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## North Korea in 2011: Countdown to Kim il-Sung's centenary

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### Abstract

As the diplomatic standoff in North Korea enters its fourth year, the crisis atmosphere on the Korean peninsula sparked by Pyongyang's military actions in 2010 has eased. Pyongyang has agreed to return to the diplomatic table, its hand strengthened by advancing its nuclear program in the interim. Washington and Seoul remain reluctant to engage, having been burned by Pyongyang's clandestine uranium enrichment program unveiled in 2010. The authors argue that re-engagement, with the immediate objective to stop a third nuclear test and prevent further missile tests, is imperative to contain the nuclear threat for now; preventing the nuclear program's expansion and preparing the way for the ultimate denuclearization of the peninsula—critical goals—must be left to a second step.

### Keywords

enrichment, North Korea, nuclear weapons, plutonium, six-party talks, uranium

In contrast to 2010, which was marked by clashes and a dangerous spike in tensions on the Korean peninsula, 2011 was a much calmer year. Two major reasons undergird the change. First, and most important, last year Pyongyang focused on securing a stable external environment in order to concentrate on economic goals for 2012, the centenary of Kim il-Sung's birth and an anticipated banner year for the regime. Second, South Korea has inched away from efforts to put maximum pressure on the North. Though overall tensions lessened on the peninsula, this does not mean they are

nonexistent—in fact they do remain, particularly in the Yellow Sea (West Sea), where both sides continue to build up their military forces.

Although the Obama administration continues to practice strategic patience, there is no reason for complacency. Tensions can escalate rapidly on the peninsula, and the disposition of forces on either side of the demilitarized zone leaves little room for error. Moreover, in 2010 Pyongyang greeted the world with a different nuclear reality—while keeping its nuclear weapons, it began construction of its own light water reactor and unveiled a uranium enrichment

program. And disturbingly, in 2011, North Korea provided very little information (or hints, even) on how far it may have advanced its nuclear weapons capability.

In 2011, North Korea worked hard to project a noticeably softer image abroad. There are no signs, however, that this translated into a diminution of efforts to develop the country's nuclear program, which, from all evidence, continued apace. Pyongyang's diplomatic strategy, as well as its nuclear ambitions, must be carefully analyzed and weighed to ascertain how the United States, for one, should move forward in 2012.

## Diplomacy in 2011

### *The charm offensive*

Pyongyang's decision to make 2011 a year of relative calm was apparent five days into the new year (and barely six weeks after it shelled a South Korean-held island in Korea's Yellow Sea), when the country's front organizations issued a barrage of statements offering to restart dialogue with South Korea. This effort was promptly labeled a "charm offensive" by many observers, but it had the hallmarks of a concerted effort by Pyongyang to reduce tensions. Overall, the North's leadership situation appeared stable in 2011: Kim Jong-un's grooming to succeed his father continued to be on track; and Kim Jong-il was in relatively good health, judging from his grueling travel itinerary both inside and outside the country. Moreover, the North's economy showed signs of improvement: Economic relations with Russia stirred again, while those with China expanded vigorously and, some might say, alarmingly.

*Russia.* After nearly a decade of moldering, Russia–North Korea relations showed signs of life again. Kim Jong-il visited President Dmitry Medvedev in August. The Russian reconstruction of the North's east coast rail line from the Tumen River to the port of Rason was given a test run. And Russia entered a form of trilateral talks with the two Koreas on the construction of a gas pipeline, which would run through the North to customers in South Korea. Greater cooperation was touted in agriculture, shipbuilding and ship repairs, trade, energy, construction, and timber processing.

*China.* It was during Kim Jong-il's eight-day, 7,000-kilometer train journey to China in May that the meaning and extent of the North's new policies became clear. Kim told his Chinese counterparts that the North wanted a "stable" environment for economic construction. Unspoken, apparently, but well understood was a parallel concern to improve the atmosphere for the North's political succession. Pyongyang's moves throughout 2011 seemed to fit with this course.

China–North Korea ties, which began seriously to take off in the autumn of 2009, developed further across the board in 2011, with Chinese work and investment on key infrastructure projects in the North growing, and high-level political and economic exchanges proceeding at an impressive clip. Their relations are now as good as, if not better than, they have been over the past 60 years. This ongoing and evolving relationship has transformed the political, economic, and security landscape on the Korean peninsula, easing the North's isolation and possibly

convincing Pyongyang that it has extra space to maneuver on the nuclear issue.

### *The return of six-party talks*

Beginning in early 2011, five of the countries included in six-party talks (North Korea, South Korea, Russia, China, and the United States; Japan remained the outlier) expressed much interest in resuming discussions—but nothing of substance materialized. Nevertheless, the *process* of dialogue (too often airily dismissed by observers) was instigated. In 2011, Pyongyang agreed to two meetings between North and South Korean nuclear negotiators, a necessary prerequisite for bilateral meetings with Washington. American and North Korean negotiators met twice—in New York in July and Geneva in October—for what Washington called “exploratory” discussions. While nothing concrete emerged, that is not surprising, or even necessarily disappointing. After years in which the negotiating table has gathered dust, it will take time, patient discussion, and careful listening for the parties to transition into substantive talks.

### *Containment of the nuclear weapons program*

Although achieving Washington’s premier goal—denuclearization of North Korea—realistically is only a distant goal, containing the nuclear program may be within reach. During a March visit from Russian Deputy Foreign Minister Aleksei Borodavkin, the North opened room for discussion on key steps that would contain, though not eliminate, elements of its nuclear and missile programs. In an unusual statement, Pyongyang declared that it could

return to six-party talks without preconditions and does not oppose the discussion of uranium enrichment at the talks. Moreover, if the talks resumed, Pyongyang announced that other issues—such as temporarily suspending nuclear tests and ballistic missile launches, and allowing International Atomic Energy Agency (IAEA) inspectors to access the centrifuge facilities at Yongbyon—can be “discussed and settled during the process of implementing the [six-party commitment made on September 19, 2005] for realizing the denuclearization of the entire Korean peninsula, in accordance with the principle of simultaneous action” (BBC News, 2011; Korean Central News Agency, 2011a).

This somewhat positive signal, however, was offset by events in Libya—particularly the use of a UN Security Council resolution to justify the West’s military intervention against the Qaddafi regime. North Korea responded with this message: “[P]eace can be preserved only when one builds up one’s own strength as long as high-handed and arbitrary practices go on in the world” (Korean Central News Agency, 2011b)—a not-too-subtle reference to its own efforts to improve its military capabilities.

## **Nuclear weapon developments in 2011**

In 2011, Pyongyang revealed very little about its nuclear progress, but all signs point to a continuing march toward a more threatening nuclear weapons capability. The most alarming developments have been a combination of two things: the operation of modern uranium centrifuge facilities and the presence of

road-mobile intermediate-range ballistic missiles (IRBM). An added source of stress is North Korea's likelihood of cooperating with illicit nuclear programs of other countries, such as Iran, and the likelihood of it importing and exporting nuclear technologies to expand its own programs or aid those of others.

### *Yongbyon*

*Uranium enrichment.* In November 2010, we, the authors, visited Yongbyon, where we were stunned to find a newly constructed, modern, 2,000-centrifuge uranium enrichment plant. Since then, North Korea has not allowed outsiders to return to Yongbyon, so nothing new was learned about the plant in 2011.

Our 2010 visit answered some questions, but it raised many more. Though the Yongbyon uranium centrifuge enrichment facility looked complete, we were unable to assess if it was operational. We were told that the facility is used to produce low enriched uranium (LEU) destined for a small light water reactor, which is under construction; the facility appeared to house sophisticated centrifuges and was sized properly for that reactor's fuel requirements.<sup>1</sup> We also were told that the facility became operational just a few days before our arrival, but we don't know if that is true. Whatever its status during our visit, the facility may be fully operational now, more than a year later. We don't know how much LEU has been produced to date or what the current production rates are. Although the facility is likely producing LEU for the reactor, it could conceivably be producing highly enriched uranium (HEU) bomb fuel. And if it is configured to do this, the reactor could produce roughly 40

kilograms of HEU annually, enough for one or so bombs. A return visit or inspection by the IAEA could answer these sorts of questions.

Though we do not know how many other uranium centrifuge facilities exist, where they are located, or how large they might be, we are convinced that North Korea has another facility at which it developed the technology and conducted operations: The Yongbyon facility could not have been constructed from scratch and made operational in only 18 months, between April 2009 and November 2010, as Pyongyang has claimed. It is conceivable that the North had one full cascade (about 340 centrifuges) operational at a separate site long before it moved into the renovated Yongbyon fuel fabrication building. It is likely that Pyongyang continues to import key materials and components, and, hence, the size of any clandestine program is constrained. But constrained or not, North Korea may be producing some HEU now and may have been doing so for some time.

During our visit, we learned that North Korea plans to follow the construction of the small light water reactor with the construction of large commercial power plants. This ambitious plan will require an enrichment facility with tens of thousands of centrifuges to supply fuel. Such a facility would be capable of producing several dozen bombs' worth of HEU per year. It seems unlikely that North Korea has the requisite materials and components (either imported or produced indigenously) on hand for such a large expansion. Caution is in order, however: North Korea has demonstrated repeatedly that it is capable of improvising, doing a lot with a little, and using its illicit

procurement networks—particularly through China—to obtain much of what is needed (Hecker et al., 2011).

*Plutonium.* The Yongbyon plutonium facilities remained dormant in 2011. The 5-megawatt electric (MWe) plutonium production reactor, operational since 1986, was shut down in July 2007 and has not been restarted. The reprocessing facility ceased operations in 2009, but remains in stand-by status. Presently, North Korea is not producing any plutonium and there is no plutonium in the pipeline.

We estimate that North Korea has roughly 24 to 42 kilograms (four to eight bombs' worth) of plutonium today. The key facilities remain in standby and could be reactivated if necessary; it would take approximately six months to do so. If reactivated, the reactor is capable of producing only six kilograms of plutonium, roughly one bomb's worth, per year.

Though we do not know an exact timeline for completion, we do know that North Korea is converting the Yongbyon plutonium production facility to a light water reactor facility and uranium enrichment plant; however, the decision to pursue uranium enrichment instead of plutonium production is puzzling—if Pyongyang simply wants to make more bomb fuel.<sup>2</sup> The missing pieces of the puzzle, however, are that Pyongyang has long sought light water reactors for electricity production, first from the Soviet Union and then from the United States—and this type of reactor fuel requires enrichment, which, in turn, opens the door to the bomb option since the centrifuge facilities needed for the reactors can also be converted to produce highly enriched uranium bomb fuel.

Thus, choosing the uranium route provides Pyongyang with a viable dual-track option—LEU for nuclear electricity with light water reactors and HEU for the second route to the bomb to augment its small plutonium bomb inventory.

It is conceivable that North Korea chose the facility conversion because it views its few plutonium bombs sufficient to deter the United States. However, North Korea's rhetoric of bolstering its deterrent in "quality and quantity" implies the use of HEU (Korean Central News Agency, 2011c; Yonhap News Agency, 2011), and this can be achieved by building more bombs or smaller bombs that can be mounted on its missiles. Typically that is done with plutonium rather than HEU devices. However, if Pyongyang has the HEU implosion design that A. Q. Khan sold to Libya (IAEA Board of Governors, 2004)<sup>3</sup>—or the more advanced implosion design for HEU systems recently found in Iran (IAEA Board of Governors, 2011b)—it may have decided that it could more quickly deploy a miniaturized, missile-capable HEU warhead.

*Yongbyon light water reactor.* Although the light water reactor construction progress can be tracked with commercial satellite imagery, many questions remain about the North's choice of materials, technologies, and construction practices. The rhetorical goal is for full completion by 2012; however, this schedule is unrealistic considering how little of the key design decisions had been finalized when we were there in 2010 (Hecker, 2010). We suspect that Pyongyang will settle for a lesser accomplishment (e.g., completing the containment structure and supporting buildings) and leave

achievement of operations for somewhere a few years down the road.

Our concerns about North Korea's ability to operate a light water reactor safely have been greatly exacerbated by the nuclear accident at the Fukushima Daiichi Nuclear Power Station in March 2011. Those events underscored the importance of constructing plants with maximum protection against seismic events and being able to respond to station blackout scenarios—regardless of what causes them. Two of the key lessons learned from Fukushima Daiichi were the importance of an independent nuclear safety regulator, which North Korea surely does not have, and emergency preparedness and disaster response, which Pyongyang has been unable to muster during its own numerous weather-related disasters.

If Pyongyang proceeds with commissioning and operating its light water reactor, the international community will likely be torn between two undesirable choices: assist North Korea to ensure safe reactor operation even though it still has nuclear weapons and is under UN sanctions to end its nuclear programs, or allow the North to operate the plant on its own, under far-from-accepted nuclear safety standards and practices.

### *Nuclear weapons and delivery systems*

Pyongyang has the bomb but not much of a nuclear arsenal. We have reasonable confidence in the number of bombs—four to eight—because plutonium inventories are easy to assess, but we simply don't know their sophistication. Since it has shut down its plutonium facilities, Pyongyang apparently is not planning to increase the number of plutonium bombs significantly.

We assume the North is working on missile-capable nuclear systems, but employing miniaturized nuclear warheads is severely handicapped by the country's lack of nuclear test experience. The first test in 2006 was only partially successful. Initial estimates of the yield of the second test in 2009 were 2 to 4 kilotons. This estimate has been revised upward to 4.6 kilotons in a recent analysis (Murphy et al., 2010).<sup>4</sup> Consequently, the North may be able to design a Nagasaki-like bomb with a yield of up to 20 kilotons, but delivery is likely to be restricted to aircraft, boat, or van. For North Korea to gain enough confidence to mount a miniaturized design on a missile, it will have to test again. Hence, the technical and military driving forces for additional tests are high, even if, as Pyongyang surely knows, the political risks are also high. Satellite imagery captured in 2011 showed preparations for what possibly could be another test site, which is located near the two previous tests in the Kilju region (Global Security Newswire, 2011). If Pyongyang decides to test, it will almost certainly be of a miniaturized design, but we don't know if it will be with plutonium or HEU.

North Korea did not launch another long-range rocket in 2011. None of its three previous attempts (in 1998, 2006, and 2009) were entirely successful. Not surprisingly, it continues to expand its missile program. Commercial satellite imagery indicates that a second long-range missile launch pad, under construction for 10 years and located at Tongchang-ri near the northwest border with China, is essentially complete (Harlan, 2011). It is considerably more sophisticated and capable than the country's first launch site, located

at Musudan-ri on the east coast. There are no indications that another launch is imminent. But even if there are plans to launch again, nothing is likely until the weather improves in the spring.

In October 2010, North Korea publicly exhibited, for the first time, a road-mobile intermediate-range ballistic missile at a military parade in Pyongyang—thus, Western analysts spent 2011 assessing the importance and potential impact of this addition to the country's arsenal. Dubbed the "Musudan" by US intelligence services, the IRBM can travel an estimated 3,000 to 5,000 kilometers, apparently farther than any other missile in the North Korean arsenal (Global Security Newswire, 2010). Although never flight-tested, the missile represents a big step forward for Pyongyang, because it is road mobile and, hence, difficult to find. In June 2011, then-Defense Secretary Robert Gates expressed concern that North Korea had also been developing a road-mobile intercontinental ballistic missile (ICBM).<sup>5</sup> The combination of Pyongyang's determined drive to more menacing and survivable missile capabilities, its apparent cooperation with other countries of concern, and the uncertainty that exists about its ability to miniaturize nuclear warheads underscores the urgency of diplomatic re-engagement.

### *Nuclear cooperation, imports, and exports*

Though 2011 cast little light on North Korea's nuclear relationships with outside countries, there is certainly cause for increased concern, considering developments like the Musudan and the new uranium enrichment facilities

at Yongbyon. North Korea has a history of being a quick study (it became self-sufficient for the entire plutonium fuel cycle after initial help from the Soviets) and enterprising (Pyongyang almost certainly built a plutonium production reactor for Syria).<sup>6</sup>

*Imports.* North Korea has historically relied on importing key materials and components for its uranium centrifuge program. We believe it still does not have all the requisite capabilities today and has to rely on imports to expand its program. The centrifuge facility we were shown in 2010 apparently benefited from imports from Europe, Russia, Japan, and the A. Q. Khan network prior to 2003. According to Pakistan's former President Pervez Musharraf, Khan not only supplied North Korea with two dozen centrifuges, but he trained cadres of North Korean specialists at the centrifuge plants in Pakistan's Khan Research Laboratories in the late 1990s (Hecker et al., 2011). Today, the most likely acquisition route for key materials and components is through China (Albright and Brannan, 2010).

*Exports.* Over the past 10 years, North Korea has developed a uranium export business, supplying Libya with 1.8 metric tons of uranium hexafluoride before Muammar Qaddafi terminated the program in 2003 (IAEA Board of Governors, 2011a). The reactor built for Syria also would have provided a lucrative fuel-export business for North Korea had it not been bombed by Israel. In 2011, Pyongyang may have continued to export nuclear technologies, know-how, and precursor materials like uranium hexafluoride or, potentially, HEU itself to dangerous states. None of these

are easy to detect or easy to stop. The footprint for uranium centrifuge activities is small, detection is difficult, and Pyongyang could claim exports are for civilian applications.

**Cooperation.** Virtually all North Korean missiles are copies or derivatives of Soviet missiles. More than 20 years ago, Pyongyang turned from import to export, becoming the major supplier of missiles and the means to manufacture them to the most unstable parts of the world. Their export business has slowed down considerably (Pollack, 2011), but it appears that North Korea is now collaborating closely with Iran's missile establishment (East-West Institute, 2009; Fitzpatrick, 2011).

Nuclear cooperation between North Korea and Iran, including the export and import of sensitive nuclear and missile technology, could greatly benefit both countries—reactor, plutonium, and weapons technologies from North Korea to Iran; centrifuge technologies from Iran to North Korea; and missile technologies in both directions.<sup>7</sup>

### **Current state of diplomacy and path forward**

The centrifuge revelations in 2010 complicated an already gridlocked diplomatic six-party process, particularly reinforcing the hardliners' stance in Washington and Seoul against diplomatic engagement with Pyongyang—and 2011 events in Libya reinforced Pyongyang's conviction that ceding ground on the nuclear front is dangerous and possibly fatal. Pyongyang, Beijing, and Moscow are

ready to return to the negotiating table; Washington and Seoul want preconditions—specifically, to halt the uranium enrichment program (Tokyo remains skeptical of the talks). The diplomatic standoff, entering its fourth year, has given North Korea valuable time to strengthen its “deterrent.”

At the end of 2008, North Korea had enough plutonium for a handful of bombs. Its one nuclear test left the international community unconvinced of its nuclear prowess. In 2012, we see a country that has made great strides, using the diplomatic standoff to its advantage: Pyongyang has conducted a successful nuclear test, erasing any doubt that it can field a Nagasaki-like bomb; it has quickly and quietly constructed a modern uranium centrifuge facility and is in the process of building its own light water reactor; and it has rolled out road-mobile IRBMs capable of carrying nuclear warheads, as well as threatening to strengthen its deterrent in both quantity and quality.

Still, Pyongyang has some way to go. It must conduct another nuclear test to have confidence that a smaller nuclear device can be mounted on a missile; it may have to test-launch its Musudan missile; and it likely must expand its covert uranium plant (or plants) in order to produce much larger quantities of HEU. These three steps will bring North Korea closer to possession of a potent—if still small-scale—nuclear arsenal. And it is these three steps that Washington should be most concerned about in the near term and should focus on blocking.

Most urgent is to re-engage North Korea diplomatically to prevent a third nuclear test and stop missile launches. Currently, Washington insists that

Pyongyang halt such activity as preconditions—or “pre-steps”—to resumption of negotiations. Rather than preconditions, it would be better to propose them as unilateral confidence-building steps for the North to take, to be balanced by actions (not yet determined) by the United States. Something similar was accomplished at the outset of the United States–North Korea talks that emerged in 1999 and 2000, when, after the North’s first long-range missile launch over Japan in 1998, former Defense Secretary William Perry led a team that recommended a course of action for United States–North Korea reconciliation.

More difficult and relatively less urgent, though obviously crucial in the long run, is stopping the North from constructing large numbers of additional centrifuges—and this is still possible by controlling imports. Preventing the North’s nuclear exports and cooperation with other nations will be an ongoing problem that requires aggressive enforcement by China. The diplomatic objective of the United States for denuclearization on the Korean peninsula should remain, but this is unlikely to be achieved if it does not, in the near term, focus on the dangers staring the country in the face.

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### Notes

1. Yongbyon officials claimed an annual throughput capacity was 8,000 separative work units (the measurement of the separation during the enrichment process), indicating that the centrifuges were second-generation, or so-called P-2 s; first generation centrifuges, by comparison, produce an annual throughput capacity of about 2,000 separative work units (Hecker, 2010).
2. Plutonium is used in all states with nuclear weapons. China switched from HEU to plutonium early on in its program, and Pakistan has begun to employ plutonium in addition to HEU.
3. The *New York Times* has also reported that the Khan network possessed electronic blueprints for an advanced nuclear weapon design (Sanger, 2008).
4. Another recent analysis claims a minimum yield of 5.7 kilotons (Rougier et al., 2011).
5. In June 2011, then-US Defense Secretary Robert Gates noted, “With the continued development of long-range missiles and potentially a road-mobile intercontinental ballistic missile and their continued development of nuclear weapons, North Korea is in the process of becoming a direct threat to the United States” (Gates, 2011).
6. There is little chance that North Korea has done this anywhere else. Additionally, reactors are difficult to hide and are vulnerable to foreign intervention, as was demonstrated by Israel’s destruction of the Syrian reactor in 2007.
7. These concerns were previously expressed by Siegfried S. Hecker in 2009 (Hecker, 2009) and have been reinforced by the recent IAEA report by the Board of Governors (IAEA Board of Governors, 2011b).

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