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North Korean Brinksmanship on Trump's Nuclear "Red Line"

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EXECUTIVE SUMMARY: Pyongyang uses the buzz that accompanies its ballistic missile and nuclear tests, as well as the obscurity that conceals the extent of its infrastructure for weapons grade fissile materials production and nuclear weaponization, as tools with which to challenge Washington. Trump is not Obama, however. Kim Jong-un will need to tread carefully to avoid provoking an American preemptive strike.

On January 3, 2017, prior to his inauguration as president of the US, Donald Trump posted on Twitter: "North Korea just stated that it is in the final stages of developing a nuclear weapon capable of reaching parts of the US. It won't happen!" With this tweet, Trump apparently drew a red line for Pyongyang.

This did not encourage North Korea to retreat. It has, in fact, conducted many ballistic missile tests since Trump's inauguration. This behavior is a continuation of its defiance of the US on nuclear and missile issues dating back to President Clinton's tenure and even earlier.

While Pyongyang did conduct several ballistic missile tests during Obama's presidency between 2012 and 2016, they mostly failed. The low number of tests conducted was thus due to the immaturity of North Korea's long-range missile technology rather than to any reluctance on the part of Kim Jong-un to challenge the Obama administration. As proof, Pyongyang severely provoked Washington by conducting three nuclear tests between 2013 and 2016, which could have had dramatic political and military implications.

Over the past year, North Korea has tested the Pukguksong-2 medium-range (1,200 km) ballistic missile and the Hwasong-12 (tested on May 13). That missile, of intermediate range (over 4,000 km), is capable of hitting the American base of Guam in the heart of the Pacific.

Particularly noteworthy, however, were the two test flights of the Hwasong-14 on July 4 and 28. According to American estimates, the apogees and ranges of the flights confirm that the Hwasong-14 is an intercontinental ballistic missile (ICBM). This weapon is estimated to be capable of reaching a range of 7,000-8,000 km, which would enable it to hit targets such as Alaska, Hawaii, and perhaps even Seattle. It can carry a payload of 500 kgs.

Pyongyang itself referred to the July 4 test as an intercontinental missile launch. According to North Korean state television, Kim Jong-un "observed the test in person", and North Korean news agency KCNA reported that he jeered, "This is a gift to the American bastards" on their Independence Day.

North Korean media claimed the test proved that the missile could be equipped with a thermally protected atmospheric reentry vehicle, implying that it can carry a nuclear warhead. According to a document distributed by the KCNA, the ICBM launch "fully demonstrated the will and capacity of the DPRK to annihilate the US."

Strikingly, Seoul differed with both Washington and Pyongyang. A member of the South Korean parliament's intelligence committee stated during a televised briefing, about a week after the test, that according to his country's intelligence assessment, North Korea has not yet mastered reentry and guidance system capabilities for ICBMs as it lacks suitable testing facilities for atmospheric reentry technology (presumably wind tunnels). They believe the missile launched on July 4 was not an ICBM but a KN-17, or possibly the medium range Hwasong-12.

Seoul's intelligence assessment may be biased to align with the political outlook of new president Moon Jae-in, who seeks to improve relations with the North. However, Russia, usually adversarial towards the US, has stated that the last test was conducted with a medium-range missile. Its early-warning radar "Voronezh-VP" in the Irkutsk region showed that the missile only reached a maximum height of 535 kms and a range of 510 km.

Contrary to the media hype accompanying its missile tests, North Korea has maintained some ambiguity in recent years over its nuclear weapons development (with the exception of its third nuclear test conducted in 2013, and the fourth and fifth tests, conducted in 2016, the publicity of which was intended to aggrandize North Korean power). According to Japanese daily *Asahi Shimbun* of June 11, North Korea was on the verge of conducting a sixth. This assessment was based on "intensified activity" in Punggye-ri, an underground nuclear test site in the mountainous region of Kilju province in the northeast.

The Japanese newspaper's claim was questioned two days later by experts from the *38 North* website of the Johns Hopkins School of Advanced International Studies, which specializes in the study of North Korea. In their view, the Japanese report was likely "fake news." *38 North* experts relied on commercial satellite imagery from June 10 that showed no unusual activity at the site. To their understanding, the most that could be determined was that the test site is on constant standby, and "a sixth nuclear test could be conducted at any time, with minimal advance warning. At this point, renewed nuclear testing is almost entirely dependent on a North Korean leadership decision."

In view of the North Korean "Iron Curtain," it is extremely difficult to obtain significant HUMINT (human intelligence) on the goings-on inside that country, especially regarding its facilities for producing fissile materials for nuclear weapons. The IAEA (International Atomic Energy Agency) and its inspectors do not have a foothold in North Korea after the latter withdrew in 2003 from the NPT (nuclear Non-Proliferation Treaty), although even prior to this, it sought to deceive IAEA inspectors when they wished to monitor its nuclear facilities.

With that said, over the past decade, significant HUMINT has been acquired by the West. Professor Siegfried Hecker, a former director of the Los Alamos National Laboratory who devoted his career to the development of US nuclear weapons, was invited to North Korea seven times by the local authorities between 2004 and 2015. Hecker led Stanford University delegations during those visits. Pyongyang's aim was apparently to prove to the world that it had nothing to hide and that its nuclear program had peaceful objectives.

At the same time, US officials saw these visits as a convenient means of obtaining inside information from within North Korea's sealed walls. Satellite imagery plays a crucial role in identifying activities within these facilities, and even thermal satellite imagery is available today. Modern-day satellites are equipped with infrared sensors that can detect heat-emitting plants all over the globe, such as nuclear reactors.

At least until the end of the previous decade, the plutonium route was dominant in the production of fissile material for North Korea's nuclear weapons. The main facilities required were a reactor to produce weapons-grade plutonium from its nuclear fuel and a "hot lab" to extract the plutonium from the spent nuclear fuel.

At the beginning of 1980, North Korea began building an independent 25-megawatt, plutonium-producing reactor (5 MWe) at the Yongbyon nuclear research center, about 90 kilometers north of Pyongyang. The reactor, which is gas-cooled/graphite-moderated, is of the British MAGNOX reactor type.

The Calder Hall reactor, the world's first MAGNOX reactor, was inaugurated in Britain in 1956 for producing electricity, but was also ideal for the production of plutonium for Britain's nuclear weapons program. In the 1950s, Britain declassified the planning and technical specifications of the MAGNOX reactor, which were then published openly in the scientific literature.

In the early 1960s, Britain sold Japan a MAGNOX reactor for its first nuclear power plant, Tokai. Some believe North Korea had secret agents within the Japanese nuclear community and thus obtained detailed information on the Japanese reactor's plans. In any event, North Korea's plutonium-producing reactor was first revealed to the US intelligence community in April 1982 via satellite imagery.

Unfortunately, the West's naiveté once again played into Pyongyang's hands. In 1989, the Americans discovered by satellite imagery that in the vicinity of the plutonium reactor a long, narrow structure was being built, the characteristics of which indicated that it was a "hot lab" with significant plutonium separation capacity. They found that this "hot lab" was quite similar to the Belgian Eurochemic facility for irradiated nuclear fuel reprocessing, near the town of Mol, in terms of building structure and the technological processes of separating irradiated nuclear fuel.

According to Western intelligence agencies, North Korean scientists had been able to get their hands on the specifications of the Eurochemic facility and implement them in the "hot lab" at Yongbyon, officially calling it a "radiochemical laboratory". It is estimated that this lab has the capacity to process spent fuel from MAGNOX reactors at an annual capacity of 200-250 tons and an extraction capacity of about 100 kgs of plutonium from the spent fuel.

During the second visit of Professor Hecker's delegation to the Yongbyon center's nuclear reactor in 2006, they were accompanied by its director, Dr. Ri Hong-Sop. When he showed them the plutonium reactor and the "radiochemical lab", he stated with pride that they had mastered the entire plutonium production cycle technology. Dr. Ri referred to the nuclear fuel fabrication facility for the Yongbyon plutonium reactor and said they were completing preparations for the facility's refurbishment, which was expected to reopen in 2007.

The exposure of Pyongyang's military nuclear program was accompanied by crises vis-à-vis the West, headed by the US and the IAEA. However, in 1994, in an effort to improve its unstable economy, Pyongyang reached an "Agreed Framework" with the US whereby it would freeze its military nuclear program and dismantle the plutonium production infrastructure. The plutonium reactor and “radiochemical laboratory” were shut down, though considerable uncertainty remains as to the amount of plutonium produced in 1986-94 in the plutonium reactor and subsequently separated.

In any case, this was not the end of North Korea's plutonium activity. In 2003, following its final withdrawal from the NPT, the plutonium reactor and “radiochemical laboratory” were reactivated.

North Korean zigzagging continued. In 2007, as a confidence-building measure, it demolished its 18m-high cooling tower, the prominent symbol of its plutonium project – but on April 25, 2009, Pyongyang announced the reactivation of the “radiochemical laboratory”. Additionally, following a further crisis with the West over its third nuclear test, Pyongyang announced in April 2013 that it intended to refurbish the reactor towards its reopening, which took place in September of that year. Satellite images indicate that the reactor was indeed operational at that time, though probably only sporadically, due to its obsolescence and to problems that appeared in the new cooling tower.

In June 2016, the IAEA assessed that North Korea was preparing to restart the plutonium reactor, the operations of which had been suspended since the end of 2015. According to *38 North*, between October 2016 and January 2017, satellite images revealed indicative signs. The channel in the Taeryong River leading to and from the reactor's cooling cisterns was re-dredged and cleared of ice. In a photo dated December 29, 2016, no snow could be detected on the roofs of the reactor or its auxiliary structures due to higher temperatures within them, in contrast to the snow that was piled up on the roofs of other buildings in the area – evidence of preparations for restarting the reactor.

Later, a satellite photo from January 22, 2017 showed an apparently warm water plume above the reactor's cooling water outlet, a probable indication that the reactor was in operation. Yet thermal satellite photos between September 2016 and June 2017 indicate that during those months, the plutonium reactor operated at a low level or not at all.

As for the “radiochemical lab”, in October-November 2016, a very high traffic level of railroad flatcars was detected in the vicinity of the reactor. This was in contrast to sparse traffic levels in the previous months of 2016 and in 2015 – and in December 2016, no railroad flatcars were seen at all.

This was an important finding. Some of the 14m-long flatcars carried huge casks, similar to those observed at the Yongbyon center in 2000, when spent nuclear fuel was unloaded from the reactor and transferred to the “radiochemical laboratory” for plutonium separation. The full explanation was revealed by the thermal satellite photos mentioned above. The “radiochemical laboratory” was reactivated during the September-June period, and at least two reprocessing campaigns of plutonium extraction were conducted from batches of the reactor's spent fuel.

The uranium enrichment program in North Korea began sometime in the mid-1990s in an exchange of information between Dr. Abdul Qadeer Khan, founder of the Pakistani nuclear program, and North Korea. Khan transferred to North Korea centrifuge technology for uranium enrichment in exchange for Nodong ballistic missile technology. At the time, two industrial-scale centrifuge models were operating in Pakistan: the P1, a first-generation centrifuge with a rotor of aluminum alloy; and the P2, with a maraging steel rotor, which is stronger and has a higher spinning velocity and therefore a greater yield than the P1.

As far back as the late 1990s, US intelligence suspected that a nuclear centrifuge enrichment program existed in North Korea, though the issue was not brought to light until October 2002. A month later, an unclassified CIA report to the US Congress stated, "North Korea's goal appears to be a plant that could produce enough weapons-grade uranium for two or more nuclear weapons per year when fully operational, which could be launched as soon as mid-decade."

Reportedly, due to the sanctions imposed on North Korea by the West, it had to use various schemes to carry out its procurement deals for the enrichment program, either directly with China or by using China as a transit point for purchased merchandise.

Only after its second nuclear test in 2009 did Pyongyang publicly announce that it would soon begin enriching uranium, which it claimed would be used as nuclear fuel for an experimental light water reactor (LWR) that was to begin construction after "a satisfactory success is achieved in the development of uranium enrichment technology." In fact, according to a *Washington Post* report at the end of 2009, Dr. Khan claimed that "North Korea began enriching uranium on a small scale from 2002, using 'maybe 3,000 or even more' centrifuges, through assistance from Pakistan for at least six years."

During the visit of Prof. Hecker and his delegation to Yongbyon in November 2010, the delegation was presented with the uranium enrichment facility at the nuclear center. Prof. Hecker was amazed by what he saw. "Instead of seeing a few small cascades of centrifuges, which I believed to exist in North Korea, we saw a modern, clean centrifuge plant of more than a thousand centrifuges all neatly aligned and plumbed below us … The control room was astonishingly modern … this control room would fit into any modern American processing facility." According to the chief engineer of the centrifuge plant, 2,000 centrifuges were installed in six cascades, all of which were manufactured in North Korea, according to the centrifuge types operating in Europe and Japan. Prof. Hecker noted that he understood from his hosts that the centrifuges in the facility were of the more advanced P2 type, intended for enriching uranium to 3.5%, a low enrichment level suitable for the production of nuclear fuel for an electricity-producing reactor.

Despite Pyongyang's declaration that its uranium enrichment program was intended to fuel power reactors, the Americans feared it had established a parallel clandestine centrifuge facility to enrich uranium to a weapons level. In August 2015, a significant upgrade of the uranium enrichment facility at Yongbyon was reported involving the construction of another centrifuge hall. Presumably, in view of the similarity between the latter and the centrifuge hall seen by the Hecker delegation in November 2010, another 2,000 centrifuges were installed in the new hall as well.

The new hall was seen in satellite images from early 2015 with an accumulation of melted snow around it. It can be concluded that a heat source operated within the hall, and therefore that the hall may already have been active. It should be noted that the thermal satellite images from September 2016 through June 2017 showed increased thermal activity in the Yongbyon uranium enrichment plant, though it is not clear whether this was due to centrifuge operations or maintenance operations.

Pyongyang claimed that its fourth nuclear test, conducted in February 2016, was thermonuclear. Although the international scientific community viewed this claim with skepticism, it is possible that there is indeed R&D activity in North Korea. According to a recent report by the Institute for Science and International Security (ISIS) in Washington, it is probable that a facility for the production of lithium-6 was set up near the town of Hungnam on the east coast of North Korea. Lithium-6 is a stable isotope found in natural lithium metal at an abundance of 7.5%. Its separation from lithium-7, the most abundant lithium isotope, is produced using a chemical enrichment process. Lithium 6 is used as an explosive material in thermonuclear weapons, or for the production of tritium (a radioactive isotope of hydrogen that is used to boost the yield of a nuclear bomb).

ISIS's assessment was based on North Korea's efforts to purchase equipment and materials in 2012, efforts that were apparently exposed when communication with its suppliers abroad was intercepted. Yet *38 North* experts did not locate in the thermal satellite images between September and June any activity in the isotope production facility at Yongbyon that is suspected of being involved in the production of tritium.

Finally, just as there is ambiguity about the extent of the efforts to produce fissile material in North Korea, there is uncertainty about its nuclear arsenal. Prof. Hecker estimated at the end of 2016 that the quantities of fissile material (plutonium and highly enriched uranium) that North Korea had accumulated were sufficient to produce about 20 bombs. At that time, ISIS Institute president David Albright put it between 13 and 30 plutonium and enriched uranium nuclear bombs, given that it was unclear whether North Korea operates one or two uranium enrichment facilities. He also estimated that North Korea was expanding its nuclear weapons stockpile by three to five bombs a year.

While Kim Jong-un desires his country's military aggrandizement and the preservation of his regime, he must be careful not to escalate too far in defying Trump, who is not Obama. Trump may well consider an American pre-emptive strike. It could be that it is caution about Trump, not technical difficulty, that has stopped Pyongyang from carrying out a nuclear test so far in 2017. With that said, the ambiguity of both North Korea's nuclear capability and Trump's "red line" are likely to aid Kim Jong-un in his brinksmanship.

As for Trump, he undoubtedly wants to maintain his credibility in a face-off with another outsized ego. But in light of the sometimes contradictory constraints imposed upon him by the complex international system, he must calibrate his "red line" on the North Korean nuclear issue. At the moment, his only response was his signing on August 2 of a sanctions bill that targets North Korea.

His future responses remain to be seen. The way things look on the road to the White House is not the way they look once you get there.

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