

Siegfried Hecker on the New Russia-DPRK Relationship and Nuclear Cooperation

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(Source: Korean Central News Agency)

On Sunday, Kim Jong Un [returned](#) triumphantly from a tour of Russia's Far East. That trip has almost certainly set the stage for dangerous changes in Northeast Asia.

Joel Wit, a Distinguished Fellow at the Henry L. Stimson Center, engaged Siegfried Hecker, former director of the Los Alamos National Laboratory, co-author of *Hinge Points: An Inside Look at North Korea's Nuclear Program*, and frequent contributor to 38 North, to look deeper into what should concern the United States about increased nuclear cooperation between Russia and the Democratic People's Republic of Korea (DPRK or North Korea).

Joel Wit: *What's your take on the new Russian-DPRK relationship and its implications for stopping the spread of nuclear weapons?*

Siegfried Hecker: Russia's actions since it invaded Ukraine 18 months ago have fractured what I call the [Global Nuclear Order](#). Russia has threatened to use tactical nuclear weapons to settle the war. It has taken the huge nuclear power complex in Zaporizhzhia hostage and trekked through the contaminated nuclear exclusion zone around the Chernobyl (Chernobyl) nuclear accident site. It has broken the security alliance system of the nonproliferation regime by trashing its promise to respect Ukraine's sovereignty given in the [1994 Budapest Memorandum](#), which had convinced Ukraine to relinquish the Soviet nuclear weapons it had inherited. These are bad omens for potential Russia-DPRK nuclear cooperation.

North Korea may offer Vladimir Putin armaments to deal with his current difficulties in the war. For Kim Jong Un, it looks like an important step toward his new strategy of alignment with Russia and China while [giving up on the US](#). However, Kim providing armaments to Putin to prolong the war and kill more innocent Ukrainians will surely find him on the wrong side of history.

JW: *The North Koreans have reported at length Kim's stops during his week-long trip to the Russian Far East, including meetings with President Putin and Minister of Defense Sergei Shoigu, touring space and*

military manufacturing facilities, and viewing advanced Russian military aircraft and warships. There is considerable speculation, seemingly supported by the itinerary, that Kim seeks high-tech space and missile technology. You have followed the North's nuclear and missile programs closely over the past two decades. What does Pyongyang need, and what do you think Moscow would be willing to provide?

SH: Although there is no reporting from the trip that either side raised the subject of the North's nuclear weapons program, in my view, that should be very much of concern. Let me begin with what North Korea might think it needs to further develop its nuclear program, which is already quite advanced after six nuclear tests beginning in 2006. Once we examine that, we can come back to what Moscow may be willing to provide and what, if anything, we could do to prevent it.

JW: Are you concerned that Russia may provide direct assistance to the North's nuclear program?

SH: Yes. My concerns have increased greatly with the changes seen in both countries during the past two years. North Korea appears to have made the fundamental policy change to seek strategic alignment with Russia and China around the beginning of 2022, abandoning its 30-year policy of seeking normalization with the United States. Russia's unprovoked invasion of Ukraine on February 24 of that year and its subsequent depiction of its drawn-out war being in defense of Russia against the hegemonic United States, assisted by the North Atlantic Treaty Organization (NATO), has dramatically changed how we must view Russia. I am afraid anything is possible now.

JW: With North Korea's nuclear program being quite advanced already, how could Russia assist the North?

SH: I like to describe nuclear weapons programs in [three parts](#): production of bomb fuel, weaponization and delivery systems (together with command and control). Today, the size of North Korea's nuclear arsenal is limited by the amount of bomb fuel—that is plutonium and highly enriched uranium for fission bombs and tritium (heavy hydrogen) for hydrogen bombs. It's quite remarkable that the North has only a tiny inventory of roughly 50 kilograms of plutonium (it takes around six kilograms for a bomb), some 37 years after it began to produce it in its small 5 MWe Plutonium Production Reactor. Earlier this year, Kim Jong Un called for an *exponential* increase in its nuclear arsenal, specifically calling for expanded fissile materials production.

JW: Why doesn't North Korea just ramp up plutonium production?

SH: It doesn't have that capacity now, and it takes a long time to develop new capabilities. Plutonium is produced in nuclear reactors. The only operating nuclear reactor the North has is the small 5 MWe Reactor. It has been operating intermittently since 1986 and is operating now. However, it can, at best, produce six kilograms per year. During my last visit to the Yongbyon nuclear complex in November 2010, they showed my Stanford University colleagues and me the construction start of an experimental light water reactor (ELWR). That reactor was likely intended as a prototype for an electricity-producing reactor, but it could be repurposed to produce plutonium. However, 13 years later, it is still not operational. Yongbyon also houses the small IRT-2000 research reactor built by the Soviets in the 1960s, but it has operated only sparingly since the collapse of the Soviet Union because of the lack of fresh reactor fuel.

JW: So, how could Russia assist North Korea with plutonium supply?

SH: For the longer term, Russia could help North Korea get the ELWR operational. It could justify that as helping the North with peaceful electrical power generation. North Korea could then repurpose it for plutonium production. Russia could also supply fresh fuel for the IRT-2000 reactor, which could provide a small amount of plutonium (as well as tritium—I'll come back to that later).

For the shorter term, what concerns me most is Russia clandestinely supplying plutonium directly. To put matters in context, the Soviet Union likely produced around 125,000 kilograms of plutonium over the years. After its demise, Russia declared 35,000 kilograms as excess in a bilateral plutonium disposition program with the United States. The disposition agreement fell apart along with most other US-Russian nuclear accords. Much of Russia's plutonium resides in the Fissile Materials Storage Facility (which the Americans helped finance in order to improve the security of Russia's fissile materials).^[1] There are no technical hurdles to shipping 100 or even 1,000 kilograms of plutonium from that facility to North Korea. Needless to say, that would allow North Korea to “exponentially” increase its nuclear arsenal.

JW: *What about highly enriched uranium (HEU)?*

SH: North Korea is in better shape with HEU, although how much it has is highly uncertain. I believe our plutonium estimates are quite good because I have been able to see their plutonium facilities, and we can tell when the reactor is operating from commercial satellite imagery. Uranium enrichment facilities are easy to hide and have few signatures of operation. The North Koreans did show us a surprisingly modern centrifuge facility during our 2010 visit to Yongbyon. I concluded then that they must have other facilities, but we don't know how many or where they are. I have previously estimated that their total—Yongbyon plus covert facilities—production capacity is about 150 kilograms (roughly six bombs' worth) per year. I estimate that the North may have as much as 1,200 kilograms, but it could be higher.

JW: *With that much HEU, why would North Korea need more plutonium? Does Russia also have an excess of HEU?*

SH: Plutonium is a much more potent bomb fuel—especially for miniaturized warheads that could be mounted on an intercontinental ballistic missile (ICBM), particularly if that warhead is a hydrogen (two-stage thermonuclear) bomb. Such warheads may have a plutonium first stage that is boosted with tritium to set off the fusion second stage. North Korea [claims](#) to have detonated a hydrogen bomb in September 2017. In fact, it featured what it [called](#) a “two-stage thermonuclear” bomb in its news release.

Russia's stockpile of HEU is enormous. It likely had produced 1.4 million kilograms of HEU during Soviet times. In fact, as part of US-Russia nonproliferation cooperation, Russia sold 500,000 kilograms of HEU to the United States after downblending HEU to low-enriched uranium (LEU) reactor fuel, which has produced a lot of electricity here. So, supplying a few thousand kilograms to North Korea would hardly make a dent in Russia's inventory.

JW: *Does North Korea have a supply of tritium for hydrogen bombs?*

SH: Tritium, like plutonium, is produced in a nuclear reactor. North Korea has the capability to produce tritium but likely has a very small stockpile—enough for only a few hydrogen bombs. Making tritium in its reactors competes with making plutonium. Besides likely having only a small amount, tritium must be replenished regularly because its half-life (the time for half of it to transmute to helium) is only 12.3

years. This is another area where Russia could be of great help to North Korea. Russia has a large tritium stockpile and the ability to replenish it.

***JW:** What about assistance with weaponization—what you have defined as designing, building and testing nuclear weapons?*

SH: Although North Korea has demonstrated that it can design and build nuclear devices (most likely both fission and fusion bombs), as demonstrated by its six nuclear tests, there could be a lot to learn from the Russians. After all, they have been at this since the late 1940s and have conducted 715 nuclear tests (I should note that the United States has conducted 1,054 such tests). They have built many thousands of nuclear devices. Its nuclear stockpile maxed out at 41,000 in the mid-1980s.

***JW:** What particularly concerns you about weaponization?*

SH: I don't think the North Koreans have yet demonstrated the ability to mount a nuclear warhead on an ICBM and deliver it to mainland America. I am concerned that the Russians may share some design information and nuclear test data to help them get there more quickly. Moreover, the Russians have designed and tested just about every nuclear weapon that can be conceived.

The ones that concern me the most at this time are tactical (non-strategic) nuclear weapons. The Russians still have a stockpile of nearly two thousand of these. They also have a strategy to use them in regional conflicts—which is a great concern as we watch the Ukraine crisis continue and the Russians threatening to use nuclear weapons. In discussions with Russian counterparts during my many visits to Russia over the years, they talked about their design and test experience with peaceful nuclear explosives (PNEs), which share some of the same requirements one would want from a tactical nuclear weapon. Since these tactical weapons are theater weapons used in close proximity to your own territory, you want them to be of lower yield and relatively clean—meaning low radiation levels, just as if you were using them for peaceful purposes like oil and gas fracking or earth excavation.^[2] The Russians conducted some 29 PNEs during Soviet times. That information could be very useful to the North Koreans.

***JW:** That's really disconcerting. How realistic is such cooperation? But first, why not finish the third leg—delivery systems?*

SH: I'll be brief. Missile delivery is the one area in which the Russians have provided the greatest help to the North, going back to the Soviet days. The early North Korean missiles, namely the Scud and Nodong short and medium-range missiles, are copies of Soviet designs. After the breakup of the Soviet Union, both Russia and Ukraine sold missile technologies to the North. It appears that Russia has continued some form of assistance over many years.

The North Koreans have made remarkable progress in missile technologies during the past decade, including launching two solid rocket motor ICBMs earlier this year. Yet, to master these technologies takes much more experience—and the Russians have it. They could significantly assist the North Koreans, especially since the North has launched all of its longer-range missiles in lofted trajectories to keep them close by and be able to monitor them. Moreover, North Korea has no test data on realistic reentry conditions for its missiles. The Russians have plenty.

It's possible that the Russians may also share rocket and satellite technologies for military surveillance from space. They may also share technologies for the other two legs of the triad of delivery systems, namely submarine-launched ballistic missiles (SLBMs) and air-delivered (either gravity bombs or cruise missiles).

***JW:** How realistic is it that Russia would help North Korea in any of these areas? They all violate various United Nations Security Council resolutions.*

SH: That won't stop Putin and the Russian government. Foreign Minister Sergey (Sergei) Lavrov said just the other day that those sanctions were imposed during very different geopolitical times, implying they are no longer relevant. I don't think additional sanctions would stop the Russians. I think a greater impediment to such transfers of materials, equipment and know-how is the Nuclear Nonproliferation Treaty (NPT). The Soviet Union and Russia had been responsible nuclear states and supporters of the NPT since it entered into force in 1970 up to the invasion of Ukraine.

***JW:** So, what if Russia just eased into providing assistance by starting with dual-use technologies under the guise of civilian nuclear assistance?*

SH: That's the most likely way it may proceed. For example, it could help the North complete the ELWR, as I mentioned previously. It could help get the IRT-2000 back into operation. On the uranium front, it could supply the North with tons of LEU, claiming that it would be for ELWR fuel for electricity production. The North Koreans could then readily up the enrichment to weapons grade since LEU gets you about halfway there in terms of effort required. It could also start on the civilian front with help in space programs—satellite launch services and help with rockets. In all of these areas, the Russians could claim they'll closely monitor to make sure the North uses these only for civilian programs—but that will ring pretty hollow to me.

***JW:** If Washington objects, couldn't Moscow just point the finger back at Washington, saying that it has given similar questionable assistance, as in the case of the India deal?*

SH: I imagine it would since the US dropped the sanctions it had applied to India after its 1998 nuclear tests. In 2005, the George W. Bush administration agreed to assist India with its civilian nuclear program and support its application to the Nuclear Suppliers Group despite India having declared itself a nuclear weapon state.

***JW:** If increased sanctions are not going to stop Russia from either the dual-use transfers or the more serious direct assistance with the North's nuclear program, what's to be done?*

SH: The best bet is to alert China and the rest of the global community to the dangers of the new Russia-DPRK relations moving in this direction by pointing out the dangers, not only for Northeast Asia, but for the world. What I have outlined would be egregious violations of the nuclear nonproliferation regime and responsible nuclear statehood. China can't possibly want such a dramatic nuclear escalation—one that might spark a greater push for South Korea and Japan to build their own nuclear forces. And beyond the region, a completely fractured nonproliferation regime that could make others, such as Iran or Taiwan, become instant nuclear weapons states has to frighten China and the rest of the world. Perhaps these concerns could even awaken the Global South, which has been sitting mostly on the sidelines watching the Ukrainian crisis, to dissuade Russia from assisting the North's nuclear program.

1. [1]

Siegfried S. Hecker, ed. *Doomed to Cooperate: How American and Russian Scientists Joined Forces to Avert Some of the Greatest Post-Cold War Nuclear Dangers* (Los Alamos: Bathtub Row Press, 2016), https://www.losalamoshistory.org/store/p265/Doomed_to_Cooperate.html.

2. [2]

Siegfried S. Hecker, ed. *Doomed to Cooperate: How American and Russian Scientists Joined Forces to Avert Some of the Greatest Post-Cold War Nuclear Dangers*, https://www.losalamoshistory.org/store/p265/Doomed_to_Cooperate.html.