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North Korea Likely to Conduct Second Nuclear Test¹

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Another round of Six-Party Talks concluded on December 22, 2006 after a 13-month hiatus, but the parties were unable to make significant progress in implementing the “Statement of Principles” of September 2005. The participants agreed to reconvene the talks “at the earliest opportunity,” and all parties ostensibly remain committed to the denuclearization of the Korean peninsula.² However, significant obstacles make this goal increasingly difficult, and we believe a second North Korean nuclear test is likely for both political and technical reasons despite claims by the South Korean government that Pyongyang is unlikely to test in the near future.³

In early December 2006, intelligence sources indicated activities were underway at the Mount Mant’ap nuclear test site near the village of Punggye-ri in North Hamgyŏng Province. The activities were first disclosed by South Korean National Assemblyman Chŏng Hyŏng-gŭn of the Grand National Party (GNP or “Hannaradang”) on December 21.⁴ Chŏng’s disclosure followed South Korean Defense Minister Kim Chang-su’s December 15th admonition to 130 senior military commanders “to be thoroughly prepared to counter the possibility of a second

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² Yonhap News Agency, “Text of Chairman’s Statement from Six-Way Nuclear Talks,” December 23, 2006, in Global News Wire, Lexis-Nexis, <http://www.lexis-nexis.com>.

³ “Seoul Sees No Immediate Signs of Second N. Korean Nuclear Test,” Yonhap News Agency, January 5, 2007, <http://bbs.yonhapnews.co.kr>; Kwang-tae Kim, “North Korea Is Capable of Another Nuclear Test, But Analysts Doubt One Is Looming,” Associated Press, January 6, 2007, in Lexis-Nexis, <http://www.lexis-nexis.com>.

⁴ “North Korea May Be Preparing to Hold Second Nuke Test – Yonhap,” AFX – Asia, December 21, 2006, in Lexis-Nexis, <http://www.lexis-nexis.com>; “North Korea ‘at it again,’ Nuke Test Suspicion,” *Geelong Advertiser* (Australia), December 22, 2006, p. 24, in Lexis-Nexis, <http://www.lexis-nexis.com>.

or third nuclear test by North Korea.”⁵ According to National Assemblyman Chŏng, North Korea had prepared two tunnels under Mount Mant’ap, and the October 9, 2006 test was conducted in a tunnel on the eastern side of the mountain while recent activities have been at the western tunnel.⁶ According to a South Korean government source, the movement of people and vehicles has been detected at the site, and the activities are similar to those that preceded the first test.⁷

National Assemblyman Chŏng revealed that in December 2006 an unidentified object was moved to the western tunnel entrance and up to 15 people were observed moving about the area. Chŏng said that the North Koreans were seen constructing a temporary building 10 meters from the tunnel entrance and it is very likely the North Koreans were preparing the tunnel for a nuclear test. Chŏng also claimed that after the October 9th test in the eastern tunnel, the North Koreans removed the three temporary support buildings near that tunnel entrance and excavated and subsequently filled in a 95-meter long ditch between the buildings and the tunnel, which indicates they could be preparing the eastern tunnel for a future test as well.⁸

The Political Variables

While the Six-Party Talks have been deadlocked, North Korean officials have warned that Pyongyang is prepared to continue its nuclear activities.⁹ During the last round of negotiations in Beijing, the U.S. delegation presented a four-page proposal that offered North Korea negative security assurances and promised economic assistance that would be delivered as

⁵ “Defense Minister Calls for Readiness against Possible N. Korean Provocation,” Yonhap News Agency, December 16, 2006, in Lexis-Nexis, <http://www.lexis-nexis.com>.

⁶ 건광삼, “北, 6者회담 결렬땀 추가 핵실험 가능성” [Additional North Korean Nuclear Test Possible if Six-Party Talks Break Down], *서울신문* [*Seoul Sinmun*], December 22, 2006, in KINDS, <http://www.kinds.or.kr>.

⁷ “北핵실험 장소서 사람·차량 움직임 지속포착” [Continuous Movement of People and Vehicles Detected at the North’s Nuclear Test Site], *조선일보* [*Chosun Ilbo*], January 5, 2006, <http://nk.chosun.com>.

⁸ “정형근 ‘풍계리 서쪽갱도 핵실험 준비 완료’” [Chŏng Hyŏng-gun, Nuclear Test Preparations Completed at the Western Tunnel in Punggye-ri], 연합뉴스 [Yonhap News Agency], January 7, 2007, <http://www.yonhapnews.co.kr/politics/2007/01/07/0504000000AKR20070107053800001.HTML>.

⁹ “N.Korea to Boost ‘Deterrent’ as Nuke Talks Flop,” *Chosun Ilbo*, December 23, 2006, <http://english.chosun.com/w21data/html/news/200612/200612230001.html>; Chua Chin Hon, “N. Korea Proclaims Itself a Nuclear Power; Taking a Tough Stance at Talks, It Demands Sanctions be Lifted before Disarmament,” *The Straits Times* (Singapore), December 19, 2006, in Lexis-Nexis, <http://www.lexis-nexis.com>.

Pyongyang denuclearized.¹⁰ However, the North Korean delegation apparently had been given no authority to negotiate on the nuclear issue and instead focused on the lifting of U.S. financial sanctions.¹¹ One South Korean press report cited “usually reliable insiders” as saying National Defense Commission Chairman Kim Jong-il instructed Kim Kye-gwan, the leader of the North Korean delegation, to be confident because Pyongyang had nuclear weapons and that North Korea no longer had to worry about its security. If true, this implies that North Korea probably felt no need to compromise at the talks.¹²

Technical preparations are a necessary condition to conduct a nuclear test, and we are not sure if North Korean scientists and engineers have completed them. However, all of the political variables seem to point to a second test soon unless there is an abrupt change. In North Korea, the Korean People’s Army (KPA) clearly has extended its influence over politics, the economy, and state governance over the last decade, and in recent years the country has intensified the deification of leader Kim Jong-il under the ideology of “*sŏn’gun* (military first) politics.”¹³ One indication of the military influence in security affairs was a statement by Chief of the KPA General Staff Kim Yŏng-chun on December 23, 2006, a day after the conclusion of the Six-Party Talks. Vice Marshall Kim said that if the “enemy forces continue to increase their sanctions and pressure, we will respond with stronger and more resolute countermeasures.” Kim also said North Korea has stood up as a “dignified nuclear power in order to defend the country and people.”¹⁴

¹⁰ “US Details Carrots on Offer to North Korea to Give up Nukes,” Deutsche Presse-Agentur, December 20, 2006, in Lexis-Nexis, <http://www.lexis-nexis.com>; “US Offers ‘Sweetened Incentives’ for North Korea at Six-Party Talks,” BBC Worldwide Monitoring, December 20, 2006, in Lexis-Nexis, <http://www.lexis-nexis.com>.

¹¹ Mitchell Landsberg, “N. Korea End with No Resolution,” *Los Angeles Times*, December 23, 2006, p. A3, in Lexis-Nexis, <http://www.lexis-nexis.com>; Nicholas Kralev, “Rice Rejects Tying Nuclear Talks to Currency Issue; Pyongyang Wants Curbs Lifted on Its Accounts in Macao Bank,” *Washington Times*, December 22, 2006, p. A15, in Lexis-Nexis, <http://www.lexis-nexis.com>; Lee Joo-hee, “N. Korea Stuck on BDA Issue in Nuclear Talks,” *Korea Herald*, December 22, 2006, in Lexis-Nexis, <http://www.lexis-nexis.com>.

¹² “Kim Jong-il ‘Told Top Nuke Negotiator to Be Confident,’” *Chosun Ilbo*, December 29, 2006, <http://english.chosun.com/w21data/html/news/200612/200612290033.html>.

¹³ Special Reporting Team and Ser Myo-ja, “Military Influence Broadens in Kim Jong-il’s North,” *JoongAng Ilbo*, January 4, 2006, <http://joongangdaily.joins.com/200701/03/200701032345381709900090409041.html>; for an overview of the KPA and its role in the DPRK government, see Ken E. Gause, *North Korean Civil-Military Trends: Military First Politics to a Point* (Carlisle Barracks, PA: U.S. Army War College Strategic Studies Institute, September 2006), <http://www.strategicstudiesinstitute.army.mil/pdf/PUB728.pdf>.

¹⁴ “北김영춘 ‘제재압력 강화시 강력한 대응조치로 대처’” [North’s Kim Yŏng-chun ‘We Will Respond with Strong Countermeasures if Sanctions and Pressure Intensify], *세계일보* [*Segye Ilbo*], December 23, 2006, <http://www.segye.com>.

Meanwhile, the domestic political environments in the United States and South Korea seem to be encouraging for North Korean advocates of another nuclear test. The November mid-term elections have left the United States with a divided government as the Bush administration enters its last two years. Furthermore, senior U.S. policymakers and the American public have become overwhelmed with the Iraq problem, leaving Washington with few practical options for dealing with North Korea except containment and deterrence while trying to signal credibly to Pyongyang that the real “red line” is nuclear transfers.

In Seoul, President Roh appears to have become a lame duck; the ruling Uri Party is on the verge of breaking up; and electoral politics are already becoming prominent in the run-up to the presidential election in December 2007. Moreover, South Korean society is divided over policy towards Pyongyang, while the U.S.-South Korea security alliance is deteriorating. Pyongyang is very cognizant of political opportunities and is usually quite adept at exploiting them. The press reports that the Six-Party Talks could resume soon, but we do not expect a swift breakthrough in efforts to denuclearize North Korea. In sum, unless there is significant movement by the United States in relaxing its financial sanctions against North Korea, all the political variables seem to be pointing towards another nuclear test.

The Technical Variables

The low yield of the October 9th test could indicate that North Korean scientists and engineers have the ability to control the yield of nuclear explosions, or that they are seeking to achieve this capability. If so, they will need additional testing, and after mastering this technology they should have little difficulty in weaponizing their nuclear bombs and mounting them on ballistic missiles.

North Korean officials reportedly informed Beijing hours before the October 9th nuclear test that the target yield for the blast was four kilotons (KT) of TNT; however, most estimates place the blast’s yield between 0.2 and 1.0 KT.¹⁵ Nuclear weapons are complicated devices, and depending on the design and type of weapon, several problems can reduce the expected yield. We can only speculate whether North Korea tested a relatively simple weapon (similar

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

to the bomb dropped on Nagasaki), or a more sophisticated device as part of an effort to design warheads for North Korea's ballistic missiles.

Dr. Siegfried Hecker, former director of Los Alamos National Laboratory, believes that North Korea tested a device with a simple design, but he does not rule out the possibility that the DPRK attempted to detonate a sophisticated device.¹⁶ On the other hand, Richard Garwin and Frank von Hippel feel that if the target yield was 4 KT, then North Korea was not testing a simple Nagasaki-type device. They speculate that the test was related to missile warhead development.¹⁷

Peter Hayes and Kang Jungmin conclude that the test was more of a failure than a success because the DPRK failed to demonstrate the capability to deliver a reliable nuclear weapon. Hayes and Kang believe Pyongyang was unable to "pole-vault into the ranks of nuclear weapons states" and that the DPRK likely will test again, but the timing will depend upon the U.S. response and the international political environment.¹⁸ Hayes and Kang correctly emphasize that achieving criticality in the test was a significant technical achievement and they raise three additional possible technical successes: DPRK scientists and engineers could be confident in their ability to detonate larger devices and are concentrating on smaller and more sophisticated weapons; the test used a small amount of plutonium, which economized on a scarce resource; and, the DPRK was able to limit the release of radioactive fallout from the test.¹⁹

There are several possible reasons for the lower than anticipated yield, such as impurities in the plutonium, imprecise machining of the plutonium, defects in the structure or detonation of the conventional explosives, or problems with the neutron initiator or neutron reflector.²⁰ However, according to anonymous analysts quoted in *Nucleonics Week*, the DPRK's 5MW(e) nuclear reactor in Yŏngbyŏn-kun produces little plutonium-240, and they

¹⁶ Ibid.

¹⁷ Garwin and von Hippel note that the Nagasaki bomb weighed about four tons, and North Korean aircraft and missiles could not deliver such a device. Garwin and von Hippel believe the DPRK could be working on a device in the range of 500-1,000 kilograms so it could be delivered by North Korean ballistic missiles. See Richard L. Garwin and Frank N. von Hippel, "A Technical Analysis: Deconstructing North Korea's October 9 Nuclear Test," *Arms Control Today*, November 2006, http://www.armscontrol.org/act/2006_11/tech.asp.

¹⁸ Jungmin Kang and Peter Hayes, "Technical Analysis of the DPRK Nuclear Test," Nautilus Institute Policy Forum Online, October 20, 2006, <http://www.nautilus.org/fora/security/0689HayesKang.html>.

¹⁹ Ibid.

²⁰ Ibid.

assume that the plutonium used in the test could have contained up to 98 percent plutonium-239.²¹

These anonymous analysts believe that if the device had such high quality weapons-grade plutonium, there could be three reasons for the low yield. First, the North Koreans might have used an internal neutron generator such as the beryllium-polonium neutron generators used in early-generation nuclear weapons, but the timing could have been off, resulting in a “pre-detonation of the device.” Second, they might have used an external neutron generator, such as those used in more advanced weapons, but the neutron generator could have delivered the neutrons imprecisely to the core. Third, light elements such as oxygen could have contaminated the core, introducing alpha particles (two protons and two neutrons) and spoiling the chain reaction sequence.²² Whatever the cause of the low yield, David Albright, president of the Institute for Science and International Security, calls the October 9th test a “partial success,” and he anticipates that North Korean scientists and engineers will fix any problems and test again.²³

Without knowledge of North Korean technical objectives and data from the October 9th test, it is impossible to make an accurate assessment of the test. However, we believe the small yield has a number of implications and North Korean technology could be more advanced than commonly believed. Plutonium is a scarce resource for Pyongyang, so North Korean scientists and engineers certainly had an incentive to use as little as possible for the test. They could have used as little as one kilogram, which indicates North Korean engineers could be confident in achieving fission with small amounts of fissile material and that they are working on miniaturized devices for missile warheads. If they are successful in their efforts, this will enable them to produce more bombs with their limited inventory of about 40-50 kilograms of plutonium.

There are three main variables that affect the yield of a nuclear explosion: 1) the neutron initiator; 2) the plutonium pit; and 3) the high-explosive device. North Korean weapons designers will address these three variables as they try to improve their designs and increase the efficiency of their weapons. Beryllium and polonium are commonly used as

²¹ Mark Hibbs, “DPRK Test Shot Highly Inefficient, May Be Design Flaw, Experts Say,” *Nucleonics Week*, Vol. 47, No. 41, October 12, 2006, pp. 1, 10-11.

²² Ibid.

²³ Anju S. Bawa, “Reworked Device A Few Months Off, U.S. Analysts Say,” *Washington Times*, October 27, 2006, p. 13.

neutron initiators for nuclear weapons, and North Korea can produce these elements with the IRT-2000 research reactor or the 5MW(e) nuclear reactor at the Yŏngbyŏn Nuclear Research Center.²⁴

North Korea also has the capability to produce the high and low explosives used for the implosion of the plutonium pit. The explosive device is usually composed of some combination of cyclotrimethylene- trinitramine (RDX), cyclotetramethylene-tetranitramine (HMX), pentaerythritol tetranitrate (PETN), and baratol (a mixture of TNT, barium nitrate, and a small amount of wax as a binder). North Korea is capable of producing all of these explosives as well as the exploding-bridge-wire detonators required to trigger a simultaneous detonation of the high explosives.

If North Korea is determined to have a robust nuclear deterrent, North Korean weapon designers will have to maximize the efficiency of the three variables mentioned above. This will require additional testing because they will have to hold two variables constant as they test the effects of changes in the other variable. Therefore, from a technical standpoint, North Korea should be expected to conduct at least one or two more nuclear tests before North Korean leaders can be confident in their “nuclear deterrent.”

²⁴ For information on these reactors and the Yŏngbyŏn Nuclear Research Center, see the Nuclear Threat Initiative’s “North Korea Country Profile” at http://www.nti.org/e_research/profiles/NK/index.html.