, submarine-launched ballistic missile deployed by Russia in the 1960s.³³

It appears that development began in the early 1990s. According to the NTI,³⁴

In 1992, a large contract between Korea Yon’gwang Trading Company and V.P. Makeyev Engineering Design Office of Miass, Russia was signed. The agreement stated that Russian engineers would go to the DPRK and assist in the development of the Zyb Space Launch Vehicle (SLV). Zyb is a term used by V.P. Makeyev for the R-027/SS-N-6. Later that year a number of Russian scientists and missile specialists were arrested while attempting to travel to Pyongyang. There are reports that many scientists and missile engineers were already working in the DPRK.

Reportedly, prototypes were developed in 2000 and it was first deployed as early as 2003 – though the ROK lists the **Musudan** as being deployed in 2007, when it was first displayed during a military parade. However, the October 2010 parade was the first time the missile was shown to Western audiences.⁸⁵

The range of the missile is disputed – Israeli sources identified North Korean SS-N-6-based missiles in Iran with a range of 2500 km, and American sources have reported a range of 3200 km with a payload of 500 kg.⁸⁶ Other sources claim a maximum range of 4000 km.⁸⁷ Assuming a range of 3200 km, the **Musudan** could hit any target in East Asia (including US bases in Guam and Okinawa) and Hawaii.⁸⁸

Some sources claim that Iran conducted surrogate flight tests of the **Musudan** in 2006 and 2007. It was reported in 2005 that the DPRK had sold 18 **Musudan** assembly kits to Iran. There is also limited evidence suggesting that North Korea tested the **Musudan** as part of its July 2006 missile tests. Furthermore, the **Musudan** was reportedly used as the **Unha**-2 SLV’s second stage, or could be used in future **Taepodong**-2 or -3 versions. While the **Unha**-2 failed in April 2009, the failure occurred after the effective firing of the second stage, indicating that the stage that potentially contained the **Musudan** was successful.⁸⁹

---

³⁸ Niksch, *North Korea’s Nuclear Weapons Development and Diplomacy*.
Although reports indicate that the design of any such missile is borrowed from a Russian submarine-launched missile, North Korea probably intends to transport and fire the missile using wheeled transport erector launchers (TEL) units or ship-based launchers. While it is uncertain whether it is operational, ROK intelligence sources believe the *Musudan* missile division has three regiments and is headquartered in Yangdok-kun, South Pyongan Province, about 80 km east of Pyongyang.

*The KN-08*

Mock-ups of the KN-08, also known as the DPRK’s road-mobile ICBM, were presented in April 2012 at a parade honoring Kim Il-sung’s 100th birthday. As only mock-ups have been seen, there are no photos of the real missile or any existence that one even exists – at least not in open source material. The missile was displayed on Chinese TELs that were too large for the KN-08 missile. If the missile was actually developed and produced, it would offer the DPRK a longer range than that of the *Nodong* (maximum 5,000 km), giving it a truly intercontinental reach.

There were reports that the DPRK tested an engine for the long-range KN-08 on February 11, 2013, one day before its third nuclear test. One ROK government source stated, “It appears that North Korea conducted the engine test aimed at extending the range of the KN-08 missile to over 5,000 kilometers.” If the North judged the test successful, it could start operationally deploying the rockets.

---

Figure VII.4: US Estimates of Primary North Korean Medium- and Long-Range Missiles

Figure VII.5: Estimates of DPRK *Hwasong* and *Nodong*Missile Range – Northeast Asia

Note: Distances are approximate.
DPRK Missile Facilities

Data on DPRK production and launch facilities for its missile programs are sparse, but some information is available. It is believed that the DPRK produces and/or stores chemicals, chemical precursors, and chemical agents in 12 factories and six major storage depots. The No. 125 Factory, the so-called Pyongyang Pig Factory in northwestern Pyongyang, reportedly produces Hwasong, Nodong, and surface-to-ship cruise missiles. Officials from Middle Eastern countries have reportedly visited the factory, but the extent of their tours is unknown. Additionally, Mangyongdae Electric Machinery Factory is another reported

---

95 Pinkston, The North Korean Ballistic Missile Program, p. 45.
The Evolving Military Balance in the Korean Peninsula and Northeast Asia

missile production facility located in the same general area of Pyongyang as the No. 125 Factory.96

The No. 7 Factory, located about five miles from the Electric Machinery Factory, is responsible for the production and testing of missile prototypes prior to the initiation of production at other plants.97 This facility is probably the same facility known as the “San’um-dong Factory” or “San’um-dong Missile Research Center.”98 The facility is under the Second Natural Science Academy, the research organization in charge of all weapons development in North Korea, working on missile design and development as well as the production of prototypes. The Academy likely draws upon human resources from other scientific institutions under the Academy of Sciences, but the extent of any such collaboration is unknown. The DPRK is also reported to have integrated their educational institutions into their missile programs.99

According to DPRK defectors, the Korea National Defense College in Kanggye, Chagang Province, has a “Rocket Engine Department,” and the college provides instruction on the “production, operation procedures, and launching of missiles.”100 North Korea’s top universities such as Kim Il Sung University, the Pyongsong College of Science, and Kim Chaek University of Technology also have programs in engineering and science that could be applied to rocket and missile development.101

The DPRK possesses a number of missile bases and launch facilities (see Figures VII.7). The Missile Division under the Ministry of the People’s Armed Forces commands at least 18 ballistic missile bases in the country, such as the Chiha-ri Missile Base in Kangwon Province and the Mayang Island Missile Base. Many of these bases likely have several alternative launch pads near the missile storage site, which in effect increases the number of locations from which they can launch missiles using mobile TELs.102

The DPRK had previously used a small, old launch facility in the northeastern part of the country near Musudan-ri for its launches, called the Tonghae Satellite Launching Ground. However, the DPRK began construction on a new facility close – Sohae, in Tongchang-ri – to the Chinese border in the Northwest in 2001, which was completed by January 2011.103

In contrast to the older Tonghae facility which has limited capabilities, the new installation in Sohae includes a movable launch pad with gantry, a missile assembly building, oxidizer and fuel storage, and a 10-story tall tower capable of supporting the DPRK’s largest ballistic missiles and SLVs. The height of the launch tower is unnecessary for any of the DPRK’s

96 Ibid.
99 Ibid.
100 Ibid.
101 Ibid.
102 Ibid.
Unha/Taepodong missiles or SLVs, which could indicate that the DPRK is looking to develop larger and more modern launch vehicles.

The facility incorporates R&D and support facilities, while Saneum-dong Weapons Research Lab and Yongbyon Nuclear Complex are both less than 50 miles away. Furthermore, the Sohae site can launch toward the South, reducing missile flight time to the ROK and Japan. The site is also obscured from direct sea or air observation. It was first used in April 2012 to launch the Unha-3 rocket; the December 2012 Unha-3 launch was also successfully conducted at this facility.104

A new Musudan-ri facility is also being developed, bigger than the Sohae facility, which should be operational by 2016-17.105

---

104 Ibid.
DPRK Air Defense and Counter-Space Capabilities

North Korea is said to have one of the densest air defense networks in the world, but its equipment is primarily Soviet-designed missiles and radars – either made in the USSR or licensed and produced in the DPRK – developed in the 1950s-1970s. The US has been working for decades to develop ways to defeat such weapons, using radar jamming, anti-radar missiles, and stealth technology; the B-2 and F-22 were designed specifically to evade this type of defense, and B-52s could take out the DPRK’s air defense system by firing
AGM-86 cruise missiles from beyond the range of DPRK defenses. The DPRK’s inventory includes the SA-2 Guideline, SA-6 Gainful, SA-3 Goa, SA-13 Gopher, SA-16 Gimlet, SA-4 Ganef, SA-5 Gammon, and the SA-17 Gadfly.\textsuperscript{106}

In his testimony before the Senate, DIA Director Ronald L. Burgess, Jr. also provided an overview of DPRK counter-space preparations.\textsuperscript{107}

North Korea has mounted Soviet-made jamming devices on vehicles near the North-South demarcation line that can disturb Global Positioning System (GPS) signals within a 50-100 kilometer (km) radius and is reported to be developing an indigenous GPS jammer with an extended range of more than 100 km.

The DPRK’s satellite program has been discussed previously in this chapter.

\section*{ROK Missile Development}

For the last thirty years, the United States has discouraged South Korea from developing long-range ballistic and cruise missiles. In a 1979 memorandum of understanding with the United States, reiterated in 1990, South Korea voluntarily pledged not to develop ballistic missiles with ranges exceeding 180 kilometers in return for technical assistance from the US. However, Seoul has sought to raise that limit since late 1995, resulting in several revisions of the ROK-US agreement.\textsuperscript{108}

Recently, the ROK has deployed a series of cruise missiles, the maximum range of which is 1500 km – capable of reaching as far as Beijing and Tokyo. In addition to their cruise missile program, the ROK has successfully launched a series of communication satellites in the last decade, meaning that, while it does not possess a known ballistic missile program, it likely possesses the know-how to produce a ballistic missile.

\textbf{The Early Program – The NHK Program}

South Korea has made attempts to develop and expand its offensive ballistic missile capabilities since the 1970s. In December 1971, ROK President Park Chung Hee issued a directive to develop a short-range ballistic missile aimed at countering the ballistic missile threat from North Korea. In 1975 the ROK successfully reverse-engineered the US Nike Hercules surface-to-air missile (SAM) system, which could also be used in a surface-to-surface capacity.\textsuperscript{109}

Named the NHK-1 (also known as the \textit{Paekkom}-1, \textit{Baekgom}-1 and \textit{Hyunmu}-1), it had a range of only 150 km (93 miles).\textsuperscript{110} Development of the NHK-1 continued into the late 1970s

\begin{footnotes}
\end{footnotes}
with a successful test in September 1978, however, fearing an arms race on the Korean Peninsula and in greater East Asia, the US became leery of a ROK missile program.

Under pressure from the US, the ROK agreed in 1979 to restrict its missile range to 180 kilometers with a 500 kg max payload in return for US technical support for ROK missile systems. In 1983, the ROK developed the NHK-2, incorporating improved technology and a range of 180 km (112 miles), which could be easily extended to 250 km (155 miles) – but at the cost of breaking the 1979 agreement.

In 2006 it was reported that the ROK would keep the NHK-2 missile in service until 2010; currently it is not known whether or not the missile has been decommissioned.

**The 2001 MTCR and the Hyunmu-3 Cruise Missile**

Seoul responded to advances in DPRK missile capabilities by notifying Washington in 1995 that it wished to adjust the restrictions agreed to in 1979. After five years of consultations, the US backed the ROK’s joining of the Missile Technology Control Regime (MTCR) in March 2001, a regime that supersedes the 1979 US agreement. The MTCR seeks to limit the risks of proliferation of weapons of mass destruction by controlling exports of goods and technologies that could make a contribution to delivery systems for such weapons (other than manned aircraft). In this context, the regime limits the range of rockets and UAVs with a payload over 500 kg to 300 km. The MTCR does not, however, restrict the development of missiles as long as the warhead does not weigh more than 500 kg.

As a result, the ROK began focusing on the development of cruise missiles such as the Hyunmu-3 series, capable of delivering payloads below 500 kg to targets deep within the DPRK and beyond. Developed indigenously in the ROK, the Hyunmu-3 system is reportedly similar in structure and guidance technology to the US Tomahawk but with a shorter range. It uses an inertial navigation system and technology that matches map images in its computer memory to the features on the ground below it, giving the missile the ability to hit within three meters of its target.

The Hyunmu-3A deployed in 2006 with a range of 500 km and is capable of striking Pyongyang – but not the DPRK’s long-range missile sites, including the Musudan-ri site in North Hamgyeong Province, located more than 300 km from Seoul. In early 2009, the

---

113 Bermudez Jr., “A History of Ballistic Missile Development in the DPRK.”
118 Ibid.
119 Ibid.
ROK deployed the *Hyunmu*-3B, an improvement of the 3A model, which has a range of 1,000 km, capable of reaching as far as Beijing and Tokyo as well as hitting key targets throughout the DPRK.\(^{122}\)

The most advanced missile in the ROK arsenal is the *Hyunmu*-3C, which has supposedly just entered into the production phase. In July 2010, it was reported that the ROK had begun manufacturing the *Hyunmu*-3C with a range of up to 1,500 km (937 miles), capable of reaching parts of China, Japan, and Russia.\(^{123}\) If these reports are true, the successful indigenous development of a long-range cruise missile would put the ROK in the company of only the US, Russia, and Israel as countries that have developed cruise missiles with ranges of more than 1,500 km.\(^{124}\)

Shin In-kyun, a military expert who heads the Korea Defense Network, told *The Korea Herald* that the missile with a 450 kg warhead “measures 6 meters in length and 53–60 centimeters in diameter and weighs 1.5 tons. It can hit targets in all nuclear facilities and major missile bases in the DPRK with high precision (a margin of error of less than 2 meters).”\(^{125}\)

However, the development of the long range, highly accurate *Hyunmu*-3 may not have a favorable effect on the force balance on the Peninsula. According to Oliver Bloom of CSIS:\(^{126}\)

> The South Korean cruise missile development certainly won’t fundamentally alter the military balance on the Korean Peninsula, nor will it give the South Koreans an incentive to launch a preventive strike (especially given the number of North Korean missiles and chemical weapons aimed at Seoul), but the new missile certainly may give South Korea another tool in its box in handling North Korean contingencies. If the situation on the peninsula deteriorated to open conflict, South Korea would have an independent means of accurately striking distant North Korean targets without risking aircraft. What’s more, the accurate cruise missiles would give South Korea a means to preempt an imminent North Korean attack, were such a thing to develop.

From 2002-2004, the ROK purchased 110 300 km-range US Army Tactical Missile Systems.\(^{127}\)

**Further Missile Limitation Agreement Revisions**

In October 2012, due to the increased provocations of the DPRK and the deteriorating security situation on the peninsula, the US and the ROK agreed on an increase to the range limits on ROK ballistic missiles. The negotiations were initiated in September 2010, in the

---

\(^{122}\) Ibid.


\(^{126}\) Oliver Bloom, “South Korea Develops New Long-range Cruise Missile.”

\(^{127}\) “South Korea,” Nuclear Threat Initiative, January 2013. nti.org/country-profiles/south-korea.
wake of the Cheonan and Yeonpyeong Island incidents, to allow the ROK enhanced deterrence capabilities against the DPRK.  

According to the new agreement, the ROK can deploy ballistic missiles with a payload of up to 500 kg and range of up to 800 km (500 miles), which is enough to reach any target in the DPRK from the ROK’s central region, is out of firing distance of the DPRK’s long-range artillery and KN-02 ballistic missile, while simultaneously does not overly threaten China or Japan. However, some areas of China and Japan will be in reach of the ROK’s new extended missile range.

At shorter ranges, the ROK can also put up to two tons of warheads on ballistic missiles. Previously, the ROK was unable to deploy ballistic missiles with a payload of 500 kg beyond a range of 300 km.

The new agreement also gives the ROK the option to use drones that can carry up to 2.5 tons of weapons and other equipment; prior to the revised agreement, the ROK could not deploy drones carrying more than half a ton of equipment and weapons. The ROK began using low-flying reconnaissance drones in 2002.

There were no changes to the maximum load weight restrictions for cruise missiles and drones flying less than 300km, or those that carry less than 500kg. Also, there remain no restrictions on research and development of missiles and UAVs that go beyond the scope of the current missile guidelines.

Two days after the ROK announced the new missile deal, the DPRK said it had missiles that could hit US bases in “Japan, Guam and the US mainland.”

ROK Missile Defense and Space

South Korea has been increasing its missile defenses and space systems to better defend against potential DPRK attacks.

---

**Missile Defense**

The ROK is also rushing to improve its ballistic missile defenses (BMDs) and create a new force to detect and intercept DPRK ballistic missiles, focusing on a low-tier system. According to *Defense News*, this capability is planned to cost a total of 300 billion won ($214 million).\(^{134}\)

Seoul plans to buy new radars which can detect objects up to 1,000 kilometers (600 miles) away for the new system, which will put the North’s missiles under close watch around the clock, they said . . . North Korea has short-range Scuds and Rodongs with a range of 1,300 kilometers, while actively developing longer-range Taepodong missiles that could reach the United States.

. . . South Korea in 2007 launched its first Aegis destroyer, which was finally deployed for operational use in December 2008 . . . The King Sejong, the $1 billion, 7,600-ton KDX-III destroyer, adopts the US-built Aegis system that allows a ship to combat multiple surface, underwater and aerial threats . . . South Korea plans to deploy a second Aegis destroyer and a third for operational use in 2010 and 2012, according to its navy.

After the December 2012 DPRK missile test and the February 2013 nuclear test, along with the October 2012 revision of the missile guidelines previously discussed, the ROK is accelerating BMD efforts. Having decided not to join the US multi-layered antimissile program, the ROK is building the Korean Air and Missile Defense (KAMD) as a low-layer defense system more appropriate for the situation on the Korean peninsula, able to shoot down missiles either using Aegis systems on destroyers or Patriot systems on land. The ROK spent $909 million buying 48 Patriot Advanced Capability 2 (PAC-2) systems from Germany in 2008, but the interception success rate of this system is below 40%. To achieve an interception rate of above 70%, the ROK is quickly moving to acquire PAC-3 systems.\(^{135}\)

One ROK analysis of the KAMD by Park Chang-kwoun of the Korea Institute for Defense Analyses stated,\(^{136}\)

During their Foreign and Defense Ministers’ Meeting held on June 14th [2012] in Washington, D.C., the ROK and the U.S. agreed to explore ways to strengthen “comprehensive and combined missile defenses” in response to North Korea’s growing missile capabilities. The two nations aim to strengthen their combined response capabilities against the North Korean missile threat through effective interworking system between the Korean Air and Missile Defense (KAMD) and the missile defense system of the United States Forces Korea (USFK). Establishing the ROK-U.S. combined missile defense system against the North Korean missile threat is an imperative measure to guarantee the security and reinforce the deterrence capability of the ROK.

. . . KAMD is designed to be a Korea-specific missile defense system that only intends to intercept incoming hostile missiles at the low-altitude (10-30km) for the purpose of local defense.

---

The U.S., on the other hand, is developing a comprehensive missile defense system that includes high-altitude missile defense in an integrated manner with its European allies and Japan. As an ally of the U.S., South Korea also seeks to join and cooperate with the U.S.-led regional missile defense system.

….The development of the KAMD would be achieved in a gradual manner, considering the limited defense budget and technological capabilities of South Korea. The U.S. is committing an astronomical amount of budget to the tune of 1.5 trillion dollars into building its missile defense system for the next decade—yet, there have been reports that there still remain a number of technical challenges. In fact, South Korea has only limited defense budget that can be devoted to the establishment of the missile defense system.

….South Korea is planning to launch its Air and Missile Defense cell (AMD-cell), a missile defense command-and-control center, by the end of this year and to deploy its own missile defense system based on surveillance platforms such as Green Pine Radars and SPY-1D in Aegis Combat System and interception platforms such as PAC-2 Gem and SM-2 Block III. The Green Pine Radars, ballistic missile early warning radars, will be acquired from Israel by the end of this year. In addition, South Korea’s indigenous antiaircraft missile, the Cheolmae-II will be added to the ballistic missile interception system.

If defense budget permits in the future, South Korea would be able to further strengthen interception capabilities of the KAMD by acquiring the PAC-3 and the SM-6, which is currently under development. Moreover, the ROK will begin a task of improving the Cheolmae-II. Since key components of the current KAMD interception system— the PAC-2, the SM-2, and the Cheolmae-II—were not originally developed as ballistic missile interception systems and have fragmentation warheads, the KAMD has a certain limitation in performing ballistic missile interception. Consequently, acquisition of new interception systems including the PAC-3 and the SM-6 is expected to bolster South Korea’s ballistic missile interception capabilities.

Meanwhile, the USFK operates a Theater Missile Operations cell (TMO-cell) and has ballistic missile interception systems including the PAC-2 and the PAC-3 deployed in its major military bases. These systems allow the USFK to be able to respond to North Korean ballistic missile threats from the early stages backed by various satellite systems of the U.S. forces. Currently, the missile defense system of the USFK is designed for effective defense of the U.S. military installations. In case of contingency, however, the missile defense capabilities of the U.S. forces would be further improved if U.S. Aegis destroyers are deployed to South Korea’s coastal areas and complement the current missile defense system.

It has also been reported that the ROK has looked into buying Israel’s Iron Dome to protect the approximately 11 million people who live in Seoul, only 35 miles from the DMZ. South Korea first offered to buy Iron Dome in January 2012 if Israel bought South Korean fighter jets in return – but Israel instead decided to buy from Italy. In November 2012, the ROK offered South Korean ships, potentially to hold Israel’s advanced missile systems, but no deal was announced.

Furthermore, Iron Dome may not be ideal for the ROK situation. The DPRK has such an extensive artillery and short-range rocket arsenal – the DPRK could fire 500,000 artillery rounds on Seoul in the first hour of a conflict\(^\text{137}\) – in addition to longer-range missiles, that it would take far too many Iron Dome batteries to protect Seoul sufficiently, unless the system was focused on just a few high-value targets. Each Iron Dome battery built to shoot down

missiles costs approximately $50 million, and the interceptor rockets cost $50,000-$80,000 each.\textsuperscript{138}

\textbf{Space}

The ROK has potential ballistic capabilities in its successful and expanding space program. Seoul began development of its own space program in the 1990s, including the development of a space-launch vehicle (SLV). After numerous delays, the ROK launched the two-stage Korea Space Launch Vehicle-1 (KSLV-1) rocket on August 25, 2009. The launch was intended to place an earth and atmospheric monitoring satellite – the \textit{Science and Technology Satellite 2} (STSTAT-2) – into orbit, but after a successful launch, the satellite failed to successfully re-enter the atmosphere.\textsuperscript{139} The partial success of this launch raised concerns that South Korea had sufficient technology for a long-range ballistic missile system that could deliver WMD payloads, especially given that the US and ROK were discussing changing the missile limitation guidelines that would allow missiles with a range of no more than 800 km, as previously discussed.\textsuperscript{140}

Following the December 2012 successful DPRK satellite launch, the ROK successfully launched a KSLV-1 rocket and put a satellite into space on January 30, 2013. The launch took place from Naro Space Center, and the rocket had been designed in partnership with the Khrunichev State Space Science and Production Center of Russia. The ROK has already begun work on an entirely domestically developed system with a projected 75 ton rocket engine, to be produced by 2021.\textsuperscript{141}

The implications of this launch are varied. While it proves that the ROK could successfully deploy ballistic missiles, perhaps acting as a deterrent to the North, the DPRK could also use the ROK’s new capabilities to justify its own program. Because the two launches were so similar, the DPRK will use the ROK’s launch as an excuse to ignore any UN sanctions, potentially claiming unfair treatment despite the two countries’ similar stated intentions of peaceful space exploration. Given the ROK’s successful January 2013 launch, it is possible that the ROK could work to couple their space program with a ballistic missile program to counter the DPRK threat apparent in its \textit{Nodong}, \textit{Musudan}, and \textit{Taepodong} missile programs.\textsuperscript{142}

\textbf{Conclusions}

It is important to stress that advanced forms of conventionally-armed ballistic and cruise missiles can be used to threaten or attack targets and do so with strategic effect. It is unclear how accurate the DPRK’s missiles are, and it seems doubtful that Pyongyang now has a real-world terminal guidance capability to use conventionally-armed ballistic and cruise missiles effectively against critical point targets. As long as the DPRK does not have such “smart” warheads, conventionally-armed missiles are largely terror weapons. Once the DPRK does

\textsuperscript{138} Kevin Baron, “Why doesn’t Seoul have Iron Dome?” \textit{Foreign Policy – The E-Ring}, April 9, 2013.
\textsuperscript{141} “South Korea Launches Space Rocket: Pyongyang Silent,” NKNEWS.org, January 30, 2013.
\textsuperscript{142} Ibid.
have this capability, however, they potentially could have “weapons of mass effectiveness,” able to destroy high-value and critical infrastructure targets with conventional warheads.

The US does have conventionally-armed, precision-guided, deep-strike SRBMs, however, and both the US and the ROK have strike aircraft and precision-guided air-to-surface weapons that targeting patterns in the Balkans conflict and both Gulf Wars show can hit critical infrastructure targets with strategic effect. This could lead to new patterns of escalation where the US and ROK use precision guided air-to-surface, surface-to-surface, and cruise missiles to destroy critical DPRK targets, or threaten to use such weapons to deter Pyongyang. The US also can deliver such weapons with “stealth” strike aircraft and bombers, and Japan and the ROK are likely to acquire strike aircraft with some “stealth” capability. Alternatively, the US and ROK might threaten or initiate the use of precision-guided air-to-surface, surface-to-surface, and cruise missiles to destroy critical DPRK targets or to halt a DPRK conventional attack.

As is discussed in Chapters 8 and 9, however, missile programs are only part of a far wider range of important issues in assessing the Korean balance:

- The DPRK has implosion fission weapons. The numbers, weapons yields, and ability to create reliable bombs and missile warheads are uncertain, but it seems likely it either has warheads or is rapidly moving toward acquiring them. It almost certainly has programs to develop boosted and thermonuclear weapons, but their status is unknown.

- The ROK had a covert nuclear weapons program that it halted after quiet negotiations with the US. This, along with its extensive civilian nuclear power industry, gives the ROK a significant nuclear breakout capability if it should reverse its decisions.

- Japan is unlikely to have nuclear weapons programs but has all of the technology and material necessary to rapidly acquire them and develop boosted and thermonuclear weapons.

- The US and China have nuclear-armed aircraft and ICBMs, IRBMs, MRBMs, and SRBMs with boosted and thermonuclear weapons. The DPRK may have long-range tactical and theater missiles with implosion nuclear weapons.

- The DPRK is a major chemical weapons state, and probably has advanced chemical warheads and bombs. China may have stocks of chemical weapons. There is no way to estimate the size, type, and lethality/effectiveness of their relative stockpiles, or doctrine and plans for using them. It should be noted, however, that relatively crude mustard gas weapons played a decisive role in area denial and disruption of Iranian forces in the final phase of the Iran-Iraq War in 1988, and that stocks of persistent nerve gas and so-called 4th generation chemical weapons are possible. Although Seoul neither confirms nor denies the existence of a CW program, the ROK is suspected to have a chemical weapons program and may have covert stocks of chemical weapons.
The DPRK is strongly suspected to have a biological weapons program and may have stocks of such weapons. These could range from basic weapons types to genetically modified types. China’s program is not discussed in unclassified official statements. The ROK may have a program. It should be noted that China, Japan, the DPRK, the ROK, and the US all have advanced civil biological, food processing, chemical processing, and pharmaceutical facilities that can be adapted to both chemical and biological weapons development and production. All have significant capability for genetic engineering of biological weapons. All would have to develop advanced biological weapons for test purposes to conduct an effective biological defense program.

No public details are available on the efforts of any power to develop small or specialized chemical, biological, radiological, or nuclear weapons for covert delivery or potential transfer to non-state actors and third-party countries.

China and the DPRK have large numbers of conventionally-armed long-range missiles capable of hitting targets in the ROK. The nature of their conventional warheads is not clear, and this is critical since unity conventional warheads have limited lethality and terminal guidance is needed to provide the accuracy necessary to strike at high-value, rather than broad-area targets. China and the DPRK may have, and are certainly developing, ballistic and cruise missiles with some form of terminal guidance.

The US has large numbers of precision-guided long-range cruise missiles for air and sea launch and precision-guided long-range multiple rocket launchers. The ROK is also developing an advanced cruise missile program of its own. US stealth aircraft can deliver precision-guided weapons at stand-off ranges from most Chinese and DPRK surface-to-air missiles with the exception of the S300/S400 series. China is developing long-range anti-ship ballistic missiles that can strike large surface ships like US carriers at long distances. These potentially are “weapons of mass effectiveness” that can be used in devastating strikes against critical facilities and infrastructure without the use of WMD warheads.

The US, Japan, and the ROK have some ballistic missile defense capability and are working together to develop wide-area theater ballistic missile defense systems. China has the Russian S300/S400 series of advanced surface-to-air missile defenses and is almost certainly seeking more advanced missile defense capabilities. The DPRK lacks such capabilities but is almost certainly seeking them. The balance of air and missile defense capabilities plays a critical role in limiting the offensive capabilities of the opposite side and reducing the risk in using one’s own missiles. This makes air and missile defenses the equivalent of a major offensive weapon.

China, the US, the ROK, and possibly the DPRK all have advanced cyber warfare capabilities. China has some anti-satellite capability and possibly some form of EMP weapon. These, too, are potential “weapons of mass effectiveness” that can
be used in devastating strikes against critical facilities and infrastructure without the use of WMD warheads.

Current assessments of the Korean balance tend to focus on the DPRK’s nuclear programs, but this list shows such programs are only part of a far more complex and rapidly evolving mix of current and potential capabilities to deliver weapons of mass destruction or mass effectiveness. The threat such weapons may be used also cannot be limited to the Korean Peninsula. It already extends to Japan and the US bases there, as well as potentially to Alaska and the Pacific coast of the US. Potential US reactions again raise the issue of what China’s response would be and whether a crisis could escalate to the point where the US-Chinese strategic and nuclear balance became relevant – a threat that could force Japan to make hard choices of its own.

The range of uncertainties on this list also raises two key issues for DPRK and Korean Peninsula arms control:

- One is the so-called “Nth weapon paradox.” It may be possible to reduce a nation’s nuclear weapons, but it is probably impossible to be certain it does not retain at least a few. The problem for arms control is that the smaller the stockpile, the more it has to be used in ways that threaten absolutely critical targets like major population centers rather than a given military target. Arms reductions can easily escalate targeting.

- The second is the “diversion effect”: the risk that nuclear controls can drive states even more toward advanced biological and chemical weapons. Advances in biotechnology have made control regimes virtually impossible, as well as vastly increased the potential lethality of biological weapons to levels beyond that of even boosted and thermonuclear weapons.

It is also clear from this list that the nuclear threat is only part of the equation. The DPRK has long been a chemical weapons power. It is believed to have active biological weapons programs, and it clearly has long-range missile programs that can target Japan and anywhere in the ROK. These can potentially be armed with a range of CBRN warheads, but no meaningful unclassified evidence exists of the range of such warheads or their lethality. The same is true of DPRK bombs and rocket warheads. This means that CBRN escalation could occur at a wide range of unpredictable levels, including asymmetric, covert, and terrorist attacks. Moreover, the DPRK is already acquiring missile engines and boosters that will give it ICBM capabilities to attack targets in the US.
VIII. Korean WMD Forces

The two Koreas differ sharply in their political and military need for weapons of mass destruction and missiles. South Korea is now a global economic power fully integrated into the international system. North Korea is close to a failed state in terms of its economy, and it needs nuclear weapons and missiles for both political prestige and leverage in negotiating with the US and its neighbors.

The ROK has examined both nuclear and missile options. It has the capability to create nuclear weapons and possesses a sound base of nuclear technology to build upon. It also can almost certainly design and build cruise and ballistic missiles that can accurately reach any target in the DPRK – in a relatively short period of time. It has all of the technology and industrial base to design and build advanced chemical and biological weapons. This gives the ROK a near breakout capability to compete with North Korea if it chooses to do so. So far, however, it has chosen to rely on the US for extended deterrence and has focused more on deploying advanced air and missile defense systems than offensive capabilities.

The DPRK, in contrast, lacks anything like the ROK’s resource and technical base. Nevertheless, it is a long-standing chemical weapons power and has tested three nuclear devices – albeit with mixed success. It is actively developing long-range missiles and almost certainly has researched biological weapons and has the capacity to build them. So far, it has not seriously modernized its air defenses or shown that it plans, or is even able, to buy and deploy missile defenses.

Nuclear weapons and long-range missiles offer North Korea the ability to pressure or intimidate its neighbors. They give international status, they deter ROK and US counterattacks and escalation, and they are a cheaper alternative than trying to compete with the ROK and US in modernizing conventional forces. They also give Pyongyang a strong incentive to retain and expand its asymmetric capabilities. As the 2012 Japanese Defense White Paper notes, “North Korea seems to maintain and reinforce its so-called asymmetric military capabilities by developing weapons of mass destruction (WMD) and ballistic missiles and by maintaining large-scale special operation forces.”

An ROK government report adds, “The development of asymmetric capabilities seems to serve three objectives: to secure military superiority over others, to have an effective bargaining chip, and to promote internal unity.”

US Director of National Intelligence James Clapper reported to the Senate in March 2013, North Korea’s nuclear weapons and missile programs pose a serious threat to the United States and to the security environment in East Asia, a region with some of the world’s largest populations, militaries, and economies. North Korea’s export of ballistic missiles and associated materials to several countries, including Iran and Syria, and its assistance to Syria’s construction of a nuclear reactor, destroyed in

---

2007, illustrate the reach of its proliferation activities. Despite the Six-Party Joint Statements issued in 2005 and 2007, in which North Korea reaffirmed its commitment not to transfer nuclear materials, technology, or know-how, we remain alert to the possibility that North Korea might again export nuclear technology.

North Korea announced on 12 February that it conducted its third nuclear test. It has also displayed what appears to be a road-mobile ICBM and in December 2012 placed a satellite in orbit using its Taepo Dong 2 launch vehicle. These programs demonstrate North Korea’s commitment to develop long-range missile technology that could pose a direct threat to the United States, and its efforts to produce and market ballistic missiles raise broader regional and global security concerns.

Because of deficiencies in their conventional military forces, North Korean leaders are focused on deterrence and defense. The Intelligence Community has long assessed that, in Pyongyang’s view, its nuclear capabilities are intended for deterrence, international prestige, and coercive diplomacy. We do not know Pyongyang’s nuclear doctrine or employment concepts. Although we assess with low confidence that the North would only attempt to use nuclear weapons against US forces or allies to preserve the Kim regime, we do not know what would constitute, from the North’s perspective, crossing that threshold.

This mix of political and military factors has made the DPRK’s nuclear programs – and efforts to acquire nuclear weapons and long-range ballistic missiles – a source of concern, negotiating efforts, and arms control attempts for the better part of two decades. Despite these efforts, the DPRK became the world’s eighth atomic power when it conducted an underground nuclear weapons test in October 2006, and it currently continues both in its nuclear weapons and long-range missile programs.

It should be stressed, however, that the DPRK’s nuclear programs are only part of this aspect of the military balance. Weapons of mass destruction include chemical, biological, radiological, and nuclear (CBRN) weapons. The DPRK reportedly possesses a sizable stockpile of chemical and, possibly, biological weapons as well as the ability to mount them on conventional and unconventional delivery systems. It is also important to note that the balance also includes the CBRN weapons of outside actors like the United State and China, which may be a reason why the ROK has chosen (or been coerced) to maintain little, if any, CBRN stockpiles relative to the DPRK.

**DPRK Chemical and Biological Developments**

While Pyongyang openly declares itself to be a nuclear and missile power, it denies possessing chemical or biological weapons or agents. The DPRK acceded to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (BWC) in March 1987, but not to the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction (CWC).\(^\text{146}\)

A wide range of sources raise serious doubts about such DPRK denials. A 2000 Department of Defense (DoD) report to Congress stated,\(^\text{147}\)

---


We assess North Korea is self-sufficient in the production of chemical components for first generation chemical agents. They have produced munitions stockpiles . . . of several types of chemical agents, including nerve, choking, blister, and blood. We assess that North Korea has the capability to develop, produce, and weaponize biological warfare agents, to include bacterial spores causing anthrax and smallpox and the bacteria causing the plague and cholera.

The Nuclear Threat Initiative reports that,\(^{148}\)

the DPRK is thought to be among the world’s largest possessors of chemical weapons, ranking third only after the United States and Russia, who are working to destroy their Cold War caches.[1] In its most recent assessment (2010), the South Korean Ministry of National Defense (MND) estimated the DPRK possesses between 2,500 and 5,000 metric tons of chemical weapons, including phosgene (choking), hydrogen cyanide (blood), mustard (blister), and sarin (nerve agent).

As long as the balance of conventional forces continues to be unfavorable for the DPRK, chemical weapons are likely to remain part of DPRK military strategy, and it seems likely that it has developed at least some biological agents.

There has been considerable debate among government officials and scholars as to whether or not the DPRK has the ability to put nuclear, biological, and/or chemical weapons on their missiles, especially on any potential ICBMs. While the country almost certainly does possess all the components – all three weapons types, as well as missiles – it is unlikely that the missiles could be equipped with WMD:\(^{149}\)

For warheads armed with biological, chemical, and nuclear weapons, verification of their functionality is a must. During flight, warheads suffer extreme mechanical loads, vibrations, accelerations, wide temperature ranges, and pressure differences from near vacuum to extreme dynamic pressures at reentry. Chemical and biological agents are highly sensitive to temperatures, as are nuclear weapons. A nuclear weapon is a complex mechanical device, and the ejection mechanisms of biological and chemical weapons are complex, as well.

The same is true for the respective detonators and fuzes. The functionalities of these devices can only be proven under real conditions, thus requiring flight tests. No test flights with nuclear, biological, or chemical warheads in North Korea are known. The functionality and reliability of these weapons is therefore unknown, even to the North Koreans. If these warheads exist, either they have been imported from Russia or China, which seems highly unlikely, or they are unlikely to perform well once launched.

DPRK Chemical Weapons

A number of sources indicate that the DPRK produced its first experimental chemical weapons during the late 1950s and early 1960s in the wake of the Korean War.\(^{150}\) Since then,


\(^{149}\) Markus Schiller, Characterizing the North Korean Nuclear Missile Threat, RAND, 2012, p. 65.

\(^{150}\) An NTI summary history indicates that, “In the aftermath of the Korean War and in light of the perceived nuclear threat from the United States, North Korea sought a less costly alternative to nuclear weapons…An indigenous chemical industry and chemical weapons production in North Korea have their roots in the ‘Three Year Economic Plan’ that spanned the years from 1954 to 1956, the period immediately following the Korean
their chemical weapons program has increased in scale and lethality, and the DPRK now ranks among the world’s largest possessors of chemical weapons. Virtually all the fire support systems in the DPRK inventory could deliver chemical agents and be employed in offensive military operations. The DPRK is one of only six countries\textsuperscript{151} that has neither signed nor acceded to the Chemical Weapons Convention and is not expected to do so in the near-term due in part to the intrusive inspection and verification requirements mandated by the agreement.\textsuperscript{152}

**Western Estimates of DPRK Stockpiles and Capacity**

According to a 2006 unclassified CIA report, the DPRK is believed to possess a sizable stockpile of chemical weapons. Since 1989, it has had the ability to indigenously produce bulk quantities of nerve, blister, choking, and blood chemical agents as well as a variety of different filled-munitions systems.\textsuperscript{153}

The Nuclear Threat Initiative (NTI) provides similar data, alleging the DPRK’s chemical arsenal to include four of the five major classes of chemical warfare (CW) agents, including phosgene (choking), hydrogen cyanide (blood), mustard (blister), and sarin (nerve agent). North Korea does not appear to possess nervous system incapacitants such as BZ. Nerve agents (i.e., Sarin and VX) are believed to be the current focus of Korean CW production.\textsuperscript{154}

Additionally, GlobalSecurity.org estimates that the DPRK may also produce tabun and adamsite.\textsuperscript{155} However, it may require imports of some specific precursors to produce nerve agents that are relatively more difficult to fabricate than the first generation blister, blood and

---

\textsuperscript{151} Angola, Egypt, Somalia, South Sudan, and Syria are the other countries that have no signed the treaty; Burma and Israel have signed but not yet ratified it.


\textsuperscript{153} US Central Intelligence Agency, “Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July through 31 December 2006.”

\textsuperscript{154} North Korea [Chemical],” Nuclear Threat Initiative, February 25, 2013.

choking agents.\textsuperscript{156} The International Crisis Group (ICG) and IISS also provide estimates of possible DPRK CW agents.

Other reports indicate that the DPRK appears to have increased its CW agent production capacity in the last two decades and has been able to develop and deploy a variety of delivery systems. The country’s arsenal includes thousands of artillery of various calibers and hundreds of forward-deployed *Hwasong*-5/-6 missiles and *Frog*-5/-7 missiles capable of being fitted with chemical warheads.\textsuperscript{157} According to defector accounts, the DPRK’s long-range missiles such as the *Nodong* and other ballistic rockets and artillery pieces with calibers larger than 80 mm are capable of delivering CW agents, and beginning in 2002 the DPRK began to substantially increase the number of long-range multiple rocket 280 mm and 320 mm launching systems near the DMZ.\textsuperscript{158}

The possible range of DPRK chemical weapons is shown in Figure VIII.1

![Figure VIII.1: DPRK Possible CW Agents](image-url)

<table>
<thead>
<tr>
<th>AGENT</th>
<th>AGENT ID</th>
<th>MAJOR EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blister Agents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Choking Agents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosgene</td>
<td>CG</td>
<td>Coughing, blurred vision, shortness of breath, nausea, pulmonary edema, heart failure, death.</td>
</tr>
<tr>
<td>Diphosgene</td>
<td>DP</td>
<td>Coughing, blurred vision, shortness of breath, nausea, pulmonary edema, heart failure, death.</td>
</tr>
<tr>
<td><strong>Vomiting Agents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adamsite</td>
<td>DM</td>
<td>Coughing, severe headache, muscle spasms, chest pains, shortness of breath, nausea, vomiting.</td>
</tr>
<tr>
<td>Vomiting Agent</td>
<td>DA</td>
<td>Headache, nausea, vomiting, diarrhea, abdominal cramps.</td>
</tr>
<tr>
<td>Chloropicrin</td>
<td>PS</td>
<td>Coughing, severe skin irritation on contact, corneal edema and liquefaction of the cornea, pulmonary edema.</td>
</tr>
<tr>
<td>Tear Gas</td>
<td>CN</td>
<td>Tears, coughing, mucus, burning in the nose and throat, disorientation,</td>
</tr>
</tbody>
</table>

\textsuperscript{156} John Chipman, *North Korea’s Weapons Programmes*, IISS, January 2004, p. 49.

\textsuperscript{157} North Korea [Chemical],” Nuclear Threat Initiative, February 25, 2013.

\textsuperscript{158} Ibid.
### Korean Estimates of DPRK Stockpiles and Capacity

Official reports and testimonies from North Korean defectors are uncertain, but most agree with the ROK Ministry of National Defense (MND), which in its most recent assessment in 2010 indicated that the DPRK could possess between 2,500 and 5,000 metric tons of chemical weapons (see Figure VIII.2).\(^{159}\) The ROK also estimates that the DPRK is capable of producing 12,000 metric tons.\(^{160}\)

Kwon Yang-Joo of The Korea Institute for Defense Analyses (KIDA) agreed with this analysis in an October 2010 report, stating that the DPRK was capable of producing “up to 12,000 tonnes of chemical weapons,” which could “contaminate about 2,500 square kilometres (950 square miles), four times the area of Seoul.”\(^{161}\) This stockpile is not believed

![Table of Chemical Weapons](image-url)

<table>
<thead>
<tr>
<th>Chemical Agent</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tear Gas (CS)</td>
<td></td>
<td>Tears, coughing, mucus, burning in the nose and throat, disorientation, dizziness, restricted breathing, burning of the skin.</td>
</tr>
<tr>
<td>Cyanide (Hydrogen Cyanide/Cyanogen Chloride)</td>
<td>ANCK</td>
<td>Rapid breathing, dizziness, weakness, headache, nausea, vomiting.</td>
</tr>
<tr>
<td>Tabun (GA)</td>
<td>Nerve Agent</td>
<td>Runny nose, watery eyes, rapid breathing, nausea, unconsciousness, paralysis, respiratory failure, death.</td>
</tr>
<tr>
<td>Sarin (GB)</td>
<td>Nerve Agent</td>
<td>Runny nose, watery eyes, rapid breathing, nausea, unconsciousness, paralysis, respiratory failure, death.</td>
</tr>
<tr>
<td>Soman (GD)</td>
<td>Nerve Agent</td>
<td>Runny nose, watery eyes, rapid breathing, nausea, unconsciousness, paralysis, respiratory failure, death.</td>
</tr>
<tr>
<td>VX</td>
<td>Nerve Agent</td>
<td>Salivation, runny nose, sweating, shortness of breath, muscle spasms, unconsciousness, death.</td>
</tr>
<tr>
<td>VE</td>
<td>Nerve Agent</td>
<td>Salivation, runny nose, sweating, shortness of breath, muscle spasms, unconsciousness, death.</td>
</tr>
</tbody>
</table>

For further information see:


---

159 It is unclear if this amount includes only CW agents or agents and munitions


161 “N. Korea could make 12,000 tons of chemical weapons: expert,” Associated Foreign Press, October 13, 2010.
to be increasing, however, because there is no indication of the necessary expansion of storage facilities to do so.\footnote{International Crisis Group, \textit{North Korea's Chemical and Biological Weapons Programs—Asia Report No. 167}, June 18, 2009, p. 7.}

\textbf{Guesstimates of Key Locations}

The DPRK maintains a number of facilities involved in producing or storing chemical precursors, agents, and weapons (see \textit{Figures VIII.4 and VIII.5}). GlobalSecurity.org estimates that North Korea has at least eight industrial facilities that can produce chemical agents; however, the production rate and types of munitions are uncertain.\footnote{Globalsecurity.org, “Chemical Weapons Program.” http://www.globalsecurity.org/wmd/world/dprk/cw.htm.}

ICG also has reported that the DPRK’s Second Natural Science Academy conducts weapons-related research and development and that the main CW research facility is co-located with a production plant in Kanggye City, Chagang Province.\footnote{International Crisis Group, \textit{North Korea’s Chemical and Biological Weapons Programs—Asia Report No. 167}, p. 7.} In addition, a number of civilian chemical facilities have been implicated in chemical weapons production, such as the Manpo Chemical Factory and Aoji-ri Chemical Complex.\footnote{Chipman, \textit{North Korea’s Weapons Programmes}, p. 56.}

Chemicals, part of heavy industry, are a key component for the DPRK’s economy, especially in an atmosphere in which military preparedness is strongly emphasized. All chemical production – and other heavy industry – is militarized in North Korea, though it is unclear exactly how much of the production is geared towards chemical warfare. According to the NTI, the DPRK has:\footnote{North Korea [Chemical],” Nuclear Threat Initiative, February 25, 2013; North Korea – Facilities [Chemical],” Nuclear Threat Initiative, April 4, 2013.}

- 4 military bases equipped with chemical weapons
- 11 facilities where chemical weapons are produced and stored
- 13 locations where research and development is carried out relating to chemical weapons
- 2 facilities near the cities of Kanggye and Sakchu are reportedly equipped for CW agent final preparation and filling of artillery shells, as well as testing, possibly in large underground facilities

The DPRK’s leadership has traditionally had total control over procedure and policy regarding armaments production. The National Defense Commission (NDC) is the highest military industry-related decisionmaking body, and the Second Economic Committee (SEC) is directly subordinate to it. Set up in the 1970s, the SEC is key for the majority of DPRK planning, development, manufacturing, and distribution of ordnance and WMD. The SEC is located in Kangdong-kun, Pyongyang, and controls eight bureaus and 190 munitions factories. The Ministry of Chemical Industry is separate from this line of command, but likely coordinates production and transfer of CW agent intermediaries with the SEC and its subordinate bureaus. The eight bureaus are:\footnote{North Korea [Chemical],” Nuclear Threat Initiative, February 25, 2013; North Korea – Facilities [Chemical],” Nuclear Threat Initiative, April 4, 2013.}
A general affairs office
First Machine Industry Bureau: ammunition and small arms
Second Machine Industry Bureau: armored personnel carriers (APCs) and tanks
Third Machine Industry Bureau: multi-stage rockets
Fourth Machine Industry Bureau: guided missiles
Fifth Machine Industry Bureau: chemical, biological, and nuclear weapons
Sixth Machine Industry Bureau: submarines and battleships
Seventh Machine Industry Bureau: production and purchase of war aircraft

While the SEC establishes requirements, the Fifth Machine Industry Bureau is the most important for chemical and biological weapons in that it carries out the production of the agents. The Nuclear and Chemical Defense Bureau (NCDB) is directly subordinate to the General Staff Department, is responsible for offensive and defensive chemical operations, and is in charge of the filling, storage, and handling of munitions. The NCDB works in the research and development of chemical weapons as well as undertakes chemical and nuclear defense measures. It is composed of seven department units and two further research institutions.\(^{168}\)

- Operations unit
- Training unit
- Materials unit
- Technology unit
- Reconnaissance unit
- Mining/underground facility operations unit
- Section 32 unit (reportedly working in developing specialized chemical-delivery warheads for the Nodong-1 missile)
- Section 55 [research institute]: simulating nuclear and chemical contamination for decontamination operations and training (approximate research staff of 70)
- Section 398 [research institute]: decontamination operations in both nuclear and chemical environments and is reportedly developing antidotes, masks, and suits (approximately 250 researchers)

Munitions plants located at Ganggye and Sakju are nominally civilian, but are under the control of the SEC’s General Machine Industry Bureau and the NCDB’s Equipment Department. At these locations, chemical weapons agents from the Fifth Machine Industry Bureau are inserted into artillery shells (including mortar shells) previously received from the Third Machine Industry Bureau. Also at these two plants, aerial munitions and chemical spray tanks are prepared and can be used in wartime when filled with chemical agents from

\(^{168}\) North Korea [Chemical],” Nuclear Threat Initiative, February 25, 2013; North Korea – Facilities [Chemical],” Nuclear Threat Initiative, April 4, 2013.
bulk storage facilities located at various airfields. Factory 279 produces defensive equipment, such as protective suits, detection systems, and decontamination chemicals.\footnote{North Korea [Chemical],” Nuclear Threat Initiative, February 25, 2013; North Korea – Facilities [Chemical],” Nuclear Threat Initiative, April 4, 2013.}

After the munitions are assembled and filled, they are taken to the Maram Materials Corporation (Maram neighborhood, Yongsong district station, Pyongyang) and the Jiha-ri Chemical Corporation (in Pangyu-gun, Gangwon province) for storage. It has been reported that DPRK chemical weapons storage facilities are in underground tunnels, with the agents stored in 12-foot-high tanks along with Factory 279’s defensive materials.\footnote{North Korea [Chemical],” Nuclear Threat Initiative, February 25, 2013; North Korea – Facilities [Chemical],” Nuclear Threat Initiative, April 4, 2013.}

According to an ROK source in 2002, the DPRK has several different chemical troops under different organizations. The NCDB has eight battalions in its department of operations – the 17th and 18th battalions are considered active, while the 13th, 14th, 15th, 16th, 27th, and 36th are reserve. The 18th Nuclear Chemical Defense Battalion is composed of six companies; according to a DPRK defector, the 18th Battalion has a nuclear/chemical reconnaissance company (the 1st Company), while the 2nd, 3rd, 4th, and 5th companies are “decontamination” units. The 6th company is flame-throwers and likely obscurant smokes (also referred to as “Smoke Screen Company”), which had once been located in Sadong district station, Pyongyang, and had been transferred to the 18th Battalion in 1993. According to the defector, none of these companies have specific offensive duties, instead being primarily concerned with reconnaissance and decontamination.\footnote{North Korea [Chemical],” Nuclear Threat Initiative, February 25, 2013; North Korea – Facilities [Chemical],” Nuclear Threat Initiative, April 4, 2015.}

\textbf{Defensive Preparations}

The DPRK has devoted considerable resources to defensive measures aimed at protecting its civilian population and military forces from the effects of chemical weapons. Such measures include extensive training in the use of protective masks, suits, detectors, and decontamination systems.\footnote{Globalsecurity.org, “Chemical Weapons Program,” http://www.globalsecurity.org/wmd/world/dprk/cw.htm.} The DPRK has chemical defense units at all levels of its forces equipped with decontamination and detection equipment, and DPRK military units conduct regular NBC (nuclear-biological-chemical) defensive training exercises in preparation for operations in a chemical environment.\footnote{Ibid.} Though these measures seem to be focused on a perceived threat from US and ROK forces, they could also support the offensive use of chemical weapons.
### Figure VIII.2: Defector Reports on the DPRK CW Program
(as of 2004)

<table>
<thead>
<tr>
<th>Name</th>
<th>Background</th>
<th>Defector Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yi Chung Kuk</td>
<td>Sergeant in the 18th Nuclear and Chemical Defense Battalion in the early 1990s. Defected in March 1994.</td>
<td>Warned that the DPRK was capable of killing everyone in the ROK with chemical and bacterial weapons. Linked the Sunchon Vinalon Complex to the DPRK’s CW program.</td>
</tr>
<tr>
<td>Choi Ju Hwal</td>
<td>Served in the Ministry of Defense from 1968 to 1995. (Acknowledged that he did not have direct knowledge of the CBW program, but he obtained second-hand information from other officials.)</td>
<td>As of 1997, the DPRK had stockpiled over 5,000 tons of toxic gases, including nerve gases (sarin, soman, tabun, and V agents), first-generation blister gases (lewiste and mustard gas), and blood agents (hydrogen cyanide and cyanogen chloride). Choi identified numerous facilities associated with CW research and production, including several civilian chemical factories involved in vinalon production.</td>
</tr>
<tr>
<td>Yi Sun Ok</td>
<td>Inmate at a DPRK prison. Defected in 1995.</td>
<td>Said that some 150 fellow inmates died due to a chemical weapons test.</td>
</tr>
<tr>
<td>Hwang Chang Yop</td>
<td>Secretary of the DPRK’s Workers Party. Defected in August 1996.</td>
<td>Claimed that the DPRK had both nuclear and chemical armed missiles capable of hitting the ROK and Japan. He quoted the DPRK leadership as saying that the DPRK ranked third or fourth in the world in chemical weapons.</td>
</tr>
<tr>
<td>Yi Chun Sun</td>
<td>Commander of a missile station. Defected from the KPA in 1999.</td>
<td>Said that chemical agents are produced in Factory 102.</td>
</tr>
<tr>
<td>Yi Mi (pseudonym)</td>
<td>Worked at the Yongbyon nuclear complex. Defected in September 2000.</td>
<td>Said the 304 Lab mainly worked on nuclear weapons development but also conducted research and development in chemical weapons.</td>
</tr>
</tbody>
</table>

Source: Chipman, “North Korea’s Chemical and Biological Weapons (CBW) Programmes,” *North Korea’s Weapons Programmes*, 2004, p. 54.
Figure VIII.3: Map of Possible DPRK Chemical Facilities

Note: Locations are approximate.

Figure VIII.4: Major DPRK Civilian Chemical Production Facilities (as of 2004)

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aoiji-ri (Haksong-ri) Chemical Complex</td>
<td>Production of methanol, ammonia, ammonium bicarbonate, coal tar derivatives, and liquid fuel products. About 3,500 employees. Processes 600,000 tons of lignite coal processing per year; produces 100,000 tons of ammonium bicarbonate and 35,000 tons of methane per year.</td>
</tr>
<tr>
<td>April 25th Vinalon Factory (Hamhung)</td>
<td>Produces 540,000 tons per year of fertilizer, herbicides, and pesticides. Other products include ammonia, as well as other chlorine-based pesticides – probably DDT and chlordane, among others.</td>
</tr>
<tr>
<td>February 8th Vinalon Complex (Hamhung)</td>
<td>One of the largest chemical facilities in the DPRK. Around 10,000 employees. Comprises about 50 large buildings. Produces 50,000 tons of vinalon and 10,000 tons of movilon per year. Also produces carbide, methanol, sodium hydroxide, livestock feed, sodium carbonate, vinyl chloride, and agricultural insecticide.</td>
</tr>
<tr>
<td>Hamhung Chemical Factory</td>
<td>Produces sulphuric acid, nitric acid, ammonia, and fertilizer products.</td>
</tr>
<tr>
<td>Hungnam Chemical Fertilizer Complex (Hamhung)</td>
<td>Produces ammonium sulphate, ammonium nitrate, phosphate, and urea. Employ more than 10,000 people. Production capacity of 1.4 million tons (unclear whether annual capacity or other time period).</td>
</tr>
<tr>
<td>Chongjin Chemical Fiber Complex</td>
<td>Employs around 3,000 people. Produces 300 tons of pesticides, 10,000 tons of other chemical products, and 30,000 tons of synthetic fiber per year. Also produces carbonic acid, formalin, and phenol.</td>
</tr>
<tr>
<td>Chongsu Chemical Complex</td>
<td>Production of large quantities of calcium carbide and smaller amounts of phosphate fertilizer and calcium cyanamide.</td>
</tr>
<tr>
<td>Hwasong Chemical Factory</td>
<td>Produces agricultural chemicals and 2,500 tons of phenol per year. Unknown iodine capacity.</td>
</tr>
<tr>
<td>Hyesan Chemical Factory</td>
<td>Produces chemicals such as benzol, phenol, and hydrochloric acid.</td>
</tr>
<tr>
<td>Manpo Chemical Factory</td>
<td>Produces ammonia, sodium hydroxide, and sulphuric acid.</td>
</tr>
<tr>
<td>Namhung Youth Chemical Complex</td>
<td>Produces ammonia, ethylene, fertilizers, fibers, and paper. Annual production capacity of approximately 500,000 tons.</td>
</tr>
<tr>
<td>Sariwon Potash Fertilizer Complex</td>
<td>Produces Fertilizers – planned production target of 510,000 tons per year of potash fertilizer (unclear whether annual capacity or other time period).</td>
</tr>
<tr>
<td>Shinhung Chemical Complex</td>
<td>Produces calcium hypochlorite, caustic soda, dyes, hydrochloric acid, paints, vinyl chloride, polyvinyl chloride, potassium carbonate, sodium carbonate, sodium bicarbonate, barium.</td>
</tr>
</tbody>
</table>
chloride, ammonium sulphate fertilizer, magnetized fertilizer, slag fertilizer, and sulphuric acid fertilizer.

**Sinuiju Chemical Fiber Complex**
Produces calcium cyanide, chlorine, sodium hydroxide, sulphuric acid, synthetic fiber, and paper products. Annual production capacity of 107,000 tons.

**Sunchon Vinalon Complex**
The DPRK’s largest chemical production facility with about 50 affiliated factories. First stage of construction completed in 1989; final construction reportedly still not completed as of 2000. Estimated annual production (if completed) of 100,000 tons of vinalon, one million tons of carbide, 750,000 tons of methanol, and 900,000 tons of vinyl chloride.

**Sunchon Calcium Cyanide Fertilizer Factory**
One of the DPRK’s four major fertilizer plants. Produces calcium cyanide and calcium carbide. Annual chemical production capacity of 100,000–150,000 tons. Probably a part of the Sunchon Vinalon Complex.


## DPRK Biological Weapons

Much less is known about the North Korean biological warfare program than about its chemical warfare program. The DPRK acceded to the Biological and Toxin Weapons Convention (BTWC) in March 1987, but most official estimates conclude that the DPRK possesses the scientists and facilities for producing traditional infectious biological warfare (BW) agents and weapons, and has done so since the 1960s. Several DPRK defectors have claimed that the North tested biological and/or chemical weapons on mentally or physically deficient children and concentration camp prisoners.\(^{174}\)

### Capabilities

An April 2012 ROK official report stated that the DPRK was able to equip its rocket launchers, mortars, and field artilleries with biological weapons and assessed that botulinum toxins, smallpox, and anthrax were the most likely to be weaponized.\(^{175}\) The South Korean government further estimated that half of the DPRK’s long-range missiles and 30% of its artillery are able to deliver biological or chemical weapons, though it is unknown if the North is able to equip missiles/artillery in a way that would allow the biological payloads to survive and effectively disperse.\(^{176}\)

---

\(^{174}\) “North Korea Biological Chronology,” Nuclear Threat Initiative and the James Martin Center for Nonproliferation Studies, August 2012.

\(^{175}\) Ibid.

\(^{176}\) “North Korea – Biological,” Nuclear Threat Initiative, April 5, 2013.
As the DPRK appears to be focusing on improving its strategically more useful nuclear and missile capabilities, recent assessments have tended to downgrade the threat of biological weapons, compared with past assessments.  

North Korea has dual-use facilities that could be used to produce biological agents and a munitions industry that could be used to weaponize such agents – a recent Deputy DNI report, noted that “North Korea has a biotechnology infrastructure that could support the production of various BW agents.” However, there is not enough information to determine whether Pyongyang has progressed beyond the research and development stage and actually has stocks of biological weapons. But while the DPRK may not possess ready-to-use weapons, it certainly has the technical abilities to produce them.

According to GlobalSecurity.org, Pyongyang’s resources presently include a rudimentary (by Western standards) biotechnology infrastructure that is sufficient to support the production of limited quantities of toxins as well as viral and bacterial biological warfare agents. BW agents are reportedly cultured in both civilian and military-related research institutes in the DPRK, and, according to NTI, pathogens that have possible utility for BW and that are allegedly being researched and developed by the DPRK include: Bacillus anthracis (anthrax), Clostridium botulinum (botulism), Mycobacterium tuberculosis (tuberculosis), Rickettsia prowazekii (typhus), Salmonella typhi (typhoid), Vibrio cholerae 01 (cholera), Yersinia pestis (plague), Korean hemorrhagic fever, Variola major (smallpox), Yellow fever virus (yellow fever), Dysentery, Brucellosis, Staphylococcus aureus, and Yellow Rain (T-2 Micro Toxins) (see Figure VIII.5).

### Figure VIII.5: Possible DPRK Biological Agents

<table>
<thead>
<tr>
<th>TYPE</th>
<th>SYMPTOMS/CHARACTERISTICS</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacteria</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

177 “North Korea – Biological,” Nuclear Threat Initiative, April 5, 2013.


180 North Korea [Biological],” Nuclear Threat Initiative.
| **Vibrio cholera**  
(Cholera) | Diarrhea, vomiting, and leg cramps. Rapid loss of body fluids, dehydration and shock. Mortality (if untreated): 5–10%. Death in 1–3 hours. Not contagious. | Unknown |
|---|---|---|
| **Yersinia pestis**  
(Plague) | Fever, headache, exhaustion, swollen lymph nodes, blood infection, and pneumonia. Mortality (if untreated): 50–60%. Incubation period: 1–3 days, death in 2–6 days. Contagious. | Unknown |
| **Salmonella Typhi**  
(Typhoid Fever) | Fever, malaise, chills, stomach pains, headache, loss of appetite, and rash. Mortality (if untreated): 12–30%. Contagious. | Unknown |
| **Typhus** | Fever, headache, chills, whole body rash, and general pains. Mortality (if untreated): 30–50%. Incubation Period: 6–12 days. Not contagious. | Unknown |
| **Mycobacterium tuberculosis**  
(tuberculosis) | Coughing, chest pain, fatigue, loss of appetite, chills, fever, and coughing blood. Mortality (if untreated): 30–50%. Incubation period: 14 days–1 year. Contagious. | Unknown |

**Virus**

| **Haemorrhagic fever**  
(Korean Strain) | Fever, fatigue, dizziness, muscle aches, exhaustion, internal bleeding, coma, delirium, and seizures. Mortality (if untreated): 5–15%. Incubation period: 7–17 days. Contagious. | Unknown |
| **Variola**  
| **Yellow Fever** | High fever, chills, headache, muscle aches, and vomiting; can lead to shock, kidney, and liver failure. Mortality (if untreated): 5–40%. Incubation: 3–6 days. Not contagious. | Unknown |

**Toxin**

| **Clostridium Botulinum**  


**Facilities**

A number of DPRK facilities have been linked to ongoing work in biological weapons research, development, and manufacture (see Figures VIII.6 and VIII.7). Although the
indicators involved are often uncertain, the IISS provides a detailed list and map of possible facilities.

Additionally, the ROK MND estimated in 2001 that the DPRK maintains at least three possible BW production facilities and six BW or BW-related research centers, including the No. 25 Factory in Chongju, the Central Biological Weapons Research Institute in Pyongyang and a plant in the City of Munchon, Kangwon Province. One ROK newspaper reported the existence of more than 10 facilities, while NTI has also reported a number of facilities in addition to the No. 25 Factory linked to BW production. They include:181

- The Research Institute of the Armed Forces Ministry (synonymous with the Bacterium Research Institute, Second Academy of Natural Sciences), responsible for developing biological weapons.
- A Biological research facility located in Songch’on County, South P’yongan Province, adjacent to the Onjong-ni chemical weapons facility; growth media is allegedly supplied (approximately 200 tons per year) by a facility in Munchon, Kangwon Province.
- A germ-producing facility known as the 25 February Plant (also known as the 25 Plant), located in Chongju, North Pyongan Province.
- The National Defense Research Institute and Medical Academy (NDRIMA), which conducts studies on disease pathogens such as the bacteria and viruses that cause anthrax, cholera, bubonic plague, smallpox, yellow fever, and others.

Few details are known about these facilities or which, if any, microorganisms have been or are being weaponized. Regardless, whatever the status of its biological weapons efforts, the DRPK possesses a number of dual-use biotechnology facilities that could be used to research biological weapons agents and produce militarily significant quantities of biological agents.182

**Figure VIII.6: Civilian DPRK Biological Facilities**

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aeguk Compound Microbe Center</td>
<td>R&amp;D and production of microbial-based fertilizer supplements.</td>
</tr>
<tr>
<td>Aeguk Preventative Medicine Production Factory</td>
<td>Comprised ten laboratories and various workshops devoted to R&amp;D and production of vaccines and medicines. The main product has been hepatitis B vaccine.</td>
</tr>
<tr>
<td>Branch Academy of Cell and Gene Engineering</td>
<td>One of nine research branches of the Academy of Sciences. Conducts research on cellular biology and genetic engineering.</td>
</tr>
<tr>
<td>National Sanitary and Anti-Epidemic Research Center</td>
<td>Administers quarantines and provides inoculations against various diseases.</td>
</tr>
<tr>
<td>Endocrinology Institute</td>
<td>Mainly diagnoses and treats diabetes.</td>
</tr>
<tr>
<td>Industrial Microbiology Institute</td>
<td>R&amp;D and production of microbial cultures.</td>
</tr>
</tbody>
</table>

182 Chipman, *North Korea’s Weapons Programmes*, p. 60.
<table>
<thead>
<tr>
<th><strong>Munchon Agar Plant</strong></th>
<th>Agar (growth media) production. As of 1992, the annual agar production capacity was 200 tons.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pharmaceutical Institute of the Academy of Medical Sciences</strong></td>
<td>R&amp;D of medicaments. Reportedly located in Pyongyang.</td>
</tr>
<tr>
<td><strong>Pyongyang Pharmaceutical Factory</strong></td>
<td>As of August 2000, the factory produced seven drugs, including antibiotics and multivitamins. Has received raw materials and support from UNICEF and Diakonie Emergency Aid of Germany.</td>
</tr>
<tr>
<td><strong>Synthetic Pharmaceutical Division, Hamhung Clinical Medicine Institute</strong></td>
<td>R&amp;D of medicaments and clinical diagnostics.</td>
</tr>
<tr>
<td><strong>Taedonggang Reagent Company</strong></td>
<td>R&amp;D of vaccines. Previously known as the November 19 Institute.</td>
</tr>
</tbody>
</table>

Figure VIII.7: Map of Possible DPRK Civilian Biological Facilities

Source: Chipman, *North Korea’s Weapons Programmes*, p. 57.
DPRK Nuclear Developments

Although little declassified data are available on intelligence estimates of the DPRK’s nuclear weapons program, there is some open source information available. DNI James R. Clapper noted in 2011:

"Based on the scale of the facility and the progress the DPRK has made in construction, it is likely that North Korea has been pursuing enrichment for an extended period of time. If so, there is clear prospect that DPRK has built other uranium enrichment related facilities in its territory, including likely R&D and centrifuge fabrication facilities, and other enrichment facilities. Analysts differ on the likelihood that other production-scale facilities may exist elsewhere in North Korea."

Pyongyang has effectively ignored or terminated its past agreements to limit the production of nuclear materials and missile tests, posing very real concerns not only in the region, but also in the international community. According to a May 2010 UN Security Council report on the DPRK’s nuclear program, “the Democratic People’s Republic of Korea believes … that its nuclear programme can provide the country a way to achieve its stated goal of becoming a ‘strong and prosperous country’ (kangsongdaeguk) by the year 2012 without succumbing to what they view as ‘foreign influences.’”

Motivations for Acquisition

The broad rationales for the DPRK’s efforts have already been discussed. US officials assess DPRK nuclear capabilities as “being more for deterrence, international prestige, and coercive diplomacy than for war fighting, and assess that Pyongyang most likely ‘would consider using nuclear weapons only under narrow circumstances.’” The DPRK noted in a state-run newspaper, “The DPRK was left with no option but to choose the way of accessing nuclear deterrent in order to put an end to the U.S. ever-more intensified nuclear threat and defend the sovereignty, dignity, and vital rights of the country” – making nuclear weapons a matter of defense and dignity, not offense.

One former DoD official called the DPRK’s nuclear weapons acquisition a “survival game” in that nuclear weapons are the only reason anyone pays attention to the DPRK, which is necessary for the regime to gain aid and assistance. As the poorest country in the region, it would receive little without calling attention to itself so forcefully. Furthermore, it should also be considered that even speculative sources estimate that North Korea cannot have more than a few nuclear weapons available. If they exist, these devices are very precious to the regime, and it seems unlikely that they would be mounted on inaccurate and unreliable missile systems—the risk of “loosing” a weapon is simply too high. Of course, a singular shot can never be totally ruled out, but the

183 James R. Clapper, Director of National Intelligence, Statement for the Record on the Worldwide Threat Assessment of the U.S. Intelligence Community, House Permanent Select Committee on Intelligence, February 10, 2011.
187 Chuck Jones, former DoD and NSC official in Asian/Korean affairs, interview on February 14, 2013.
188 Markus Schiller, Characterizing the North Korean Nuclear Missile Threat, RAND, 2012, p. 65.
chances of success are very low. And even if this unlikely event was to happen, with North Korea unable to repeat this feat on short notice, this scenario should be seen more like a terrorist attack than nuclear warfare.

In June 2010, a DPRK Foreign Ministry spokesman stated that “recent developments” have underscored the need for the DPRK “to bolster its nuclear deterrent in a newly developed way.” Given the aggressiveness in the DPRK sinking of the ROK Corvette Cheonan in March 2010 and the shelling of Yeonpyeong Island in November, there may be little possibility that the DPRK will give up its nuclear weapons program any time soon.

Moreover, many experts feel that North Korea sees Muammar Qaddafi’s willingness to give up Libya’s nuclear programs as one reason that the UN and NATO were willing to impose a no-fly zone and make a de facto effort to remove him from power. It also sees India, Iran, Israel, and Pakistan as examples of states whose nuclear efforts also give them political and military leverage where they may not have had it. Looking at the examples of Libya and Iraq, countries that gave up their WMD programs, the DPRK state media outlet noted on April 4, 2013 that “the nuclear weapons of Songun Korea are not something for display and the DPRK is very different from Iraq, Libya and the Balkans.”

After the third nuclear test in February 2013, it has become clear that the DPRK is attempting to establish itself as a nuclear power or, at the very least, a de-facto nuclear state – like Israel, India, and Pakistan – a nation that is implicitly recognized as a nuclear state by the international community, though not formally recognized under the NPT framework. If the DPRK achieved this status, it would no longer be under international sanctions, despite the fact its program would technically remain illegal under international law. Moreover, it seems that the DPRK, due to its constrained economic circumstances, will not be able to develop a large-scale nuclear force necessary for credible self-defense deterrence against the US. Instead, it is more likely that the North will take its neighbors – Japan and the ROK – as nuclear hostages in an attempt to achieve strategic gains through strategic ambiguity about its nuclear capabilities.

Assessments of Capabilities: Plutonium and Uranium

It is difficult to determine just how large the DPRK’s nuclear program is and how much progress it is making. The DPRK is an extremely isolated and secretive state and provides few signals of the existence – let alone the extent – of its nuclear weapons program, which has resulted in substantial uncertainty about its size and capability. However, a general picture of the program has become relatively clear over the past two decades.

The US Intelligence Community assesses that Pyongyang views its nuclear capabilities as intended for “deterrence, international prestige, and coercive diplomacy,” and thus would

---

189 Simon Martin, “N. Korea vows to bolster nuclear deterrent,” Agence France Presse, June 27, 2010; see also KCNA, June 28, 2010.
consider using nuclear weapons only “under certain narrow circumstances.” In addition, research centers like Institute for Science and International Security (ISIS) have indicated that the DPRK may be sharing at least some aspects of its nuclear weapons technology with Iran and the Syria.

CSIS’s Mike Green also notes “the danger of horizontal escalation by the DPRK – namely, transferring weapons to third parties in the event of tensions or conflict. The DPRK directly threatened the United States with this in March 2003.”

While unclassified estimates must depend to some extent on sophisticated guesswork, the DPRK has probably obtained enough plutonium from its power reactors to have 4-13 nuclear weapons – even allowing for the material used in its two tests. The DPRK reported in May 2008 that it had extracted roughly 38.5 kg of weapons-grade plutonium from fuel rods.

A February 2013 report by the Congressional Research Service (CRS) reported that North Korea had between 30 and 50 kilograms of separated plutonium, enough for at least half a dozen nuclear weapons. In 2011, the NTI estimated that the DPRK had 6-10 kg of weapons-grade plutonium and another 29-34 kg of plutonium in spent fuel stockpiles that could be reprocessed and weaponized.

ROK MND figures are similar, estimating that the DPRK has secured about 40 kg of plutonium as a result of three reprocessing procedures (as of 2010). Additionally, the Strategic Studies Institute (SSI) believes that the DPRK has discharged anywhere from 43 to 61 kg from its 5MWe reactor since 1989 (see Figure VIII.8). Furthermore, it has been reported that approximately 3,000 people work on the DPRKs nuclear program, including about 200 key researchers and scientists.

Along these lines, the ISIS released a report in mid-2012 warning that, in the best case scenario, the DPRK would use its uranium centrifuges at Yongbyon to make enough low enriched uranium to have a maximum of 25 nuclear weapons by 2015 – an increase of two from the ISIS’s current estimate. In the worst case scenario – the absence of effective

193 See http://isis-online.org/isis-reports/imagery/category/korean-peninsula/ and other material in the Korea section (http://isis-online.org/countries/category/korean-peninsula) of the ISIS web page. Additional material can be found in the Global Security, Federation of American Scientists, and Nuclear Threat Initiative web pages.
194 E-mail from Mike Green, February 7, 2011.
199 This compares with an estimated 80,000 people that worked on the early US ICMB programs in the 1950s – along with significant industrial participation; Markus Schiller, Characterizing the North Korean Nuclear Missile Threat, RAND, 2012, p. 37.
sanctions – the DPRK could built as many as 48 nuclear weapons by 2015 (an increase of 25).

Some sources indicate that DPRK nuclear technologies and materials appear to be poorly guarded and could be exploited or stolen by personnel in the security services or military and transferred to criminal groups, terrorist organizations, and/or other states. After his visits to the DPRK, Dr. Siegfried Hecker stated that he had seen “little recognition of the safety hazards posed by primitive nuclear bombs,” likely meaning that security is also minimal.

The DPRK has halted its plutonium production from its 5MWe reactor in Yongbyon, but plutonium production and weaponization could easily be restarted and the DPRK announced in March 2013 that it was going to do so. According to a December 2010 CRS report:

In order to produce additional plutonium, the North Koreans would need to restore their 5-MWe reactor or build a new reactor. Timelines for restoring the 5-MWe reactor are uncertain, although experts estimate between six months and one year. Rebuilding the cooling tower, which was destroyed in June 2008, could take approximately six months, but other venting solutions for the reactor could be possible. Additionally, this aging reactor may be in need of additional parts or repair. . . . After the facilities were operating, they could produce approximately 6 kg of plutonium per year.

While North Korea’s weapons program was plutonium-based at the start, intelligence has emerged in the last decade showing that the country is pursuing a second route using highly enriched uranium (HEU). The DPRK confirmed this in June 2009 when it announced it would commence uranium enrichment, stating “enough success has been made in developing uranium enrichment technology to provide nuclear fuel to allow the experimental procedure.”

Three months later, DPRK officials announced that experimental uranium enrichment had entered into the “completion phase.” According to the US Intelligence Community, the exact intent of these announcements is unclear, and they do not speak definitively to the technical status of the uranium enrichment program.

In November 2010, a visit by Dr. Hecker to Yongbyon shed additional light on the DPRK’s HEU program. On his visit he saw “a small, recently completed, industrial-scale uranium-enrichment facility” that appeared fully operational, though Dr. Hecker and his colleagues were unable to confirm whether it was in fact operating at full capacity.

204 “DPRK Permanent Representative Sends Letter to President of UNSC,” KCNA, September 4, 2009.
These reports were followed by press reports that the International Atomic Energy Agency (IAEA) suspected that the DPRK had at least one additional covert centrifuge site and might have significant additional sites. These reports mean that the DPRK may have substantial stocks of enriched uranium as well as plutonium.

At a minimum, this means the DPRK’s future production of weapons-grade material is impossible to predict and that both targeting and arms control are far more difficult because of the inability to predict how many dispersed centrifuge facilities the DPRK may have. However, the DPRK is probably far from having a self-sufficient program. According to ISIS:

Whatever North Korea has accomplished in building centrifuges, it faces an ongoing, fundamental problem. It is not self-sufficient in making and operating centrifuges. It acquired key equipment and materials abroad and appears to be continuing its overseas procurements. North Korea will undoubtedly need additional equipment and materials to build and operate large numbers of centrifuges successfully.

![Figure VIII.8: Estimates of DPRK Plutonium Production (as of 2006)]

<table>
<thead>
<tr>
<th>Plutonium Discharged from 5 M We Reactor</th>
<th>Plutonium Separation</th>
<th>Weapon Equivalents*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Amount (kg)</td>
<td>Date</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>------</td>
</tr>
<tr>
<td>Before 1990</td>
<td>1-10**</td>
<td>1989-1992</td>
</tr>
<tr>
<td>Spring 2005</td>
<td>0-15</td>
<td>2005-2006</td>
</tr>
<tr>
<td>In core of 5 M We Reactor</td>
<td>5-7</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>43-61</td>
<td></td>
</tr>
</tbody>
</table>

*It is assumed that each nuclear weapon would require 4-5 kg of separated plutonium
**This quantity includes up to 1-2 kg of plutonium produced in the IRT reactor prior to 1994 (see “Early Program”).
***The upper bound of the number of weapons is higher than the sum of the individual upper bounds, because particular periods list more plutonium than needed to give the upper bound for that period.

**Nuclear Weapons and Warhead Developments**

Despite the progress of the DPRK’s nuclear program, it is unclear whether the DPRK has mastered the ability to efficiently weaponize a nuclear device. The detonation of a nuclear

---

The Evolving Military Balance in the Korean Peninsula and Northeast Asia 59

explosive device is a significant scientific achievement, but creating a device that can be included in a small bomb or a missile warhead presents a number of difficult engineering problems.\textsuperscript{209} Theoretically, the DPRK could use an aircraft, a ship, or even a vehicle to deliver a nuclear weapon, but these platforms are either vulnerable or unreliable.

It is difficult to eliminate the possibility that North Korea has achieved weaponization. ROK intelligence believes DPRK engineers were able to make significant progress in warhead miniaturization between 1999 and 2001, and the national defense ministry – along with ROK experts – now believes the DPRK has warheads that can be mounted on ballistic missiles.\textsuperscript{210} Furthermore, ROK intelligence sources told the ICG in 2009 they believe the DPRK has deployed nuclear warheads for \textit{Nodong} missiles in the northern part of the country.\textsuperscript{211}

It is equally unclear how reliable or safe such a warhead would be, what the risks would be it might malfunction, how well it could survive an accident, and whether the DPRK could predict its operational yield in kilotons.\textsuperscript{212}

\textit{The Early Program}

North Korea’s strengths and weaknesses in weaponizing and deploying nuclear weapons become clearer if one examines the history of its efforts. The origins of the DPRK nuclear program seem to stem from the gross insecurity felt by then-leader Kim-Il-sung following the near defeat of his forces in the Korean War. Although nuclear weapons were never used, US political leaders and military commanders threatened their use during the war. In February 1956, Pyongyang signed the founding charter of the Soviet Union’s Joint Institute for Nuclear Research and began to send scientists and technicians to the USSR for training shortly thereafter.\textsuperscript{213}

When the US deployed nuclear weapons to South Korea for the first time in 1958, the DPRK began a rudimentary nuclear program primarily focused on basic training and research, relying on assistance from the Soviet Union. The program trained North Korean scientists and engineers and helped to construct basic research facilities, including a small research reactor (the IRT-2000) in Yongbyon.\textsuperscript{214}

In the late 1960s, the DPRK expanded its educational and research institutions to support a nuclear program for both civilian and military applications. By the early 1970s, DPRK engineers had begun using indigenous technology to expand the IRT-2000 reactor, and

\textsuperscript{210} Ibid., p. 10; “N. Korea can make nuke-tipped missiles able to hit S. Korea: expert,” Yonhap News Agency, April 24, 2013.
\textsuperscript{214} Chipman, \textit{North Korea’s Weapons Programmes}, p. 27.
Pyongyang began acquiring plutonium reprocessing technology from the Soviet Union.\(^{215}\) In July 1977, the DPRK signed a trilateral safeguards agreement with the IAEA and the USSR that brought the IRT-2000 research reactor and a critical assembly plant in Yongbyon under IAEA safeguards.\(^{216}\)

In 1980, Pyongyang’s nuclear program began a period of expansion to the point that it could produce substantial amounts of nuclear energy and weapons-grade plutonium.\(^{217}\) This expansion included uranium milling facilities, a fuel rod fabrication complex, and a 5 MW(e) nuclear reactor, as well as research and development institutions.\(^{218}\) By the mid-1980s, Pyongyang began construction on a 50 MW(e) nuclear power reactor in Yongbyon and expanded its uranium processing facilities.\(^{219}\)

Pyongyang was also exploring the acquisition of light water power reactors (LWRs), and agreed to sign the Non-Proliferation Treaty (NPT) in December 1985 in exchange for Soviet assistance in the construction of four LWRs.\(^{220}\) However, the DPRK refused to sign a safeguards agreement with the IAEA, an obligation under the NPT.\(^{221}\)

*Denuclearization of the Korean Peninsula and the 1993–1994 Crisis*

In September 1991, US President George H.W. Bush announced that the US would withdraw its nuclear weapons from the ROK, and on December 18, 1991, South Korean President Roh Tae Woo declared that South Korea was free of nuclear weapons.\(^{222}\) As a result, the DPRK and ROK signed the Joint Declaration on the Denuclearization of the Korean Peninsula. In the document, both sides promised to “not test, manufacture, produce, receive, possess, store, deploy or use nuclear weapons,” “use nuclear energy solely for peaceful purposes,” and to forgo the possession of “nuclear reprocessing and uranium enrichment facilities.”\(^{223}\)

Following the signing of the Joint Declaration, the DPRK signed an IAEA safeguards agreement on January 30, 1992. Under the terms of the agreement, North Korea provided an “initial declaration” of its nuclear facilities and materials and allowed IAEA inspectors to verify the completeness and correctness of the initial declaration.\(^{224}\) Inspections began in May 1992 and concluded in February 1993; however, when the IAEA requested access to two suspect nuclear waste sites, North Korea declared them to be military sites and therefore

\(^{215}\) NTI, “North Korea Nuclear Profile.”

\(^{216}\) Ibid.

\(^{217}\) Chipman, North Korea’s Weapons Programmes, p. 27.

\(^{218}\) NTI, “North Korea Nuclear Profile.”

\(^{219}\) Ibid.

\(^{220}\) Ibid.


\(^{222}\) NTI, “North Korea Nuclear Profile.”


In response, the UN Security Council passed Resolution 825 on May 11, 1993, urging the DPRK to cooperate with the IAEA and to implement the 1991 North-South denuclearization accord.

At a deadlock with the IAEA and facing sanctions from the UN, North Korea announced on March 12, 1993 that it intended to withdraw from the NPT. The US responded by holding political-level talks with the DPRK in early June 1993 that led to a joint statement outlining the basic principles for continued US-DPRK dialogue and North Korea’s “suspending” its withdrawal from the NPT before it became legally effective. The agreement was short-lived. Immediately following the return of IAEA inspectors to North Korea in March 1994, the DPRK refused to allow the inspection teams to inspect a plutonium reprocessing plant at Yongbyon, and in May 1993 the IAEA confirmed that North Korea had begun removing spent fuel – which can be reprocessed for use in nuclear weapons – from its 5 MW(e) nuclear research reactor even though international monitors were not present.

Faced with renewed UN sanctions, the DPRK withdrew from the IAEA on June 13, 1994. Although still a member of the NPT, the DPRK no longer participated in IAEA functions as a member state and thus refused to allow inspectors to carry out their work under the Safeguards Agreement.

The crisis was defused by then-former President Jimmy Carter’s visit to the DPRK in June 1994. Four months of negotiations concluded in an Agreed Framework between the US and the DPRK on October 21, 1994. Under the agreement the US committed to arranging for the provision of a LWR with a generating capacity of approximately 2,000 MW(e) in exchange for a DPRK “freeze” and ultimate dismantlement of its reactors and related facilities. Although the accord froze North Korea’s plutonium production facilities and placed them under IAEA monitoring, the US estimated that the DPRK could have recovered enough plutonium for one or two nuclear weapons before the agreement came into force.


Following the agreement, the DPRK’s indigenous plutonium production facilities remained frozen, and its known plutonium stocks were subject to IAEA monitoring. The facilities subject to the freeze were the 5 MW(e) reactor, the Radiochemical Laboratory (reprocessing), the fuel fabrication plant, and the partially-built 50 and 200 MW(e) nuclear power plants. It was during this time that the international community discovered the

---

225 NTI, “North Korea Nuclear Profile.”
228 Ibid.
229 Ibid.
230 Ibid.
232 Chipman, North Korea’s Weapons Programmes, p. 27.
extent of the DPRK’s plutonium production in the late 1980s and early 1990s. According to the American Federation of Scientists,\textsuperscript{233}

A close examination by the IAEA of the radioactive isotope content in the nuclear waste revealed that North Korea had extracted about 24 kilograms of Plutonium. North Korea was supposed to have produced 0.9 gram of Plutonium per megawatt every day over a 4-year period from 1987 to 1991. The 0.9 gram per day multiplied by 365 days by 4 years and by 30 megawatts equals to 39 kilograms. When the yearly operation ratio is presumed to be 60 percent, the actual amount was estimated at 60% of 39 kilograms, or some 23.4 kilograms. Since 20-kiloton standard nuclear warhead has 8 kilograms of critical mass, this amounts to mass of material of nuclear fission out of which about 3 nuclear warheads could be extracted.

Estimates vary of both the amount of plutonium in North Korea’s possession and number of nuclear weapons that could be manufactured from the material. South Korean, Japanese, and Russian intelligence estimates of the amount of plutonium separated, for example, are reported to be higher—7 to 22 kilograms, 16 to 24 kilograms, and 20 kilograms, respectively—than the reported US estimate of about 12 kilograms. At least two of the estimates are said to be based on the assumption that North Korea removed fuel rods from the 5-MW(e) reactor and subsequently reprocessed the fuel during slowdowns in the reactor’s operations in 1990 and 1991. The variations in the estimates about the number of weapons that could be produced from the material depend on a variety of factors, including assumptions about North Korea’s reprocessing capabilities—advanced technology yields more material—and the amount of plutonium it takes to make a nuclear weapon. Until January 1994, the Department of Energy (DOE) estimated that 8 kilograms would be needed to make a small nuclear weapon. Thus, the United States’ estimate of 12 kilograms could result in one to two bombs. In January 1994, however, DOE reduced the estimate of the amount of plutonium needed to 4 kilograms—enough to make up to three bombs if the US estimate is used and up to six bombs if the other estimates are used.

Despite the freeze, neither party was completely satisfied with either the compromise reached or its implementation. The United States was dissatisfied with the postponement of safeguards inspections to verify Pyongyang’s past activities, and North Korea was dissatisfied with the delayed construction of the LWRs.

\textbf{Uranium Enrichment, Six Party Talks, and the Banco Delta Asia (2002-2005)}

With the plutonium route partly blocked by the Agreed Framework, Pyongyang seems to have instigated a secret program in the late 1990s to develop the means to produce weapons-grade enriched uranium utilizing gas centrifuge technology.\textsuperscript{234} These efforts were brought to light in October 2002 with the announcement by the US that the DPRK had acknowledged, in talks with Assistant Secretary of State for East Asian and Pacific Affairs James Kelly, a “program to enrich uranium for nuclear weapons.”\textsuperscript{235}

This led to the conclusion that the DPRK’s program was a violation of the Agreed Framework, the NPT, the DPRK-IAEA Safeguards Agreement, and the North-South Joint Declaration on the Denuclearization of the Korean Peninsula.\textsuperscript{236} In November 2002 the IAEA adopted a resolution calling upon North Korea to “clarify” its “reported uranium-


\textsuperscript{234} Chipman, North Korea’s Weapons Programmes, p. 27.

\textsuperscript{235} “Fact Sheet on DPRK Nuclear Safeguards,” International Atomic Energy Agency. \url{http://www.iaea.org}.

\textsuperscript{236} Ibid.
enrichment program.” The DPRK rejected the resolution, saying the IAEA’s position was biased and in favor of the United States.

The United States responded in December 2002 by suspending heavy oil shipments, and North Korea subsequently retaliated on January 10, 2003 by lifting the freeze on its nuclear facilities, expelling IAEA inspectors, and announcing its withdrawal from the NPT.

On December 26, 2002, an IAEA press release stated that North Korea had cut all IAEA seals, disrupted IAEA surveillance equipment on its nuclear facilities and materials, and started moving fresh fuel rods into the reactor. It was reported in mid-2002 that US intelligence had found evidence of HEU materials and/or technology transfers from Pakistan to the DPRK, in return for ballistic missile technology. Furthermore, it was reported in 2004 that the DPRK had been part of the AQ Kahn network, purchasing gas-centrifuge technology.

The US government also established the Illicit Activities Initiative, an attempt to create a parallel track to diplomacy by increasing efforts to stop the DPRK’s international criminal activities (i.e., illicit weapons sales, counterfeiting, drug smuggling, etc – discussed in Chapter 5). Japan cut economic ties with the DPRK, curtailed remittances to the DPRK from the pro-DPRK ethnic Korean population in Japan, and increased oversight and restrictions on DPRK ships ferrying between the DPRK and Japan. However, the ROK and China did not introduce any new sanctions, although there were reports that the PRC briefly stopped energy shipments in March 2003.

In terms of arms control, little progress was made following the DPRK’s withdrawal from the NPT. In early 2003, US intelligence detected activities around Yongbyon, which indicated that North Korea was probably reprocessing the 8,000 spent fuel rods that had been in a temporary storage pond. The assessment was reaffirmed in September when a DPRK Foreign Ministry spokesman said that reprocessing of this spent fuel had been completed, providing enough plutonium for approximately four to six nuclear devices. This was

---

confirmed in January 2004 when a delegation of invited US experts, headed by Dr. Hecker, confirmed that the canisters in the temporary storage pond were empty.\(^{245}\)

In April 2003, a multilateral dialogue involving six nations – the US, ROK, DPRK, China, Russia, and Japan – began with the aim of ending the DPRK’s nuclear weapons program; however, little was accomplished. Throughout the Six Party Talks, DPRK officials often expressed their preference for bilateral engagement with the US rather than the multilateral forum. After multiple meetings spanning two years, the parties could only agree to a Statement of Principles.\(^{246}\) However, due to disagreements over light water reactors and the Banco Delta Asia sanctions, progress on both the Statement and on further Six Party Talks stalled.\(^{247}\) **Figure VIII.9** highlights the progress made during the Talks, while **Figure VIII.10** summarizes the primary agreements reached.

Throughout the talks, the DPRK had continued its plutonium reprocessing, and when the Six-Party process stagnated April 2005, the North shut down its 5MW(e) reactor and removed the spent fuel.\(^{248}\) The reactor had been operating since February 2003, meaning that it could have produced enough plutonium for between one and three nuclear devices in its spent fuel.\(^{249}\)

In 2005, the US government, via the Patriot Act, designated Banco Delta Asia (BDA; a small Macanese bank holding DPRK accounts) as an institution of money laundering concern, based on Section 311 of the USA PATRIOT Act, 31 U.S.C. 5318A. In the wake of this designation, the government of Macau froze the DPRK’s accounts at the BDA, totaling approximately $25 million, an action that was quickly followed by other major international financial institutions refusing to undertake transactions with the DPRK, apparently fearing that they could be cut off from the US financial system. This was very effective in reducing the DPRK’s access to its international financial accounts, but at the same time became a major source of tension in the Six Party Talks – though positively, also contributing to DPRK concessions several years later. The funds were returned in February 2007.\(^{250}\) As to the impact of the measures, the CRS reports,\(^{251}\)

> In addition to the issue of returning the frozen funds, some analysts claim that the BDA issue brought to the surface lingering questions about the way the international banking community treats DPRK accounts. Specifically, the financial effects of the BDA action were larger than expected. It caused a run on accounts at the bank that compelled the government of Macau to take over BDA’s operations and place a temporary halt on withdrawals. It also appears to have obstructed some legitimate North Korean financial interests, as the BDA action caused other banks around the region, including Chinese, Japanese, Vietnamese, Thai, and Singaporean banks, to impose voluntarily more stringent regulations.


\(^{246}\) NTI, “North Korea Nuclear Profile.”


\(^{248}\) “N. Korea Moves to Bolster Nuclear Arsenal,” Korea Times, April 18, 2005.

\(^{249}\) NTI, “North Korea Nuclear Profile.”


against North Korean account holders. As North Korean traders and others move forward, some question whether the situation will return to “business as usual,” “business with caution,” or remain as “no business at all.” In the case of China, a media report indicates that the country is allowing North Koreans to open bank accounts in China to settle business transactions in Chinese yuan. This enables them to conduct transactions in the Chinese currency.

**The October 2006 Test and 2007 Accords and the Chinese Reaction**

The situation continued to deteriorate throughout 2006, reaching a low point in October when North Korea conducted its first nuclear test. Following the underground test, the US Director of National Intelligence (DNI) issued a press release stating, “Analysis of air samples collected on October 11, 2006, detected radioactive debris which confirms that North Korea conducted an underground nuclear explosion in the vicinity of P’unggye on October 9, 2006. The explosion yield was less than a kiloton.”

North Korea was reportedly expecting at least a 4 kiloton yield, perhaps indicating that the North Korean plutonium program still had a number of technical hurdles to overcome before it had a usable warhead.

In response, China “used unprecedentedly harsh language to rebuke Pyongyang for ‘flagrantly’ conducting a nuclear test in disregard of the universal opposition of the international community;” until this point, China had only used the term “flagrantly” to condemn acts of its adversaries. Furthermore, China voted in favor of UN Security Council Resolution 1718, which prohibited states from transferring or providing luxury goods, heavy military equipment, or dual-use items to the DPRK.

After intense diplomatic activity by the Chinese government and others involved in the Six-Party process, the parties met again, and in February 2007 they agreed on the “Initial Actions for the Implementation of the Joint Statement.” The DPRK agreed to abandon all its nuclear weapons and existing nuclear programs and return to the NPT and IAEA safeguards in exchange for energy assistance and a release of the DPRK’s frozen Banco Delta Asia assets. After the February 2007 agreement, Pyongyang began shutting down and sealing its main nuclear facilities at Yongbyon under IAEA supervision.

Further progress was made in the Six Party Talks when the parties adopted the second “action plan” that called on the DPRK to disable its main nuclear facilities and submit a complete and correct declaration of all its nuclear programs by December 31, 2007. While disablement activities on the three key plutonium production facilities at Yongbyon progressed (see Figure VIII.11), Pyongyang failed to meet the December 31 deadline to submit its declaration. Almost six months past the deadline, on June 26, 2008, North Korea

---


253 NTI, “North Korea Nuclear Profile.”


256 NTI, “North Korea Nuclear Profile.”

257 NTI, “North Korea Nuclear Profile.”
submitted its declaration, which indicated that North Korea had separated a total of about 30 kilograms of plutonium and used approximately 2 kilograms for its 2006 nuclear test.\footnote{258}

However, according to NTI, various media reports claimed that the declaration failed to address the DPRK’s alleged uranium enrichment program or suspicions of its nuclear proliferation to other countries, such as Syria.\footnote{259} Despite these issues, in return for North Korea’s declaration, President George W. Bush rescinded the application of the Trading with the Enemy Act toward Pyongyang and notified Congress of his intention to remove the DPRK from the list of state sponsors of terrorism after 45 days, in accordance with US law.\footnote{260}

Following the US government’s action, Pyongyang demolished the cooling tower at the Yongbyon reactor.\footnote{261} Yet, when the 45-day period expired, the US did not carry out the de-listing. The State Department claimed that the 45-day period was a “minimum” rather than a deadline.\footnote{262} In response, the Korean Central News Agency (KCNA) released a statement by the Foreign Ministry stating that because the US had not carried out its commitment to remove the DPRK from the State Department’s terrorism list, Pyongyang would suspend the disablement of its key nuclear facilities at Yongbyon and consider taking steps to restore them “to their original state.”\footnote{263}

The following month, the DPRK asked the IAEA to remove seals and surveillance from the reprocessing plant in Yongbyon.\footnote{264} Then in April 2009, North Korea’s Foreign Ministry indicated that Pyongyang would withdrawal from the Six Party Talks and “would no longer be bound” by any of its agreements, saying instead that it would “fully reprocess” the 8,000 spent fuel rods from its Yongbyon reactor in order to extract plutonium for nuclear weapons.\footnote{265} Two days later, IAEA inspectors at the Yongbyon nuclear facilities removed safeguards equipment and left the country.\footnote{266} Although there were moves in mid-2011 to restart the process, the Six Party Talks have been suspended since late 2008.

While some see the Six Party Talks as useless, one ROK Deputy Foreign Minister has argued that they are still helpful in dealing with the DPRK. There are actually many bilateral relationships and working groups formed under the umbrella of the Talks that continue to this day. Through these meetings, there is still a signaling dialogue going on with the DPRK. Furthermore, should North Korea decide to return to the negotiating table, the Deputy Foreign Minister believes that the Six Party Talks have a lot of merit – the intransigence of

\footnotesize
\begin{itemize}
\item \footnote{259}{NTI, “North Korea Nuclear Profile.”}
\item \footnote{261}{NTI, “North Korea Nuclear Profile.”}
\item \footnote{262}{“US Won’t Take North Korea Off Terrorism List Yet,” Reuters, August 11, 2008.}
\item \footnote{263}{“Foreign Ministry’s Spokesman on DPRK’s Decision to Suspend Activities to Disable Nuclear Facilities,” KCNA, August 26, 2008.}
\item \footnote{264}{“Fact Sheet on DPRK Nuclear Safeguards,” International Atomic Energy Agency. http://www.iaea.org.}
\item \footnote{265}{“DPRK Foreign Ministry Vehemently Refutes UNSC’s ‘Presidential Statement,’” KCNA, April 14, 2009.}
\item \footnote{266}{“Fact Sheet on DPRK Nuclear Safeguards,” International Atomic Energy Agency. http://www.iaea.org.}
\end{itemize}
the DPRK has been the problem, not the format of the forum. Every major regional player is involved in the discussions, so any decision reached would have a lot of weight. Furthermore, if the Talks are able to resolve the DPRK nuclear issue, the forum could continue as an inter-governmental or multilevel forum for a Northeast Asian security dialogue, a framework that is currently lacking in the region.267

Figure VIII.9: Major Progress in the Six Party Talks

<table>
<thead>
<tr>
<th>Round</th>
<th>Date</th>
<th>Major Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>August 27-29, 2003</td>
<td>Formation of a consensus on denuclearization of the Korean Peninsula and the principle of peaceful resolution through dialogue</td>
</tr>
<tr>
<td>Third</td>
<td>June 23-26, 2005</td>
<td>Formation of a consensus on the need for initial actions for denuclearization of the Korean Peninsula and phased process based on the principle of “commitment for commitment, action for action”</td>
</tr>
<tr>
<td>Fourth</td>
<td>Session 1</td>
<td>July 26 – August 7, 2005 Adoption of the September 19 Joint Statement</td>
</tr>
<tr>
<td></td>
<td>Session 2</td>
<td>September 13-19, 2005 Affirmation of willingness to fully implement the September 19 Joint Statement</td>
</tr>
<tr>
<td>Fifth</td>
<td>Session 1</td>
<td>November 9-11, 2005 Reaffirmation of willingness to fully implement the September 19 Joint Statement and agreement on taking coordinated steps in implementation</td>
</tr>
<tr>
<td></td>
<td>Session 2</td>
<td>December 18-22, 2006 Agreement on first-phase actions for the implementation of the September 19 Joint Statement (the February 13 Agreement)</td>
</tr>
<tr>
<td></td>
<td>Session 3</td>
<td>February 8-13, 2007 Agreement on the second-phase actions for the implementation of the September 19 Joint Statement (the October 3 Agreement)</td>
</tr>
<tr>
<td>Sixth</td>
<td>Session 1</td>
<td>March 19-22, 2007 Affirmation of willingness to fully implement the September 19 Joint Statement</td>
</tr>
<tr>
<td></td>
<td>Session 2</td>
<td>September 27-30, 2007 Agreement on the second-phase actions for the implementation of the September 19 Joint Statement (the October 3 Agreement)</td>
</tr>
</tbody>
</table>


267 ROK Deputy Foreign Minister Sung-nam Lim, speech at Seoul National University, October 24, 2012.
### Figure VIII.10: Key Agreements in the Six Party Talks

<table>
<thead>
<tr>
<th>Agreement Name</th>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Statement (September 19, 2005)</td>
<td><strong>Dismantlement of North Korea’s Nuclear Programs and Removal of North Korea’s Security Concerns</strong>&lt;br&gt;  o North Korea committed to abandoning all nuclear weapons and existing nuclear programs.&lt;br&gt;  o The United States affirmed that it has no nuclear weapons on the Korean peninsula and has no intention to attack or invade North Korea.&lt;br&gt;  o North Korea stated that it has the right to peaceful uses of nuclear energy. The other parties expressed their respect and agreed to discuss, at an appropriate time, the subject of the provision of light water reactor to North Korea.** Normalization of Relations**&lt;br&gt;  o North Korea and the United States undertook to respect each other’s sovereignty, exist peacefully together, and take steps to normalize their relations.&lt;br&gt;  o North Korea and Japan undertook to take steps to normalize their relations.** International Assistance to North Korea**&lt;br&gt;  o The six parties undertook to promote economic cooperation in the fields of energy, trade and investment.&lt;br&gt;  o China, Japan, ROK, Russia and the US stated their willingness to provide energy assistance to North Korea.&lt;br&gt;  o The ROK reaffirmed its proposal of July 12, 2005 concerning the provision of 2 million kilowatts of electric power to North Korea.** Vision for Peace and Stability on the Korean Peninsula and Northeast Asia**&lt;br&gt;  o The directly related parties will negotiate a permanent peace regime on the Korean peninsula at an appropriate separate forum.&lt;br&gt;  o The six parties agreed to explore ways and means for promoting security cooperation in Northeast Asia.** Principles for Implementation**&lt;br&gt;  o The six parties agreed to take coordinated steps to implement the aforementioned consensus in a phased manner in line with the principle of “commitment for commitment, action for action.”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agreement Name</th>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreement on  February 13, 2007</td>
<td><strong>Action Plans for Initial Phase: Within first 60 days</strong>&lt;br&gt;  o North Korea will shut down and seal existing nuclear facilities, including the reprocessing facility, and invite back IAEA inspectors.&lt;br&gt;  o North Korea will discuss with other parties a list of all its nuclear programs.&lt;br&gt;  o North Korea and the US will start bilateral talks aimed at moving toward full diplomatic relations. The US will begin the process of removing the designation of North Korea as a state-sponsor of terrorism and terminating the application of the Trading with the Enemy Act with respect to North Korea.&lt;br&gt;  o North Korea and Japan will start bilateral talks aimed at taking steps to normalize their relations.&lt;br&gt;  o The parties agreed to the provision of emergency energy assistance equivalent to 50,000 tons of heavy fuel oil to North Korea.** Establishment of Five Working Groups: First WG meetings within next 30 days**&lt;br&gt;  o Denuclearization of the Korean Peninsula, Normalization of North Korea-US Relations, Normalization of North Korea-Japan Relations, Economy and Energy Cooperation, Northeast Asia Peace and Security Mechanism.** Action Plans for Next Phase: After the completion of the initial phase**&lt;br&gt;  o North Korea would make a complete declaration of all nuclear programs and disable all existing nuclear facilities.</td>
</tr>
</tbody>
</table>
The other parties would provide economic, energy, and humanitarian assistance equivalent of 950,000 tons of heavy fuel oil to North Korea.

<table>
<thead>
<tr>
<th>Agreement on October 3, 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>• North Korea agreed to disable all existing nuclear facilities by the end of year.</td>
</tr>
<tr>
<td>• North Korea agreed to declare all its nuclear programs by the end of year.</td>
</tr>
<tr>
<td>• North Korea reaffirmed its commitment not to transfer nuclear materials, technology, or know-how.</td>
</tr>
<tr>
<td>• The United States would begin the process of removing the designation of North Korea as a state sponsor of terrorism.</td>
</tr>
<tr>
<td>• The United States would advance the process of terminating the application of the Trading with the Enemy Act with respect to North Korea.</td>
</tr>
<tr>
<td>• The United States and Japan would make sincere efforts to normalize their relations with North Korea.</td>
</tr>
<tr>
<td>• The five parties would provide economic, energy and humanitarian assistance equivalent of one million tons of heavy fuel oil.</td>
</tr>
</tbody>
</table>

**Figure VIII.11: Known Disablement Steps at Yongbyon (as of January 2013)**

<table>
<thead>
<tr>
<th>Step</th>
<th>Facility</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge of 8000 spent fuel rods to the spent fuel pool</td>
<td>5-megawatt reactor</td>
<td>6400 completed as of April 2009</td>
</tr>
<tr>
<td>Removal of control rod drive mechanisms</td>
<td>5-megawatt reactor</td>
<td>To be done after spent fuel removal completed</td>
</tr>
<tr>
<td>Removal of reactor cooling loop and wooden cooling tower interior structure</td>
<td>5-megawatt reactor</td>
<td>Tower demolished June 26, 2008</td>
</tr>
<tr>
<td>Disablement of fresh fuel rods</td>
<td>Fuel fabrication facility</td>
<td>Not agreed to by DPRK; consultations held Jan. 2009 with ROK on possibility of purchase</td>
</tr>
<tr>
<td>Removal and storage of 3 uranium ore concentrate dissolver tanks</td>
<td>Fuel fabrication facility</td>
<td>Completed</td>
</tr>
<tr>
<td>Removal and storage of 7 uranium conversion furnaces, including storage of refractory bricks and mortar sand</td>
<td>Fuel fabrication facility</td>
<td>Completed</td>
</tr>
<tr>
<td>Removal and storage of both metal casting furnaces and vacuum system, and removal and storage of 8 machining lathes</td>
<td>Fuel fabrication facility</td>
<td>Completed</td>
</tr>
<tr>
<td>Cut cable and remove drive mechanism associated with the receiving hot cell door</td>
<td>Reprocessing facility</td>
<td>Completed</td>
</tr>
<tr>
<td>Cut two of four steam lines into reprocessing facility</td>
<td>Reprocessing facility</td>
<td>Completed</td>
</tr>
<tr>
<td>Removal of the drive mechanisms for the fuel cladding shearing and slitting machines</td>
<td>Reprocessing facility</td>
<td>Completed</td>
</tr>
<tr>
<td>Removal of crane and door actuators that permit spent fuel rods to enter the reprocessing facility</td>
<td>Reprocessing facility</td>
<td>Completed</td>
</tr>
</tbody>
</table>


**The May 2009 Test**

On May 25, 2009, the DPRK issued the following statement: “The Democratic People’s Republic of Korea successfully conducted one more underground nuclear test on May 25 as part of the measures to bolster up its nuclear deterrent for self-defense in every way as
requested by its scientists and technicians.”

The DPRK also expelled nuclear inspectors and declared it would “never” return to the Six Party Talks. The US Intelligence Community assessed that the DPRK probably conducted an underground nuclear explosion in the vicinity of Punggye with an explosion yield of approximately a few kilotons.

Most yield estimates were in range of 4 to 5 kilotons, but an initial Russian statement gave a much higher estimate of 20 kilotons. The test produced seismic signals characteristic of an explosion, indicating that they were generated by human activity, but no radioactive materials were reportedly detected, in contrast to the first test.

Verification technology experts such as Professor Paul Richards considered the scenario of a bluff – the creation of a nuclear explosion-like seismic signal using conventional explosives – but while technically possible, he stated that it was highly implausible, seeing as “several thousand tons of conventional explosives to be fired instantaneously would have been virtually impossible under the prevailing circumstances and would not have escaped detection.”

It is generally agreed that the test suggested the DPRK had the capability to produce nuclear weapons with a yield of roughly a couple kilotons TNT equivalent.

In response, China condemned the test using critical language, while a spokesperson for the Foreign Ministry described DPRK-Chinese relations as “normal state-to-state relations” that were similar “with any country around the world” – in contrast to its past official references to the DPRK as a traditional ally and friend. Also, China voted in favor of UN Security Council Resolution 1874, which tightened financial sanctions and trade restrictions on the DPRK while also calling on all countries to inspect vessels believed to be carrying prohibited cargo, in ports and on the high seas, and to seize and dispose of such cargo if it was identified.

Furthermore, in March 2010, the DPRK announced plans to construct a 25-30 MW(e) light-water reactor, which US nuclear expert Siegfried Hecker confirmed during his November visit. The reactor could be operational by 2014. Hecker also reported DPRK construction of a uranium enrichment facility at Yongbyon with 2,000 P-2 centrifuges in six cascades, claimed

---


by the DPRK to be used for producing low-enriched uranium to fuel the light water reactor under construction. This enrichment facility would be able to make up to 40 kg – enough for one or two nuclear warheads – of HEU each year.276

**The Leap Day Agreement**

After a series of bilateral meetings with the US beginning in the summer of 2011, on February 29, 2012, the US and the DPRK prepared for resumption of the Six Party Talks by announcing the Leap Day Agreement. The DPRK promised to halt uranium enrichment and missile testing as well as resume international monitoring of its nuclear sites, while the US committed to 240,000 tons of food aid, at an estimated cost of $200-250 million. The two countries released separate statements regarding the agreement:277

The United States announced that the two countries would hold further talks to finalize details on a “targeted U.S. program consisting of an initial 240,000 metric tons of nutritional assistance with the prospect of additional assistance based on continued need.” The U.S. statement also emphasized several wider security issues, such as its continued commitment to the 1953 armistice agreement and desire to increase people-to-people contacts with the DPRK.

The DPRK statement included a reference to a “discussion of issues concerning the lifting of sanctions on the DPRK and provision of light water reactors” as priorities once the Six-Party Talks have resumed. The United States did not include those issues in its statement, and they are likely areas of continued disagreement between the parties. In the past, U.S. officials have not supported the lifting of sanctions until after full denuclearization and a determination by the U.N. Security Council, and have supported only “discussion” of light-water reactors in the 2005 Six Party statement.

During the meetings, “U.S. negotiators verbally warned their North Korean counterparts that any missile testing, including under the guise of a peaceful satellite launch, would violate the terms of the agreement, but this message was not received or was ignored by Pyongyang.”278

Two and a half weeks later, on March 16, the DPRK announced it would be conducting another satellite launch, undertaking the test the following April, while also proclaiming itself a “nuclear armed state” and revised its constitution accordingly. The US suspended the promised food aid and cancelled another outreach program that had planned to resume US-DPRK missions to search for missing US soldiers’ remains from the Korean War,279 and the UN Security Council passed Resolution 2087 condemning the rocket launch. A further satellite test launch was conducted in December 2012, which has been discussed previously in this report.

**The February 2013 Test and Continued Tensions**

---


279 Ibid., p. 2.
After widespread speculation, the DPRK quickly followed the December launch with a third nuclear test on February 12, 2013. Since mid-2012, activity at the Punggye nuclear test site had given analysts advance indication that the DPRK was likely planning another nuclear test. After the test, the DPRK official news organ announced a “successful” underground detonation, while seismic monitoring equipment in the vicinity registered a 5.1 magnitude earthquake with waves similar to the nuclear tests in 2006 and 2009. According to the CRS,\textsuperscript{280}

The South Korean Ministry of Defense estimated that the test yield was between 6 and 7 kilotons. North Korea claimed that the February 12, 2013, nuclear test was to develop a “smaller and light” warhead. At a minimum, the test would likely contribute to North Korea’s ability to develop a warhead that could be mounted on a long-range missile. It is unclear what impact a third nuclear test would have on future negotiations, but it would make their success far less likely, and the UN Security Council was discussing additional sanctions measures.

Observers are also waiting for evidence from test emissions that might show whether the North Koreans tested a uranium or plutonium device. This information could help determine the type and sophistication of the North Korean nuclear warhead design about which little is known. Two U.S. experts, Hecker and Pabian, have assessed that North Korea used plutonium in both the 2006 and 2009 tests, and that without at least one additional successful plutonium test, the North would not have confidence in its miniaturized plutonium design. Other experts believe North Korea may choose to test highly enriched uranium-based devices. Testing of a uranium device might indicate a clandestine supply of highly enriched uranium, potentially from an enrichment facility in North Korea. If venting of the nuclear test site has occurred, air samples could indicate what kind of material was used.

The earthquake magnitude of the 2006 test was 3.9, the 2009 test was 4.4, and the February 2013 test was 5.0-5.1, according to the US Geological Survey.\textsuperscript{281} At a yield of approximately 6 kilotons, the test was larger than the first test (less than a kiloton of power) and the second test (approximately two kilotons). However, this is small compared to other countries – for example, China’s first three nuclear tests were measured at 22 kilotons, 35 kilotons, and 250 kilotons.\textsuperscript{282}

One Western diplomat said that Iranian scientists may have witnessed the nuclear test – indeed, Iran may have paid the DPRK tens of millions of dollars (in Chinese currency) to gain access to the test.\textsuperscript{283}

\textbf{Moves Toward Sanctions}

In an immediate response, all UN Security Council members approved a press statement condemning the test and pledging further action – setting the stage for negotiations over a fourth round of sanctions. While Russia announced it was ready to support additional sanctions on the DPRK’s nuclear program, the Russian Deputy Foreign Minister said it

\begin{footnotesize}
\begin{itemize}
\item 281 Victor Cha and Ellen Kim, “North Korea’s Third Nuclear Test,” CSIS, February 12, 2013.
\end{itemize}
\end{footnotesize}
would “oppose any sanctions damaging normal trade and economic relations with North Korea.”

Furthermore, in a 15-0 vote on March 7, the UN Security Council passed sanctions that further constrained DPRK trade, travel, and banking, while imploring countries to search any suspect DPRK cargo. The vote came just hours after the DPRK, angry with the proposed resolution and annual US-ROK joint military exercises, threatened for the first time to carry out “a pre-emptive nuclear strike” on the ROK and the US.

According to UN Security Council diplomats, the latest resolution is intended to make the DPRK sanctions regime similar to the tough sanctions against Iran’s nuclear program – which they argue have been more effective than previous DPRK sanctions – using the Iranian sanctions used as a model. However, similar US sanctions on Iran have been judged to be ineffective, at least in stopping Iran from nuclear development, according to US Central Command head General James Mattis.

One of the most important aspects of the sanctions, however, is that China participated in the three-week drafting process – suggesting that China is losing patience with its ally. China’s Foreign Ministry has repeatedly condemned the DPRK’s recent actions.

Beijing’s reaction was strong and swift. Immediately after the test, Chinese Foreign Minister Yang Jiechi summoned the North Korean Ambassador and ‘lodged a solemn representation’ over the test. He said that China ‘was strongly dissatisfied with and firmly opposed to’ the test. Chinese media carried editorials and essays expressing frustration and opposition to the North Korean action — even the Global Times, known for its critical stance against the west, issued an editorial arguing that China should reduce aid to North Korea and that if Pyongyang is not happy, so be it. Pyongyang’s ill-conceived criticism of China’s agreement to an UN resolution condemning the test further fuelled Chinese frustration with Pyongyang. It is against this background that the debate in China has changed from one about whether China should work with other countries to impose sanctions against North Korea to one about the kind of sanctions China should endorse.

Conversely, Russian officials and general public have not reacted particularly to the DPRK’s third nuclear test. The US, ROK, and Japan all believe that Russia should be more proactive regarding the DPRK nuclear issue, but for several likely reasons, Russia does not agree. One is that Russian policy-makers do not actually think that the DPRK would ever attack Russia or use nuclear arms against it. Russia has maintained a stable relationship with the DPRK and has never called for regime change. Second, though missile and nuclear tests are carried out near the DPRK-Russian border, Russia does not see these as particularly dangerous.

---


Radiation has stayed at normal levels, and while a missile could theoretically crash into Russia in a failed launch, the low population density in Eastern Russia means that not much damage would be done.\textsuperscript{289}

Third, the US would not likely reduce its missile defense buildup even if the DPRK did give up its nuclear weapons and missiles, and Russia is more worried about European-area US missile defense. Also, Russia has not accused the DPRK of missile and nuclear trafficking, unlike other Western countries. Finally, Russia perceives a rising “geopolitical pressure on Russia on behalf of the United States and its allies,” according to Russian Federal Security Service chief Alexander Bortnikov, meaning that it likely is more concerned about a potential confrontation with the US.\textsuperscript{290}

In March 2013, independent of UN sanctions, the US Treasury imposed its own financial sanctions on the Foreign Trade Bank of North Korea, the DPRK’s primary foreign exchange institution. The Treasury Undersecretary also visited the ROK, Japan, and China to persuade the countries to adopt similar measures, in an attempt to apply further pressure on the DPRK to disrupt their nuclear development.\textsuperscript{291} In addition, the US Army Pacific (USARPAC) elevated the USARPAC Commander position from a three-star to a four-star general, because the DoD saw a war on the Korean Peninsula as increasingly likely – in which case a four-star general would be better-equipped to lead USARPAC forces.\textsuperscript{292}

Two weeks after the DPRK’s third nuclear test, one Chinese academic, Deng Yuwen, the deputy editor of a respected journal published by a Party school, published an article in a British newspaper entitled, “China should abandon North Korea.” Several other leading Chinese academics have made similar calls. Deng wrote that the DPRK’s third nuclear test was a good time for the PRC to re-evaluate the DPRK-PRC alliance, and there were several good reasons for China to withdraw its support of North Korea and instead support reunification of the Peninsula:\textsuperscript{293}

- Basing a state-to-state relationship on ideology is dangerous.
- The DPRK no longer holds much value as a geopolitical ally – especially if the US launched a preemptive strike, with the Chinese then being obligated to respond and in turn engage the US military.
- The DPRK will not and likely cannot reform and it cannot continue indefinitely in its current state, so why should China keep a relationship with a country and leadership that will ultimately fail?
- The DPRK is repudiating its relationship with China. During the Korean War, hundreds of thousands of Chinese soldiers were killed while supporting the DPRK, so China views the bilateral relationship as cemented by this shared sacrifice. However, starting in the 1960s, the DPRK rewrote the history of the war – and left the Chinese out. Kim Il-sung took all the credit, and many cemeteries with Chinese soldiers’ remains were leveled.

---

\textsuperscript{289} Artyom Lukin, “Russia shows little concern of North Korean nukes (for now),” \textit{East Asia Forum}, March 3, 2013.

\textsuperscript{290} Ibid.


\textsuperscript{292} Kevin Baron, \textit{Foreign Policy – Situation Report}, March 25, 2013.

\textsuperscript{293} Deng Yuwen, “China should abandon North Korea,” \textit{Financial Times}, February 27, 2013.
The DPRK could use its nuclear weapons as a means of blackmail against China. According to one Chinese scholar, during President Clinton’s 2009 visit to the DPRK, the North Koreans blamed China’s “selfish” strategy and American sanctions for their economic poverty. During the same visit, Kim Jong-il also hinted that the DPRK had withdrawn from the Six Party talks in order to gain more independence from China, and that if the US agreed to help the DPRK, North Korea could become a strong fortress against China.

Overall, Deng concluded that the DPRK should think about abandoning the DPRK, or at least trying to force the country to start acting more accommodating to the PRC and/or give up nuclear weapons. 294

North Korea’s development of nuclear weapons is, in part, based on the illusion that it can achieve an equal negotiating position with the US, and thereby force Washington to compromise. But it is entirely possible that a nuclear-armed North Korea could try to twist China’s arm if Beijing were to fail to meet its demands or if the US were to signal goodwill towards it.

Considering these arguments, China should consider abandoning North Korea. The best way of giving up on Pyongyang is to take the initiative to facilitate North Korea’s unification with South Korea. Bringing about the peninsula’s unification would help undermine the strategic alliance between Washington, Tokyo and Seoul; ease the geopolitical pressure on China from northeast Asia; and be helpful to the resolution of the Taiwan question.

The next best thing would be to use China’s influence to cultivate a pro-Beijing government in North Korea, to give it security assurances, push it to give up nuclear weapons and start moving towards the development path of a normal country.

In response, Deng was given a month-long suspension from his job. Other Chinese commentators, especially those linked to the security and military establishment, argue that China should strengthen relations with the DPRK – and Russia – to counterbalance the US pivot to Asia. One recent commentary in the main military newspaper, the People’s Liberation Army Daily, argued: “The main reason why North Korea is bent on developing nuclear weapons is basically the threat that the U.S. poses to its security.” 295

At the same time, China has announced that it would not abandon the DPRK and that support of tougher sanctions should not be interpreted to mean that China’s basic attitude was changing or that it did not still believe that dialogue was the best way to persuade the DPRK to abandon its nuclear weapons program. 296 In late March 2013, one state-run Chinese newspaper ran an editorial supporting the DPRK and blaming the US for the nuclear situation on the Korean Peninsula: 297

It is time for both sides to take a step back and let cooler minds prevail to avoid any escalation of the situation. The US has long adopted a punishment heavy approach in dealing with ties to the DPRK. It has imposed rounds after rounds of severe sanctions against Pyongyang… the approach has only heightened Pyongyang’s seeds of insecurity and forced it to resort to more extreme actions to defend itself… Both the DPRK and the US should tone down their rhetoric and work with Beijing for an early return to the long stalled six-party talks.

294 Ibid.
While setting up back-channel negotiations with the DPRK, there are indications that China was increasing DPRK-bound cargo inspections in the wake of the March 2013 UN sanctions.\textsuperscript{298} Other reports note that prices of rice and other produce rose sharply as Chinese customs and border control impose more stringent inspections on exports to the DPRK. A Japanese newspaper reported that the price of rice had increased 50%, from 6,000 to 9,000 won per kilogram.\textsuperscript{299} It also appears that Chinese exports of rice to the DPRK dropped to zero in January, then rebounded in February, while exports of crude oil also dropped to zero in February. It is not clear if these are cyclical declines or signs of a changing policy in China.\textsuperscript{300}

Yet, traders in Jilin Province, a northeastern Chinese province that is next to the DPRK, reported there was not a noticeable slowdown of goods passing across the border, and no crackdown on smugglers had taken place.\textsuperscript{301} It does, however, appear that increased border controls by both the DPRK and China have resulted in a significantly decreased number of DPRK defectors to China – compared with the first several months of 2012, there have been approximately 57% fewer in 2013.\textsuperscript{302} It was further reported in early May 2013 that the state-controlled Bank of China had ended all dealings with a key DPRK bank. Experts evaluated this move as the strongest public PRC response to the DPRK’s continued development of its nuclear and missile programs to date.\textsuperscript{303}

Though China and Russia both supported the March 2013 UN Security Council sanctions, Russia has very little trade with or control over the DPRK, meaning it has little influence. China has in the past voted for sanctions against the DPRK, followed them for several months, and then quietly returned to assisting the Kim regime. Although China has said it wanted to see “full implementation” of the March sanctions,\textsuperscript{304} it remains to be seen if that will happen this time around.

\textit{Key Current Issues, Weapons Design, and Further Tensions}

The DPRK has unfrozen its plutonium program and instigated a highly enriched uranium program – efforts in violation of the 1991 North-South denuclearization agreement, the 1994 Agreed Framework, and the basic tenants agreed upon in the Six Party Talks. As a result, arms control negotiations on the peninsula seem to have come unglued. According to Dr. Christopher Ford, “there seems to be increasing agreement across the breadth of the US policy community that there is little to be gained from further engagement.”\textsuperscript{305}

\begin{itemize}
\end{itemize}
If such is the case, the DPRK may continue to pursue an advanced weapons program as a deterrent to perceived American and ROK aggression, which could pose a threat to the existing force balance on the Peninsula. As has been noted earlier, there is no way to be certain of the DPRK’s progress in weaponizing its nuclear capabilities. Moreover, experts debate the number of nuclear weapons it could now make and can acquire in the near term, and there are critical areas of uncertainty like its access to Chinese designs and the level of technology sharing with Iran and Syria.

According to an ROK government report discussing DPRK nuclear and strategic weapons,306

As early as in the 1960s, North Korea had sent its nuclear scientists to the largest nuclear research institute in the Soviet Union, the Joint Institute for Nuclear Research in Dubna. The number of professionals currently working in the North Korean nuclear industry is known to be about 3,000, including over 200 top-class experts. North Korea is also known to have about 4 million tons of uranium in recoverable deposits…. Over 300 scientists and engineers are known to have been stricken with atomic-related diseases during the course of their work.

To date, however, the DPRK has only conducted three low-yield nuclear tests – on October 9, 2006 with a yield of less than one kiloton, one on May 25, 2009 with a yield of a few kilotons, and a third on February 12, 2013 with a yield of approximately six kilotons (a 5.1 magnitude seismic shock in the area was reported by the US Geological Service). This compares with a yield that would have been at least three to five times higher (20 kilotons) in an efficient fission weapons system.

This indicates that it may be years before the DPRK can develop high-yield boosted weapons or the megaton and thermally dominated yields of fusion weapons. While no one can dismiss a low-yield fission weapon, it is very different in war-fighting lethality and deterrent impact from a high-yield weapon and presents further substantial problems if the DPRK deploys long-range missiles with operational accuracy that can be more in tens of kilometers than several hundred meters.

While US officials do not know whether the DPRK has achieved weaponization of its arsenal, they assess it has the capability to do so.307 The common assumption is that Pyongyang’s current nuclear weapon designs are, or will be, based on a first-generation implosion device, the logical choice for states in the initial stage of nuclear weapon development.308 Data collected from the DPRK’s May 2009 and February 2013 nuclear tests suggest the DPRK has the capability to produce nuclear weapons with a yield of roughly five or six kilotons TNT equivalent.309

Additionally, experts estimate that no DPRK nuclear bombs have been transferred to the KPA; Kim Jong-un apparently maintains control, possibly through the Second Economic

308 Chipman, North Korea’s Weapons Programmes, p. 45.
Committee, which is responsible for the production of weapons and military equipment – including missiles and nuclear weapons.310

**Miniaturization**

According to the CRS, many experts assess that the DPRK’s nuclear program’s primary objective is to develop a nuclear warhead capable of being mounted on intermediate- and long-range missiles. This would require miniaturization – making the nuclear warhead small enough to be mounted on a missile – and would likely require further missile and nuclear tests. Most experts believe that the DPRK has not yet achieved miniaturization of its nuclear arsenal. However, it has been reported that the DPRK received materials/assistance from the AQ Khan network, potentially providing the DPRK with a Chinese HEU-based nuclear weapon design that could help the DPRK create a reliable ballistic missile warhead – robust, small, and light.

Furthermore, an assessment by the US Defense Intelligence Agency that, “with moderate confidence, the DPRK has nuclear weapons capable of delivery by ballistic missile” – meaning small enough – was made public on April 11, 2013. The DIA also said that the weapon would have “low reliability.” The DIA has been making similar assessments since 2005.

However, DNI James R. Clapper issued a statement that the DIA assessment was not the consensus of the US intelligence community, commenting, “North Korea has not yet demonstrated the full range of capabilities necessary for a nuclear armed missile.” Secretary of State John Kerry responded similarly, and the Obama Administration downplayed the report.

In March 2013, the vice chairman of the Joint Chiefs of Staff said that the KN-08 could probably reach the US.311

**Fuels – Plutonium and the Potential for Uranium**

There has also been speculation about whether the DPRK can create bombs of both plutonium and uranium. Scientists believe that first two nuclear tests conducted used bombs made of plutonium, although no radioactive gas signatures were able to be collected after the second test. In a CSIS assessment, Victor Cha and Ellen Kim commented,312

A uranium-fueled test would suggest several disturbing new problems in the effort to denuclearize North Korea. First, it would mean that the DPRK has not one, but two ways to make a bomb which doubles the problem. Second, highly-enriched uranium is much easier to hide than plutonium. It can be made in [sic] from centrifuges operating in buildings the size of a warehouse unlike the big and easily identifiable footprint of a plutonium nuclear plant facility. Third, the North can potentially produce a lot more uranium than it can plutonium and proliferate horizontally to others (like Iran) who may not need to test a device and feel confident that it has acquired a working device. Moreover, if this is proven to be a test of a miniaturized device as the North claims, then they will have crossed another

---

technological threshold in [making] a nuclear warhead with a long-range ballistic missile that could threaten U.S. security and that of its allies. Basically, none of this is good at all.

As mentioned, the DPRK displayed uranium reprocessing facilities to Dr. Hecker in 2010, claiming it had the ability to convert plutonium reactor rods into uranium. According to the CRS, the DPRK has\textsuperscript{313}...

...industrial-scale uranium mining and plants for milling, refining, and converting uranium; it also has a fuel fabrication plant, a nuclear reactor, and a reprocessing plant — in short, everything needed to produce Pu-239/ It has recently been built a uranium enrichment facility at Yongbyon that could produce HEU for weapons, or LE7U reactor fuel which could be irradiated for plutonium production. In its earlier 5 MWe nuclear reactor, North Korea used magnox fuel — natural uranium (>99%U-238) metal, wrapped in magnesium-alloy cladding to produce plutonium for weapons. About 8,000 fuel rods constitute a fuel core for the reactor.

As the DPRK has announced it has finished reprocessing these 8,000 fuel rods, it is entirely possible that the third nuclear test in February 2013 was of a uranium weapon. Like the second nuclear test, sensors were unable to pick up any gas radioactive gas signatures after the test, so no open-source information is available regarding whether the third test was of a plutonium or uranium weapon.

While the UN’s Comprehensive Nuclear Test Ban Treaty Organization announced on April 23, 2013 that it had detected traces of radioactive materials from the February 2013 test, giving the first conclusive evidence that the test was of a nuclear weapon — and not just a large amount of conventional explosives — it remains unclear what type of fuel was used.\textsuperscript{314} One ROK analyst at a government-sponsored think tank, Korea Institute for Defense Analyses, wrote that “it is more likely that North Korea detonated HEU-based nuclear weapons in the third nuclear test.”\textsuperscript{315}

In addition to the 8,000 claimed reprocessed fuel rods, the DPRK still has 2,400 5-MWt and 12,000 50-MWt fresh fuel rods stored at Yongbyon.\textsuperscript{316} It is also assessed that, if the February 2013 test was a plutonium weapon, the DPRK has used up a significant amount of their available plutonium, and would thus need to produce more or make sure its uranium enrichment programs were working.

\textbf{Early 2013 Escalation}

In late January 2013, the DPRK proclaimed the 1992 Joint Declaration on Denuclearization of the Korean Peninsula to be null and invalid.\textsuperscript{317} In late February, the chief delegate of the DPRK military mission to the DMZ (Panmunjom mission), Pak Rim-su, in a rare direct

\textsuperscript{315} Ham, Hyeong-pil. “Changes in North Korea’s Strategic Line and Efforts for Strengthen Nuclear Capabilities,” ROK Angle, Korea Institute for Defense Analyses, April 22, 2013.
message to USFK Commander General James Thurman, warned that, “If your side ignites a war of aggression by staging the reckless joint military exercises... at this dangerous time, from that moment your fate will be hung by a thread with every hour” and that US forces would “meet a miserable destruction.”

In early March 2013, the DPRK said the 1953 Korean War armistice was null and void and that it would also cut off the DPRK-USFK hotline, with the DPRK Foreign Ministry announcing that a “second Korean War is unavoidable.” The two sides normally speak twice a day during the week on the hotline, which was established in 1971. The DPRK has also shut down the Red Cross hot lines with the ROK, and it decided in late March to further cut off military hot lines with the ROK – although it was reported that one dialogue channel, a hotline between civil aviation authorities, still remained.

Citizens in the DPRK were seen covering up buses and trains with camouflage in an attempt to be ready for war, while some citizens were evacuated into tunnels with emergency provisions. Kim Jong-un continued his visits to DPRK military installations and commented, “Once an order is issued, you should break the waists of the crazy enemies, totally cut their windpipes and thus clearly show them what a real war is like.” On March 30, the DPRK proclaimed it had entered “a state of war” with the ROK.

At the same time, the DPRK announced that it would “exercise the right to a preemptive attack” if US-ROK military exercises went ahead. The three-star general and Vice Defense Minister of the DPRK, Kang Pyo-yong, also claimed, “With their targets set, our intercontinental ballistic missiles and other missiles are on a standby, loaded with lighter, smaller, and diversified nuclear warheads... If we push the button, they will blast off and their barrage will turn Washington, the stronghold of American imperialists and the nest of evil, and its followers, into a sea of fire.” The DPRK also declared a no-fly, no-sail zone off of its costs – suggesting possible short-range rocket testing – and the DPRK army “ratified” a potential “diversified nuclear strike” against the US.

---

320 Freya Peterson, “North Korea cuts hotline with South, threatens nuclear strike as war games begin,” Global Post, March 11, 2013.
The DPRK argued that the armistice was a military document, not a peace treaty. DPRK state media further argued that the country had made repeated demands for peace talks since the 1970s, only to be rebuffed by the US – further justifying a unilateral nullification of the armistice. However, the armistice states that any change must be agreed to by all signers, and that unilateral declarations are unacceptable.329

This was the seventh time the DPRK has said it would nullify the armistice.330 The DPRK has also cut off, and later restored, the military hotline at least six times in the past when it wanted to raise tensions. The DPRK last cut off all military hotlines during US-ROK military drills in 2009.331 In fact, the ROK and DPRK have together formally accused each other of more than 1.2 million armistice violations:332

Since the end of the war, South Korea has accused North Korea repeatedly of violating the armistice by sending armed spies across the border, infiltrating submarines in South Korean waters, kidnapping hundreds of South Korean fishermen and still holding them there and launching an artillery attack on a South Korea island in 2010 that killed four people. Thousands of men from both sides, including many American soldiers, are believed to have died or remain missing.

As of the mid-1990s, North Korea had violated the truce 420,000 times, according to American and South Korean military data. North Korea alleged more violations by its enemies; until recently it has routinely accused them of sending spy planes into its airspace and bringing heavier weapons into the Demilitarized Zone along the border than allowed.

At the same time, the DPRK announced, "If they think we have acquired our nuclear weapons to trade them for some economic benefits, it will be nothing but an utterly absurd miscalculation… as long as the United States does not abandon its hostile policy, we have no intention of talking with it, and we will stick fast to our course under ‘songun.’” This is in contrast to its until-recently stated ultimate goal of ridding the Korean Peninsula of all nuclear weapons.333 In response, the US has announced on multiple occasions that the US would not accept the DPRK as a nuclear state.334

---

332 For example, the ROK says that the DPRK has violated the armistice by digging infiltration tunnels, deploying machine guns inside the DMZ, and triggering gunfire exchanges along the border; the DPRK has accused the ROK and US of conducting war maneuvers targeting the North, employing combat personnel and heavy weapons inside the DMZ, and firing at DPRK fishing boats near the NLL. Foster Klug, Hyung-Jin Kim, and Sam Kim, “A look at what NKorea vow to scrap armistice means,” Yahoo! News, March 6, 2013; Rick Gladstone, “Threats Sow Concerns Over Korean Armistice,” New York Times, March 9, 2013; “Pyongyang Cuts Hotline As U.S.-South Korean Military Drills Begin,” NKNews.org, March 10, 2013; Choe Sang-hun, “South Korea Disputes North’s Dismissal of Armistice,” New York Times, March 12, 2013.
**ROK and US Response**

The ROK, acting in the context of the new (pro)active deterrence strategy, has responded in kind to the DPRK’s elevated rhetoric. While dismissing DPRK threats as propaganda, the ROK MoD told reporters that, “If North Korean attacks South Korea with a nuclear weapon, Kim Jong-un’s regime will perish from the earth.” The ROK military also warned that if it was provoked by the DPRK, it would strike the North’s “command leadership.” At the same time, many analysts, as well as the ROK government, believe that Kim Jong-un is attempting to create an atmosphere of crisis within his country in order to enhance his own prestige and consolidate his leadership.

ROK President Park Geun-hye reiterated in early April that “Our military exists to defend our nation and its people from such threats… If [the North] stages any provocation against our people, you [the ROK MoD] should make a strong and swift response in initial combat without any political considerations.” The ROK MoD also unveiled a plan to accelerate the setup of a missile system called “Kill Chain” that works to pre-emptively detect, target, and destroy missile and military installations in the DPRK, as well as its command structure – in the event signs of an attack are detected. Although there was no update on the timeframe for deployment of the system, the ROK had previously announced it would be implemented by the end of 2015. The ROK also announced it would strengthen Cyberwarfare forces and develop measures to counter DPRK cyberattacks.

To underscore its commitment to the ROK, the US flew B-52 bombers over the Peninsula in mid-March, leading the DPRK to threaten to attack US military bases in Japan and Guam. Several days later, the DPRK announced that all of its long-range artillery and strategic rockets “are assigned to strike bases of the U.S. imperialist aggressor troops in the U.S. mainland and on Hawaii and Guam and other operational zones in the pacific as well as all the enemy targets in south Korea and its vicinity.”

In response, the ROK MoD vowed a “thousandfold, ten-thousandfold retaliation” against any Cheonan-like provocation, while government officials stated that the ROK would retaliate by, among other measures, launching missiles at gigantic statues of Kim Il-sung and Kim Jong-il – to which the DPRK strongly reacted, saying that the monuments were “symbols of the dignity of the supreme leadership” and that the DPRK would in return “destroy the den of confrontation, including Chongwadae [the ROK presidential office], hotbed of all evils.”

The US may have to go further. It has already discussed the possibility of providing extended deterrence to the ROK. US options are limited by the fact that North Korea has a powerful – if cautious and sometimes restraining – protector in China. It is far harder for the United States to talk about preventive strikes after the fact and in the face of Chinese desire to keep a

---

340 Ibid.
buffer state between it and the US. US options are also affected by the fact that any deployment of US nuclear forces or extended deterrence that focuses on North Korea will be seen by China as a potential threat.

At the same time, the US faces the reality that the risks of a growing DPRK nuclear force – coupled to a large stock of chemically armed bombs and missiles and possible biological weapons – means it cannot simply let a key ally like the ROK bear a one-sided threat or leave Japan in the position where it, too, has no balancing force. While arms control options are not impossible, it is also all too clear that they offer even less chance of success than negotiations with Iran.

This leaves the US with several alternatives, none of which offer the prospect of lasting stability, but all of which are very similar to the options the US might use against Iran and would also put pressure on both North Korea and China:

- Turn to China and say the US will offer extended nuclear deterrence to Japan and the ROK unless China can persuade the DPRK to halt and roll back its nuclear programs. It could confront China and aid the ROK with two major options:
  - The most “quiet” or discrete extended deterrence option would be nuclear armed submarine- or surface-launched cruise missiles backed with the deployment of conventionally-armed cruise or ballistic missiles with terminal guidance systems capable of point attacks on North Korea’s most valuable civil and military assets.
  - The most decisive extended deterrence options would be the equivalent of the combination of Pershing II and ground-launched cruise missiles that were land-based, had US operating crews both deep inside South Korea and in or near its major cities, and had both nuclear and precision conventional warheads. The DPRK would be faced with the inability to strike at key ROK population centers without striking at US forces and still see mobile US nuclear armed forces in reserve. It also could not use conventional warheads without facing a more accurate and reliable US strike force in return.

- The US could work with the ROK to create the same kind of layered defenses against missiles and rockets being developed in Israel, and use the ROK model to help create layered defenses in the Gulf, allowing an indirect form of cooperation between Israel and the Gulf states without overt ties or relations.

As is the case in the Gulf, the US does not have to support proliferation by either South Korea or Japan. Experts may argue the timing, but none argue over ROK and Japanese capability in building long-range missiles and nuclear weapons, and doing so with minimal – if any – testing. In fact, the ROK would already have nuclear weapons if the US had not pressed the ROK to not continue its nuclear development, reaching an agreement on the matter with South Korea in 1975 – as previously discussed.

The US can put pressure on both the DPRK and China in ways that would allow several years for negotiation while not seriously opposing the ROK in any way that would bind or sanction its ally. While Japan is far less likely to take a decision to go nuclear, particularly in
the near-term, the US could decide that the Missile Technology Control Regime had essentially outlived its usefulness – binding the US without binding China – and encourage Japan to create precision strike conventional missiles as well as missile defenses.

This would confront both the DPRK and China with the reality that once such a Japanese force was created, Japan could quickly arm them with nuclear weapons if it came under increasing North Korean or Chinese pressure. Such options would give the US, the ROK, and Japan growing leverage to pressure China to restrain the DPRK as well as deter and contain the expansion of Chinese nuclear forces.

In fact, one way to put pressure on China would be to start a dialogue that could be either official or think tank, including discussions of both missile defense and extended deterrence, and encourage the ROK and Japan to surface the nuclear option. If this succeeded in pushing China into far more decisive pressure on North Korea, there would be no need for either extended deterrence or ROK or Japanese nuclear forces. Along these lines, and in response to recent ROK Foreign Ministry suggestions, on April 25, 2013 China signaled that it was “positively” considering holding a trilateral, informal US-China-ROK “1.5-track” security dialogue – which would include both government officials and academics – to discuss policy and security issues related to the DPRK.341

Moreover, such options could be used to lever Chinese restraint in transferring missile technology to Iran. There also is no reason that the US, the ROK and Japan could not offer quid pro quos in terms of incentives for a North Korean roll back, including some formal agreement on all sides for a local WMD-free zone and economic incentives for a more open DPRK.

At the same time, the US may have to tacitly encourage ROK and Japanese creation of at least precision-guided conventional missile forces and possibly nuclear forces as a local regional counterbalance to the Chinese nuclear effort. This is scarcely a desirable option, or one that can easily be kept stable, but the DPRK is only part of the problem and the US should not passively allow itself to be trapped into a Chinese-US nuclear relationship. It should be clear to China that it faces other potential nuclear powers if its nuclear forces grow too much and are even indirectly linked to Chinese pressure on maritime and island disputes in the Pacific.

**Japanese Response**

Japan is also feeling threatened, and in March 2013 the Japanese government was reportedly planning to give orders to intercept any DPRK missiles, while Aegis destroyers carrying SM-3 missiles were deployed to the northwest of Japan – as has happened in all previous DPRK missile launches.342

In early April 2013, Prime Minister Abe put the Self-Defense Forces (SDF), already mobilized for missile defense, on “full alert status” due to the DPRK threat. The Navy deployed two Aegis destroyers to the Sea of Japan, and the Air Force readied its land-based


PAC-3 missile interceptors. This is the fourth time that Japan has undertaken its highest state of defense readiness in response to DPRK missile threats, with the first in March 2009 and the second and third in response to 2012 missile launches. The April 2013 orders were the first time Japan had gone to full alert status without any DPRK-stated intention to launch a missile.\(^{343}\)

The DPRK’s bellicosity has also allowed Abe to call for a build-up in Japan’s military – a move the US has encouraged so that Japan can play a larger role in the region’s security. According to Abe, Japan would be unable to shoot down any potential DPRK-launched missile aimed at the US, as it would not be in self-defense – and thus against the Japanese constitution. Other potential scenarios that are constitutionally forbidden but Abe argues should be permissible include defending US military vessels under attack during joint US-Japan operations and providing logistical support to nations and/or protecting allied troops under attack while engaged in peacekeeping missions.\(^{344}\)

According to Abe, Japan’s military should have more latitude to fight a broader range of threats to Japan’s allies in a new doctrine of “collective self-defense.” Abe has other proposals, in addition to building up the Japanese military – including increasing Japanese military spending for the first time in 11 years (by .8%) and increasing the number of SDF personnel.

Japan’s new military budget also calls for enhanced weapons – including F-35s, an attack submarine, amphibious troop carriers, and funding to develop new anti-ship missiles. Increased Japanese command and control in joint US-Japan military exercises is one manifestation of this trend. One newspaper poll found that 54% of respondents supported Abe’s moves to increase the defense budget, while 36% were opposed. Military officials in both Japan and the US say that new DPRK threats justify a broader re-examination of long-standing Japanese regional defense policies. Japan is also worried about increasing tensions with China over disputed islands.\(^{345}\)

**Russian and Chinese Response**

Russia has also expressed concern about the risk of escalation on the Korean Peninsula, with Prime Minister Vladimir Putin remarking in early April 2013, “I would make no secret about, we are worried about the escalation on the Korean peninsula because we are neighbours… And if, God forbid, something happens, Chernobyl which we all know a lot about, may seem like a child’s fairy tale. Is there such a threat or not? I think there is… I would urge everyone to calm down… and start to resolve the problems that have piled up for many years there at the negotiating table.”\(^{346}\)

As has been discussed previously, there seems to be a debate among Chinese citizens, government officials, and academics as to whether China should continue its significant

---


\(^{346}\) Christine Kim, “North Korea suspends last project with South, Putin cites Chernobyl,” Yahoo! News, April 8, 2013.
support of the DPRK. While one Chinese academic was suspended from his job after publishing an article pushing for abandonment of the DPRK – as discussed previously in this chapter – Xi Jinping, China’s new president, said in an early-April speech that no Asian country “should be allowed to throw a region and even the whole world into chaos for selfish gain,” an indirect though clear criticism of the DPRK.\textsuperscript{347}

According to US Joint Chiefs of Staff Chairman General Martin E. Dempsey, the Chinese government wants to limit the DPRK’s nuclear ambitions though it remains unclear what China would do to realize that goal. General Dempsey stated, “Chinese leadership is as concerned as we are with North Korea’s march toward nuclearization and ballistic missile technology. And they have given us an assurance that they are working on it, as we are. But I didn’t gain any insights into particularly how they would do that.”\textsuperscript{348} His interlocutor, Chief of the General Staff Gen. Fang Fenghuim, said Beijing is firmly opposed to the DPRK’s nuclear weapons program and believes it should be addressed through dialogue.\textsuperscript{349}

It was also reported that the Chinese and ROK Foreign Ministers agreed in late April 2013 to set up a 24-hour hotline to facilitate policy consultations on the DPRK.\textsuperscript{350}

\textbf{Further DPRK-ROK-US Tensions}

While initial reports indicated no sign of imminent DPRK military action accompanying the February 2013 nuclear test, by March 29, extra troop and vehicle movements at the DPRK’s mid- and long-range missile sites were reported in the South Korean news. On March 28, the US had flown two radar-evading B-2 spirit bombers over South Korea, flying from the US and back, dropping inert munitions as a practice run in the South for the first time. The following day, the DPRK put its missile units on standby to attack US military bases, with Kim Jong-un reportedly signing a plan to technically prepare the country’s strategic rockets to be on standby. In previous periods of US-ROK joint military exercises, the DPRK has similarly put its military on highest readiness to fight, and Kim Jong-un has also previously given “final orders” for the DPRK military to wage revolutionary war with the ROK.\textsuperscript{351}

At the end of March, the DPRK also announced a “new strategic line” to build both its nuclear arsenal and its economy simultaneously – because a growing nuclear deterrent would allow the DPRK to reduce military spending and invest more resources into light industries and the agricultural sector. In order to promote the new guidelines, the Central Committee of the ruling Workers’ Party met for the first time since 1993, with Kim Jong-un presiding; the

\textsuperscript{349} “China says new North Korea nuclear test possible,” Associated Press, April 22, 2013.
\textsuperscript{350} “Top diplomats of S. Korea, China to set up hotline amid N. Korea tensions,” Yonhap News Agency, April 24, 2013.
next day the Supreme People’s Assembly – the DPRK’s rubber-stamp Parliament – was expected to follow up and pass the guidelines.\textsuperscript{352}

In early April, the DPRK passed a decree at the 7\textsuperscript{th} session of the 12\textsuperscript{th} Supreme People’s Assembly on “further consolidation of the self-defense nuclear power status.”\textsuperscript{353} The North also announced that, as part of a plan to put all of its nuclear facilities to use in expanding its nuclear arsenal, it would restart its plutonium reactor at Yongbyon, the cooling tower of which had been destroyed pursuant to the Six Party Talks in 2007 – and continue construction on other reactors. The DPRK also cited the need to generate more electricity as a motivation for its actions.

Siegfried Hecker noted that it could take six months to a year for the DPRK to restart the aging plutonium reactor, and another three years to reprocess and extract enough fissile material for more weapons. Hecker has stated that the DPRK could do so without needing foreign materials or equipment, and, once operational, could produce 6 kg of plutonium per year.\textsuperscript{354}

Simultaneously, the US reported that an Aegis-class warship had been moved to the ROK’s southwest coast, and an SBX-1 sea-based radar platform was being moved to the western Pacific to monitor the DPRK as well.\textsuperscript{355}

In addition, the DPRK moved what appeared to be two Musudan missiles (unveiled in 2010 but not yet tested) and seven mobile launchers to its east coast in early April, and a ROK military source noted on April 21, 2013 that satellite images showed that the DPRK had moved an additional two short-range Scud mobile missile launchers to South Hamgyeong Province (also on the east coast). These missiles appeared to have been removed by early May 2013.\textsuperscript{356}

In response to the Musudan missiles on the east coast, Japan deployed ballistic missile interceptors near Tokyo.\textsuperscript{357} The US repositioned two Aegis missile destroyers – the John McCain and the Decatur – in waters near the Korean Peninsula, and announced it would deploy a second TPY-2 missile-defense tracking radar in Japan,\textsuperscript{358} along with the Terminal High-Altitude Area Defense (THAAD) system – a land-based missile defense system that


\textsuperscript{357} Christine Kim, “North Korea suspends last project with South, Putin cites Chernobyl,” Yahoo! News, April 8, 2013.

includes a truck-mounted launcher, a component of interceptor missiles, an AN/TPY-2 tracking radar, and an integrated fire control system – to Guam within the next several weeks. 359

The US deployed B-2 and B-52 planes, both with nuclear capabilities, over the ROK, and used F-22s in drills with the ROK. 360 On April 10, ROK-US combined forces raised their alert level to Watchcon 2 to increase surveillance monitoring, while the ROK had raised its alert level to “vital threat,” as it appeared that at least one of the Musudan missiles was fuelled and ready for launch. 361

The US also announced that it would deploy additional ballistic missile interceptors in California and Alaska, increasing the number of ground-based interceptors from 30 to 44 at a cost of just under $1 billion. While the system has only been successful in 50% of tests, the weapons send a signal of credible deterrence, showed the ROK and Japan that the US remained committed, and also warned Beijing to restrain the DPRK or face an expanding US military focus in the Asian-Pacific region; according to one senior government official, “We want to make it clear that there’s a price to be paid for letting the North Koreans stay on the current path.” The missiles could also be used to deter Iran. 362 At the same time, in an attempt to avoid misperception by the DPRK, a long-scheduled test of Minuteman-3 ICBMs was delayed. 363

Several foreign companies operating in the ROK announced they were considering contingency plans for their employees’ safety, 364 while the ROK stock market was negatively affected by the growing tension on the Peninsula. One expert noted that the DPRK was attempting to use extreme propaganda to damage foreign direct investments in South Korea, a type of asymmetrical psychological warfare attack on the ROK’s economic strength. 365 While on a visit to China, Secretary of State John Kerry attempted to garner increased Chinese support of the US position towards the DPRK – meaning, a reduction in Chinese support of the North – and reportedly offered to reduce US missile defense in the Asia-Pacific if the DPRK abandoned its nuclear program. 366

**Halting Operations at the ROK-DPRK Joint Industrial Complex at Kaesong**

On April 3, the DPRK shut down the ROK-DPRK joint industrial complex at Kaesong, followed shortly thereafter by a pull-out of 53,000 workers. It has blocked border traffic three

360 “South Korea pledges strong response against North,” BBC, April 2, 2013.
361 “South Korea raises alert with North to ‘vital threat,’” BBC, April 10, 2013.
363 “Pentagon Delays Missile Test to Avoid Misperception by N. Korea,” ABC TV Foreign News, April 6, 2013.
times before – in 2009 – the longest of which was for three days, the April 2013 closing has been the longest period since the facility was first installed. The factories in Kaesong produced approximately $470 million annually in textiles and other labor-intensive products. A basic map of Kaesong’s location can be seen in Figure VIII.12.

However, there reportedly was friction within the ruling elite over the decision, with the military demanding an immediate shut-down of the complex and some Workers’ Party officials arguing instead that a shutdown would affect 50,000 DPRK workers’ livelihoods, as well as their 200,000 family members. If the complex closes permanently, the total loss to ROK business owners, the ROK government, and investors would be approximately $5.3 billion. North Korea, which makes approximately $2 billion annually in trade due to the complex ($90 million in wages alone), remarked in its state-run press, But the puppet group of south Korea, its dutiful media and hack writers are saying that “the north does not take up the issue of the zone because it is a source for its foreign currency income” and talking about “two faces of the north”. They are even insulting the dignity of the supreme leadership of the DPRK.

It is an extremely unusual thing that the Kaesong Industrial Zone is still inexistence under the rave situation in which the north-south relations have plunged into a deadlock and the Korean Peninsula is on the verge of a war due to the U.S. and the south Korean warmongers’ vicious moves for igniting an nuclear war against the DPRK.

Under the situation, the south Korean puppet forces are left with no face to make complaint even though we ban the south sides’ personnel’s entry into the zone and close it.

But we have exercised self-restraint, taking into consideration that the closure of the zone on which the livelihood of small and medium businesses of south Korea hinge can leave those businesses bankrupt and lots of people jobless. In fact, it is the puppet group and small and medium businesses of south Korea, not the DPRK, which benefit from the zone.

By the middle of April 2013, the 123 ROK companies that had operations at Kaesong were beginning to feel the effects. Several companies reported that their foreign business partners had cancelled contracts and asked for their investments to be returned, while others indicated they might move their factories to China. On April 24, ROK President Park Geun-hye announced a financial aid package of $8 billion in special loans and $14.3 million in bank loans with government-assisted postponed repayments. Two weeks later, this was enlarged to

a $270 million emergency loan fund. The companies would also receive tax relief and unemployment allowances if they had to lay off workers because of the Kaesong troubles.373

Two days later, the ROK announced it would pull out the remaining 175 factory managers from Kaesong, hours after the DPRK rejected the ROK’s proposal for talks about the future of the Kaesong Complex despite the ROK’s threat of a “grave measure” if its proposal was rejected. President Park reportedly told her cabinet that she had no intention of “waiting forever” for the DPRK to change its mind about the industrial complex. One DPRK analyst stated that the DPRK was likely to confiscate the assets of the ROK companies in Kaesong – which had happened after operations at the joint tourism resort on Diamond Mountain were suspended in 2008 following the fatal shooting of a 53-year-old ROK tourist. The ROK’s Unification Minister warned the DPRK not to seize ROK assets at Kaesong, which had cost the ROK almost $1 billion to build after an agreement was reached in 2000 to begin the project.374

The ROK’s decision to evacuate Kaesong, though fully supported by the US, was criticized by Chinese media. The PRC’s official Xinhua News Agency ran an article asserting that a total shutdown would cost the ROK $1 trillion annually, while the DPRK would lose $87 million per year – and the livelihoods of the 300,000 people living there would be directly affected.375 While the DPRK attempted to tell the residents of the city that the shutdown was temporary, it was reported that workers – who had been earning $134 monthly – and residents were increasingly discontent and voicing their complaints.376

For a long time, the DPRK has used bluffs and blustering as self-defense and away to keep enemies off guard, magnify external threats to promote domestic unity, strengthen internal political control, and symbolically express dissatisfaction with international trends that are not favoring the country.377 Experts in the ROK believe that the DPRK was trying to pressure the ROK over Kaesong as a way to avoid dialogue, but that the move backfired due to President Park’s strong response. The DPRK was judged to be likely to “await a pretext to revive the Kaesong complex depending on the situation, such as a special envoy from China or improvement in relations with Washington,” according to one ROK-based expert.378

On April 23, several days after hundreds of leaflets supporting the DPRK and threatening ROK Defense Minister Kim Kwan-jin were distributed near the Defense Ministry, Kim received a letter containing a suspicious white powder – which was concluded to be wheat


flour – and a leaflet in the mail. The leaflet threatened to “punish” Kim if he dared to challenge the DPRK’s “highest dignity” and instigate war on the Korean Peninsula. The Minister is known for his tough stance on the DPRK and has often promised to respond harshly to any provocation; in turn, the DPRK’s state media has called him a “war maniac,” a “traitor,” and published pictures of DPRK soldiers shooting paper targets with his likeness. Although it is unclear who sent the letter, the Defense Ministry called it “an attempted act of terrorism.”

The results of the early-2013 DPRK provocations on South Korean public opinion can be seen in Figure VIII.13. It is interesting to note that while most ROK citizens viewed their current security situation as not particularly positive, many had a much higher perception of future security – and thus, it appears that South Koreans do not believe that the DPRK’s provocations would be particularly lasting or have a significant effect on the future.

**De-escalation**

It would appear that the cycle of DPRK provocation that spiked in early 2013 had ended by mid-year – perhaps due to prodding from China. The US began to take a more cautious posture because of fears that the DPRK could misperceive its actions. Instead, the US has worked with Korea on a Counterprovocation plan, calling for an immediate but proportional “response in kind” to any potential DPRK attack, and as discussed earlier, delayed a planned missile defense test.

China consistently called for both sides to engage in dialogue, arguing that this was the only want to ease tensions on the Peninsula. In mid-April 2013, the ROK made a conditional offer of talks to the North, but these were rejected as a “crafty trick.” The US said it was willing to talk to the North – but only if the DPRK upholds its previous disarmament agreements, meaning providing a promise to give up nuclear weapons, something at which the North scoffs.

The DPRK responded by releasing its own conditions for negotiations through its state-run newspaper on April 18, 2013, along with its own analysis of ROK and US offers for talks:

> The preconditions for dialogue raised by them include a stop to “provocative” remarks which the DPRK has so far been engaged in and demonstration of its intention to realize denuclearization and suspend missile launch. These are absurd ones…. It is another provocation against the DPRK that the U.S. urged the former to show the “will for denuclearization” as a precondition for dialogue.

> The U.S. and the south Korean puppet regime should make a bold decision to take the following practical measures if they want to shirk off the historical responsibility for the prevailing grave

---

situation on the Korean Peninsula, escape sledge-hammer retaliatory blows of the army and people of the DPRK and if they truly stand for dialogue and negotiations:

First, they should immediately stop all their provocative acts against the DPRK and apologize for all of them. As the first phase, they should take the measure of retracting the UNSC’s “resolutions on sanctions” cooked up under absurd pretexts. They should bear in mind that doing so would be a token of good will towards the DPRK. The south Korean puppet forces should promptly halt all their anti-DPRK rackets, not linking their own mishaps such as Cheonan warship sinking incident and the “March 20 hacking case” to the north.

Second, they should give formal assurances before the world that they would not stage again such nuclear war drills to threaten or blackmail the DPRK. Dialogue can never go with war actions. Frequent nuclear war maneuvers will only strain the situation and totally block the way of dialogue.

Third, they should make a decision to withdraw all nuclear war means from south Korea and its vicinity and give up their attempt to reintroduce them as their immediate duty. They should bear in mind that the denuclearization of the Korean Peninsula… may lead to the global denuclearization.

The chief of Chongwadae should not forget that the prospect of south Korea may be rosy when the north’s nukes are considered as a property common to the nation but south Korea is bound to go to ruin when it remains under the U.S. nuclear umbrella.

A ROK Foreign Ministry spokesman rejected these, responding, “North Korea’s demands are totally incomprehensible. It’s absurd.”

The North issued several threats in late April 2013, claiming that the DPRK was “one click away from pushing the launch button” (Strategic Rocket Force Commander Kim Rak-gyom) and “Stalwart pilots, once given a sortie order, will load nuclear bombs, instead of fuel for return, and storm enemy strongholds to blow them up” (Air and Anti-Air Force Commander Ri Pyong-Chol).

Chinese Chief of the General Staff General Fang Fenghui also stated on April 22 that a fourth DPRK nuclear test was a possibility.

Yet, in early June 2013, the DPRK and ROK met to discuss potential further negotiations – the first high-level dialogue in six years. Potential topics for discussion included resumption of economic and humanitarian projects, such as the Mount Kumgang tours, Kaesong Industrial complex, and Red Cross reunification programs. However, subsequent meetings were delayed due to issues over the government officials chosen to lead each side’s delegations. It remains to be seen whether or not this cycle of negotiations will even take place, and if it does, if it will lead to meaningful results – either in the projects listed above or in the longer-term goal of North Korean denuclearization. It is highly likely that the DPRK is simply employing its usual tactic of stalling through negotiations without actually intending to resolve any of the many outstanding issues between the two sides.

Figure VIII.12: Inter-Korean Transportation Corridors


Figure VIII.13: South Korean Positive Perceptions of National Security (Present and Future), March 2013

DPRK Facilities

The DPRK possesses numerous known and suspected nuclear facilities – completed, under construction, or in planning (see Figures VIII.14 to VIII.17). Most of the facilities are in Yongbyon county, including a small nuclear research reactor (the IRT-2000), a 5 MW(e) gas-graphite moderated reactor, an unfinished 50 MW(e) reactor, waste storage sites, and a spent fuel reprocessing facility. The cooling tower of the 5MW(e) facility was demolished in 2008, but construction of a light water reactor and uranium enrichment facility have since begun. There is also a testing site at Punggye and an unfinished, abandoned 200 MW(e) reactor in Taechon country (the same province as Yongbyon, North Pyongan Province).389

The DPRK’s newest facilities are working with uranium enrichment – such as the facility revealed in 2010. A light-water reactor is also under construction near Yongbyon and could be operational by 2014. As Figure VIII.17 shows, there are also a variety of milling, mining, testing, research/development, industrial, and educational facilities around the country.390

According to the World Nuclear Association,391

The Democratic People’s Republic of Korea (DPRK, aka North Korea) generated 34 TWh in 2002 and 19 TWh in 2003, 71% from hydro and 29% from fossil fuels. Per capita consumption in 2002 was 1364 kWh. Recent estimates suggest that operable generating capacity is 2000-3000 MWe. In 1985, it brought into operation a small gas-cooled, graphite-moderated, natural-uranium (metal) fuelled “Experimental Power Reactor” of about 25 MW (thermal) at Yongbyon. It exhibited all the features of a plutonium production reactor for weapons purposes and produced only about 5 MWe as an incidental feature. North Korea also made substantial progress in the construction of two larger reactors designed on the same principles, a prototype of about 200 MWt (potentially 50 MWe) at Yongbyon, and a full-scale version of about 800 MWt (potentially 200 MWe) at Taechon.

DPRK Nuclear Reactors392

The DPRK has an 8 MWth-capacity nuclear research reactor, the IRT-2000, constructed by the USSR and completed in 1965. It originally used 10% enriched uranium as fuel, but was upgraded to use highly enriched uranium; the USSR provided fuel rods until 1973. In 1992, DPRK officials admitted that 300 mg of plutonium had been separated in 1975; since 1992, due to a lack of fuel, the IRT-2000 has operated only intermittently. As it was not covered by the 1994 Agreed Framework, it was not frozen and continues to operate on occasion.

Construction on the Yongbyon 5 MWe reactor began in 1979, and the reactor was operational by 1986. It uses natural uranium as a fuel source. Although the DPRK claimed it was for electricity generation, it can easily produce weapons-grade plutonium – with which the DPRK has conducted nuclear weapons tests in 2006, 2009, and 2013. The reactor was shut down under the 1995 Agreed Framework, and the cooling tower was demolished in 2008 as part of a 2007 Six Party agreement. As of 2010, it appears to be inactive – though

390 Ibid.
DPRK officials told US experts that it was in stand-by status and received regular maintenance. The DPRK has threatened to restore the reactor, most recently in April 2013.

The Yongbyon 50 MWe reactor was started in 1985/1986 and was due to be completed in 1995. It would have been able to produce approximately 55 kg of plutonium per year. Construction was frozen within a year of completion under the 1994 Agreed Framework. Dr. Hecker reported in 2010 that it was being dismantled with large cranes and remains unfinished and abandoned.

The DPRK began construction of a 200 MWe reactor in Taechon in 1989 with an expected completion date of 1996. When completed, it could have been capable of producing about 220 kg of plutonium annually. Construction was frozen in 1994 under the US-DPRK Agreed Framework, and it appears to remain unfinished, without any significant changes since 2002.

The Geumho-Jigu Light Water Reactor site in Hamgyeongnam province was part of the 1994 Agreed Framework between the DPRK and the US. The Korean Peninsula Energy Development Organization (KEDO) was established to oversee the construction of two 1,000 MWe light water reactors (LWRs). While excavation began in 2001 and construction in mid-2002, the project was suspended in late 2003 due to the DPRK’s suspected uranium enrichment and expelling of IAEA inspectors. The project, only 35% completed, was officially terminated in May 2006.

An experimental LWR (25-30 MWe / 100 MWth) at Yongbyon is apparently under construction. According to visiting US experts in 2010, the site was described as a “large excavated pit... roughly 40 meters by 50 meters by 7 meters deep” where “a concrete foundation 28 meters square with round concrete preforms for the reactor containment vessel was visible.” Construction was reportedly begun in July 2010 with a target completion of 2012, though experts saw this as highly optimistic and instead projected an operational start date of 2014-15. The reactor will be fueled with 4.5% enriched U02 fuel, and all components of the reactor – and the fuel – will be manufactured domestically. The DPRK says this reactor will be used for electricity production.

A US expert analysis of satellite imagery on May 2, 2013 indicated that the DPRK was in the final “cleanup” stage of completing the reactor, and it appeared that the DPRK could begin startup activities “in the coming weeks.”

Recent Developments

The visit by Dr. Hecker to the DPRK in November 2010 shed additional light on developments in the DPRK’s nuclear program, especially regarding the DPRK’s potential uranium enrichment programs. Highlights of the information gleaned from his trip included:

- A small, recently completed, industrial-scale uranium-enrichment facility. The sight of 2,000 centrifuges and an ultramodern control room stunned Dr. Hecker. “Instead of finding a few dozen first-generation centrifuges, we saw rows of advanced centrifuges, apparently fully operational.”

383 38 North (operated by Johns Hopkins) made the analysis; “Satellite imagery indicates N. Korea close to operating light-water reactor,” Yonhap News Agency, May 2, 2013.

394 Hecker, “What I Found in North Korea.”
Initial construction on a small, experimental LWR designed to deliver roughly 25 to 30 megawatts of electric power. “The construction of the reactor raises a number of policy issues: an LWR requires enriched uranium, and once enrichment capabilities are established for reactor fuel, they can be readily reconfigured to produce HEU bomb fuel. The centrifuge facility...is most likely designed to make reactor, not bomb, fuel, because it would not make sense to construct it in a previously inspected site and show it to foreign visitors. However, it is highly likely that a parallel covert facility capable of HEU production exists elsewhere in the country.”

The 5 MWe reactor had not been restarted since it was shut down in July 2007. No new fuel had been produced and the fresh fuel produced prior to 1994 (sufficient for one more reactor core) is still in storage. Pyongyang apparently decided not to make more plutonium or plutonium bombs for the time being. Dr. Hecker’s assessment was that they could resume all plutonium operations within approximately six months and make one bomb’s worth of plutonium per year for some time to come.

Dr. Hecker’s report was followed by press reports that the IAEA suspected that the DPRK had at least one additional covert centrifuge site and might have significant additional sites. These reports mean that the DPRK may have sizeable stocks of enriched uranium as well as plutonium. A December 2010 CRS report held that, all together, with all facilities operating, the DPRK could produce approximately 6 kg of plutonium per year and an unknown amount of HEU per year, depending on the status of their uranium enrichment program.

Significant future growth in North Korea’s arsenal would be possible only if larger reactors were completed and operating, and growth would also depend on any progress in the reported uranium enrichment program. At a minimum, this means the DPRK’s future production of weapons-grade material is impossible to foresee, and that both targeting and arms control are far more difficult because of the inability to predict how many dispersed centrifuge facilities the DPRK may have.

395 Ibid.
397 Chico Harlan, “UN Report Suggests N. Korea Has Secret Nuclear Sites.”
**Figure VIII.14: North Korean Nuclear Power Reactor Projects (as of January 2011)**

<table>
<thead>
<tr>
<th>Location</th>
<th>Type/Power Capacity</th>
<th>Status</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yongbyon</td>
<td>Graphite-moderated Heavy Water Experimental Reactor/5 MWe</td>
<td>Currently shut-down; cooling tower destroyed in June 2009 as part of Six-Party Talks; estimated restart time would be 6 months</td>
<td>Weapons-grade plutonium production</td>
</tr>
<tr>
<td>Yongbyon</td>
<td>Graphite-moderated Heavy Water Power Reactor/50 MWe</td>
<td>Never built; Basic construction begun; project halted since 1994</td>
<td>Stated purpose was electricity production; could have been used for weapons-grade plutonium production</td>
</tr>
<tr>
<td>Yongbyon</td>
<td>Experimental Light-Water Reactor/100 MWT (25-30 MWe)</td>
<td>US observers saw basic construction begun in November 2010</td>
<td>Stated Purpose was electricity production; could have been used for weapons-grade plutonium production</td>
</tr>
<tr>
<td>Taechon</td>
<td>Graphite-moderated Heavy Water Power Reactor/200 MWe</td>
<td>Never built; Basic construction begun; project halted since 1994</td>
<td>Stated purpose was electricity production; could have been used for weapons-grade plutonium production</td>
</tr>
<tr>
<td>Sinp’o</td>
<td>4 Light-water reactors/440 MWe</td>
<td>Never built; part of 1985 deal with Soviet Union when DPRK signed the NPT; canceled by Russian Federation in 1992</td>
<td>Stated purpose is electricity production; could have been sued for weapons-grade plutonium production</td>
</tr>
<tr>
<td>Sinp’o</td>
<td>2 Light-water reactors (turn-key)/1000 MWe</td>
<td>Never built; part of 1994 Agreed Framework, reactor agreement concluded in 1999; Project terminated in 2006 after DPRK pulled out of Agreed Framework</td>
<td>Electricity production</td>
</tr>
</tbody>
</table>

### Figure VIII.15: List of Major North Korean Nuclear Sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hagap</td>
<td>The US Defense Intelligence Agency reported an underground nuclear-facility under construction in 1993, to be finished possibly by 2003. Commercial satellite images show tunnel entrances, but not other indications of the facility’s use.</td>
</tr>
<tr>
<td>Hamhung</td>
<td>This branch of the Academy of Defense Science is known for training engineers and chemists, and is also near a site with uranium deposits.</td>
</tr>
<tr>
<td>Musudan</td>
<td>On the east coast, a long-range rocket was fired from here in April 2009.</td>
</tr>
<tr>
<td>Pakchon</td>
<td>Location of uranium mine and milling facility (known as the April Industrial Enterprise), declared to the IAEA in 1992. The uranium milling facility reportedly processes ore from mines in the Sunchon area. Current status is unknown.</td>
</tr>
<tr>
<td>Punggye</td>
<td>This is the site of the DPRK’s underground nuclear tests in 2006, 2009, and 2013.</td>
</tr>
<tr>
<td>Pyongsan</td>
<td>Location of uranium mining and a uranium milling facility, which reportedly processes ore from the Pyongsan and Kumchon uranium mines. Current status is unknown.</td>
</tr>
<tr>
<td>Pyongyang</td>
<td>Laboratory-scale hot cells provided by the Soviet Union in the 1960s where believed to be used to extract small quantities of uranium; also in Pyongyang are the Colleges of Nuclear Physics at Kim Il Sung University and Kim Chaek University of Technology.</td>
</tr>
<tr>
<td>Sinpo</td>
<td>Location of two 1,000 MWe light water reactors constructed by the Korean Energy Developmental Organization (KEDO); under the terms of the Agreed Framework, given to the DPRK in return for freezing its nuclear program. Construction was halted and site abandoned after the outbreak of another crisis in late 2002.</td>
</tr>
<tr>
<td>Sunchon</td>
<td>Location of an important uranium mine.</td>
</tr>
<tr>
<td>Taechon</td>
<td>Location of incomplete 200MWe graphite-moderated nuclear power reactor. Construction began in 1989 and was frozen in 1994 (under the 1994 Agreed Framework). Current status is unknown.</td>
</tr>
<tr>
<td>Tongchang-ri</td>
<td>This site, on the Northwest coast, is where the new Sohae launch pad is located. The DPRK is getting ready to fire long-range rockets from this launch pad, and fired a rocket mounted with a satellite (SLV) from here in April, 2012.</td>
</tr>
<tr>
<td>Yongbyon</td>
<td>Location of a Nuclear Research Center, comprising a 5MWe graphite moderated prototype power reactor, reprocessing facility, uranium conversion plant, fuel fabrication plant, and spent fuel and waste storage facilities. Also location. Also Location of a Soviet-supplied IRT research reactor and radioisotope laboratory, and where the DPRK revealed a uranium enrichment facility under development in 2009. Satellite imagery from early 2012 showed progression in construction. Also located here are a 5 MWe, a 50 MWe reactor, and a plutonium reprocessing facility that has been shut down.</td>
</tr>
<tr>
<td>Youngdoktong</td>
<td>Reported location of site (active in the 1990s) for nuclear weapons-related high-explosive testing. In 2003, the CIA reportedly detected an advanced nuclear testing site, but ROK experts were skeptical.</td>
</tr>
</tbody>
</table>

Figure VIII.16: Map of Major North Korean Nuclear Sites

Note: Locations on map are approximate.
Source: Chipman, *North Korea’s Weapons Programmes*, p. 45.
Figure VIII.17: Map of Possible DPRK Nuclear, Biological, Missile, and Chemical Sites

Source: “Interactive North Korea Facilities Map,”


**ROK Chemical Developments**

The ROK has the technology base to create advanced chemical and biological weapons. It has conducted research on defense in both areas, and much of such research is indistinguishable from research on weapons. There are no meaningful indicators, however, that the ROK now has, or is seeking, stockpiles of such weapons.

The ROK signed the Chemical Weapons Convention (CWC) in 1993, ratified it in April 1997, and began destroying its CW stocks in 1999. It completed the destruction of its stockpile in July 2008 – the second CWC member to do so.\(^\text{399}\)

The South’s destruction of its CW stocks has largely gone unnoticed because Seoul has a confidentiality agreement with the Organization for the Prohibition of Chemical Weapons (OPCW) and neither confirms nor denies the existence of its abandoned CW program.\(^\text{400}\) The issue is sensitive in the ROK, and the government is divided. Diplomats in the Foreign and Trade Ministries generally favor disclosure, but the Defense Ministry prefers ambiguity because of the supposed residual deterrent effect on Pyongyang.\(^\text{401}\)

The ROK – according to many reliable sources – declared possession of several thousand metric tons of chemical warfare agents and one chemical weapons production facility to the OPCW upon its ratification of the CWC.\(^\text{402}\) Paul Walker, security and sustainability chief at Global Green USA, said that discussions with informed sources and his own research indicate that the ROK probably held between 3,000 and 3,500 metric tons of chemical warfare material, likely including 400 to 1,000 metric tons of sarin nerve agent in artillery shells.\(^\text{403}\) The rest could have been binary agents that would have become dangerous when mixed together.\(^\text{404}\)

After the Yeonpyeong Island shelling, the South Korean National Emergency Management Agency provided 1,300 gas masks for the residents of the islands near the NLL and an additional 610,000 masks for the civil defense corps. The agency also reported that it would renovate subway stations and underground parking structures to better provide shelter in the case of a chemical attack. Yet, these measures could be more to mitigate public fears than legitimately protect civilians, as the gas masks would not be of much use in that the masks do not protect against many of the chemical weapons believed to be possessed by the DPRK.\(^\text{405}\)

**ROK Biological Developments**

The ROK ratified the Biological and Toxin Weapons Convention (BTWC) in June 1987, and while the country possesses a well-developed pharmaceutical and biotech infrastructure – the

---

\(^{399}\) International Crisis Group, *North Korea’s Chemical and Biological Weapons Programs—Asia Report No. 167*, p. 3-4.

\(^{400}\) Ibid.

\(^{401}\) Ibid.


\(^{404}\) Ibid.

\(^{405}\) “North Korea – Chemical,” Nuclear Threat Initiative, April 5, 2013.
ROK was the 12th largest pharmaceutical market in the world in 2005 valued at USD 7.7 billion – which could serve as the basis for a biological weapons program, there is no evidence that Seoul has an offensive biological weapons (BW) program. Though the 2006 Defense White Paper, citing a biological threat from North Korea, stated the need for the ROK to conduct defensive BW research and development, including the development of vaccines against anthrax and smallpox, this research was not discussed in the 2010 Defense White Paper.

**ROK Nuclear Developments**

Although, the ROK once had an ambitious nuclear weapons program of its own, it currently does not have one. Seoul abandoned its program and signed the Treaty on the NPT in April 1975 before it had produced any fissile material and is a state party to the Comprehensive Nuclear Test Ban Treaty (CTBT). However, the ROK does possess a large and extensive civilian nuclear power industry – the world’s fifth-largest, with 21 reactors providing almost 40% of the ROK’s electricity, with plans for a total of 40 reactors providing 59% of the ROK’s electricity by 2030. Coupled with past weapons research, some estimate this technology could serve as a basis for any plans to develop nuclear weapons in the future should it feel that DPRK nuclear threats or a potential downturn in the US-ROK alliance warrant such a move.

**Initial Weapons Research**

The ROK formally initiated nuclear activities when it became a member of the International Atomic Energy Agency in 1957. In 1958 the Atomic Energy Law was passed, and in 1959 the Office of Atomic Energy was established by the government. The first nuclear reactor to achieve criticality in South Korea was a small research unit in 1962.

The ROK apparently began considering developing nuclear weapons in the late 1960s when it began to have worries about the strength of its US alliance guarantees as a result of the US’s problems in Vietnam and regional reductions in the US military presence under the Nixon Doctrine. ROK President Park Chung Hee reportedly decided in 1970 to begin a nuclear weapons program, including the creation of a “Weapons Exploitation Committee,” after US President Richard Nixon announced the withdrawal of 26,000 American troops from the ROK. Park is said to have decided to pursue a plutonium bomb, and in 1973 the ROK sought to acquire a reprocessing facility from France and a research reactor and heavy water reactor from Canada to produce bomb-grade plutonium.

---

409 Ibid.
410 Ford, “Challenges of North Korean Nuclear Negotiation.”
Seoul’s weapons program ran into difficulties, however, when some of its supply arrangements fell through amidst international concern over India’s 1974 nuclear test – which, inconveniently for Seoul, was just the sort of misappropriation of dual-use plutonium technology that the ROK hoped to achieve for itself.413

US officials soon threatened to cancel US alliance guarantees if Seoul continued its weapons program and pressured France into not delivering the reprocessing facility, effectively ending the ROK’s attempt to develop nuclear weapons.414 Soon thereafter, the ROK ratified the NPT under pressure from the US. And although President Park said in 1977 that Seoul would not develop nuclear weapons so long as the US nuclear umbrella continued to cover Seoul against Soviet and DPRK aggression, it is believed he continued a clandestine program that only ended with his assassination in October 1979.415

Despite US security assurances and Park’s assassination, ROK nuclear activities continued. The Korea Atomic Energy Research Institute (KAERI) contracted with the Youngnam Chemical Corporation to import phosphate compounds with a high level of uranium in the early 1980s. KAERI specifically selected phosphate rock with high uranium content for extraction and conversion, and between 1981 and 1984, yellow cake (U3O8) was converted to uranium oxide (UO2), which was used to produce fuel rods for the Wolsong-1 Nuclear Power Reactor in 1985.416

**Reprocessing and Enrichment Activities**

Seoul continued to conduct several nuclear-related experiments in the 1990s dealing primarily with reprocessing and uranium enrichment. ROK scientists conducted a series of laboratory-scale experiments, allegedly without the government’s knowledge, up to 2000, all without properly declaring them to the IAEA.417

Once the IAEA discovered these experiments, Seoul cooperated with the IAEA and no evidence emerged that the work had formed part of a possible nuclear weapons program, that the program had been continued since the 1970s, or that anything more than basic research was involved.418 According to interviews of US diplomats conducted in 2004 by the Washington Post, during these experiments, ROK scientists enriched uranium to levels four times higher than had their counterparts in Iran (as of 2004).419

Further information on the ROK’s nuclear efforts was brought to light in August 2004 when the ROK’s Ministry of Science and Technology (MOST) reported to the IAEA that South Korea had conducted experiments to enrich uranium, extract plutonium, and had produced

---

413 Ford, “Challenges of North Korean Nuclear Negotiation.”
414 Globalsecurity.org, “South Korea Special Weapons.”
415 Ibid.
uranium metal. The Laboratory for Quantum Optics at KAERI conducted experiments to enrich uranium three times during January and February 2000. The experiments yielded about 0.2 grams of uranium enriched to an average of 10% in the three experiments, with the peak level of enrichment in the experiments reaching 77%.

The ROK is strongly interested in developing an indigenous, plutonium fuel cycle for its civilian power program and had negotiated with the IAEA and the US Department of Energy over safeguards for a “partially constructed, pilot pyroprocessing facility” that it wanted to complete by 2012, with a semi-commercial facility in place by 2025. While ROK officials have claimed that the desire for such a facility was the result of “scientific curiosity” or part of plans to localize the production of nuclear fuel, it should be noted that these actions do have applications for weapons development, and questions remain about past activities that appear to have had more direct weapons applications.

The experiments in plutonium extraction and uranium enrichment were technically violations of Seoul’s NPT safeguards commitments that had been in effect since 1975 as well as a violation of the 1992 North and South Korean Joint Declaration on the Denuclearization of the Korean Peninsula, but it is important to understand that they do not appear to have been part of a robust program to develop nuclear weapons.

As David Pinkston has observed, while the experiments “provided data and experience that could be applied to a bomb program or to a peaceful nuclear fuel cycle that could later be part of a ‘virtual bomb program’ under certain contingencies, [...] the experiments were insignificant in terms of bomb production.”

However, past and current experiments, along with the recent ROK development of long-range land-attack cruise missiles and pursuit of a space-launch capability, will not help alleviate suspicions in Pyongyang or the region, making it more difficult for diplomats working to achieve a non-nuclear Korean peninsula.

2010-2013 and the ROK Nuclear Development Debate

After the 2010 DPRK military provocations, the idea of nuclear weapons in the ROK has again become a matter of debate. Conservatives of the Saenuri party wanted the US to redeploy tactical nuclear weapons, while an August 2011 survey of 2,000 South Koreans

---

420 Pinkston, “South Korea’s Nuclear Experiments.”
421 Mark Hibbs, “77% U-235 Was Peak Enrichment Reported to IAEA by South Korea,” NuclearFuel 29, no. 30 (September 27, 2004): 7–8.
423 Miles A Pomper, “Concerns Raised as South Korea Joins GNEP,” Arms Control Today (January/February 2008).
424 Ibid.
425 Pinkston, “South Korea’s Nuclear Experiments.”
revealed that 63% supported the idea that the ROK should indigenously develop nuclear weapons to counteract the DPRK.

In 2010, a similar survey reported that 56% supported such development. In 2012, 66% were in favor of a weapons program; approximately the same results were seen in a 2013 poll that was taken several weeks after the DPRK’s third nuclear test. From 2010 to 2012, the number of those who “strongly supported” such a program rose from 13% to 25%. At the same time, the 2013 poll results show that the “most salient” issue facing the country was job creation (40%), not North-South relations (8-15%).

Outgoing President Lee Myung-bak gave qualified support for the idea in mid-February, saying, “There are some people saying South Korea should also have nuclear weapons. Those remarks are patriotic and I think highly of them. I don’t think the comments are wrong because they also serve as a warning to North Korea and China.” But, despite the DPRK announcing it was no longer interested in denuclearization – meaning that the ROK could make a case that the 1992 Korean Peninsula denuclearization agreement was dead – Lee added, “It is premature and improper for our government to discuss nuclear armament because the ultimate goal is for Pyongyang to give up its nuclear program through international cooperation.”

ROK analysts have argued that the DPRK’s third nuclear test was the ROK’s Cuban missile crisis. Many in the South are now convinced that the DPRK may never give up its nuclear weapons, leading some to argue that the ROK should either develop its own or the US should restore the nuclear balance on the Peninsula by reintroducing US nuclear weapons, which had been removed in 1991.

A small but growing number of South Koreans are concerned that the US, either because of budget cuts or a lack of will, might not provide its nuclear umbrella indefinitely – perhaps even pulling out of the country, like in Vietnam. Koreans are also frustrated that the US and international community has been unable to end the DPRK’s nuclear program.

One prominent national assemblyman (and the controlling interest in Hyundai) recently spoke at the April 2013 Carnegie International Nuclear Policy Conference, arguing that the ROK could potentially think about temporarily withdrawing from the NPT. As the US was not stopping the DPRK’s development of nuclear weapons, and the US would not trade Seattle for Seoul, Chung argued that the ROK might need to develop nuclear capabilities of its own. It has

---

431 Ibid.
also been noted that if there was not powerful (government) support for his comments in the
ROK, he would not be saying such things in a public forum.432

Facing an extraordinary threat to national security, South Korea may exercise the right to withdraw
from the NPT as stipulated in Article X of the treaty. South Korea would then match North Korea’s
nuclear program step by step, while committing to stop if North Korea stops…. South Korea should be
given this leeway as a law-abiding member of the global community who is threatened by a nuclear
rogue state…. The alliance has failed to stop North Korea from acquiring nuclear weapons. Telling us
not to consider any nuclear weapons option is tantamount to telling us to simply surrender.

Yet, developing nuclear weapons would risk the ROK’s nuclear program and energy
security. The ROK would run out of nuclear fuel and might not be able to access imported
fossil fuels, while the US might remove its security guarantee as punishment. The ROK
would also have to drop out of the NPT, freezing relations with China, Japan, and Russia,
and correspondingly increasing the likelihood of a DPRK attack.433

Bill Gates visited the ROK in April 2013 to meet with President Park Geun-hye in order to
promote his project of developing a next-generation nuclear reactor. His plan is for his
nuclear start-up (TerraPower) and the Korea Atomic Energy Research Institute to jointly
develop a 600 megawatt prototype by 2022, after which a final decision could be made on
the feasibility of more large-scale production. Gates argued that it could be an effective
means of dealing with the ROK’s nuclear waste stockpiles – discussed further in the
following sections – and that TerraPower was developing a safer and more economical next-
generation reactor.

One ROK nuclear expert with links to the current administration said it agreed to do a three-
month feasibility study with Gates. The reactor is called a “traveling wave reactor,” similar to
the ROK’s sodium-cooled fast reactor development project. Both types use spent fuel from
conventional reactors, and can greatly reduce the volume of nuclear waste and its toxicity,
compared to existing reactors.434

**Civilian Facilities and the 123 Agreement**

The ROK possesses a the world’s fifth-largest civilian nuclear power industry, with 21
reactors providing almost 40% of the ROK’s electricity and plans for a total of 40 reactors
providing 59% of the ROK’s electricity by 2030. It is projected that ROK nuclear energy
capacity will increase by 56% to 27.3 GWe by 2030 and 43 GWe by 2030. Korea Hydro &
Nuclear Power (KHNP) expects to spend 4.7 trillion won ($3.68 billion) on nuclear plants in
2009 and complete 18 nuclear power plants by 2030 at a cost of 40-50 trillion won ($32 to 40
billion).435 The country plans to invest $1.3 billion in research and development of a 150
megawatt fourth-generation reactor by 2028.436 Currently, the ROK has four nuclear power
reactor complexes and four nuclear research reactors.

---

432 Mark Hibbs, “Chung Mong-joon, the 123, and the State-Level Approach,” Carnegie Endowment for
International Peace, April 14, 2013.


nuclear.org/info/Country- Profiles/Countries-O-S/South-Korea/.

Nuclear Power Reactors\textsuperscript{437}

The Kori Complex, located near Busan, houses eight reactors, though only five are currently operational. Three more are under construction, and an additional two are currently projected to be start construction in 2014. Kori-1, which commenced operation in 1978 and is planned to be closed in 2017, is a 576 MWe two-loop pressurized light water reactor (PWR). It was South Korea’s first nuclear power reactor.

Kori-2 (1983) is a 637 MWe two-loop PWR and the ROK’s second nuclear power reactor. Kori-3 (1985) produces 1007 MWe and is a three-loop PWR, as is Kori-4 (1986). Shin (New) Kori-1 (2011) is a 1000 MWe PWR, as is Shin Kori-2 (2011). Shin Kori-3, the ROK’s first advanced PWR with a 1400 MWe capacity, is expected to begin operations in the end of fall 2013. Shin Kori-4, also an advanced PWR with a 1400 MWe capacity, is expected to commence operations by the end of 2014.

The Uljin Complex, located in North Gyeongsang province, is comprised of six power reactors, all of which are operational. Ulchin-1 (1988 – 945 MWe) and Ulchin-2 (1989 - 942 MWe) are both three-loop PWRs. Ulchin-3 (1998) is a two-loop PWR, as is the 998 MWe Ulchin-4 (1998). Ulchin-5 (2004) is a 1001 MWe PWR, and Ulchin-6 (2005) is a 996 MWe PWR.

Wolsong Complex is also located in North Gyeongsang province and has six reactors, four of which are operational and two of which are under construction. Wolsong-1 (1983) is a 597 MWe pressurized heavy water reactor (PHWR), Wolsong-2 (1997) is a 710 MWe PHWR, Wolsong-3 (1998) is a 707 MWe PHWR, and Wolsong-4 (1999) is a 708 MWe PHWR.

Shin (New) Wolsong-1 (2011) is an indigenously-designed 960 MWe PWR, as is Shin Wolsong-2, which was expected to commence in late 2012 but does not yet seem to be connected to the grid. Plans for Shin Wolsong-3 and Shin Wolsong-4 are in place, but construction has not yet been scheduled. They will be Advanced Pressurized Reactors with a 1400 MW(e) generating capacity and have estimated operational dates of 2020 and 2021, respectively.

Yonggwang Complex, located in South Jeolla province, also has six reactors, all of which are operational. Yonggwang-1 (1986) is a 953 MWe PWR, Yonggwang-2 (1987) is a 947 MWe PWR, Yonggwang-3 (1989) is a 997 MWe PWR, Yonggwang-4 (1996) is a 994 MWe PWR, Yonggwang-5 (2002) is a 988 MWe PWR, and Yonggwang-6 (2002) is a 996 MWe PWR.

Nuclear Research Reactors\textsuperscript{438}

The Training, Research, Isotope, General Atomics Mark II (TRIGA-Mark II) Research Reactor was the ROK’s first research reactor and is located in Seoul at the former location of the Korea Atomic Energy Research Institute (KAERI). The reactor began operations in 1960 and cost $73,000 (of which $35,000 was provided by the US). The original 100 KWth


\textsuperscript{438} Ibid.
capacity was upgraded to a 250 KWth capacity in 1969. It used 20% enriched uranium for fuel. It was shut down at the end of 1995 and currently is part of a memorial display.

TRIGA-Mark III was South Korea’s second research reactor, also under the aegis of KAERI; it used 70% enriched uranium fuel and had a capacity of 2 MWth. In the early 1980s, ROK scientists conducted plutonium extraction experiments in violation of the ROK’S NPT commitments, extracting .7 grams of fissile PU-239. Along with TRIGA-Mark II, TRIGA-Mark III was shut down in 1995 and completely dismantled by 2009.

The Aerojet General Nucleonics Model Number 201 (AGN-201) Research Reactor, located at Kyung Hee University (Suwon), was the ROK’s first educational research reactor, donated by Colorado State University in 1976, becoming operational in 1982. The reactor uses 20% enriched uranium for fuel and has a 0.1 MWe capacity. The High-Flux Advanced Neutron Application Reactor (HANARO) has a capacity of 30 MWth. It began operations in 1996, and uses low-enriched uranium as fuel (19.75%).

**Figure VIII.18** shows the reactors currently operating in the ROK, along with their type, date of initial operation, and net capacity. **Figure VIII.19** shows the ROK reactors that are either under construction or in the planning process, along with their type, start date of construction, projected date of operation, and capacity. Because the previous discussion of reactors and the figures below come from different sources, the declared net capacity of the various reactors may be slightly different.

**The 123 Agreement**

There have also been issues over renegotiation of the ROK-US peaceful nuclear cooperation agreement (the 123 Civil Nuclear Agreement), was initially signed 40 years ago and set to expire in March 2014. Under the existing regime, the ROK works with US government agencies and companies to build a nuclear power infrastructure, including almost 20 reactors that generate 30% of the nation’s electricity.\(^{439}\)

The ROK is building more reactors and also has facilities for nuclear waste treatment, disposal, equipment manufacture, engineering, research, medicine, and fuel fabrication – all together, the ROK’s nuclear assets are likely worth several billion dollars. Korean firms are now partnering with American businesses to develop nuclear power plants based on US technology in the ROK, China, and the US, as well as working to sell to other countries. The ROK currently has a contract to build reactors in the UAE.\(^{440}\)

One ROK Assemblyman asked Bill Gates, during the latter’s April 2013 trip to the ROK, to play a role in persuading the US government to let the ROK have more capabilities in its peaceful use of nuclear energy; without the revision in the 123 Agreement, Gates’ plan to cooperate with the ROK in the development of next-generation nuclear technology would be difficult.\(^{441}\)

---


\(^{440}\) Ibid.

However, an updated agreement was not reached despite two years of negotiations. The ROK asked it be allowed to extract uranium and plutonium from its thousands of tons of spent fuel, which originally came from the US. The ROK argued that reprocessing would be useful in reducing the used fuel stockpiles at its power plants, producing new fuel, and gaining public acceptance for building new reactors by showing it has a solution for nuclear waste issues.442

South Korea also argued that even though the ROK had no current plans to build a pyroprocessing facility, it wanted a US commitment that when the ROK does decide to start construction, the US would support it.443 Furthermore, the ROK asserted that this capability – the ability to offer full nuclear fuel cycle services – is key to its competitiveness in the strategic export of nuclear services.444 President Park Geun-hye’s Foreign Minister noted that the negotiations would be an important test of “trust” between the two countries.445

The ROK plans that nuclear services will become a significant export for the country in the future,446 with the government claiming that South Korea can enrich uranium more cheaply than others and that it plans to export 80 nuclear power reactors over the next 20 years (equivalent to 20% of the international market). Industry leaders, alternatively, believe it is more likely that approximately 10 reactors could be exported over that time frame. Especially in a post-Fukushima context, the market for reactors is saturated, and the industry is not a huge money-maker in any event.447 It is unlikely that the ROK would be able to reach the government’s export goals; but, if the US refuses to allow pyroprocessing, the US becomes the scapegoat when the export goal fails, resulting in increased alliance tensions and hurting ROK public opinion of the US.448

The US has several problems with the ROK’s request. It is unsure if pyro-processing is the most suitable method for the ROK to treat nuclear waste,449 and it does not want other countries enriching spent fuel because the same technology allows countries to produce the explosive core of a nuclear weapon.450 It has never granted reprocessing consent to countries that did not already have prior enrichment and reprocessing facilities.

Allowing the ROK to add this capability would set a precedent that others – like Taiwan, which also has a significant civilian nuclear program and waste issues – would also want to be allowed this capacity. Also, if the ROK is allowed to develop reprocessing, the DPRK (and Iran) could use this as an excuse to keep their programs, claiming equal treatment.

China’s reaction to such an increase in ROK nuclear capabilities is uncertain. Continuation of the DPRK’s program also pressures the ROK and Japan to withdraw from the NPT and develop their own nuclear deterrent – and ROK defense officials see a reprocessing

442 Mark Hibbs, “Will South Korea Go Nuclear?” Foreign Policy, March 15, 2013.
443 Gary Samore, discussion at “What is at Stake in the US-ROK 123 Agreement?” CSIS, April 22, 2013.
444 Sharon Squassoni, discussion at “What is at Stake in the US-ROK 123 Agreement?” CSIS, April 22, 2013.
446 Gary Samore, discussion at “What is at Stake in the US-ROK 123 Agreement?” CSIS, April 22, 2013.
447 Sharon Squassoni, discussion at “What is at Stake in the US-ROK 123 Agreement?” CSIS, April 22, 2013.
448 Christopher Hill, discussion at “What is at Stake in the US-ROK 123 Agreement?” CSIS, April 22, 2013.
450 Mark Hibbs, “Will South Korea Go Nuclear?” Foreign Policy, March 15, 2013.
capability as a shortcut to a potential nuclear option if future ROK-DPRK relations become worse.\textsuperscript{451} The US would like to wait for the results of the 10-year joint feasibility study recently undertaken and then revisit the issue.\textsuperscript{452}

There are also significant elements of pride and nationalism. South Korea argues that just because it did not have these capabilities 30 years ago when the initial agreement was negotiated, that shouldn’t mean that they remain denied the capabilities – what the ROK sees as being relegated to a permanent second class status.\textsuperscript{453}

Furthermore, the US-Japan nuclear cooperation agreement gives Japan the right to separate the plutonium from its spent fuel, and thus the ROK believes that it should be given the same right. On the other hand, the US-Japan agreement was signed in 1988 – when the Asia-Pacific had fewer nationalized territorial conflicts, the Cold War superpowers worked together against nuclear proliferation, and the DPRK was an NPT member without nuclear weapons.\textsuperscript{454} The ROK also likely sees India as another case that should be applicable to its situation.\textsuperscript{455}

It was announced on April 24, 2013 that the deadline to renegotiate the agreement had been delayed until 2016, though unconfirmed reports of the deadline delay had been circulating for several days in the ROK. While a spokesman for the ROK Foreign Ministry said that the two countries had agreed to a treaty extension in order to give the negotiators more time to sort out “the complexity of details and technologies,” the ROK media was not as supportive. One editorial in the \textit{JoongAng Ilbo} stated, “Washington does not seem to trust South Korea as much as it reiterates blood-tight relations… Just because the pact has been extended for two years does not assure that the two will narrow their differences. It is merely a makeshift move to avoid a dispute.”\textsuperscript{456}

\textsuperscript{451} Gary Samore, discussion at “What is at Stake in the US-ROK 123 Agreement?” CSIS, April 22, 2013.
\textsuperscript{452} Ibid.
\textsuperscript{453} Ibid.
\textsuperscript{454} Mark Hibbs, “Will South Korea Go Nuclear?” \textit{Foreign Policy}, March 15, 2013.
\textsuperscript{455} Christopher Hill, discussion at “What is at Stake in the US-ROK 123 Agreement?” CSIS, April 22, 2013.
Figure VIII.18: Nuclear Power Reactors Operating in the ROK

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Type</th>
<th>Net Capacity</th>
<th>Commercial Operation</th>
<th>Planned Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kori 1</td>
<td>PWR (Westinghouse)</td>
<td>576 MWe</td>
<td>4/1978</td>
<td>2017</td>
</tr>
<tr>
<td>Kori 2</td>
<td>PWR (Westinghouse)</td>
<td>637 MWe</td>
<td>7/1983</td>
<td></td>
</tr>
<tr>
<td>Wolsong 1</td>
<td>PHWR (Candu 6)</td>
<td>666 MWe</td>
<td>4/1983</td>
<td>2036</td>
</tr>
<tr>
<td>Kori 3</td>
<td>PWR (Westinghouse)</td>
<td>1007 MWe</td>
<td>9/1985</td>
<td></td>
</tr>
<tr>
<td>Kori 4</td>
<td>PWR (Westinghouse)</td>
<td>1007 MWe</td>
<td>4/1986</td>
<td></td>
</tr>
<tr>
<td>Yonggwang 1</td>
<td>PWR (Westinghouse)</td>
<td>953 MWe</td>
<td>8/1986</td>
<td></td>
</tr>
<tr>
<td>Yonggwang 2</td>
<td>PWR (Westinghouse)</td>
<td>947 MWe</td>
<td>6/1987</td>
<td></td>
</tr>
<tr>
<td>Ulchin 1</td>
<td>PWR (Framatome)</td>
<td>945 MWe</td>
<td>9/1988</td>
<td></td>
</tr>
<tr>
<td>Ulchin 2</td>
<td>PWR (Framatome)</td>
<td>942 MWe</td>
<td>9/1989</td>
<td></td>
</tr>
<tr>
<td>Yonggwang 3</td>
<td>PWR (Syst 80)</td>
<td>997 MWe</td>
<td>12/1995</td>
<td></td>
</tr>
<tr>
<td>Yonggwang 3</td>
<td>PWR (Syst 80)</td>
<td>994 MWe</td>
<td>3/1996</td>
<td></td>
</tr>
<tr>
<td>Wolsong 2</td>
<td>PHWR (Candu)</td>
<td>710 MWe</td>
<td>7/1997</td>
<td></td>
</tr>
<tr>
<td>Wolsong 3</td>
<td>PHWR (Candu)</td>
<td>707 MWe</td>
<td>7/1988</td>
<td></td>
</tr>
<tr>
<td>Wolsong 4</td>
<td>PHWR (Candu)</td>
<td>708 MWe</td>
<td>10/1999</td>
<td></td>
</tr>
<tr>
<td>Ulchin 3</td>
<td>OPR-1000</td>
<td>994 MWe</td>
<td>8/1998</td>
<td></td>
</tr>
<tr>
<td>Ulchin 4</td>
<td>OPR-1000</td>
<td>998 MWe</td>
<td>12/1999</td>
<td></td>
</tr>
<tr>
<td>Yonggwang 5</td>
<td>OPR-1000</td>
<td>988 MWe</td>
<td>5/2002</td>
<td></td>
</tr>
<tr>
<td>Yonggwang 6</td>
<td>OPR-1000</td>
<td>996 MWe</td>
<td>12/2002</td>
<td></td>
</tr>
<tr>
<td>Ulchin 5</td>
<td>OPR-1000</td>
<td>1001 MWe</td>
<td>7/2004</td>
<td></td>
</tr>
<tr>
<td>Ulchin 6</td>
<td>OPR-1000</td>
<td>1001 MWe</td>
<td>4/2005</td>
<td></td>
</tr>
<tr>
<td>Shin Kori 1</td>
<td>OPR-1000</td>
<td>1001 MWe</td>
<td>2/2011</td>
<td></td>
</tr>
<tr>
<td>Shin Kori 2</td>
<td>OPR-1000</td>
<td>1001 MWe</td>
<td>7/2012</td>
<td></td>
</tr>
<tr>
<td>Shin Wolsong 1</td>
<td>OPR-1000</td>
<td>1001 MWe</td>
<td>7/2012</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>20,787 MWe</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Type</th>
<th>Gross Capacity</th>
<th>Construction Start</th>
<th>Commercial Operation (Planned)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shin Wolsong 2</td>
<td>OPR-1000</td>
<td>1050 MWe</td>
<td>September 2008</td>
<td>10/2013</td>
</tr>
<tr>
<td>Shin Kori 3</td>
<td>APR-1400</td>
<td>1350 MWe</td>
<td>October 2008</td>
<td>12/2013</td>
</tr>
<tr>
<td>Shin Kori 4</td>
<td>APR-1400</td>
<td>1350 MWe</td>
<td>August 2009</td>
<td>9/2014</td>
</tr>
<tr>
<td>Shin Ulchin 1</td>
<td>APR-1400</td>
<td>1350 MWe</td>
<td>July 2012</td>
<td>4/2017</td>
</tr>
<tr>
<td>Shin Ulchin 2</td>
<td>APR-1400</td>
<td>1350 MWe</td>
<td>September 2013</td>
<td>2/2018</td>
</tr>
<tr>
<td>Shin Kori 5</td>
<td>APR-1400</td>
<td>1350 MWe</td>
<td>August 2014</td>
<td>12/2019</td>
</tr>
<tr>
<td>Shin Kori 6</td>
<td>APR-1400</td>
<td>1350 MWe</td>
<td>August 2015</td>
<td>12/2020</td>
</tr>
<tr>
<td>Shin Ulchin 3</td>
<td>APR-1400</td>
<td>1350 MWe</td>
<td></td>
<td>6/2021</td>
</tr>
<tr>
<td>Shin Ulchin 4</td>
<td>APR-1400</td>
<td>1350 MWe</td>
<td></td>
<td>6/2022</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>12,250 MWe (~11,580 MWe net)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: “Start construction” in bold means the reactors are already under construction
IX. The Broader Balance of Missile, WMD, and Strategic Forces

It is unclear that China and the US will ever directly confront each other in a conflict in the Koreas, but both countries are developing a mix of new conventional missile, precision strike, nuclear-armed missile, nuclear weapon, and space warfare capabilities that have a major impact on the balance in the Koreas, Northeast Asia, and the entire Pacific region.

The interactions between these forces are growing steadily more complex and cannot be separated from the other patterns of force modernization summarized in Chapters 1 and 3. Like the differences between “conventional” and “asymmetric” warfare, the differences between conventional precision strikes and nuclear strikes can also be exaggerated; both can be involved as elements in deterrence, limiting escalation, or a nuclear-conventional conflict.

Any assessment of the balance in the Koreas and Northeast Asia must consider just how important it is to emphasize Chinese and US cooperation that will avoid any confrontation or conflict that could escalate to the use of such forces, the potential impact that a DPRK-ROK use of missile and WMD forces could have on Chinese and US tension and escalation, and the reality of the impact that US rebalancing and Chinese emphasis on sea-air-missile capabilities for A2AD can have under worst case conditions.

Both China and the US have every strategic and economic reason to show restraint, negotiate, and avoid such worst cases. Cooperation will not be easy, but the following analysis makes it all too clear that every effort needs to be made to avoid repeating the mistakes that drove the US and China into the Korean War and the “worst case” miscalculations that led to World War I and World War II. Even some Asian repetition of the Cold War, and even one limited to conventional air and missile combat, would be a costly tragedy of incredible proportions.

China’s Evolving Force Mix and Strategy

The US has long been a power with extensive conventional precision-strike, space-based, and nuclear capabilities. China, however, is rapidly modernizing and expanding its capabilities in all these areas. China does formally oppose all forms of nuclear, biological, and chemical proliferation in the Koreas. Its 2010 White Paper states that,

China firmly opposes the proliferation of weapons of mass destruction (WMD) and their means of delivery, and consistently deals with non-proliferation issues in a highly responsible manner. China maintains that, in order to prevent proliferation at source, efforts should be made to foster a global and regional security environment featuring mutual trust and cooperation, and the root causes of WMD proliferation should be eliminated. It holds that non-proliferation issues should be resolved through political and diplomatic means. It holds that the authority, effectiveness and universality of the international non-proliferation regime should be upheld and enhanced.

The international community should ensure fairness and prevent discrimination in international non-proliferation efforts, strike a balance between non-proliferation and the peaceful use of science and

---

technology, and abandon double standards. China has joined all international treaties and international organizations in the field of non-proliferation, and supports the role played by the United Nations in this regard, and has conscientiously implemented any relevant resolutions of the UN Security Council.

China advocates resolving the nuclear issue in the Korean Peninsula peacefully through dialogues and consultations, endeavoring to balance common concerns through holding six-party talks in order to realize the denuclearization on the Korean Peninsula and maintain peace and stability of the Korean Peninsula and the Northeast Asia. China, always considering the whole situation in the long run, painstakingly urges related countries to have more contacts and dialogues in order to create conditions for resuming six-party talks as early as possible...

The 2013 Chinese white paper provided relatively little substantive data on China’s policies and strategy regarding the use of nuclear weapons, but did describe China’s strategic missile forces as follows,

The PLA Second Artillery Force (PLASAF) is a core force for China’s strategic deterrence. It is mainly composed of nuclear and conventional missile forces and operational support units, primarily responsible for deterring other countries from using nuclear weapons against China, and carrying out nuclear counterattacks and precision strikes with conventional missiles. Following the principle of building a lean and effective force, the PLASAF is striving to push forward its informationization transform, relying on scientific and technological progress to boost independent innovations in weaponry and equipment, modernizing current equipment selectively by applying mature technology, enhancing the safety, reliability and effectiveness of its missiles, improving its force structure of having both nuclear and conventional missiles, strengthening its rapid reaction, effective penetration, precision strike, damage infliction, protection and survivability capabilities.

The PLASAF capabilities of strategic deterrence, nuclear counterattack and conventional precision strike are being steadily elevated. The PLASAF has under its command missile bases, training bases, specialized support units, academies and research institutions. It has a series of “Dong Feng” ballistic missiles and “Chang Jian” cruise missiles.

... The PLASAF keeps an appropriate level of readiness in peacetime. It pursues the principles of combining peacetime needs with wartime needs, maintaining vigilance all the time and being ready to fight. It has formed a complete system for combat readiness and set up an integrated, functional, agile and efficient operational duty system to ensure rapid and effective responses to war threats and emergencies. If China comes under a nuclear threat, the nuclear missile force will act upon the orders of the CMC, go into a higher level of readiness, and get ready for a nuclear counterattack to deter the enemy from using nuclear weapons against China. If China comes under a nuclear attack, the nuclear missile force of the PLASAF will use nuclear missiles to launch a resolute counterattack either independently or together with the nuclear forces of other services. The conventional missile force is able to shift instantly from peacetime to wartime readiness, and conduct conventional medium- and long-range precision strikes.

The most striking aspect of the 2013 Defense White Paper was that it not only omitted China’s previous commitments to “no first use” of nuclear weapons, but it also omitted any description of the fact China was making major improvements in its nuclear strike capability. China is improving its missile forces, is developing missile defense and counterspace capabilities, and is upgrading its nuclear capabilities in ways that affect the US and Chinese nuclear balance as well as the balance in the Koreas.

Growing Chinese Deterrent and A2AD Capabilities

Chinese military analysts publicly explore a wide range of innovative strategies designed to use missile and precision strike forces to deter or limit US military capabilities in the region, although many of these forces are now are deployed in ways that focus on Taiwan. China already has conventionally-armed missiles with terminal guidance systems and has improved such systems under development, including ballistic anti-ship missiles that pose a long-range strategic threat to US carrier task forces.

As Bonnie S. Glaser, a leading US expert on Chinese military forces, notes, “these strategies are laid out in publications by military academies and scholars on questions of military strategy and doctrine, including multiple editions of Zhanlue Xue (The Science of Strategy) and Zhanyi Xue (The Science of Campaigns) as well as Zhanyi Lilun Xuexi Zhinan (Campaign Theory Study Guide).”

The US DoD put heavy emphasis on these “anti-access” and “area denial” (A2AD) capabilities – and their potential impact on US power projection capabilities in the Koreas and Northeast Asia – in its report on Military and Security Developments Affecting the People’s Republic of China for 2011.

China is developing measures to deter or counter third-party intervention, including by the United States. Although many of these capabilities were developed with a focus on Taiwan, they have broad applications and implications extending beyond a Taiwan scenario. China’s approach to this challenge, which it refers to as “counter-intervention,” is manifested in a sustained effort to develop the capability to attack, at long ranges, military forces that might deploy or operate within the western Pacific. The U.S. Department of Defense characterizes these as “anti-access” and “area denial” capabilities. China is pursuing a variety of air, sea, undersea, space, counterspace, information warfare systems, and operational concepts to achieve this capability, moving toward an array of overlapping, multilayered offensive capabilities extending from China’s coast into the western Pacific.

An essential element of China’s emerging A2AD regime is the ability to control and dominate the information spectrum in all dimensions of the modern battlespace. PLA authors often cite the need in modern warfare to control information, sometimes termed “information blockade” or “information dominance,” and gain an information advantage in the early phases of a campaign to achieve air and sea superiority. China is improving information and operational security to protect its own information structures, and is also developing electronic and information warfare capabilities, including denial and deception, to defeat those of its adversaries. China’s “information blockade” likely envisions employment of military and non-military instruments of state power across the battlespace, including in cyberspace and outer space. China’s investments in advanced electronic warfare systems, counterspace weapons, and computer network operations, combined with more traditional forms of control historically associated with the PLA and CCP systems, such as propaganda, deception, and denial through opacity, reflect the emphasis and priority China’s leaders place on building capability for information advantage.

In more traditional domains, China’s A2AD focus appears oriented toward restricting or controlling access to the land, sea, and air spaces along China’s periphery, including the western Pacific. For example, China’s current and projected force structure improvements will provide the PLA with systems that can engage adversary surface ships up to 1,850 km from the PRC coast. These include:

---

459 Bonnie S. Glaser, e-mail of February 8, 2010.
The Evolving Military Balance in the Korean Peninsula and Northeast Asia

- **Anti-Ship Ballistic Missiles**: Medium Range Ballistic Missiles (MRBMs) designed to target forces at sea, combined with overhead and over-the-horizon targeting systems to locate and track moving ships.

- **Conventional and nuclear-powered attack submarines**: KILO, SONG, YUAN, and SHANG-class attack submarines capable of firing advanced ASCMs.

- **Surface combatants**: LUZHOU, LUYANG I/II, SOVREMENNY-II-class guided missile destroyers with advanced long-range anti-air and anti-ship missiles.

- **Maritime Strike Aircraft**: FB-7 and FB-7A, B-6G, and the SU-30 MK2, armed with ASCMs to engage surface combatants.

Similarly, current and projected systems such as the J-20 stealth fighter and longer-range conventional ballistic missiles could improve the PLA’s ability to strike regional air bases, logistical facilities, and other ground-based infrastructure. PRC military analysts have concluded that logistics and power projection are potential vulnerabilities in modern warfare, given the requirements for precision in coordinating transportation, communications, and logistics networks. China is fielding an array of conventionally armed ballistic missiles, modern aircraft, UAVs, ground- and air-launched land-attack cruise missiles, special operations forces, and cyber-warfare capabilities to hold targets at risk throughout the region.

The DoD provided further data in its 2013 updates to *Military and Security Developments Affecting the People’s Republic of China*. It described China’s missile developments as follows:

The Second Artillery controls China’s nuclear and conventional ballistic missiles. It is developing and testing several new classes and variants of offensive missiles, forming additional missile units, upgrading older missile systems, and developing methods to counter ballistic missile defenses. (p. 5-6)

By December 2012, the Second Artillery’s inventory of short-range ballistic missiles (SRBM) deployed to units opposite Taiwan stood at more than 1,100. This number reflects the delivery of additional missiles and the fielding of new systems. To improve the lethality of this force, the PLA is also introducing new SRBM variants with improved ranges, accuracies, and payloads.

China is fielding a limited but growing number of conventionally armed, medium-range ballistic missiles, including the DF-21D anti-ship ballistic missile (ASBM). The DF-21D is based on a variant of the DF-21 (CSS-5) medium-range ballistic missile (MRBM) and gives the PLA the capability to attack large ships, including aircraft carriers, in the western Pacific Ocean. The DF-21D has a range exceeding 1,500 km and is armed with a maneuverable warhead. (p. 5-6)

The Second Artillery continues to modernize its nuclear forces by enhancing its silo-based intercontinental ballistic missiles (ICBMs) and adding more survivable mobile delivery systems. In recent years, the road-mobile, solid-propellant CSS-10 Mod 1 and CSS-10 Mod 2 (DF-31 and DF-31A) intercontinental-range ballistic missiles have entered service. The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach most locations within the continental United States. China may also be developing a new road-mobile ICBM, possibly capable of carrying a multiple independently targetable re-entry vehicle (MIRV). (p. 5-6)

**Land-Based Platforms.** China’s nuclear arsenal currently consists of approximately 50-75 ICBMs, including the silo-based CSS-4 (DF-5); the solid-fueled, road-mobile CSS-10 Mods 1 and 2 (DF-31 and DF-31A); and the more limited range CSS-3 (DF-4). This force is complemented by liquid-fueled CSS-2 intermediate-range ballistic missiles and road-mobile, solid-fueled CSS-5 (DF-21) MRBMs for regional deterrence missions. By 2015, China’s nuclear forces will include additional CSS-10 Mod 2

---

Sea-Based Platforms. China continues to produce the JIN-class SSBN, with three already delivered and as many as two more in various stages of construction. The JIN-class SSBNs will eventually carry the JL-2 submarine-launched ballistic missile with an estimated range of 7,400 km. The JIN-class and the JL-2 will give the PLA Navy its first long-range, sea-based nuclear capability. After a round of successful testing in 2012, the JL-2 appears ready to reach initial operational capability in 2013. JIN-class SSBNs based at Hainan Island in the South China Sea would then be able to conduct nuclear deterrence patrols. (p. 31-32)

...PLA Underground Facilities
China maintains a technologically advanced underground facility (UGF) program protecting all aspects of its military forces, including C2, logistics, missile, and naval forces. Given China’s NFU nuclear policy, China has assumed it may need to absorb an initial nuclear blow while ensuring leadership and strategic assets survive. (p. 31)

China determined it needed to update and expand its military UGF program in the mid to late 1980s. This modernization effort took on a renewed urgency following China’s observation of U.S. and NATO air operations in Operation Allied Force and of U.S. military capabilities during the 1991 Gulf War. A new emphasis on “winning hi-tech battles” in the future precipitated research into advanced tunneling and construction methods. These military campaigns convinced China it needed to build more survivable, deeply-buried facilities, resulting in the widespread UGF construction effort detected throughout China for the last decade. (p. 31)

...Future Efforts. China is working on a range of technologies to attempt to counter U.S. and other countries’ ballistic missile defense systems, including maneuverable reentry vehicles (MaRVs), MIRVs, decoys, chaff, jamming, thermal shielding, and anti-satellite (ASAT) weapons. China’s official media also cite numerous Second Artillery training exercises featuring maneuver, camouflage, and launch operations under simulated combat conditions, which are intended to increase survivability. Together with the increased mobility and survivability of the new training enhancements strengthen China’s nuclear force and enhance its strategic strike capabilities. Further increases in the number of mobile ICBMs and the beginning of SSBN deterrence patrols will force the PLA to implement more sophisticated command and control systems and processes that safeguard the integrity of nuclear release authority for a larger, more dispersed force. (p. 32)
Chinese Conventional Missile Capabilities

China is acquiring the ability to project conventional missile power deep into the Pacific in ways that make the traditional discussion of “blue water” navies increasingly less relevant. The issue today is the overall mix of sea-air-missile-space capabilities and how they interact with both conventional forces and asymmetric forces, including new forms of conflict like cyberwarfare. One can only speculate on the pace of change that these shifts will trigger in US, Chinese, and other regional powers over the coming decades, but they are already a major new aspect of the balance.

Moreover, China’s emerging missile proficiencies include both conventional and nuclear strike capabilities in ways that interact even if China and the US never openly threaten to use nuclear forces. Chinese nuclear capabilities can deter or limit the US response to China’s use of conventionally-armed missiles, and even a worst case escalation to the use of nuclear armed missiles may still lead China to use conventionally-armed precision strike systems against US or politically sensitive targets in ways intended to limit or shape the process of escalation. Declassified US intelligence estimates of China’s missile strength are shown in Figure IX.1.

The DoD notes in its 2012 report on Chinese military power that:

The DoD report for 2013 discusses the interlocking relationships between China’s full range of missile and other precision strike systems in supporting the A2AD mission – all of which potentially can affect China’s capabilities if it intervenes in a Korean conflict as well as have an effect in shaping the broader balance in Northeast Asia.\(^{463}\)

- **Short-Range Ballistic Missiles (< 1,000 km):** The Second Artillery had more than 1,100 SRBMs at the end of 2012, a modest increase over the past year. The Second Artillery continues to field advanced variants with improved ranges and more sophisticated payloads, while gradually replacing earlier generations that do not possess true precision strike capability.

- **Medium-Range Ballistic Missiles (1,000-3,000 km):** The PLA is fielding conventional MRBMs to increase the range at which it can conduct precision strikes against land targets and naval ships (including aircraft carriers) operating far from China’s shores out to the first island chain.

- **Intermediate-Range Ballistic Missiles (3,000-5,000 km):** The PLA is developing conventional intermediate-range ballistic missiles (IRBM), increasing its capability for near-precision strike out to the second island chain. The PLA Navy is also improving its over-the-horizon (OTH) targeting capability with sky wave and surface wave OTH radars, which can be used in conjunction with reconnaissance satellites to locate targets at great distances from China (thereby supporting long-range precision strikes, including employment of ASBMs).

- **Land-Attack Cruise Missiles:** The PLA continues to field air- and ground-launched LACMs for stand-off, precision strikes. Air-launched cruise missiles include the YJ-63, KD-88, and the CJ-20.

- **Ground Attack Munitions:** The PLA Air Force has a small number of tactical air-to-surface missiles as well as precision-guided munitions including all-weather, satellite-guided bombs, anti-radiation missiles, and laser-guided bombs.

- **Anti-Ship Cruise Missiles:** The PLA Navy is deploying the domestically-produced, ship-launched YJ-62 ASCM; the Russian SS-N-22/SUNBURN supersonic ASCM, which is fitted on China’s SOVREMENNY-class DDGs acquired from Russia; and the Russian SS-N-27B/SIZZLER supersonic ASCM on China’s Russian-built KILO SS. It has, or is acquiring, nearly a dozen ASCM variants, ranging from the 1950s-era CSS-N-2 to the modern Russian-made SS-N-22 and SS-N-27B. China is working to develop a domestically-built supersonic cruise missile capability. The pace of ASCM research, development, and production has accelerated over the past decade.

- **Anti-Radiation Weapons:** China is starting to integrate an indigenous version of the Russian Kh-31P (AS-17) known as the YJ-91 into its fighter-bomber force. The PLA imported Israeli-made HARPY UAVs and Russian-made anti-radiation missiles during the 1990s.

- **Artillery-Delivered High Precision Munitions:** The PLA is developing or deploying artillery systems with the range to strike targets within or even across the Taiwan Strait, including the PHL-03 300 mm multiple-rocket launcher (MRL) (100+ km range) and the longer-range AR-3 dual-caliber MRL (out to 220 km).

- **Second Artillery:** As detailed elsewhere in this report, the Second Artillery is expanding its conventional MRBM force and developing IRBMs to extend the distance from which it can threaten other countries with conventional precision or near-precision strikes.

---

Work by Andrew S. Erickson further highlights the fact that these Chinese efforts have led to the development of a DF-21D anti-ship ballistic missile (ASBM):\textsuperscript{464}

China’s DF-21D anti-ship ballistic missile (ASBM) is no longer merely an aspiration. Beijing has successfully developed, partially tested and deployed in small numbers the world’s first weapons system capable of targeting the last relatively uncontested U.S. airfield in the Asia-Pacific from long-range, land-based mobile launchers. This airfield is a moving aircraft carrier strike group (CSG), which the Second Artillery, China’s strategic missile force, now has the capability to at least attempt to disable with the DF-21D in the event of conflict. With the ASBM having progressed this far, and representing the vanguard of a broad range of potent asymmetric systems, Beijing probably expects to achieve a growing degree of deterrence with it.

In December 2010, then-PACOM Commander Admiral Robert Willard stated, “The anti-ship ballistic missile system in China has undergone extensive testing. An analogy using a Western term would be ‘Initial Operational Capability (IOC),’ whereby it has—I think China would perceive that it has—an operational capability now, but they continue to develop it. It will continue to undergo testing, I would imagine, for several more years.”\textsuperscript{465}

In January 2011, Vice Admiral David Dorset said that the PLA “likely has the space-based intelligence, surveillance and reconnaissance (ISR), command and control structure, and ground processing capabilities necessary to support DF-21D employment...[and also] employs an array of non-space based sensors and surveillance assets capable of providing the targeting information,” several days later adding that the PRC had tested the DF-21D missile system over land “a sufficient number of times that the missile system itself is truly competent and capable... they have ISR, they have sensors onboard ship that can feed into the targeting aspect of it. So could they start to employ that and field it operationally? Yes, I think so.” In March 2011, it was reported by the Taiwanese National Security Bureau Director-General that the PLA had already tested and started deploying the DF-21D in 2010.\textsuperscript{466}

Reportedly, China conducted another test of its missile interceptor system on January 27, 2013 in the Xinjiang Uyghur Autonomous Region. China has again stated the defensive nature of the test. In all likelihood, the system is a reconfigured DF-21C or DF-25 (KS/SC-19) – both of which are two-stage medium-range (1500-1700 km) ballistic missiles capable of carrying a 600 kg payload – in this case, an exo-atmospheric kill vehicle.\textsuperscript{467}

As the estimates in Figure IX.2 show, this anti-ship ballistic missile is just one part of the interlocking extension of Chinese precision strike capabilities that affect the Koreas, Northeast Asia, and Pacific region. China can now use precision strike systems against US bases as far out as Guam and the rest of what is sometimes called the “second island chain.”


\textsuperscript{465} Ibid.

\textsuperscript{466} Ibid.

\textsuperscript{467} A. Vinod Kumar, “Impressions on China’s Second Missile Interceptor Test,” Institute for Defence Studies and Analyses [India], February 22, 2013.
### Figure IX.1: Chinese Missile Forces, 2010-2012

#### 2010 estimate

<table>
<thead>
<tr>
<th>China’s Missile Inventory</th>
<th>Ballistic and Cruise</th>
<th>Estimated Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Missiles</td>
<td>Launchers</td>
</tr>
<tr>
<td>CSS-2</td>
<td>15-20</td>
<td>5-10</td>
</tr>
<tr>
<td>CSS-3</td>
<td>15-20</td>
<td>10-15</td>
</tr>
<tr>
<td>CSS-4</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>DF-31</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>DF-31A</td>
<td>10-15</td>
<td>10-15</td>
</tr>
<tr>
<td>CSS-5</td>
<td>85-95</td>
<td>75-85</td>
</tr>
<tr>
<td>CSS-6</td>
<td>350-400</td>
<td>90-110</td>
</tr>
<tr>
<td>CSS-7</td>
<td>700-750</td>
<td>120-140</td>
</tr>
<tr>
<td>DH-10</td>
<td>200-500</td>
<td>45-55</td>
</tr>
<tr>
<td>JL-2</td>
<td>Developmental</td>
<td>Developmental</td>
</tr>
</tbody>
</table>

Note: China’s Second Artillery maintains at least five operational SRBM brigades; an additional two brigades are subordinate to PLA ground forces – one garrisoned in the Nanjing MR and the other in the Guangzhou MR. All SRBM units are deployed to locations near Taiwan.

#### 2012 Estimate

<table>
<thead>
<tr>
<th>System</th>
<th>Missiles</th>
<th>Launchers</th>
<th>Estimated Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICBM</td>
<td>50-75</td>
<td>50-75</td>
<td>5,500+ km</td>
</tr>
<tr>
<td>IRBM</td>
<td>5-20</td>
<td>5-20</td>
<td>3,000-5,500 km</td>
</tr>
<tr>
<td>MRBM</td>
<td>75-100</td>
<td>75-100</td>
<td>1,000-3,000 km</td>
</tr>
<tr>
<td>SRBM</td>
<td>1,000-1,200</td>
<td>200-250</td>
<td>&lt;1,000 km</td>
</tr>
<tr>
<td>GLCM</td>
<td>200-500</td>
<td>40-55</td>
<td>1,500+ km</td>
</tr>
</tbody>
</table>

Figure IX.2: Range of Chinese Precision Strike Capabilities – Part One (US 2013 Estimate)

Figure IX.2: Range of Chinese Precision Strike Capabilities – Part Two (US 2012 Estimate)

Note: Conventional Counter-intervention Capabilities. The PLA’s conventional forces are currently capable of striking targets well beyond China’s immediate periphery. Not included are ranges for naval surface- and sub-surface-based weapons, whose employment distances from China would be determined by doctrine and the scenario in which they are employed.

Chinese Nuclear-Armed Missiles

China has a large variety of nuclear-armed ballistic missiles and is currently transitioning its arsenal from liquid-fueled, relatively inaccurate, silo- or cave-based missiles (such as the DF-3, DF-4, and DF-5) to solid-fueled, more accurate, mobile missiles (like the DF-11, DF-15, DF-21, DF-31 ICBM, and JL-2 SLBM). Japanese and US estimates of the ranges of these systems are shown in Figure IX.3.

Some of these newer missiles could eventually be equipped with multiple independent targetable reentry vehicle (MIRV) warheads. In December 2012, China successfully conducted a second test of its DF-31A missile, allowing it to reach any city in the US. The missile is believed to have three warheads per missile and a range of approximately 7,000 miles. While the Chinese CSS-4 has similar capabilities, the CSS-4 requires a stationary launch pad and contains only one nuclear warhead. In contrast, the DF-31A is portable and can be launched from the back of a truck, train, or tank.\footnote{Robert Johnson, “China’s New MIRV Ballistic Missile is A Big Deal,” Business Insider, December 11, 2012. http://www.businessinsider.com/china-df-3a-mirv-multiple-us-targets-one-missle-2012-12.} China appears to have supplied missiles to Saudi Arabia, Iran, Iraq, Libya, Pakistan, Syria, and North Korea.\footnote{“China,” Nuclear Threat Initiative, January 2013. http://www.nti.org/country-profiles/china/}

The US assessment of China’s military capabilities has long focused on China’s growing nuclear and missile forces and increasing capability to target the US and Japan in ways that directly affect the Korean balance and the potential risk of US and Japanese involvement in a Korean crisis or conflict. The DoD report on Military and Security Developments Affecting the People’s Republic of China for 2011 stated that,\footnote{Office of the Secretary of Defense, Annual Report to Congress, Military and Security Developments Involving the People’s Republic of China 2011, p. 2-3, 34-35.}

China has prioritized land-based ballistic and cruise missile programs. It is developing and testing several new classes and variants of offensive missiles, forming additional missile units, upgrading older missile systems, and developing methods to counter ballistic missile defenses.

The PLA is acquiring large numbers of highly accurate cruise missiles, many of which have ranges in excess of 185 km. This includes the domestically-produced, ground-launched DH-10 land-attack cruise missile (LACM); the domestically-produced ground- and ship-launched YJ-62 anti-ship cruise missile (ASCM); the Russian SS-N-22/SUNBURN supersonic ASCM, which is fitted on China’s SOVREMENNY-class DDGs acquired from Russia; and, the Russian SS-N-27B/SIZZLER supersonic ASCM on China’s Russian-built, KILO-class diesel-electric attack submarines.

By December 2010, the PLA had deployed between 1,000 and 1,200 short-range ballistic missiles (SRBM) to units opposite Taiwan. To improve the lethality of this force, the PLA is introducing variants of missiles with improved ranges, accuracies, and payloads.

China is developing an anti-ship ballistic missile (ASBM) based on a variant of the CSS-5 medium-range ballistic missile (MRBM). Known as the DF-21D, this missile is intended to provide the PLA the capability to attack large ships, including aircraft carriers, in the western Pacific Ocean. The DF-21D has a range exceeding 1,500 km and is armed with a maneuverable warhead.

China is modernizing its nuclear forces by adding more survivable delivery systems. In recent years, the road mobile, solid propellant CSS-10 Mod 1 and CSS-10 Mod 2 (DF-31 and DF-31A)
intercontinental-range ballistic missiles (ICBMs) have entered service. The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach most locations within the continental United States.

China may also be developing a new road-mobile ICBM, possibly capable of carrying a multiple independently targetable re-entry vehicle (MIRV).

... China’s nuclear arsenal currently consists of approximately 55-65 intercontinental ballistic missiles (ICBMs), including the silo-based CSS-4 (DF-5); the solid-fueled, road-mobile CSS-10 Mods 1 and 2 (DF-31 and DF-31A); and the more limited range CSS-3 (DF-3). This force is complemented by liquid-fueled CSS-2 intermediate-range ballistic missiles and road-mobile, solid-fueled CSS-5 (DF-21D) MRBMs for regional deterrence missions. The operational status of China’s single XIA-class ballistic missile submarine (SSBN) and medium-range JL-1 submarine-launched ballistic missiles (SLBM) remain questionable.

By 2015, China’s nuclear forces will include additional CSS-10 Mod 2s and enhanced CSS-4s. The first of the new JIN-class (Type 094) SSBN appears ready, but the associated JL-2 SLBM has faced a number of problems and will likely continue flight tests. The date when the JIN-class SSBN/JL-2 SLBM combination will be fully operational is uncertain. China is also currently working on a range of technologies to attempt to counter U.S. and other countries’ ballistic missile defense systems, including maneuvering re-entry vehicles, MIRVs, decoys, chaff, jamming, thermal shielding, and anti-satellite (ASAT) weapons. PRC official media also cites numerous Second Artillery Corps training exercises featuring maneuver, camouflage, and launch operations under simulated combat conditions, which are intended to increase survivability. Together with the increased mobility and survivability of the new generation of missiles, these technologies and training enhancements strengthen China’s nuclear force and enhance its strategic strike capabilities.

The introduction of more mobile systems will create new command and control challenges for China’s leadership, which now confronts a different set of variables related to deployment and release authorities. For example, the PLA has only a limited capacity to communicate with submarines at sea, and the PLA Navy has no experience in managing a SSBN fleet that performs strategic patrols with live nuclear warheads mated to missiles. Land-based mobile missiles may face similar command and control challenges in wartime, although probably not as extreme as with submarines.

Beijing’s official policy towards the role of nuclear weapons continues to focus on maintaining a nuclear force structure able to survive an attack, and respond with sufficient strength to inflict unacceptable damage on the enemy. The new generation of mobile missiles, maneuvering and MIRV warheads, and penetration aids are intended to ensure the viability of China’s strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic intelligence, surveillance, and reconnaissance; precision strike; and missile defense capabilities.

Beijing has consistently asserted that it adheres to a “no first use” (NFU) policy, stating it would use nuclear forces only in response to a nuclear strike against China. China’s NFU pledge consists of two stated commitments: China will never use nuclear weapons first against any nuclear-weapon state, and China will never use or threaten to use nuclear weapons against any non-nuclear-weapon state or nuclear-weapon-free zone. However, there is some ambiguity over the conditions under which China’s NFU policy would apply, including whether strikes on what China considers its own territory, demonstration strikes, or high altitude bursts would constitute a first use.

Moreover, some PLA officers have written publicly of the need to spell out conditions under which China might need to use nuclear weapons first; for example, if an enemy’s conventional attack threatened the survival of China’s nuclear force, or of the regime itself. However, there has been no indication that national leaders are willing to attach such nuances and caveats to China’s “no first use” doctrine.

Beijing will likely continue to invest considerable resources to maintain a limited nuclear force, also referred to by some PRC writers as “sufficient and effective” to ensure the PLA can deliver a damaging retaliatory nuclear strike.
The DoD provided further updates in the 2013 edition of *Military and Security Developments Affecting the People’s Republic of China*, describing China’s latest nuclear-armed missile developments as follows:471

The Second Artillery controls China’s nuclear and conventional ballistic missiles. It is developing and testing several new classes and variants of offensive missiles, forming additional missile units, upgrading older missile systems, and developing methods to counter ballistic missile defenses. (p. 5-6)

By December 2012, the Second Artillery’s inventory of short-range ballistic missiles (SRBM) deployed to units opposite Taiwan stood at more than 1,100. This number reflects the delivery of additional missiles and the fielding of new systems. To improve the lethality of this force, the PLA is also introducing new SRBM variants with improved ranges, accuracies, and payloads.

China is fielding a limited but growing number of conventionally armed, medium-range ballistic missiles, including the DF-21D anti-ship ballistic missile (ASBM).472 The DF-21D is based on a variant of the DF-21 (CSS-5) medium-range ballistic missile (MRBM) and gives the PLA the capability to attack large ships, including aircraft carriers, in the western Pacific Ocean. The DF-21D has a range exceeding 1,500 km and is armed with a maneuverable warhead. (p. 5-6)

The Second Artillery continues to modernize its nuclear forces by enhancing its silo-based intercontinental ballistic missiles (ICBMs) and adding more survivable mobile delivery systems. In recent years, the road-mobile, solid-propellant CSS-10 Mod 1 and CSS-10 Mod 2 (DF-31 and DF-31A) intercontinental-range ballistic missiles have entered service. The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach most locations within the continental United States. China may also be

---


472 A number of sources agree with the US Department of Defense assessment that China has completed development of the DF-21D anti-ship ballistic missile (ASBM). The IISS Military Balance for 2013 states that “China’s DF-21D anti-ship ballistic missile (ASBM) is no longer merely an aspiration. Beijing has successfully developed, partially tested and deployed in small numbers the world’s first weapons system capable of targeting the last relatively uncontested U.S. airfield in the Asia-Pacific from long-range, land-based mobile launchers. This airfield is a moving aircraft carrier strike group (CSG), which the Second Artillery, China’s strategic missile force, now has the capability to at least attempt to disable with the DF-21D in the event of conflict. With the ASBM having progressed this far, and representing the vanguard of a broad range of potent asymmetric systems, Beijing probably expects to achieve a growing degree of deterrence with it…. On March 16, 2011, Taiwan National Security Bureau Director-General Tsai De-sheng restated a previous claim from August 2010 that the PLA already had tested and was deploying the DF-21D....” The 2011 ROC National Defense Report confirmed that “a small quantity of” DF-21D ASBMs “were produced and deployed in 2010.” (“Taiwan’s Intelligence Chief Warns about the PLA’s Growing Strategic Weapon Systems,” *China Brief*, March 25, 2011).

In December 2010, then-Commander of U.S. Pacific Command Admiral Robert Willard asserted “The anti-ship ballistic missile system in China has undergone extensive testing. An analogy using a Western term would be ‘Initial Operational Capability (IOC),’ whereby it has—I think China would perceive that it has—an operational capability now, but they continue to develop it. It will continue to undergo testing, I would imagine, for several more years” (*Asahi Shimbun*, December 28, 2010). As for supporting infrastructure, on January 3, 2011, Vice Admiral David Dorsett stated that the PLA “likely has the space-based intelligence, surveillance and reconnaissance (ISR), command and control structure, and ground processing capabilities necessary to support DF-21D employment...[and also] employs an array of non-space based sensors and surveillance assets capable of providing the targeting information” (Bloomberg, January 3, 2011). Two days later, Dorsett added “The Chinese have tested the DF-21D missile system over land a sufficient number of times that the missile system itself is truly competent and capable. …they have ISR, they have sensors onboard ship that can feed into the targeting aspect of it. So could they start to employ that and field it operationally? Yes, I think so” (*Air Force Magazine*, January 5, 2011).
developing a new road-mobile ICBM, possibly capable of carrying a multiple independently targetable re-entry vehicle (MIRV). (p. 5-6)

**Land-Based Platforms.** China’s nuclear arsenal currently consists of approximately 50-75 ICBMs, including the silo-based CSS-4 (DF-5); the solid-fueled, road-mobile CSS-10 Mods 1 and 2 (DF-31 and DF-31A); and the more limited range CSS-3 (DF-4). This force is complemented by liquid-fueled CSS-2 intermediate-range ballistic missiles and road-mobile, solid-fueled CSS-5 (DF-21) MRBMs for regional deterrence missions. By 2015, China’s nuclear forces will include additional CSS-10 Mod 2 and enhanced CSS-4 ICBMs. (p. 31)

**Sea-Based Platforms.** China continues to produce the JIN-class SSBN, with three already delivered and as many as two more in various stages of construction. The JIN-class SSBNs will eventually carry the JL-2 submarine-launched ballistic missile with an estimated range of 7,400 km. The JIN-class and the JL-2 will give the PLA Navy its first long-range, sea-based nuclear capability. After a round of successful testing in 2012, the JL-2 appears ready to reach initial operational capability in 2013. JIN-class SSBNs based at Hainan Island in the South China Sea would then be able to conduct nuclear deterrence patrols. (p. 31-32)

**...Future Efforts.** China is working on a range of technologies to attempt to counter U.S. and other countries’ ballistic missile defense systems, including maneuverable reentry vehicles (MaRVs), MIRVs, decoys, chaff, jamming, thermal shielding, and anti-satellite (ASAT) weapons. China’s official media also cite numerous Second Artillery training exercises featuring maneuver, camouflage, and launch operations under simulated combat conditions, which are intended to increase survivability. Together with the increased mobility and survivability of the new training enhancements strengthen China’s nuclear force and enhance its strategic strike capabilities. Further increases in the number of mobile ICBMs and the beginning of SSBN deterrence patrols will force the PLA to implement more sophisticated command and control systems and processes that safeguard the integrity of nuclear release authority for a larger, more dispersed force. (p. 32)

Outside sources provide further insights into these developments. The IISS reported in 2013,

In July 2012, unnamed US officials reportedly said that China had test-fired a DF-41 intercontinental ballistic missile, although little information was provided. The DF-41 would, if deployed, be the first land-based missile able to reach the entire continental United States. The July test was reported to include a multiple independently targetable re-entry vehicle (MIRV), though it is unclear whether MIRVed warheads have yet been deployed on China’s current longest-range ICBM, the DF-31A. This continues to be produced, with satellite imagery from 2011 suggesting that the 809 Brigade in Datong was receiving DF-31s in place of DF-21s. Taiwan’s 2010 report on Chinese military power claimed that the Second Artillery had also deployed a few new DF-16 MRBMs.

Within a month, China also conducted a successful test of the JL-2 ballistic missile. The JL-2 is the submarine-launched version of the DF-31 road-mobile ICBM, to be deployed on the Type-094 nuclear-ballistic-missile submarine. Successful development and deployment of the hitherto troubled JL-2 would give China a more secure second-strike deterrent, as the four Type-094 submarines currently in the water would then be able to provide continuous at-sea deterrence.

---

Figure IX.3: Chinese Ballistic Missile Ranges – Part One
(2012 Japanese Estimate)

Figure IX.3: Chinese Ballistic Missile Ranges – Part Two
(2013 US Estimate)

Figure IX.3: Chinese Ballistic Missile Ranges – Part Three
(2012 US Estimate)

Note: Medium and Intercontinental Range Ballistic Missiles. China is capable of targeting its nuclear forces throughout the region and most of the world, including the continental United States. Newer systems such as the DF-31, DF-31A, and JL-2 will give China a more survivable nuclear force.

Chinese Missile Defense Capabilities

The 2010 Chinese Defense White Paper argued against international missile defense programs. The paper also included sections on the desire to prohibit biological and chemical weapons, prevent an arms race in outer space, promote military expenditure transparency, and work towards conventional arms control. In the section on non-proliferation, the PRC wrote,\textsuperscript{474}

China maintains that the global missile defense program will be detrimental to international strategic balance and stability, will undermine international and regional security, and will have a negative impact on the process of nuclear disarmament. China holds that no state should deploy overseas missile defense systems that have strategic missile defense capabilities or potential, or engage in any such international collaboration.

The 2013 Paper mentioned missile defense but did not really address it. In contrast, the 2013 DoD report on \textit{Military and Security Developments Involving the People’s Republic of China 2013} noted that,\textsuperscript{475}

China has made efforts to go beyond defense from aircraft and cruise missiles to gain a ballistic missile defense capability in order to provide further protection of China’s mainland and strategic assets. China’s existing long-range SAM inventory offers limited capability against ballistic missiles. The SA-20 PMU2, the most advanced SAM Russia offers for export, has the advertised capability to engage ballistic missiles with ranges of 1,000km and speeds of 2,800m/s. China’s domestic CSA-9 long-range SAM system is expected to have a limited capability to provide point defense against tactical ballistic missiles with ranges up to 500km. China is proceeding with the research and development of a missile defense umbrella consisting of kinetic energy intercept at exo-atmospheric altitudes (>80km), as well as intercepts of ballistic missiles and other aerospace vehicles within the upper atmosphere. In January 2010, and again in January 2013, China successfully intercepted a ballistic missile at mid-course, using a ground-based missile.

China tested an advanced missile defense system on January 11, 2010. The test, entitled the \textit{Test of the Land-based Mid-course Phase Anti-ballistic Missile Interception Technology}, targeted a missile during the mid-course phase when the target was exoatmospheric. According to press reports, the US DoD stated: “We detected two geographically separated missile launch events with an exoatmospheric collision also being observed by space-based sensors.”\textsuperscript{476}

Reportedly, China carried out a second land-based mid-course missile interception test on January 27, 2013 in the Xinjiang Uyghur Autonomous Region. Although no other information was given, the Chinese Defense Ministry remarked that the test was “defensive in nature” and appeared to be successful. In all likelihood, the system is a reconfigured DF-21C or DF-25 (KS/SC-19), both of which are two-stage medium-range (1500-1700 km)

\textsuperscript{474} 2010 White Paper, 35-36.
\textsuperscript{476} “China did not notify US before anti-missile test: Pentagon,” Agence France-Presse, January 12, 2010. http://www.google.com/hostednews/afp/article/ALeqM5gIyJwTWQjzwLtHke9NhVHNS7qiHQ.
ballistic missiles capable of carrying a 600 kg payload – in this case, an exoatmospheric kill vehicle. However, China likely remains far from an operational anti-missile shield.\footnote{“China carries out land-based mid-course missile interception test,” Xinhua, January 28, 2013. http://news.xinhuanet.com/english/china/2013-01/28/c_124285293.htm; A. Vinod Kumar, “Impressions on China’s Second Missile Interceptor Test,” Institute for Defence Studies and Analyses [India], February 22, 2013.}

China is also working to increase its tactical ballistic missile defense capabilities – which add another level of deterrence and defense capabilities. China is beginning to produce its own variant of the S-300 and may be able to deploy significantly more advanced theater missile defense systems in the mid-term.

**Chinese Counterspace Capabilities**

China is developing counterspace capabilities that affect the entire spectrum of warfighting capabilities, from the tactical to the strategic levels. Both China and Russia “continue developing systems and technologies that can interfere with or disable vital U.S. space-based navigation, communication, and intelligence collection satellites.”\footnote{Ronald L. Burgess Jr., *Annual Threat Assessment*, Senate Armed Services Committee, February 16, 2012, p. 26.} China has tested anti-satellite weapons that could also have a massive impact on US battle management and ISR systems, and may have some capability to use EMP weapons.


> PLA strategists regard the ability to utilize space and deny adversaries access to space as central to enabling modern, informatized warfare. Although PLA doctrine does not appear to address space operations as a unique operational “campaign,” space operations form an integral component of other PLA campaigns and would serve a key role in enabling A2/AD operations. Publicly, China attempts to dispel any skepticism over its military intentions for space.

> In 2009, PLA Air Force Commander General Xu Qiliang publically retracted his earlier assertion that the militarization of space was a “historic inevitability” after President Hu Jintao swiftly contradicted him. General Xu Qiliang is now a Vice Chairman of the Central Military Commission and the second highest-ranking officer in the PLA.

> The PLA is acquiring a range of technologies to improve China’s space and counter-space capabilities. China demonstrated a direct-ascent kinetic kill anti-satellite capability to low Earth orbit when it destroyed the defunct Chinese FY-1C weather satellite during a test in January 2007. Although Chinese defense academics often publish on counterspace threat technologies, no additional anti-satellite programs have been publicly acknowledged. A PLA analysis of U.S. and coalition military operations reinforced the importance of operations in space to enable “informatized” warfare, claiming that “space is the commanding point for the information battlefield.”

> PLA writings emphasize the necessity of “destroying, damaging, and interfering with the enemy’s reconnaissance...and communications satellites,” suggesting that such systems, as well as navigation and early warning satellites, could be among the targets of attacks designed to “blind and deafen the enemy.” The same PLA analysis of U.S. and coalition military operations also states that “destroying
or capturing satellites and other sensors…will deprive an opponent of initiative on the battlefield and [make it difficult] for them to bring their precision guided weapons into full play.”

Space

China is expanding its own space-based systems in ways that will enhance its deterrent, missile, and other military capabilities in the Koreas and Northeast Asia. The new Party leadership has emphasized such activities as long-range missiles and other aerospace programs in its military modernization push. Chinese companies are also looking at increasing domestic development and production through the acquisition of parts manufacturers, leasing businesses, cargo airlines, materials producers, and airport operators. However, many of these Chinese companies that are pursuing joint ventures and technical cooperation agreements alongside acquisitions have deep ties to the military, raising issues for American regulators.480

The main contractor for the country’s air force, the state-owned China Aviation Industry Corporation, known as Avic, has set up a private equity fund to purchase companies with so-called dual-use technology that has civilian and military applications, with the goal of investing as much as $3 billion. In 2010, Avic acquired the overseas licensing rights for small aircraft made by Epic Aircraft of Bend, Ore., using lightweight yet strong carbon-fiber composites — the same material used for high-performance fighter jets.

Provincial and local government agencies in Shaanxi Province, a hub of Chinese military aircraft testing and production, have set up another fund of similar size for acquisitions. Last month, a consortium of Chinese investors, including the Shaanxi fund, struck a $4.23 billion deal with the American International Group to buy 80 percent of the International Lease Finance Corporation, which owns the world’s second-largest passenger jet fleet.

In 2010, China conducted 15 space launches while expanding its space-based surveillance, reconnaissance, intelligence, meteorological, navigation, and communications satellites. At the same time, China is developing a multi-dimensional program in order to improve its ability to prevent or limit adversaries’ use of space-based assets.481

The 2013 DoD report on China cited earlier remarks that, 482

In 2012, China conducted 18 space launches. China also expanded its space-based intelligence, surveillance, reconnaissance, navigation, meteorological, and communications satellite constellations. In parallel, China is developing a multi-dimensional program to improve its capabilities to limit or prevent the use of space-based assets by adversaries during times of crisis or conflict. (p. 9)

During 2012, China launched six Beidou navigation satellites. These six satellites completed the regional network as well as the in-orbit validation phase for the global network, expected to be completed by 2020. China launched 11 new remote sensing satellites in 2012, which can perform both civil and military applications. China also launched three communications satellites, five experimental small satellites, one meteorological satellite, one relay satellite, and a manned space mission. (p. 9)

China continues to develop the Long March 5 (LM-5) rocket, which is intended to lift heavy payloads

into space. LM-5 will more than double the size of the Low Earth Orbit (LEO) and Geosynchronous Orbit (GEO) payloads China is capable of placing into orbit. To support these rockets, China began constructing the Wenchang Satellite Launch Center in 2008. Located on Hainan Island, this launch facility is expected to be complete around 2013, with the initial LM-5 launch scheduled for 2014. (p. 9-10)

China is the third country to develop an independent human spaceflight program, and early in 2012 the PRC achieved its first manned space docking at an orbital laboratory. The country has a stated goal of building a 60-ton space station for future missions. China has traditionally been relying on its manned Shenzhou spacecraft, capsule-based vehicles. It would appear that China is in the test-flight stages of a new Shenlong space plane, a drone that is similar to, though less capable than, the US’ X-37B.483

China’s growing space capabilities translate into military capabilities that affect all aspects of conventional and nuclear targeting, ground-air-sea operations, precision conventional strike capacities, and missile defense. China is also using its intelligence collection efforts to improve technological capacity. In his 2012 Senate testimony, DIA Director Ronald L. Burgess, Jr. remarked,484

China is beginning to develop and test technologies to enable ballistic missile defense. The space program, including ostensible civil projects, supports China’s growing ability to deny or degrade the space assets of potential adversaries and enhances China’s conventional military capabilities. China operates satellites for communications, navigation, earth resources, weather, and intelligence, surveillance, and reconnaissance, in addition to manned space and space exploration missions. China successfully tested a direct ascent anti-satellite weapon (ASAT) missile and is developing jammers and directed-energy weapons for ASAT missions. A prerequisite for ASAT attacks, China’s ability to track and identify satellites is enhanced by technologies from China’s manned and lunar programs as well as technologies and methods developed to detect and track space debris. Beijing rarely acknowledges direct military applications of its space program and refers to nearly all satellite launches as scientific or civil in nature.

China has used its intelligence services to gather information via a significant network of agents and contacts utilizing a variety of methods to obtain U.S. military technology to advance their defense industries, global command and control, and strategic warfighting capabilities. The Chinese continue to improve their technical capabilities, increasing the collection threat against the U.S. The Chinese also utilize their intelligence collection to improve their economic standing and to influence foreign policy. In recent years, multiple cases of economic espionage and theft of dual-use and military technology have uncovered pervasive Chinese collection efforts.

One example of Chinese space technologies is the Beidou satellite position, navigation, and timing system, which has been in development and regional use since 2000. The second generation version has been operational in the region since 2012 and is planned to be available globally by 2020. The system will “enable subscribers outside of China to purchase receivers and services that give civilian and military applications greater redundancy and independence in a conflict scenario that employs space assets.”485

485 Ibid., p. 25.
China conducted anti-satellite (ASAT) weapons tests in January 2007 and 2010. Over the next several years, China plans to put more than 20 new navigational satellites in medium-earth orbit to improve the functionality of its Beidou system. An editorial in the state-run Global Times stated, “it is necessary for China to have the ability to strike US satellites. This deterrent can provide strategic protection to Chinese satellites and the whole country’s national security.”

Anti-Access/Area Denial Sea-based Space Programs

China’s A2AD programs rely on a mix of space-based systems. China is relying on land and sea launch capabilities as well as sea-based systems that utilize “Long View” space support ships to perform tasks like monitoring and tracking space vehicles – such as spacecraft, missiles, and rockets – while also coordinating and communicating with ground-based assets. This system can increase space operations and situational awareness while also providing potential military applications.

In a conflict, ship-based C4ISR capabilities could have advantages over ground-based installations. Again, Andrew S. Erikson provides a history and more in-depth description of the program, which began in 1965 with Premier Zhou Enlai and was further developed in the 1970s under Project 718. In order to support Chinese ICBM sea tests, the Yuanwang program was initiated, though it was soon delayed by subsequent political events. It was jointly designed and developed by the Seventh Academy of the Sixth Ministry of Machine Building, the Seventh Ministry of Machine Building, and the Commission of Science and Technology for National Defense’s concept-study team.

Design and development of the Yuanwang started in 1974, with construction from 1975 and the first ships ready for trials in the late 1970s. Though six were originally built, only three are in operation today. It appears that the Yuanwang-class ship was first used in 1980 to retrieve the instrument package from China’s first successful DF-5/CSS-4 ICBM test – showing that the ships were able to successfully track missiles from the sea. The ships were further deployed in support of civilian and military space launches and tracking of space operations, including communications satellites, ballistic missile tests, and manned spacecraft (the Shenzhou). The fleet complements the PRC’s two Tianlian data-relay satellites and many ground stations, facilitating communication between satellites and these stations.

The Yuanwang fleet was technologically upgraded starting in the 1980s; for example, the ships were initially able to track almost 25,000 miles above Earth, later increasing to almost 250,000 miles. Better radars improved the communication and tracking systems; most of the ships in the fleet have C- and S-band monopulse tracking radar, velocimetry systems, cinetheodolite laser ranging and tracking systems, computers, and navigation and positioning approaches. A variety of communications systems can secure data transfer, and the ships can

---

488 Ibid.
operate in any maritime environment except polar areas. The ships could be used to detect and track foreign satellites and provide support to any PRC attempt to threaten them.489

While a ship-based tracking system has advantages such as flexibility, there are also disadvantages – it is expensive to operate and maintain, and during longer missions the lack of necessary engineers and equipment could make repairs difficult. Deploying such critical systems overseas makes them vulnerable targets, and any signals interference – or PRC supporting vessels – could affect their operation. Their sea-based nature also makes advanced communications connectivity difficult, especially during bad weather. There are still technological issues, such as calibration and stabilization, that frustrate the ships’ operations.490

As of mid-2008, the fleet had “completed 68 maritime space-tracking missions, sailed more than 1.4 million nautical miles safely, and performed more than 7,600 days of operations at sea…. During 2011-12, Yuanwang ships 3, 5, and 6 completed a cumulative 120,000-nautical-mile, 539-day trip to provide space-tracking and control support for the docking of the Tiangong-1 space-lab module and Shenzhou-8 spacecraft.” There have also been reports that a seventh ship was under construction; in 2006 the chief engineer of Yuanwang 6 noted that another boat was in the pre-research stages and could potentially be used in deep-space exploration missions. There has also been significant research on ship-based multi-target simulators to track and control satellite launches or missiles, which the PLA sees as a key capability. The Yuanwang could also provide support to PRC development of ground-based laser and kinetic anti-satellite capabilities. Overall, Andrew S. Erikson notes,491

In reapplying indispensable positioning information and controlling space assets overseas, the Yuanwang fleet represents a vital node in China’s aerospace infrastructure. The construction and proliferation of these ships over the past four decades underscores their importance and utility to the country’s space and military operations. Space-tracking vessels have successfully participated in full-range ICBM tests, submarine-to-shore guided-missile underwater-launch tests, communications-satellite launches, manned and unmanned space-vehicle launches, and an Antarctic visit. They have played a significant role in the development and testing of technologies and weapons…. Chinese research literature also points to a larger role for space TT&C ships as the nation’s space operations continue to expand.

Anti-Access/Area Denial Land-based Space Programs

China also has a broad range of land-based stations that enhance its space warfare capabilities in ways that can threaten or attack US power projection capabilities:492

China has three satellite launch centers and stations: Jiuquan (also known as Base 20 and Dongfeng Space City), Xichang (Base 27), and Taiyuan (Base 25). The country is currently constructing a station in Wenchang (also known as Wenchang Space City and Wenchang Satellite Launch Center), which should be operational in 2013. Additionally, it has two control facilities: an Aerospace Command and Control Center in Xi’an (also known as Base 26). The Aerospace Telemetry Oceanic Ship Base is a crucial ground station, as it tracks Yuanwang data on both commercial satellites and spacecraft. Established in 1978 in Jiangyin, Jiangsu Province, the base sends the ships it operates primarily to the

489 Ibid.
490 Ibid.
491 Ibid.
492 Ibid.
Pacific and Indian Oceans. China operates three integrated land-based space-monitoring and control network stations in Kashi, Jiamusi, and Sanya.…

China has overseas tracking stations in Karachi, Pakistan; Malindi, Kenya; and Swakopmund, Namibia. The Malindi station, in an Indian Ocean coastal town, became operational in July 2005 to support the Shenzhou 6 mission. In Swakopmund, the station works in conjunction with Yuanwang 3 to provide telemetry, tracking and command (TT&C) support during Shenzhou spacecraft landings. China also had a ground station in Tarawa, Kiribati; but it was dismantled in 2003 after Kiribati recognized Taiwan. Beijing plans to construct three ground-control stations in South America by 2016 for deep-space network support. Additionally, China reportedly shares space-tracking facilities with France, Sweden, and Australia.

**US Missile Forces**

The US does not discuss details of the use of missile warfare in Asia in its unclassified military literature and has not made this a major part of its discussion of force rebalancing in Asia. It is clear, however, that conventional and nuclear missile capabilities are as important to the US side of the sea-air-missile-space balance as they are to China and the Koreas, that they sharply affect the land balance in terms of joint warfare, and that the degree of future US and Chinese cooperation or competition will affect every aspect of the Korean, Northeast Asian, and Pacific balances.

The US has a variety of liquid- and solid-fueled cruise and ballistic missiles that affect the military balance in any region in the world. Most of the longer-range US missile systems are nuclear-armed. These include the forces shown in Figure IX.4.

According to the NTI, nuclear-armed US missile forces now include:

…500 warheads on 450 Minuteman nuclear-tipped intercontinental at bases in Montana, North Dakota, and Wyoming. The bomber force deploys approximately 300 and consists of 76 nuclear-capable B-52 bombers that can deliver air-launched cruise missiles (ALCM), advanced cruise missiles (ACM), or gravity bombs, and 18 nuclear-capable B-2 bombers that carry gravity bombs. The Navy’s 14 operational Ohio-class nuclear-powered ballistic missile submarines (SSBN) carry approximately 1,152 Trident submarine-launched ballistic missiles (SLBM). In the 2010 Nuclear Posture Review, the United States decided to retire the Navy’s nuclear-tipped Tomahawk sea-launched cruise missiles (TLAM-N).

Following the Intermediate-Range Nuclear Forces Treaty (INF), the United States eliminated its entire stockpile of intermediate-range ballistic missiles (IRBM) and medium-range ballistic missiles (MRBM). Pursuant to the restrictions of the INF, the United States does not possess ballistic or cruise missiles with ranges between 500 and 5,500 kilometers.

Unlike China, which emphasizes the development of long-range conventionally-armed ballistic missiles, the US emphasizes precision-guided cruise missiles and stand-off air-delivered precision-guided weapons. These now make up the conventionally-armed part of the US inventory. The US is, however, examining new ways to use its strategic missiles and new conventional strike systems in Prompt Global Strike missions (PGS). These systems could become conventional weapons of mass effectiveness and play a major role in deterrence, defense, and countering the use of nuclear weapons by the DPRK or China.

A report by Amy Woolf of the US Congressional Research Service notes that,

Many analysts believe that the United States should use long-range ballistic missiles armed with conventional warheads for the PGS mission. These weapons would not substitute for nuclear weapons in the U.S. war plan but would, instead, provide a “niche” capability, with a small number of weapons directed against select, critical targets, which might expand the range of U.S. conventional options. Some analysts, however, have raised concerns about the possibility that U.S. adversaries might misinterpret the launch of a missile with conventional warheads and conclude that the missiles carry nuclear weapons. DOD is considering a number of systems that might provide the United States with long-range strike capabilities.

The Air Force and Navy have both considered deploying conventional warheads on their long-range ballistic missiles. The Navy sought to deploy conventional warheads on a small number of Trident II submarine-launched ballistic missiles. In FY2008, Congress rejected the requested funding for this program, but the Navy has continued to consider the possibility of deploying intermediate-range technologies for the prompt strike mission. The Air Force and DARPA are developing a hypersonic glide delivery vehicle that could deploy on a modified Peacekeeper land-based ballistic missile—a system known as the Conventional Strike Missile (CSM). In FY2008, Congress created a single, combined fund for the conventional prompt global strike (CPGS) mission. This fund is supporting research and development into the Air Force CSM and two possible hypersonic glide vehicles. Congress appropriated $174.8 million for CPGS capability development in FY2012; DOD has requested $110.4 million in FY2013.

Unclassified studies do not specifically mention the role of these missiles in deterring and defending against China, but the target types that are suggested clearly affect Chinese forces.495

The United States might also be faced with circumstances during an ongoing conflict when it would need to destroy targets that could appear quickly and remain vulnerable for short periods of time. These might include leadership cells that could move during a conflict or mobile military systems that the adversary had chosen to keep hidden prior to their use. These types of targets might only be vulnerable to weapons that the United States could launch promptly and direct to their targets quickly. Analysts have noted that PGS might provide the means to attack such targets if the United States did not have the necessary weapons located near the conflict.

The Defense Science Board outlined several of these potential scenarios in a March 2009 report prepared by the Task Force on Time Critical Conventional Strike from Strategic Standoff. This report “formulated five representative scenarios” that might require a “very rapid strike response to a developing situation.”...These scenarios included several cases:

A near-peer competitor had used its emerging counter-space capability to destroy a U.S. satellite.

The United States wanted to destroy a package of special nuclear materials that a terrorist organization had shipped to a neutral country.

A small package of weapons of mass destruction was located temporarily in a rural area of a neutral country.

The leadership of a terrorist organization had gathered in a known location in a neutral country.

A rogue state armed with a nuclear weapon was threatening to use that weapon against a U.S. ally.

495 Ibid., p. 5.
The US Navy and Air Force both have suggested programs, but the Air Force currently seems to have the most chance of sustained funding, and its programs illustrate the capabilities of the possible delivery systems.496

… [M]odified Minuteman II missiles might each be able to carry a single warhead that weighed between 500 and 1,000 pounds; a modified Peacekeeper could possibly carry between 6,000 and 8,000 pounds of payload, which would allow for multiple warheads or reentry vehicles.51 According to some estimates, these missiles could even destroy some targets without an explosive warhead, using the, “sheer force of impact of a reentry vehicle moving at 14,000 feet per second…”

According to the DSB study, Peacekeeper missiles could also carry a single reentry body that had been modified to improve accuracy by allowing for the maneuverability of the warhead, like the E2 warhead described above.

In addition, as was noted above, the United States could use a hypersonic glide vehicle, like the CAV under consideration in the Falcon Study, as the reentry body on a long-range ballistic missile. According to the Falcon Study, the CAV would be an unpowered, maneuverable hypersonic glide vehicle capable of carrying approximately 1,000 pounds in munitions or other payload….This vehicle is a cone-shaped winged body that, after launch aboard a booster derived from a ballistic missile, would fly within the atmosphere at hypersonic speeds and maneuver to its target. …DOD has funded this program through the defense-wide Conventional Prompt Global Strike (CPGS) program since FY2008.

The US is also examining the option of deploying shorter-range systems called the Forward-Based Global Strike (FBGS).497

Analysts have also explored the option of deploying long-range land-based ballistic missiles at bases outside the continental United States. For example, they might be deployed in Guam, Diego Garcia, or Alaska. This system would use a two-stage rocket motor, with a payload of up to 1,000 pounds, a flight time to target of less than 25 minutes, and an accuracy of less than 5 meters. It could employ many of the same reentry vehicle and warhead options as the CTM and CSM systems. Because it would rely on existing rocket technologies, it might be available for deployment by 2012, in roughly the same time frame as the CSM system. However, because it would be launched from outside the continental United States, its trajectory would not resemble that of a land-based ICBM. Hence, some analysts argue that it would solve many of the questions about misunderstandings and misperceptions that plague the CTM and CSM systems.

At the same time, the USAF is seeking to develop a new manned strategic bombers for conventional munitions delivery as one of the procurement priorities in its FY2014 budget request, although some outside experts feel this may be a financial place holder for funding a future unmanned combat aerial vehicle (UCAV) or shifting future funds to make up for the cost-escalation in the F-35.

**Missile Defense and Space**

The US has long focused on the development of missile defense systems, including systems capable of intercepting missiles at the boost, midcourse, and terminal phases. Most of these systems are still in the early stages of research and development and focus on hit-to-kill capacities. According to NTI,498

496 Ibid., p. 14.
497 Ibid., p. 36.
The “most mature” short-range system is the PAC-3 patriot system. Use of PAC-3 systems in the 2003 Iraq war produced mixed results: while it successfully intercepted the nine “most threatening” ballistic missiles, it failed to detect several low-flying Iraqi cruise missiles and ultralight aircraft, and friendly fire on coalition aircraft resulted in the deaths of three soldiers. The Army has activated two batteries, with a total of 48 interceptors, of the land-based terminal-phase Terminal High Altitude Area Defense (THAAD) system. The Navy operates 26 ships equipped with the Aegis Ballistic Missile Defense system, which has been deployed to Europe and sold to Japan. Finally, the Air Force has deployed 30 Ground Based Midcourse Defense (GMD) interceptors in silos at Fort Greely, Alaska, and Vandenberg Air Force Base, California. As of December 2010, the system had hit eight out of fifteen targets in testing.

In its FY2014 defense budget overview, the US summarized its strategy in dealing with deterrence and nuclear forces as follows:

The FY 2014 budget funds the development and deployment of ballistic missile defense capabilities that support the Administration’s priorities: protecting the U.S. homeland, deployed forces, allies, and partners. The United States will maintain and improve the Ground-based Midcourse Defense (GMD) system currently operationally available in Fort Greely, Alaska, and Vandenberg Air Force Base, California to defeat limited ICBM attacks. We are supporting a presidential decision to implement the existing homeland defense hedge by increasing our operational fleet of Ground Based Interceptors (GBI) from 30 to 44 in order to counter larger raid sizes. In February 2013 the Ground Based Interceptor (GBI) returned to flight in a successful non-intercept test flight using the CE II GBI. Our highest priority this year is the execution of a successful intercept using a Capability Enhancement II (CE II) GBI.

As we focus on threats from Asia-Pacific and the Middle East we will continue to support the European Phased Adaptive Approach (EPAA), which is designed to protect our European NATO allies and deployed forces from ballistic missile attacks. The Department met its objectives for EPAA Phase I by deploying in 2011 Aegis Ballistic Missile Defense (BMD) ships in the Mediterranean Sea, a land-based radar in Turkey, and Command, Control, Battle Management system at Ramstein Air Force Base in Germany. The next two EPAA phases (Phases 2 and 3) include deploying Aegis Ashore capabilities in Romania with the Standard Missile-3 Block IB (SM-3 Blk IB) in 2015 and in Poland with Standard Missile-3 Block IIA in 2018.

Key changes include:

- The Department is restructuring the Standard Missile-3 Block IIB program, transitioning our efforts to focus on common kill vehicle technology for the GBI exo-atmospheric kill vehicle (EKV), and future SM-3 variants. Consolidating these into one technology effort accelerates our ability to address emerging threats and increase the protection of the homeland.
- The Department of Defense concluded that the schedule risk and cost associated with the Precision Tracking Space System (PTSS) concurrent acquisition strategy and long term fiscal sustainability was too high so the program was terminated. Other key efforts supported by this budget include:
- Continued acquisition of GBIs to support GMD operations, testing, spares, and interceptor reliability growth testing and component reliability programs to eliminate known risks and identify reliability improvements for GBI component hardware
- Continued conversion of Aegis ships to provide BMD capability, with a planned operational availability of up to 41 Aegis BMD ships by FY 2018, and procurement of 52 SM-3 Blk IB interceptors for Aegis BMD ships in FY 2014

• Procurement of the sixth Terminal High Altitude Area Defense (THAAD) battery and 36 THAAD interceptors, to be delivered by FY 2017

• Contributions to the Israeli Iron Dome system to defeat short range missiles and rockets

• Procurement of 56 new Missile Segment Enhancement (MSE) missiles which evolved from the Patriot Advanced Capability-3 (PAC-3) providing a more agile, lethal interceptor missile resulting in substantial performance improvement. Delivery is set for FY 2015, 4th Quarter. The program continues integration of missile and ground system hardware and software as well as activities that support the Test and Evaluation Master Plan (TEMP).

• Patriot Mods continues its modernization mission with the Radar Digital Processor, Enhanced Launcher Electronics System (ELES) upgrade kits to increase PAC-3 capability, Air Defense Artillery (ADA) School upgrades, and Cryptographic Modification. Patriot Mods also continues Reliability, Availability, and Maintainability (RAM), Recapitalization, and Battery Command Post/Tactical Command System (BCP/TCS) efforts.

The FY 2014 budget request balances capabilities and risks to deter aggression, protect the interests of the United States and its allies, respond to warfighter requirements, and pursue cost- and operationally-effective capabilities against future threats. To advance the Administration’s missile defense priorities, the FY 2014 budget includes $9.162 billion, including $7.684 billion for the Missile Defense Agency.

**Space**

The US has long led the world in space capabilities, although Russia remains a competitor and – as has already been described – this is a key priority in Chinese force development that is already affecting the balance in Asia. It is unclear how this competition and current US budget cuts will affect this lead. The FY2014 Future Year Defense Program includes the following developments.500

The FY 2014 budget proposal includes $8.0 billion for the DoD Space Investment Programs. This year, the Department realized savings across the FYDP from the efficient space procurement contract negotiations for the Advanced Extremely High Frequency (AEHF) communication satellite block buy and reinvested the savings in high priority space programs to improve space protection and our warfighters’ ability to operate through a degraded space environment. Additionally, the Department funded Space Based Infrared System (SBIRS) to $936 million in FY 2014 to sustain our strategic and tactical warning capability; funded the Space Fence to $403 million in FY 2014, which, when fielded, will significantly increase space situational awareness and provide revolutionary improvement to small object detection; and funded the Global Positioning System’s (GPS) next generation Operational Control System required for enabling a new military signal designed to further improve our GPS anti-jamming capability. The Department also increased funding for the Space Test Program to $13 million in FY 2014 to provide space launch opportunities for DoD space experiments, technologies, and demonstrations. Additionally, the Department restored $3 million per year for the Joint Navigation Warfare Center to enable operational field assessments directly supporting the warfighter and added $15 million in FY 2014 to assess the cost and technical risk of accelerating our modernized Military GPS User Equipment program.

The Department achieved additional efficiencies through a new acquisition strategy for the Evolved Expendable Launch Vehicle program that stabilized the program, introduced competition, and further reduced launch costs. The FY 2014 budget proposal also terminates the Space-Based Surveillance System Follow-on satellite totaling $8 million in FY 2014. To address our future space-based

---

500 Ibid.
surveillance capability, the Department is conducting a CY 2013 study to inform the FY 2015 budget proposal regarding space situational awareness.

The US is also China’s only peer in ship-based space tracking.\(^{501}\)

The U.S. Military Sealift Command, founded in 1958, has a Sepcal Mission Program that currently includes 25 ships supporting military and government tasks. It operates three active instrumentation ships… which “provide platforms for monitoring missile launches and collecting data that can be used to improve missile efficiency and accuracy.” The Observation Island is fitted with Cobra Judy (AN/SPQ-11), a passive electronically scanned array radar that supports space and ballistic-missile tracking as well as other instrumentation. It is linked to two types of non-maritime radars: the ground-based Cobra Dane (AN/FPS-108) in Shemya, Alaska; and three Cobra Ball (RC-135S) aircraft. As part of the U.S. ballistic-missile defense system, the Military Sealift Command operates the Sea-based X-band Radar Platform (SBX-1).

These assets represent parts of a larger U.S surveillance network that includes such allied land-based components as the ballistic-missile detection radars at Fylingdales, U.K.; and Thule, Greenland. With its global ground- and space-based C4ISR, the United States is far less reliant than China on this sea-based approach. Few other countries even have space-event support ships. Russia today operates only the Akademik Sergei Korolev, and France the Monge. No other country maintains a significant presence in this field.

**Nuclear Forces**

There is no way to assess the exact probability that the US or China would make threats to use their nuclear weapons in a Korean conflict, or ever escalate to their actual use, but the probability they would even make explicit threats seems extremely low. Each side’s nuclear weapons have a deterrent impact in restraining the other’s behavior without such threats, and even raising the possibility of an actual nuclear exchange would threaten the stability of Asia, the global economy, and the US and Chinese economies in ways in which the end result could not be calculated. Both sides seem likely to calculate that moving beyond the tacit threat posed by the existence of the other’s nuclear forces and would almost certainly be so destructive as to be more costly than any strategic or military gains in a limited war could ever be worth.

At the same time, neither side can predict what would happen if the ROK and DPRK became involved in a conflict that led the DPRK to threaten the use of nuclear weapons or make extensive use of other WMD. A successful major offensive that threatened the existence of either the DPRK or ROK could trigger threats to use nuclear forces. The US offer of extended deterrence links the US to the nuclear balance in the Koreas and indirectly to China, while China’s treaty alliance with the DPRK links it to the Korean nuclear balance and the US as well. The possible use of precision conventional-strike capability against high-value strategic and economic targets – “weapons of mass effectiveness” could produce a process of escalation neither side intended but both would then have to deal with. The possibility that the ROK or Japan might eventually develop nuclear weapons could add a further level of uncertainty in the future.

---

Unclassified estimates of the present structure of US, Chinese, and other outside nuclear forces are shown in the following figures:

- **Figure IX.4** compares the overall strength of US and major Northeast Asian nuclear powers.
- **Figure IX.5** provides an estimate of the global holdings of nuclear weapons.

These nuclear balances include Russia, and it is important to note that most US thinking about the nuclear balance still focuses on Russia and Europe. The forces on each side are also anything but static. The US is pursuing ways to reduce nuclear forces. China is increasing its forces and their capability, although there is little credible unclassified data on Chinese plans and activity.

It is also unclear that weapons numbers would be meaningful unless events forced both sides into a major nuclear engagement. The fact the US will have much larger weapons numbers for the foreseeable future might mean the US could theoretically “win” in terms of inflicting the most strikes and damage, but such a victory would be as pyrrhic a “victory” as a feared Cold War-era exchange between the US and Russia. Nevertheless, the US and China are major nuclear powers with boosted and thermonuclear weapons. While neither is likely to use these weapons, they have the capability and – at a minimum – their possession of nuclear weapons plays a major role in the balance of deterrence and in shaping the risks of asymmetric escalation.

**Figure IX.4: US and Asian Nuclear Capable Forces**

### China

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Role/Type</th>
<th>IRBM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Strategic Missiles (figures are estimates)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICBM</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>DF-31 (CSS-9)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>DF31A (CSS-9 Mod 2)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>DF-4 (CSS-3)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>DF-5A (CSS-4 Mod 2)</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>DF-21/21A (CSS-5 Mod 1/2)</td>
<td>MRBM</td>
</tr>
<tr>
<td>36</td>
<td>DF21C (CSS-5 Mod 3)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>DF-21D (CSS-5 Mod 4 – ASBM)</td>
<td></td>
</tr>
<tr>
<td>Some</td>
<td>DF-16</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DF-3A (CSS-2 Mod)</td>
<td>SRBM</td>
</tr>
</tbody>
</table>

**Figure IX.4: US and Asian Nuclear Capable Forces**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Role/Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ICBM</td>
</tr>
<tr>
<td>12</td>
<td>DF-31 (CSS-9)</td>
</tr>
<tr>
<td>30</td>
<td>DF31A (CSS-9 Mod 2)</td>
</tr>
<tr>
<td>10</td>
<td>DF-4 (CSS-3)</td>
</tr>
<tr>
<td>20</td>
<td>DF-5A (CSS-4 Mod 2)</td>
</tr>
<tr>
<td>80</td>
<td>DF-21/21A (CSS-5 Mod 1/2)</td>
</tr>
<tr>
<td>36</td>
<td>DF21C (CSS-5 Mod 3)</td>
</tr>
<tr>
<td>6</td>
<td>DF-21D (CSS-5 Mod 4 – ASBM)</td>
</tr>
<tr>
<td>Some</td>
<td>DF-16</td>
</tr>
<tr>
<td>2</td>
<td>DF-3A (CSS-2 Mod)</td>
</tr>
</tbody>
</table>

**Figure IX.4: US and Asian Nuclear Capable Forces**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Role/Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MRBM</td>
</tr>
<tr>
<td>80</td>
<td>DF-21/21A (CSS-5 Mod 1/2)</td>
</tr>
<tr>
<td>36</td>
<td>DF21C (CSS-5 Mod 3)</td>
</tr>
<tr>
<td>6</td>
<td>DF-21D (CSS-5 Mod 4 – ASBM)</td>
</tr>
<tr>
<td>Some</td>
<td>DF-16</td>
</tr>
</tbody>
</table>

**Figure IX.4: US and Asian Nuclear Capable Forces**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Role/Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IRBM</td>
</tr>
<tr>
<td>2</td>
<td>DF-3A (CSS-2 Mod)</td>
</tr>
</tbody>
</table>

**Figure IX.4: US and Asian Nuclear Capable Forces**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Role/Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SRBM</td>
</tr>
</tbody>
</table>

**Figure IX.4: US and Asian Nuclear Capable Forces**
<table>
<thead>
<tr>
<th>Quantity</th>
<th>Role/Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Navy</td>
</tr>
<tr>
<td>14</td>
<td>Ohio SSBN 730 Each with up to 24 UGM-133A Trident D-5 strategic SLBM</td>
</tr>
<tr>
<td></td>
<td>Air Force</td>
</tr>
<tr>
<td>6</td>
<td>SQN with 71 B-52H Stratofortress Each with up to 20 AGM-86B nuclear ALCM and/or AGM-129A nuclear ACM</td>
</tr>
<tr>
<td>2</td>
<td>SQN with 19 B-2A Spirit Each with up to 16 free-fall bombs (or 80 when fitted with Small Diameter Bombs)</td>
</tr>
<tr>
<td>9</td>
<td>SQN with 450 LGM-30G Minuteman III Each with a capacity of 1-3 MIRV Mk12/Mk12A per missile</td>
</tr>
</tbody>
</table>

**Russia**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Role/Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Navy</td>
</tr>
<tr>
<td>3</td>
<td>Kalmar (Delta III) Each with 16 RSM-50 (SS-N-18 Stingray) strategic SLBM</td>
</tr>
<tr>
<td>6</td>
<td>Delfin (Delta IV) Each with 16 R-29RMU Sineva (SS-N-23Skiff) strategic SLBM (1 vessel in repair, 2014 expected return to service)</td>
</tr>
<tr>
<td>1</td>
<td>Akula (Typhoon)</td>
</tr>
</tbody>
</table>

**United States**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Role/Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Xia With 12 JL-1 (CSS-N-3) strategic SLBM</td>
</tr>
<tr>
<td>3</td>
<td>Jin With up to 12 JL-2 (CSS-NX-4) strategic SLBM (3rd and 4th vessels under construction)</td>
</tr>
</tbody>
</table>
Strategic Rocket Force Armies

3 Strategic Rocket Forces is a separate branch of the Russian Armed Forces, directly subordinate to the General Staff. The Strategic Rocket Forces were demoted to this status from that of a separate service of the Armed Forces by a presidential decree of March 24, 2001. Strategic Rocket Forces include three missile armies: the 27th Guards Missile Army (HQ in Vladimir), the 31st Missile Army (Orenburg), the 33rd Guards Missile Army (Omsk). The 53rd Missile Army (Chita) was disbanded in 2002. It appears that the 31st Missile Army (Orenburg) will be liquidated by 2016. As of 2012, the missile armies included 11 missile divisions with operational ICBMs.*

As of March 2012, the Strategic Rocket Forces were estimated to have 332 operational missile systems of five different types. Intercontinental ballistic missiles of these systems could carry 1092 warheads.*

Strategic Missiles

54 RS-20 (SS-18) Satan (mostly mod 5, 10 MIRV per msl)
120 RS-12M (SS-25) Sickle
40 RS-18 (SS-19) Stiletto (mostly mod 3, 6 MIRV per msl)
60 RS-12M2 Topol-M (SS-27M1), silo based
18 RS-12M2 Topol-M (SS-27M1), road mobile
21 RS-24 (SS-27M2) Yars (estimated 3 MIRV per msl)

Long-Range Aviation Command

1 Sqn Tu-160 Blackjack
16 Tu-160 each with up to 12 Kh-55SM (AS-15A/B Kent) nuclear ALCM
3 Sqn Tu-95MS Bear
32 Tu-95MS6 (Bear H-6) each with up to 6 Kh-55 (AS-15A/B Kent) nuclear ALCM
31 Tu-95MS16 (Bear H-16) each with up to 16 Kh-55 nuclear ALCM

Source: Based primarily on material in IISS, The Military Balance 2013. Figures do not include equipment used for training purposes. Some equipment and personnel figures are estimates. All equipment figures represent equipment in active service.

* Based on “Strategic Nuclear Forces” section of Russian Forces Project, http://russianforces.org/missiles/.
Figure IX.5: Comparative Estimate of Global Holdings of Nuclear Weapons

<table>
<thead>
<tr>
<th>Country</th>
<th>Russia</th>
<th>US</th>
<th>China</th>
<th>DPRK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FAS</td>
<td>FAS</td>
<td>FAS</td>
<td>FAS</td>
</tr>
<tr>
<td>Information Source</td>
<td>CAC</td>
<td>CAC</td>
<td>CAC</td>
<td>CAC</td>
</tr>
<tr>
<td>Operational: Strategic</td>
<td>1,740</td>
<td>1,950</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Operational: Non-strategic</td>
<td>0</td>
<td>200</td>
<td>?</td>
<td>n/a</td>
</tr>
<tr>
<td>Non-deployed/ Reserve</td>
<td>2,700</td>
<td>2,500</td>
<td>180</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Total Inventory</td>
<td>8,500</td>
<td>7,700</td>
<td>240</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Growth Trend</td>
<td>Decrease</td>
<td>Decrease</td>
<td>Growing</td>
<td>Growing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>UK</th>
<th>Israel</th>
<th>Pakistan</th>
<th>India</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FAS</td>
<td>FAS</td>
<td>FAS</td>
<td>FAS</td>
<td>FAS</td>
</tr>
<tr>
<td>Information Source</td>
<td>CAC</td>
<td>CAC</td>
<td>CAC</td>
<td>CAC</td>
<td>CAC</td>
</tr>
<tr>
<td>Operational: Strategic</td>
<td>160</td>
<td>&lt;160</td>
<td>0</td>
<td>n/a</td>
<td>0</td>
</tr>
</tbody>
</table>

Nuclear weapons programs are generally shrouded in secrecy, and all of the totals listed above should be considered estimates. The numbers in the chart are based on the most recent available estimates from the Bulletin of the Atomic Scientists Nuclear Notebook series by Robert S. Norris and Hans M. Kristensen. The specific sources include 2013 data on “Non-P5 Nuclear-Armed States” and “US Nuclear Forces,” 2012 data on “Indian Nuclear Forces,” and 2011 data on “British Nuclear Forces.” According to State Department figures from the latest New START data exchange, as of September 1, 2012, the United States had 1,722 deployed strategic warheads and Russia had 1,499 deployed strategic warheads. This is a respective drop of 15 and increase of 9 warheads since the data exchange six months previously. U.S. totals are lower than the estimates in the chart primarily because New START counts bombers as having one warhead each, even though up to 20 warheads can be assigned to each bomber. In Russia’s case, the number of warheads assigned to delivery systems in the chart also includes warheads assigned to submarines in overhaul, which are also not counted as deployed by the treaty. Under New START, both the United States and Russia must reduce their stockpiles of deployed strategic warheads to less than 1,550 warheads by 2018. According to the December 2012 State Department report, operations to reduce U.S. missile launchers will begin in 2015. The US government disclosed in April 2010 that as of September 30, 2009, the total US stockpile had 5,113 warheads. On March 1, 2013, Drs. Hans Kristensen and Robert S. Norris revised that total to an estimated 4,650 warheads. This number excludes approximately 3,000 thousand warheads awaiting dismantlement, whereas the totals in the chart above include weapons awaiting dismantlement.

---

502 Nuclear weapons programs are generally shrouded in secrecy, and all of the totals listed above should be considered estimates. The numbers in the chart are based on the most recent available estimates from the Bulletin of the Atomic Scientists Nuclear Notebook series by Robert S. Norris and Hans M. Kristensen. The specific sources include 2013 data on “Non-P5 Nuclear-Armed States” and “US Nuclear Forces,” 2012 data on “Indian Nuclear Forces,” and 2011 data on “British Nuclear Forces.” According to State Department figures from the latest New START data exchange, as of September 1, 2012, the United States had 1,722 deployed strategic warheads and Russia had 1,499 deployed strategic warheads. This is a respective drop of 15 and increase of 9 warheads since the data exchange six months previously. U.S. totals are lower than the estimates in the chart primarily because New START counts bombers as having one warhead each, even though up to 20 warheads can be assigned to each bomber. In Russia’s case, the number of warheads assigned to delivery systems in the chart also includes warheads assigned to submarines in overhaul, which are also not counted as deployed by the treaty. Under New START, both the United States and Russia must reduce their stockpiles of deployed strategic warheads to less than 1,550 warheads by 2018. According to the December 2012 State Department report, operations to reduce U.S. missile launchers will begin in 2015. The US government disclosed in April 2010 that as of September 30, 2009, the total US stockpile had 5,113 warheads. On March 1, 2013, Drs. Hans Kristensen and Robert S. Norris revised that total to an estimated 4,650 warheads. This number excludes approximately 3,000 thousand warheads awaiting dismantlement, whereas the totals in the chart above include weapons awaiting dismantlement.

### Chinese Nuclear Forces

China is one of the five nuclear weapons states acknowledged in the Nuclear Non-Proliferation Treaty (NPT). China’s first nuclear test occurred in 1964. Since then, China has conducted 45 nuclear tests, including thermonuclear weapons and a neutron bomb. It has also become a party to the Comprehensive Test Ban Treaty, the Biological and Toxin Weapons Convention, and the Chemical Weapons Convention.

**Chinese and US Views of China’s Nuclear Forces**

Until at least 2010, China maintained a no-first-use policy. China’s 2008 Defense White Paper stated that:

> The Second Artillery Force is a strategic force under the direct command and control of the CMC, and the core force of China for strategic deterrence. It is mainly responsible for deterring other countries from using nuclear weapons against China, and for conducting nuclear counterattacks and precision strikes with conventional missiles.

> The Second Artillery Force sticks to China’s policy of no first use of nuclear weapons, implements a self-defensive nuclear strategy, strictly follows the orders of the CMC, and takes it as its fundamental mission the protection of China from any nuclear attack. In peacetime the nuclear missile weapons of the Second Artillery Force are not aimed at any country. But if China comes under a nuclear threat, the nuclear missile force of the Second Artillery Force will go into a state of alert, and get ready for a nuclear counterattack to deter the enemy from using nuclear weapons against China.

> If China comes under a nuclear attack, the nuclear missile force of the Second Artillery Force will use nuclear missiles to launch a resolute counterattack against the enemy either independently or together with the nuclear forces of other services. The conventional missile force of the Second Artillery Force is charged mainly with the task of conducting medium- and long-range precision strikes against key strategic and operational targets of the enemy.

Similarly, China’s 2010 White Paper argued that:

---


China has never evaded its obligations in nuclear disarmament and pursues an open, transparent and responsible nuclear policy. It has adhered to the policy of no-first-use of nuclear weapons at any time and in any circumstances, and made the unequivocal commitment that under no circumstances will it use or threaten to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-free zones. China has never deployed nuclear weapons in foreign territory and has always exercised the utmost restraint in the development of nuclear weapons, and has never participated in any form of nuclear arms race, nor will it ever do so. It will limit its nuclear capabilities to the minimum level required for national security.

China’s 2013 Defense White Paper did not address these issues. China is, however, in the process of a major modernization of its nuclear-armed missile forces and is developing a “stealth” strike aircraft – the J-20. It is also now MIRVing its nuclear systems. As a result, The US Department of Defense report on Chinese military power for 2013 provided the following analysis of how these developments interact with China’s no first use policy.

China’s official policy on nuclear weapons continues to focus on maintaining a nuclear force structure able to survive an attack and respond with sufficient strength to inflict unacceptable damage on an enemy. The new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of China’s strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic intelligence, surveillance, and reconnaissance (ISR), precision strike, and missile defense capabilities. The PLA has deployed new command, control, and communications capabilities to its nuclear forces. These capabilities improve the Second Artillery’s ability to command and control multiple units in the field. Through the use of improved communications links, the ICBM units now have better access to battlefield information, uninterrupted communications connecting all command echelons, and the unit commanders are able to issue orders to multiple subordinates at once, instead of serially via voice commands.

China has consistently asserted that it adheres to a “no first use” (NFU) policy, stating it would use nuclear forces only in response to a nuclear strike against China. China’s NFU pledge consists of two stated commitments: China will never use nuclear weapons first against any nuclear-weapon state, and China will never use or threaten to use nuclear weapons against any non-nuclear-weapon state or nuclear-weapon-free zone. However, there is some ambiguity over the conditions under which China’s NFU policy would apply, including whether strikes on what China considers its own territory, demonstration strikes, or high-altitude bursts would constitute a first use. Moreover, some PLA officers have written publicly of the need to spell out conditions under which China might need to use nuclear weapons first; for example, if an enemy’s conventional attack threatened the survival of China’s nuclear force or of the regime itself. However, there has been no indication that national leaders are willing to attach such nuances and caveats to China’s NFU doctrine.

China will likely continue to invest considerable resources to maintain a limited, but survivable, nuclear force (sometimes described as “sufficient and effective”), to ensure the PLA can deliver a damaging retaliatory nuclear strike.

...China’s official policy on nuclear weapons continues to focus on maintaining a nuclear force structure able to survive an attack and respond with sufficient strength to inflict unacceptable damage on an enemy. The new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of China’s strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic intelligence, surveillance, and reconnaissance (ISR), precision strike, and missile defense capabilities. The PLA has deployed new command, control, and communications capabilities to its nuclear forces. These capabilities improve the Second Artillery’s ability to command and control multiple units in the field. Through the use of improved communications links, the ICBM units now have better access to battlefield information, uninterrupted communications connecting all command echelons, and the unit commanders are able to issue orders to multiple subordinates at once, instead of serially via voice commands.

China has consistently asserted that it adheres to a “no first use” (NFU) policy, stating it would use nuclear forces only in response to a nuclear strike against China. China’s NFU pledge consists of two stated commitments: China will never use nuclear weapons first against any nuclear-weapon state, and China will never use or threaten to use nuclear weapons against any non-nuclear-weapon state or nuclear-weapon-free zone. However, there is some ambiguity over the conditions under which China’s NFU policy would apply, including whether strikes on what China considers its own territory, demonstration strikes, or high-altitude bursts would constitute a first use. Moreover, some PLA officers have written publicly of the need to spell out conditions under which China might need to use nuclear weapons first; for example, if an enemy’s conventional attack threatened the survival of China’s nuclear force or of the regime itself. However, there has been no indication that national leaders are willing to attach such nuances and caveats to China’s NFU doctrine.

China will likely continue to invest considerable resources to maintain a limited, but survivable, nuclear force (sometimes described as “sufficient and effective”), to ensure the PLA can deliver a damaging retaliatory nuclear strike.

...China’s official policy on nuclear weapons continues to focus on maintaining a nuclear force structure able to survive an attack and respond with sufficient strength to inflict unacceptable damage on an enemy. The new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of China’s strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic intelligence, surveillance, and reconnaissance (ISR), precision strike, and missile defense capabilities. The PLA has deployed new command, control, and communications capabilities to its nuclear forces. These capabilities improve the Second Artillery’s ability to command and control multiple units in the field. Through the use of improved communications links, the ICBM units now have better access to battlefield information, uninterrupted communications connecting all command echelons, and the unit commanders are able to issue orders to multiple subordinates at once, instead of serially via voice commands.

China has consistently asserted that it adheres to a “no first use” (NFU) policy, stating it would use nuclear forces only in response to a nuclear strike against China. China’s NFU pledge consists of two stated commitments: China will never use nuclear weapons first against any nuclear-weapon state, and China will never use or threaten to use nuclear weapons against any non-nuclear-weapon state or nuclear-weapon-free zone. However, there is some ambiguity over the conditions under which China’s NFU policy would apply, including whether strikes on what China considers its own territory, demonstration strikes, or high-altitude bursts would constitute a first use. Moreover, some PLA officers have written publicly of the need to spell out conditions under which China might need to use nuclear weapons first; for example, if an enemy’s conventional attack threatened the survival of China’s nuclear force or of the regime itself. However, there has been no indication that national leaders are willing to attach such nuances and caveats to China’s NFU doctrine.

China will likely continue to invest considerable resources to maintain a limited, but survivable, nuclear force (sometimes described as “sufficient and effective”), to ensure the PLA can deliver a damaging retaliatory nuclear strike.

...China’s official policy on nuclear weapons continues to focus on maintaining a nuclear force structure able to survive an attack and respond with sufficient strength to inflict unacceptable damage on an enemy. The new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of China’s strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic intelligence, surveillance, and reconnaissance (ISR), precision strike, and missile defense capabilities. The PLA has deployed new command, control, and communications capabilities to its nuclear forces. These capabilities improve the Second Artillery’s ability to command and control multiple units in the field. Through the use of improved communications links, the ICBM units now have better access to battlefield information, uninterrupted communications connecting all command echelons, and the unit commanders are able to issue orders to multiple subordinates at once, instead of serially via voice commands.

capabilities to its nuclear forces. These capabilities improve the Second Artillery’s ability to command and control multiple units in the field. Through the use of improved communications links, the ICBM units now have better access to battlefield information, uninterrupted communications connecting all command echelons, and the unit commanders are able to issue orders to multiple subordinates at once, instead of serially via voice commands.

China has consistently asserted that it adheres to a “no first use” (NFU) policy, stating it would use nuclear forces only in response to a nuclear strike against China. China’s NFU pledge consists of two stated commitments: China will never use nuclear weapons first against any nuclear-weapon state, and China will never use or threaten to use nuclear weapons against any non-nuclear-weapon state or nuclear-weapon-free zone. However, there is some ambiguity over the conditions under which China’s NFU policy would apply, including whether strikes on what China considers its own territory, demonstration strikes, or high-altitude bursts would constitute a first use.

Moreover, some PLA officers have written publicly of the need to spell out conditions under which China might need to use nuclear weapons first; for example, if an enemy’s conventional attack threatened the survival of China’s nuclear force or of the regime itself. However, there has been no indication that national leaders are willing to attach such nuances and caveats to China’s NFU doctrine.

China will likely continue to invest considerable resources to maintain a limited, but survivable, nuclear force (sometimes described as “sufficient and effective”), to ensure the PLA can deliver a damaging retaliatory nuclear strike.

Estimates of Chinese nuclear forces differ by source, as has been seen in Figures IX.4 and IX.5. An estimate by the Nuclear Threat Initiative (NTI) estimated that China has approximately 130-195 deployed nuclear-capable ballistic missiles. It also appears that their XIA- and JIN-class ballistic missile submarines are able to be deployed, while the associated JL-1 and JL-2 systems are not yet ready. It also seems that China has an unofficial moratorium on fissile material production. The country is estimated to have 16 +/-4 tons of HEU and 1.8 +/- .5 tons of plutonium. China was also the first nuclear weapons state to declare a “no first use policy.”

The NTI goes on to describe the Chinese nuclear stockpile in more detail:

On 16 October 1964 China exploded its first nuclear device. China has since consistently asserted that its nuclear doctrine is based on the concept of no-first-use, and Chinese military leaders have characterized the country’s nuclear weapons as a minimum deterrent against nuclear attacks. Although the exact size of China’s nuclear stockpile has not been publicly disclosed, reports indicate that as of 2011 China has produced a total of 200 to 300 nuclear warheads. In 2011, Robert S. Norris and Hans M. Kristensen estimated the size of China’s current nuclear stockpile to be approximately 240 warheads, with 178 deployed…

… China successfully tested its first atomic bomb on 16 October 1964 — with highly enriched uranium produced at the Lanzhou facility — and just 32 months later on 17 June 1967, China tested its first thermonuclear device. This achievement is remarkable in that the time span between the two events is substantially less than it was for the other nuclear weapon states. By way of comparison, 86 months passed between the United States’ first atomic test and its first hydrogen bomb test; for the USSR, it was 75 months; for the UK, 66 months; and for France, 105 months…

… China’s nuclear tests in the late-1980s and 1990s were geared toward further modernizing its nuclear forces. Although China officially declared in 1994 that these tests were for improving safety
features on existing warheads, they were also likely intended for the development of new, smaller warheads for China’s next-generation solid-fueled ICBMs (e.g., DF-31 and DF-31A), and possibly to develop a multiple warhead (MRV or MIRV) capability as well... China’s last test was on 29 July 1996, and less than two months later on 24 September 1996 Beijing signed the Comprehensive Nuclear Test Ban Treaty (CTBT).... In order to sign the treaty China overcame several of its initial concerns, including allowing an exemption for Peaceful Nuclear Explosions and the use of national technical means and on-site inspections for verification. The National People’s Congress, however, has yet to ratify the treaty.

Since the inception of its nuclear weapons program, China has relied on a mixture of foreign and indigenous inputs to steadily develop and modernize its nuclear arsenal from its first implosion device to the development of tactical nuclear weapons in the 1980s... As a result, The Federation of American Scientists assesses China to have at least six different types of nuclear payload assemblies: a 15-40 kiloton (kt) fission bomb; a 20 kt missile warhead; a 3 megaton (Mt) thermonuclear missile warhead; a 3 Mt thermonuclear gravity bomb; a 4-5 Mt missile warhead; and a 200-300 kt missile warhead. China is thought to possess a total of some 150 tactical nuclear warheads on its short-range ballistic, and possibly cruise missiles....

In its... (2011) Annual Report to Congress on the Military and Security Developments of the People’s Republic of China, the U.S. Department of Defense noted that “China is both qualitatively and quantitatively improving its strategic missile forces.”... The report stated that China’s nuclear capable missile arsenal consists of a total of 55-65 intercontinental ballistic missiles (ICBMs), including: silo-based, liquid-fueled DF-5 (CSS-4) ICBMs; solid-fueled, road-mobile DF-31 (CSS 10 Mod-1) and DF-31A (CSS-10 Mod 2) ICBMs; limited-range CSS-3 ICBMs; and liquid-fueled CSS-2 intermediate-range ballistic missiles; DF- 21 (CSS-5) road-mobile, solid-fueled MRBMs; and JL-1 submarine-launched ballistic missiles (SLBM) for China’s single XIA-class SSBN.

China also possesses DF-15 (CSS-6) and 700-750 DF-11 (CSS-7) short-range ballistic missiles (SRBMs), though China maintains significantly fewer launchers, and 200-500 DH-10 (a cruise missile thought to be able to support a nuclear payload). The Department of Defense assesses that all Chinese SRBMs are deployed near Taiwan. Most recently, China has developed the long-range DF-31 and DF-31A ICBMs. The 2011 report assessed that while the JIN-class submarine appeared ready, its accompanying JL-2 SLBM system had failed several flight tests and remained in the development stage. It is currently uncertain when the JIN/JL-2 combination will become fully operational....

There is an ongoing effort to shift from liquid-fueled missiles to solid-fueled ones which, among other advantages, can be launched more rapidly... China has also continued to develop new missile launch sites and underground storage facilities in remote inland regions, including the Gobi Desert and the Tibetan highlands. As there is no evidence of long-range missiles being deployed to these new locations, the launch sites appear to be intended primarily as forward bases for potential launches against Russia and India.

Even as it continues to develop its arsenal, however, China has also slowly moved towards increased openness in its willingness to share a limited amount of deployment information and strategy. For example, the 2010 China Defense White Paper details Beijing’s no-first-use policy and roughly outlines several stages of nuclear alert. The paper states that “nuclear-weapon states should negotiate and conclude a treaty on no-first-use of nuclear weapons against each other.” The White Paper also states China’s “unequivocal commitment that under no circumstances will it use or threaten to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-free zones.”...

... China’s nuclear tests in the late-1980s and 1990s were geared toward further modernizing its nuclear forces. Although China officially declared in 1994 that these tests were for improving safety features on existing warheads, they were also likely intended for the development of new, smaller warheads for China’s next-generation solid-fueled ICBMs (e.g., DF-31 and DF-31A), and possibly to develop a multiple warhead (MRV or MIRV) capability as well.
China’s last test was on 29 July 1996, and less than two months later on 24 September 1996 Beijing signed the Comprehensive Nuclear Test Ban Treaty (CTBT). In order to sign the treaty China overcame several of its initial concerns, including allowing an exemption for Peaceful Nuclear Explosions and the use of national technical means and on-site inspections for verification. The National People’s Congress, however, has yet to ratify the treaty.

China’s 1996 signing of the CTBT was the latest in a series of policy shifts on nuclear nonproliferation issues. In fact, it was during the 1980s that China’s position on nuclear proliferation first started to change. Since the 1960s, Beijing had criticized the Treaty on the Non-Expansion of Nuclear Weapons (NPT) as imbalanced and discriminatory, but by the 1980s the country had also indicated that it accepted in principle the norm of nuclear nonproliferation …

In August 1991, shortly after France acceded to the NPT, China also declared its intention to join, though it again expressed its reservations about the treaty’s discriminatory nature…China formally acceded to the NPT in March 1992, as a nuclear weapon state. In its statement of accession, the Chinese government called on all nuclear weapon states to issue unconditional no-first-use pledges, to provide negative and positive security assurances to non-nuclear weapon states, to support the development of nuclear weapon-free zones, to withdraw all nuclear weapons deployed outside of their national territories, and to halt the arms race in outer space. Since its accession, China has praised the NPT’s role in preventing the proliferation of nuclear weapons, and also supported the decision to indefinitely extend the NPT at the 1995 Review and Extension Conference…

However, China has continued to state that it views nonproliferation not as an end in itself, but rather as a means to the ultimate objective of the complete prohibition and thorough destruction of nuclear weapons. Despite this, China was embroiled in nuclear proliferation scandals throughout the late 1980’s and early 1990’s, particularly with respect to its sale of ring magnets to Pakistan in 1995. China provided Pakistan with a nuclear bomb design (used in China’s October 1966 nuclear test). These designs were later passed to Libya by the A.Q. Khan network, and discovered by IAEA inspectors in 2004 after then President Muammar Qadhafi renounced his nuclear weapons program and allowed inspectors to examine related facilities.

The plans contained portions of Chinese text with explicit instructions for the manufacture of an implosion device….In the late 1990s, the U.S. Congress formed the Select Committee on U.S. National Security and Military-Commercial Concerns with China (also known as the Cox Committee). According to the Cox Committee Report, China engaged in an active espionage program and stole several nuclear bomb designs as early as the late 1970s. Designs compromised include the United States’ then-most advanced W-88 warhead and a design for an enhanced radiation weapon (neutron bomb). However, the Cox Report has been severely criticized by both experts and officials in the United States and China as a political document that has several technical inaccuracies…

There is much speculation that China’s nuclear modernization program may be geared toward developing the capacity to move from a strategy of minimum deterrence to one of limited deterrence. Under a “limited deterrence” doctrine, China would need to target nuclear forces in addition to cities, which would require expanded deployments. However, such a limited deterrence capability may still be a long way off. According to Alastair Johnston, “…is fairly safe to say that Chinese capabilities come nowhere near the level required by the concept of limited deterrence.”…

Meanwhile, tensions between China and Taiwan have declined, and in the wake of Japan’s 2011 nuclear crisis, China and Taiwan are taking concrete measures to cooperate on nuclear safety issues. Such cross-strait cooperation includes establishing a formal nuclear safety agreement and an official contact mechanism between the two sides, which will be used to facilitate information exchanges and emergency responses in case of an accident…

While China’s decreased threat perception may not slow its nuclear modernization efforts, which are seen simply as representing the replacement of obsolete equipment, it does have the potential to slow acquisitions in key areas — for example, the buildup of short-range missiles. If sustained, the shift may
also make both sides more amenable to nonproliferation efforts such as ratification of the Comprehensive Nuclear Test Ban Treaty.

**Chinese Biological and Chemical Weapons**

While China is a party to many of the international agreements regulating biological weapons, past US government reports have alleged that China maintains a small offensive weapons program and has engaged in proliferation of related items to countries such as Iran. There have also historically been concerns in the US about Chinese will to enforce export controls on dual use items, but the State Department concluded in 2011 that there were no compliance issues raised between the two.

In ratifying the Chemical Weapons Convention in 1997, China declared three former production facilities. While the US has doubted that China was fully declaring its previous and current activities in this area, the US reported most of its concerns resolved in 2011.  

**Role of Chinese Special Forces and Tunnel Facilities**

The PLA has also been building underground tunnels to protect and conceal its key assets since the early 1950s; the underground tunnel network reportedly stretches for over 5,000 km. Experts like Phillip Karber note their value in terms of both missile deployments and the potential ability to stockpile much larger numbers of nuclear weapons than are normally estimated to be in China’s forces.

The US DoD, however, sees these efforts as largely defensive:

... China maintains a technologically advanced underground facility (UGF) program protecting all aspects of its military forces, including C2, logistics, missile, and naval forces. Given China’s NFU nuclear policy, China has assumed it may need to absorb an initial nuclear blow while ensuring leadership and strategic assets survive.

China determined it needed to update and expand its military UGF program in the mid to late 1980s. This modernization effort took on a renewed urgency following China’s observation of U.S. and NATO air operations in Operation Allied Force and of U.S. military capabilities during the 1991 Gulf War. A new emphasis on “winning hi-tech battles” in the future precipitated research into advanced tunneling and construction methods. These military campaigns convinced China it needed to build more survivable, deeply-buried facilities, resulting in the widespread UGF construction effort detected throughout China for the last decade.

**US Nuclear Forces**

President Obama declared in April 2009 that the US was committed to the long-term goal of zero nuclear weapons, and there has been a unilateral Congressional moratorium on nuclear tests since 1992. Although the 2001 Nuclear Posture Review suggested that the US might develop new types of nuclear weapons, the 2010 Nuclear Posture Review reversed course.

---

512 Ibid.
513 Ibid., p. 31.
The new posture is that nuclear weapons research will only involve components based on previous designs, not new capabilities or missions.

**Nuclear Forces**

Since the end of the Cold War, the US has been removing its deployed nuclear weapons from Europe and Asia. In 2008, the US informed Japan it would be retiring its sea-based nuclear warhead Tomahawk cruise missiles from the region.\(^{514}\)

**Figure IX.5** shows that the US had over 1,700 deployed strategic warheads as of March 2013. It had an additional 200 active theater nuclear weapons. The FAS reported that the US had an estimated 2,200 strategic and 300 non-strategic warheads in central storage. Some 260 nonstrategic W80-0 warheads for the Tomahawk land-attack cruise missile (TLAM/N) have been retired. Another 3,000 retired warheads were “awaiting dismantlement.” In addition, more than 15,000 plutonium cores (pits) and some 5,000 Canned Assemblies (secondaries) from dismantled warheads are in storage at the Pantex Plant in Texas and Y-12 plant in Tennessee.\(^{515}\)

The US summarized its strategy in dealing with deterrence and nuclear forces as follows in its FY2014 defense budget overview,\(^{516}\)

> The United States will maintain a safe, secure, and effective nuclear arsenal. We will field nuclear forces that can operate effectively under all conditions to deny a potential adversary their war aims, and confront them with the prospect of unacceptable damage. This posture is essential for deterring potential adversaries and assuring U.S. allies and other security partners that they can count on America’s security commitments. DoD will maintain effective nuclear forces even as it seeks to reduce the role and number of nuclear weapons and as it proceeds with New START implementation. Key enhancements and protected capabilities associated with this mission area include developing a new penetrating bomber and a next-generation ballistic missile submarine.

> … DoD conducts a range of activities in partnership with other elements of the U.S. Government and international allies and partners aimed at preventing the proliferation and use of nuclear, biological, and chemical weapons. These activities include strengthening non-proliferation regimes, building partner capacity to counter WMD, Cooperative Threat Reduction (CTR) initiatives, and planning and operations to locate, monitor, track, intercept, interdict, secure, and dispose of WMD and WMD-related components and the means to make them. They also include participation in an active whole-of-government effort to frustrate the ambitions of nations and non-state actors bent on possessing WMD. DoD will continue to invest in capabilities to predict, detect, protect against, and respond to WMD proliferation and use, should preventive measures fail. Key enhancements associated with this mission area include: maintaining the Chemical Biological Incident Response Force (CBIRF); continuing efforts to expand the geographic reach of the CTR program; and providing additional funds for ground-based prompt nuclear forensics diagnostics systems.

One key question, however, is what will happen if the US is confronted with both North Korean nuclear forces and the need to deter or respond to Chinese theater or strategic nuclear forces. The US has several options: it can (1) rely on containment in peacetime and military restraint in advancing into the DPRK in wartime, (2) deter Chinese threats or use of strategic nuclear forces.

---


theater nuclear weapons by the threat of using its own strategic weapon, (3) it can deploy, threaten to use, or use theater nuclear weapons, or (4) it can create conventional strike options that will be weapons of “mass effectiveness” by precisely targeting key Chinese and DPRK facilities rather than using nuclear warheads.

**US Theater Nuclear Forces**

Theater nuclear weapons present another set of complex issues because US policy has changed and the current status of such forces in contingencies outside Europe remains somewhat ambiguous. A report by Amy Woolf of the US Congressional Research Service notes that,

> In 1991, the United States and Soviet Union both withdrew from deployment most and eliminated from their arsenals many of their nonstrategic nuclear weapons. The United States now has approximately 760 nonstrategic nuclear weapons, with around 200 deployed with aircraft in Europe and the remaining stored in the United States. Estimates vary, but experts believe Russia still has between 1,000 and 6,000 warheads for nonstrategic nuclear weapons in its arsenal. The Bush Administration quietly redeployed and removed some of the nuclear weapons deployed in Europe. Russia, however seems to have increased its reliance on nuclear weapons in its national security concept. Some analysts argue that Russia has backed away from its commitments from 1991 and may develop and deploy new types of nonstrategic nuclear weapons.

Recent discussions about the U.S. nuclear weapons policy have placed a renewed emphasis on the role of U.S. nonstrategic nuclear weapons in extended deterrence and assurance. Extended deterrence refers to the U.S. threat to use nuclear weapons in response to attacks, from Russia or other adversaries, against allies in NATO and some allies in Asia. Assurance refers to the U.S. promise, made to those same allies, to come to their defense and assistance if they are threatened or attacked. The weapons deployed in Europe are a visible reminder of that commitment; the sea-based nonstrategic nuclear weapons in storage that could be deployed in the Pacific in a crisis served a similar purpose for U.S. allies in Asia. Recent debates, however, have focused on the question of whether a credible U.S. extended deterrent requires that the United States maintain weapons deployed in Europe, and the ability to deploy them in the Pacific, or whether other U.S. military capabilities, including strategic nuclear weapons and conventional forces, may be sufficient.

In the 2010 Nuclear Posture Review, the Obama Administration stated that the United States “will continue to assure our allies and partners of our commitment to their security and to demonstrate this commitment not only through words, but also through deeds.” The NPR indicated that a wide range of U.S. military capabilities would support this goal, but also indicated that U.S. commitments would “retain a nuclear dimension as long as nuclear threats to U.S. allies and partners remain.” The Administration did not, however, specify that the nuclear dimension would be met with nonstrategic nuclear weapons; the full range of U.S. capabilities would likely be available to support and defend U.S. allies. In addition, the Administration announced that the United States would retire the nuclear-armed sea-launched cruise missiles that had helped provide assurances to U.S. allies in Asia. In essence, the Administration concluded that the United States could reassure U.S. allies in Asia, and deter threats to their security, without deploying sea-based cruise missiles to the region in a crisis.

Moreover, the possible use of nuclear weapons, and extended nuclear deterrence, were a part of a broader concept that the Administration referred to as “regional security architectures.” The NPR indicated that regional security architectures were a key part of “the U.S. strategy for strengthening regional deterrence while reducing the role and numbers of nuclear weapons.” As a result, these architectures would “include effective missile defense, counter-WMD capabilities, conventional

---

power-projection capabilities, and integrated command and control—all underwritten by strong political commitments.” In other words, although the United States would continue to extend deterrence to its allies and seek to assure them of the U.S. commitment to their security, it would draw on a political commitments and a range of military capabilities to achieve these goals.

...In the past, U.S. discussions about nonstrategic nuclear weapons have also addressed questions about the role they might play in deterring or responding to regional contingencies that involved threats from nations that may not be armed with their own nuclear weapons. For example, former Secretary of Defense Perry stated that, “maintaining U.S. nuclear commitments with NATO, and retaining the ability to deploy nuclear capabilities to meet various regional contingencies, continues to be an important means for deterring aggression, protecting and promoting U.S. interests, reassuring allies and friends, and preventing proliferation (emphasis added).”

... Specifically, both during the Cold War and after the demise of the Soviet Union, the United States maintained the option to use nuclear weapons in response to attacks with conventional, chemical, or biological weapons. For example, in 1999, Assistant Secretary of Defense Edward Warner testified that “the U.S. capability to deliver an overwhelming, rapid, and devastating military response with the full range of military capabilities will remain the cornerstone of our strategy for deterring rogue nation ballistic missile and WMD proliferation threats. The very existence of U.S. strategic and theater nuclear forces, backed by highly capable conventional forces, should certainly give pause to any rogue leader contemplating the use of WMD against the United States…”

The George W. Bush Administration also emphasized the possible use of nuclear weapons in regional contingencies in its 2001 Nuclear Posture Review. The Bush Administration appeared to shift towards a somewhat more explicit approach when acknowledging that the United States might use nuclear weapons in response to attacks by nations armed with chemical, biological, and conventional weapons, stating that the United States would develop and deploy those nuclear capabilities that it would need to defeat the capabilities of any potential adversary whether or not it possessed nuclear weapons. This does not, by itself, indicate that the United States would plan to use nonstrategic nuclear weapons. However, many analysts concluded from these and other comments by Bush Administration officials that the United States was planning for the tactical, first use of nuclear weapons. The Bush Administration never confirmed this view, and, instead, indicated that it would not use nuclear weapons in anything other than the most grave circumstances.

The Obama Administration, on the other hand, seemed to foreclose the option of using nuclear weapons in some regional contingencies. Specifically, it stated, in the 2010 NPR, that, “the United States will not use or threaten to use nuclear weapons against non-nuclear weapons states that are party to the Nuclear Non-Proliferation Treaty (NPT) and in compliance with their nuclear nonproliferation obligations.” Specifically, if such a nation were to attack the United States with conventional, chemical, or biological weapons, the United States would respond with overwhelming conventional force, but it would not threaten to use nuclear weapons if the attacking nation was in compliance with its nuclear nonproliferation obligations and it did not have nuclear weapons of its own...At the same time, though, the NPR stated that any state that used chemical or biological weapons “against the United States or its allies and partners would face the prospect of a devastating conventional military response—and that any individuals responsible for the attack, whether national leaders or military commanders, would be held fully accountable.”...

...Through the late 1990s and early in George W. Bush Administration, the United States maintained approximately 1,100 nonstrategic nuclear weapons in its active stockpile. Unclassified reports indicate that, of this number, around 500 were air-delivered bombs deployed at bases in Europe. The remainder, including some additional air-delivered bombs and around 320 nuclear-armed sea-launched cruise missiles, were held in storage areas in the United States...

After the Clinton Administration’s 1994 Nuclear Posture Review, the United States eliminated its ability to return nuclear weapons to U.S. surface ships (it had retained this ability after removing the weapons under the 1991 PNI). It retained, however, its ability to restore cruise missiles to attack
submarines, and it did not recommend any changes in the number of air-delivered weapons deployed in Europe. During this time, the United States also consolidated its weapons storage sites for nonstrategic nuclear weapons. It reportedly reduced the number of these facilities “by, over 75%” between 1988 and 1994. It eliminated two of its four storage sites for sea-launched cruise missiles, retaining only one facility on each coast of the United States. It also reduced the number of bases in Europe that store nuclear weapons from over 125 bases in the mid-1980s to 10 bases, in seven countries, by 2000...

The Bush Administration did not recommend any changes for U.S. nonstrategic nuclear weapons after completing its Nuclear Posture Review in 2001. Reports indicate that it decided to retain the capability to restore cruise missiles to attack submarines because of their ability to deploy, in secret, anywhere on the globe in time of crisis. The NPR also did not recommend any changes to the deployment of nonstrategic nuclear weapons in Europe, leaving decisions about their status to the members of the NATO alliance.

Nevertheless, according to unclassified reports, the United States did reduce the number of nuclear weapons deployed in Europe and the number of facilities that house those weapons during the George W. Bush Administration. Some reports indicate that the weapons were withdrawn from Greece and Ramstein Air Base in Germany between 2001 and 2005. In addition reports indicate that the United States also withdrew its nuclear weapons from the RAF Lakenheath air base in the United Kingdom in 2006.5…According to a recent unclassified report, the United States now deploys 160-200 bombs at six bases in Belgium, Germany, Italy, the Netherlands, and Turkey. Some of these weapons are stored at U.S. bases and would be delivered by U.S. aircraft. Others are stored at bases operated by the “host nation” and would be delivered by that nation’s aircraft if NATO decided to employ nuclear weapons.

The Obama Administration has not announced any further reductions to U.S. nuclear weapons in Europe and has indicated that the United States would “consult with our allies regarding the future basing of nuclear weapons in Europe.” In the months prior to the completion of NATO’s new Strategic Concept, some politicians in some European nations did propose that the United States withdraw these weapons. For example, Guido Westerwelle, Germany’s foreign minister, stated that he supported the withdrawal of U.S. nuclear weapons from Germany. Some reports indicate that Belgium and the Netherlands also supported this goal…. As was noted above, NATO did not call for the removal of these weapons in its new Strategic Concept, but did indicate that it would be open to reducing them as a result of arms control negotiations with Russia.

Moreover, in the 2010 NPR, the Obama Administration indicated that it would take the steps necessary to maintain the capability to deploy U.S. nuclear weapons in Europe. It indicated that the U.S. Air Force would retain the capability to deliver both nuclear and conventional weapons as it replaced aging F-16 aircraft with the new F-35 Joint Strike Fighter. The NPR also indicated that the United States would conduct a “full scope” life extension program for the B61 bomb, the weapon that is currently deployed in Europe, “to ensure its functionality with the F-35.” This life extension program will consolidate four versions of the B61 bomb, including the B61-3 and B61-4 that are currently deployed in Europe, into one version, the B61-12. Reports indicate that this new version will reuse the nuclear components of the older bombs, but will include enhanced safety and security features and a new “tail kit” that will increase the accuracy of the weapon….

On the other hand, the NPR indicated that the U.S. Navy would retire its nuclear-armed, sea-launched cruise missiles (TLAM-N). It indicated that “this system serves a redundant purpose in the U.S. nuclear stockpile” because it is one of several weapons the United States could deploy forward. The NPR also noted that, “U.S. ICBMs and SLBMs are capable of striking any potential adversary.” As a result, because “the deterrence and assurance roles of TLAM-N can be adequately substituted by these other means,” the United States could continue to extend deterrence and provide assurance to its allies in Asia without maintaining the capability to redeploy TLAM-N missiles....
The US remains committed to civil nuclear programs as well. It has 104 nuclear power reactors producing approximately 20% of US energy needs, and is considering the construction of 28 further reactors.518

**Other US Nuclear-Related Programs**

The documents submitted with the US proposed FY2014 budget describe several other current US plans for strategic forces, deterrence, and defense. It is not clear how they will affect the future US stockpile of nuclear weapons, but they do reflect both budget cutbacks and ongoing improvements in other areas:519

The Department will maintain a strong nuclear deterrence posture in the face of all potential threats, including developments in North Korea and risks from Iran. We are also committed to providing effective missile defense and maintaining a safe, secure, and effective nuclear arsenal. Despite budget pressures, DoD has ensured robust funding for these mission areas, making investments and taking actions to ensure the U.S. remains ahead of threat developments, including:

- Refocusing technologically advanced systems unlikely to be fielded quickly towards tech development activities to reduce risk and cost but that will field later (SM-3 IIB)
- Cancelling expensive surveillance systems and reinvesting in achievable, near-term upgrades to ground based radars (PTSS)
- Adding to national hedge against ballistic missile attack from rogue states (GBIs)
- Partnering with the National Nuclear Security Agency (NNSA) to assess the true requirements of the nuclear stockpile and associated infrastructure.

**SM-3 IIB.**

The SM-3 IIB missile defense interceptor was previously planned to be based in Europe and provide an additional capability to defend the U.S. from ballistic missile attack. Given the advancing threat posed by North Korea in particular, the DoD assessed that the SM-3 IIB would be late to need and therefore restructured the program by reinvesting the funds into advanced interceptor technology development to include a common kill vehicle, and other enabling programs. The restructuring also funds the increased number of Ground Based Interceptors (GBIs), from 30 to 44. The SM-3 IIB program would have provided an expensive niche capability while homeland defense gaps widen. Changing the investment strategy to advanced technology development and additional deployment of GBIs will better address current and future threat challenges.

**Precision Tracking Space Sensor.**

PTSS was intended to be a constellation of satellites to track medium and intermediate range ballistic missiles as well as intercontinental ballistic missiles. A review of the program found significant cost growth, schedule concurrency, technical risk, and utility concerns. Therefore, DoD terminated the PTSS program and reinvested some of the savings in evolutionary upgrades to existing systems. Reinvesting PTSS funds addresses key sensor gaps, including discrimination, raid size, and coverage. These investments provide upgrades to existing radars and strengthen operational support of missile defense systems.

Ground Based Interceptors. GBIs are missile interceptors based in Alaska and California, intended to defend the U.S. from limited ballistic missile attack. Restructure of the SM-3 IIB program allowed for

---

additional buys of 14 GBIs and corresponding refurbishment of the Alaskan missile field at Fort Greely. This restructure decision was driven by increased concerns and intelligence regarding the current threat environment. The increase in GBIs closes the near-term gap between our defense capabilities and threat intelligence projections.

**Partnering with the Department of Energy.**

In addition to missile defense, DoD partnered with the Department of Energy’s National Nuclear Security Agency to assess nuclear stockpile and infrastructure requirements. As an outcome, the DoD and DoE better postured the nation to ensure an executable, safe nuclear weapons program for years to come by:

- Funding maintenance, upgrades, and replacements for aging nuclear infrastructure.
- Finding cost-effective approaches to extending the life of our nuclear arsenal without compromising safety, security, or effectiveness.
- Robustly funding a broad array of non-proliferation projects to reduce global nuclear dangers.
- Restructuring efforts for disposition of excess plutonium on a path to ensure efforts are both effective and fiscally responsible.
- Initiating efforts to gain numerous efficiencies across the enterprise.

**Japan**

Under the Japanese constitution, the country is allowed to possess the minimum necessary level of self-defense capability. What the “minimum necessary level” is can vary depending on available technologies, the general international situation, and other factors. However, any capability of “war potential” is prohibited by Article 9, Paragraph 2 of the Japanese Constitution. Furthermore, any arms deemed to be offensive weapons designed only for the mass destruction of another country by definition exceed the “minimum necessary level of self-defense,” and thus are never allowed. As such, the SDF is unable to have technologies such as ICBMs, attack aircraft carriers, or long-range strategic bombers.520

Maritime self-defense is charged with defending the seas surrounding Japan, ensuring sea lane security, and international peace cooperation activities. The force consists of destroyers, submarines, patrol aircraft, and minesweeping units. The Air Self-Defense Force works to conduct continuous intelligence, surveillance, and reconnaissance (ISR) in the air and seas around Japan and is in charge of air defense. Capacities include aircraft warning and control units, fighter units, and a Surface-to Air Guided Missile Squadron.521

**Missile Defense**

The US and Japan are cooperating in ballistic missile defense (BMD), initiating development in 2004. A timeline of Japanese missile defense progress can be seen in Figure IX.6, and a graphic showing the Japanese system is provided in Figure IX.7. As the 2012 Japanese Defense White Paper notes,522

Japan’s BMD is an effective multi-tier defense system with the upper tier interception by Aegis destroyers and the lower tier by Patriot PAC-3, both interconnected and coordinated by Japan Aerospace Defense Ground Environment (JADGE). To establish this multi-tier defense structure, the

MOD and SDF have been improving the capability of existing Aegis destroyers and Patriot systems and further promoting the BMD system development.

By the end of FY2010, the MSDF equipped its four Aegis destroyers with Standard Missile-3 (SM-3) missiles, and the ASDF deployed a total of 164 FUs, 5 of Patriot PAC-3, achieving the deployment targets set in the annex table of the 2004 NDPG. The MOD and SDF are to continue the development of the BMD system, based on the latest NDPG and Mid-Term Defense Program. Immediate objective is to establish a system consisted of six BMD-capable Aegis destroyers (two vessels added), 17 Patriot PAC-3 FUs (six Air Defense Missile Groups, Air Missile Training Group, and 2nd Technical School) (one additional FU), four FPS-56 radars (already deployed), and seven upgraded FPS-3 radars (already deployed) with these assets interconnected through various types of command, control, battle management and communications systems, such as JADGE.

Recent exercises also show that the US and Japan are succeeding in developing steadily more integrated approaches to such capabilities. For example, the US Missile Defense Agency reported on October 29, 2010 that the Japan Maritime Self-Defense Force (JMSDF) and the United States Missile Defense Agency (MDA) had successfully completed an Aegis BMD intercept flight test, in cooperation with the US Navy, off the coast of Kauai in Hawaii. The event marked the fourth time that a JMSDF ship has engaged a ballistic missile target, including three successful intercepts, with the sea-based midcourse engagement capability provided by Aegis BMD:^523

The JFTM-4 test event verified the newest engagement capability of the Japan Aegis BMD configuration of the recently upgraded Japanese destroyer, JS KIRISHIMA. At approximately 5:06 p.m. (HST), 12:06 p.m. Tokyo time on Oct. 29, 2010, a separating 1,000 km class ballistic missile target was launched from the Pacific Missile Range Facility at Barking Sands, Kauai, Hawaii. JS KIRISHIMA crewmembers detected and tracked the target. The Aegis Weapon System then developed a fire control solution and launched a Standard Missile -3 (SM-3) Block IA missile. Approximately three minutes later, the SM-3 successfully intercepted the target approximately 100 miles above the Pacific Ocean. JFTM-4 is a significant milestone in the growing cooperation between Japan and the US in the area of missile defense. Also participating in the test was USS LAKE ERIE and USS RUSSELL, Aegis ships which cooperated to detect, track and conduct a simulated intercept engagement against the same target.

In September 2012, the US and Japan agreed to develop a new missile defense system, upsetting China during a time of prolonged tension over the disputed islands in the East China Sea. Japan and the US agreed to deploy a second advanced missile-defense radar on Japanese territory.^524 Former US Defense Secretary Leon Panetta remarked at the time, “[It] will enhance the alliance’s ability to defend Japan, our forward deployed forces and the US homeland from a ballistic missile threat posed by North Korea.”^525 The new land-based X-band radar can track ballistic missiles up to 1,000 km away, allowing US forces to intercept the missiles. The model is smaller than a sea-based X-band radar, which can track missiles up to 4,800 km away. The current radars are based in Aomori

---


Prefecture, while the new system will be deployed near Kyoto. Japanese Prime Minister Shinzo Abe also said that Japan intends to ease the domestic laws limiting the operational scope of the Japanese Self-Defense Forces, allowing Japan to shoot down any missiles from North Korea. Japan has reportedly spent $12 billion on its missile defense system.526

US and Japanese capabilities are likely to increase sharply in the near term as more advanced tactical and long-range, wide-area theater missile defense systems like the Standard SM-2 and SM-3 and THAAD enter service.

Japan has developed a ballistic missile defense that is a “multi-tier defense system consisting of an upper-tier defense through the SM-3-equipped Aegis destroyers and a lower-tier defense through the Patriot PAC-3 for base protection.”527 As regards the principal equipment and core units that make up Japan’s ballistic missile defense, the 2012 Defense White paper reported,528

(1) Under the four-ship structure for Aegis destroyers specified in the 2004 NDPG, if the necessity for regular maintenance, replenishment, recreation, and training is taken into account, basically two Aegis destroyers would be able at all times to execute their missions, and thus there would be limitations on maintaining a continuous readiness. In addition, in order to ensure the country’s defense against the threat of ballistic missiles, including response to the future threat of ballistic missiles equipped with capabilities to avoid interceptor missiles, Aegis destroyers would have to be equipped with an Aegis BMD system, which, in case advanced interceptor missiles are developed in the future, could operate them.

In view of these circumstances, the 2010 NDPG, taking into account factors such as the Government’s severe financial circumstances and the need for rapid improvement of anti-ballistic missile defense capabilities, provides a total of six Aegis destroyers equipped with ballistic missile defense capabilities, including two Aegis destroyers equipped with Aegis BMD systems capable of operating the advanced interceptor missiles mentioned above. In addition, the 2010 NDPG states that additional acquisition of BMD-capable Aegis destroyers, if to be provided separately, will be allowed within the number of destroyers after consideration of development of BMD-related technologies and fiscal conditions in the future, among other factors.

(2) As a result of the reorganization of units described in (1) above, the air warning and control unit capable of ballistic missile defense are to be reformed into a 11-unit warning group/squadrons from a seven-unit warning group and a four-unit warning squadrons. While three anti-aircraft groups used to possess Patriot PAC-3, the entire six anti-aircraft groups will be equipped with PAC-3, in order to make quick responses across the nation possible. On this occasion, the newly introduced PAC-3 will be limited to a one-unit FU6 under the 2010 NDPG in view of the severe financial circumstances, and together with the existing 16-unit FU (for anti-aircraft squadrons and that required for education), 17-unit FU are to be stationed uniformly throughout the country, creating the most efficient system possible.

Space

528 Ibid.
Japan is also working to develop its space capabilities. According to the 2012 Japanese Defense White Paper.  

Japan, a country which has an exclusively defense-oriented policy, is strongly required to use outer space, which does not belong to the national territory of any country and is not constrained by conditions such as surface topography, to strengthen information gathering functions for detecting signs of various contingencies in advance, and warning and surveillance functions in sea and air space surrounding Japan, and to ensure lines of communication during the international peace cooperation activities of the SDF.

The enactment of the Basic Space Law, passed by the Diet in May 2008, has made it clearer that the development and use of space by Japan shall be carried out under the pacifism enshrined in the Constitution of Japan in compliance with international commitments. The law also stipulates that the Government of Japan shall take necessary measures to promote the development and use of space that contributes to ensuring the peace and security of the international community, as well as to the security of Japan.

In 2009, the strategic Headquarters for Space Policy Cabinet Secretariat which was established based on the Basic Space Law formulated the Basic Plan for Space Policy, which includes the six key elements such as the realization of a secure, pleasant, and affluent society utilizing space, as well as the enhancement of national security utilizing space.

Furthermore, the 2010 NDPG stipulate promotion of the development and the use of outer space with a view to strengthening information gathering and communications functions, etc.

Meanwhile, on January 2009, the Committee on Promotion of Space Development and Use established in the Ministry of Defense formulated the “Basic Guidelines for Space Development and Use of Space” (Basic Guidelines). The Basic Guidelines stipulates that it is extremely beneficial to take advantage of the nature of space for defense purpose and it will be an effective means to strengthen C4ISR capability in light of the focus of the buildup of defense capabilities on enabling accurate situational awareness, information sharing, command and control operations, and thereby achieving systemization – maximizing of the equipment’s performance as an ensemble.

The Ministry of Defense will promote new development and use of space for the national security in coordination with related ministries, based on the Basic Plan for Space Policy, the 2010 NDPG, and the Basic Guidelines. In FY2012, it will address projects such as 1) research for enhancement of C4ISR utilizing space, 2) enhancement, maintenance, and operation of X-band SATCOM functions, and 3) participation in the USAF Space Fundamentals Course.

Of these, with regard to the enhancement of X-band SATCOM, in light of the fact that two of the communications satellites (Superbird-B2 and Superbird-D) used by the Ministry of Defense and Self-Defense Forces for command and control of tactical forces are due to reach the end of their service lives in FY2015, these satellite communications networks will be reorganized. This reorganization will facilitate high-speed, large capacity communications that are more resistant to interference, in order to accommodate the recent growth in communications requirements, as well as integrating communications systems, thereby contributing to the construction of a dynamic defense force. Moreover, from the perspective of maximizing cost-effectiveness, it has been decided to implement the project by means of the PFI (private finance initiative) system, and 19 years’ worth of costs (approximately 122.4 billion yen) has been allocated in the FY2012 budget, to cover expenses from the manufacture of the satellites through to the end of their service life. In this project, after guaranteeing transparency and fairness in tenders, etc. through open tendering, the content of the proposals will be screened impartially, from the perspective of security, with bidders being asked to implement the appropriate management systems and conservation measures.

---

529 Ibid., p.158.
### Figure IX.6: Timeline of Japanese Missile Defense Development

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>Commenced a comprehensive study on the posture of the air defense system of Japan and a Japan–U.S. joint study on ballistic missile defense</td>
</tr>
<tr>
<td>1998</td>
<td>North Korea launched a ballistic missile over Japanese territory</td>
</tr>
<tr>
<td></td>
<td>The Security Council and the Cabinet meeting approved the Japan–U.S. joint cooperative technical research on ballistic missile defense (BMD) as part of a sea-based upper-tier system</td>
</tr>
<tr>
<td>1999</td>
<td>Started the joint Japan–U.S. technical research on four major components for advanced interceptor missiles</td>
</tr>
<tr>
<td>2000</td>
<td>The Security Council and the Cabinet meeting approved the Mid-Term Defense Program (FY2001–FY2005) with a decision to continue the Japan–U.S. joint cooperative technical research on a sea-based upper-tier system and to take necessary measures after the review of its technical feasibility</td>
</tr>
<tr>
<td>2002</td>
<td>Decision by the United States on the initial deployment of BMD</td>
</tr>
<tr>
<td>2003</td>
<td>The Security Council and the Cabinet meeting approved the introduction of BMD system and other measures, and the deployment of BMD in Japan started</td>
</tr>
<tr>
<td>2004</td>
<td>The Security Council and the Cabinet meeting approved the National Defense Program Guidelines and the Mid-Term Defense Build-up Program, with a decision to take necessary measures after examining possible transition of the joint technical research to a development stage, together with continued efforts of build-up to establish a necessary defense posture including development of the BMD system</td>
</tr>
<tr>
<td>2005</td>
<td>The Security Council and the Cabinet meeting approved a Japan–U.S. Cooperative Development on advanced interceptor missiles for BMD</td>
</tr>
<tr>
<td>2006</td>
<td>North Korea launched seven ballistic missiles toward the Sea of Japan</td>
</tr>
<tr>
<td>2007</td>
<td>The deployment of Patriot PAC-3 units started</td>
</tr>
<tr>
<td></td>
<td>SM-3 test-launch by Aegis destroyer Kongo</td>
</tr>
<tr>
<td>2008</td>
<td>Test-launch of Patriot PAC-3</td>
</tr>
<tr>
<td></td>
<td>SM-3 test-launch by Aegis destroyer Chokai</td>
</tr>
<tr>
<td>2009</td>
<td>2009 North Korea launched one ballistic missile toward the Pacific Ocean in April and seven toward the Sea of Japan in July</td>
</tr>
<tr>
<td></td>
<td>Orders for ballistic missile destruction measures were issued for the first time</td>
</tr>
<tr>
<td></td>
<td>Test-launch of Patriot PAC-3</td>
</tr>
<tr>
<td></td>
<td>SM-3 test-launch by Aegis destroyer Myoko</td>
</tr>
<tr>
<td>2010</td>
<td>Patriot PAC-3 units deployment completed</td>
</tr>
<tr>
<td></td>
<td>SM-3 Test-launch by Aegis destroyer Kirishima (upgrading BMD of four Aegis-equipped vessels completed)</td>
</tr>
<tr>
<td>2011</td>
<td>Completing deployment of FPS-5 (4 radars total)</td>
</tr>
<tr>
<td>2012</td>
<td>North Korea launched a missile which it calls a &quot;Satellite&quot;</td>
</tr>
<tr>
<td></td>
<td>An order was issued to destroy the ballistic missile</td>
</tr>
</tbody>
</table>

Russia

It is extremely unlikely that Russian forces would be involved in even a high level of conflict in the Korean Peninsula, but Russia’s status as a nuclear power cannot be ignored. The IISS estimated that Russia has 1,499 warheads that could be deployed on SLMs, ICBMs, and heavy bombers. However, there is no accurate count of the country’s tactical nuclear weapons, so the current total stockpile of tactical and strategic warheads is unknown. Furthermore, it is estimated that Russia possesses 737 metric tons of weapons-grade-equivalent HEU and approximately 128 metric tons of plutonium; however, it should be noted that transparency in these areas is limited.530

All three arms of the Russian military are working to revamp its nuclear triad. The Russian Air Force was planning to deploy a new strategic cruise missile in 2012, the Navy is building Borei-class SSBN (Project 995), and the Strategic Rocket Forces are looking into a new

liquid-propelled ballistic missile while continuing to use the solid-fueled RS-24 Yars. It does not look like much progress has been made on previous proposals to create a unified strategic command. According to the Nuclear Threat Initiative,531

The Kh-101/Kh-102 (AS-2X) likely entered service with the Russian air force in 2012, carried on the Tupolev Tu-95MS Bear H. The Kh-102 is the nuclear variant of this large cruise missile, with the Kh-101 a conventionally armed derivative. It is not known if the missile also entered service during 2012 with the half-dozen or so Tu-160 Blackjack bomber aircraft the air force has operational at any one time.

The Kh-101/102 programme has been under way since at least the latter half of the 1980s. Development was hampered by the collapse in defence expenditure in the 1990s and 2000s, but funding has improved in the last few years. After nearly 20 years in the doldrums the Russian air force now has a fifth-generation fighter in flight-test and also harbours ambitions to introduce a new strategic bomber (PAK-DA) after 2025. Tupolev, the USSR’s main bomber design house, was selected in 2009 to develop the aircraft in preference to a bid from Sukhoi. Though the decision may seem obvious in that Tupolev has design history in bomber fleets, it has fared poorly since the collapse of the Soviet Union. Sukhoi, by comparison, has emerged as the country’s pre-eminent combat-aircraft manufacturer. The government and industry finally concluded a contract in May 2012 covering the purchase of five Project 955A Borei SSBNs following prolonged negotiations over price and the schedule for the delivery of boats.

**Missile Capabilities**

Russia has been working to modernize its rocket forces with both silo-based and mobile ICBMs as well as MIRVed variants. The country has had technical issues developing a new generation of SLBMs, though tests in December 2011 of the new Bulava SLBM were reported successful. Other modified and new missiles have also been under development.532

In his early 2012 remarks on Russia, DIA Director Ronald L. Burgess, Jr. stated,533

Russia is upgrading massive underground facilities that provide command and control of its strategic nuclear forces as well as modernizing strategic nuclear forces as another top priority. Russia will field more road-mobile SS-27 Mod-2 ICBMs with multiple independently targetable reentry vehicles. It also will continue development of the Dolgorukiy/SS-NX-32 Bulava fleet ballistic missile submarine/submarine-launched ballistic missile and next-generation air-launched cruise missiles.

**Missile Defense**

Russia is also working to increase its missile air defense capabilities. The IISS reports that Russia created an Aerospace Defense Command on December 1, 2011, in order to unify as one force (the Aerospace Defense Forces) the country’s Space Forces, Air Force air-defense units, and Air-Space Defense Strategic Command. It has been reported that air-defense units that were previously part of the Air Force have been reorganized into 11 brigades that include both radio-radar and anti-aircraft missile regiments. It seems that this new Command

will focus on medium- and upper-tier threats, leaving lesser threats to the geographical areas in which they appear. The IISS gives more detail on Russia’s missile defense capabilities:

Equipment includes early-warning systems (in two echelons – space and ground), space-tracking systems, Russia’s Ballistic Missile Defence System (A-135) and missile systems in the service of AA brigades. The early-warning space echelon presently consists of only three satellites, providing limited surveillance with significant time gaps, a problem due to be solved by the introduction of new satellites. The ground echelon consists of seven independent radio-radar centres equipped with Dnepr, Daryal, Volga and Voronezh over-the-horizon radar stations. These systems can acquire a ballistic target at ranges from 4,000 to 6,000 kilometres. The only gap in the ground echelon’s coverage is presently in the north-east, which will be closed when Voronezh-DM radars are put into service (possibly in Barnaul, Yeniseisk and Omsk). The A-135 system is deployed around Moscow and has only a 150km operational radius. It consists of a warning and monitoring system, silos of 53T6 Gazelle short-range anti-ballistic missiles and 51T6 Gorgon long-range anti-ballistic missiles. Though the system is relatively old, no modernisation plans have been announced. Meanwhile, the in-service date of the S-500 missile system, billed as a replacement, has slipped further.

The State Armaments Programme 2011–2020 allocated R4tr (US$136bn) for aerospace defence, and the plan is for around 100 SAM and Pantsyr-S1 systems, as well as more than 30 Vityaz medium-range missile systems, to be in service by 2020. Vityaz is currently in development and, according to media reports, will replace some S-300 systems. It is believed that the system uses the 9M96 and 9M100 missiles. Three anti-aircraft brigades were transferred from the air force and are deployed in the central industrial region, with 12 AA regiments (32 batteries in total) mainly armed with the S-300. Two AA regiments, with two batteries of S-400 in each, are deployed in Electrostat and Dmitrov. Two more S-400 regiments are deployed in the Baltic Fleet AOR and in the city of Nakhodka (Primorsk Territory). A fifth regimental S-400 unit is supposed to be delivered by the end of 2012. By 2015, the plan is for nine regimental S-400 units to be deployed.

**Space**

In early 2012, DIA Director Ronald L. Burgess, Jr. also commented on Russia’s use of space:

Russia recognizes the strategic value of space as a military forces multiplier. Russia already has formidable space and counterspace capabilities and is improving its navigation, communications, ballistic missile launch detection, and intelligence-gathering satellites. It has extensive systems for space surveillance and tracking and others with inherent counterspace applications, such as satellite-tracking laser rangefinders. Russia is researching or expanding directed-energy and signal jamming capabilities that could target satellites.

**Biological and Chemical Weapons**

While Russia ratified the Biological and Toxin Weapons Convention in 1975, it continued development of a large program until the fall of the USSR in 1991. Russia continues dual-use research activities, and it remains unclear if Russia has fulfilled its Article 1 treaty obligations.

Russia also ratified the CWC in 1997, and as of March 2012 has destroyed over 60% of its stockpile (24,000 of 40,000 metric tons). The country anticipates completing destruction by December 2014.

---

About the Authors

Anthony H. Cordesman holds the Arleigh A. Burke Chair in Strategy at CSIS and acts as a national security analyst for ABC News. He is a recipient of the Department of Defense Distinguished Service Medal. During his time at CSIS, he has completed a wide variety of studies on energy, US strategy and defense plans, the lessons of modern war, defense programming and budgeting, NATO modernization, Chinese military power, the lessons of modern warfare, proliferation, counterterrorism, armed nation building, the security of the Middle East, and the Afghan and Iraq conflicts. (Many of these studies can be downloaded from the Burke Chair section on the CSIS website at http://www.csis.org/program/burke-chair-strategy.) Cordesman has directed numerous CSIS study efforts on terrorism, energy, defense planning, modern conflicts, and the Middle East. He has traveled frequently to Afghanistan and Iraq to consult for MNF-I, ISAF, US commands, and US embassies on the wars in those countries, and he was a member of the Strategic Assessment Group that assisted General Stanley McChrystal in developing a new strategy for Afghanistan in 2009. He frequently acts as a consultant to the US State Department, Defense Department, and intelligence community and has worked with US officials on counterterrorism and security areas in a number of Middle Eastern countries.

Before joining CSIS, Cordesman served as director of intelligence assessment in the Office of the Secretary of Defense and as civilian assistant to the deputy secretary of defense. He directed the analysis of the lessons of the October War for the secretary of defense in 1974, coordinating the US military, intelligence, and civilian analysis of the conflict. He also served in numerous other government positions, including in the State Department and on the NATO International Staff. In addition, he served as director of policy and planning for resource applications in the Energy Department and as national security assistant to Senator John McCain. He had numerous foreign assignments, including posts in the United Kingdom, Lebanon, Egypt, and Iran, as well as with NATO in Brussels and Paris. He has worked extensively in Saudi Arabia and the Gulf.

Ashley Hess received her B.A. in international relations and classics from Brown University in 2008. While working in South Korea after graduation, she was awarded a scholarship in 2010 to study Korean and earn a master’s degree under the Korean Government Scholarship Program. During her time in Korea, she traveled extensively throughout the country, including to the DMZ. She received her M.A. in international relations from Seoul National University in 2013, during which she focused on terrorism, national security, and the Northeast Asian strategic environment. At CSIS, she has worked on reports related to the Asia-Pacific and the 2014 transition in Afghanistan.