Assessing North Korea's Nuclear Deterrent and Its Implications

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Introduction

The Democratic People's Republic of North Korea's (DPRK) continued defiance of UNSC resolutions and sanctions has intensified international condemnation of its behaviour. Furthermore, the rapid growth of its nuclear and missile programmes has alarmed South Korea, Japan and the US. Notwithstanding its trade relations with the country, China has also expressed concerns about the North's provocative actions in the region. In February 2017, China condemned Pyongyang's January and September 2016 nuclear tests and several missiles launches, suspending its coal imports from the country.[1] Responding to the incident, North Korea said that the ban would have very little effect on its economy and the country would not stop its nuclear and missile programme.[2] Heightened tensions on the Korean Peninsula have prompted the US and its allies to review their respective security policies.[3] The US began deploying its Terminal High Altitude Area Defence (THAAD) system in South Korea on March 6, 2017, to provide the South with the capability of intercepting ballistic missiles coming from the North.[4]

Despite international opposition and imposed United Nations Security Council (UNSC) sanctions on the country, North Korea continues to develop its nuclear programme both qualitatively and quantitatively.[5] DPRK conducted tests of its nuclear explosive devices in 2006, 2009, 2013 and twice in 2016. The country is capable of enriching uranium and producing weapons-grade plutonium. In its fourth nuclear test, conducted on

January 6, 2016, North Korea claimed that it had conducted a thermonuclear or a hydrogen bomb test.[6] However, international nuclear experts rejected the claim and called it a 'boosted nuclear device test.'[7] On September 9, 2016, North Korea conducted a fifth nuclear test. Following the test, the South Korean Defence Ministry and Meteorological department recorded an earthquake of magnitude 5.3.[8] Based on this figure, nuclear experts suggested that the yield of the nuclear explosion was between 10 to 12 kilotons,[9] a yield larger than all the previous nuclear tests conducted by the country. North Korea claimed that its latest test had been a nuclear warhead miniaturised enough to fit on a ballistic missile.[10] North Korea's delivery systems have also been developing slowly, albeit with some failures.[11]

As the situation on the Korean Peninsula has become intractable, uncertainty regarding North Korea's nuclear and missile programme has increased especially after it claimed miniaturisation of its nuclear warheads and the development of an intercontinental ballistic missile (ICBM). This study is an assessment of North Korea's nuclear and missile capabilities. It will review both the programmes separately identifying relative advancements in both. It would also identify regional implications of North Korea's developing nuclear deterrent and international responses and policies towards it. It will examine the following questions: What sort of advancements has North Korea achieved in its nuclear and missile programme? Has North Korea attained the ability to miniaturise a nuclear warhead small enough to be mounted on a ballistic missile? Is North Korea capable of successfully launching an ICBM? What are the regional implications of North Korea's nuclear deterrent?

The conduct of this study will mostly rely on secondary sources as DPRK does not release official documents pertaining to its nuclear and missile programme. The country's official statements and its stance on major issues will be collected from its state-run media agencies including the Korean Central News Agency (KCNA) because North Korea engages with the outside world through its state-run media outlets.

Brief History of North Korea's Nuclear Programme

North Korea's nuclear programme originated with the development of its Atomic Energy Research Institution in 1952. The country's nuclear programme accelerated with technical assistance provided by the Soviet Union. In 1959, North Korea signed an agreement with Soviet Union on the peaceful use of nuclear energy that included a provision for Soviet help to establish a nuclear research complex in Yongbyon, in North Pyongan Province.[12] During the 1960s Soviet Union provided extensive assistance for the construction of the Yongbyon Nuclear Research Centre, the IRT-2000 nuclear research reactor[13] and associated facilities.[14] During the 1970s, North Korea began to acquire plutonium reprocessing technology from the Soviet Union. In July 1977, North Korea signed a trilateral safeguards agreement with the International Atomic Energy Agency (IAEA) and the Soviet Union that brought the IRT-2000 research reactor and a critical assembly in Yongbyon under IAEA safeguards. The Soviets were included in the agreement because they supplied the reactor's fuel.[15]The North Koreans received training in these facilities and acquired education in nuclear technology which ultimately enabled them to launch a nuclear programme without external assistance.[16]

Though during the initial stages the Soviet Union assisted North Korea, the country soon significantly expanded its nuclear programme without foreign assistance by expanding its indigenous educational and research institutes.[17] North Korea's indigenous development of its nuclear capabilities was consistent with the idea of self-reliance, the Juche Ethos. Kim Il Sung regime's Juche thesis emphasised on independence from great powers, reliance on national resources and strong military posture.[18] North Korean engineers used indigenous technology to expand the IRT-2000 research reactor.[19] By the 1980s North Korea also began an ambitious programme to build national nuclear power industry. The programme was aimed at constructing gas-cooled, graphite-moderated reactors. Under that programme, North Korea started constructing significant facilities including uranium milling facilities, fuel rod fabrication complex, and a 5 megawatt-electric (MWe) gas graphite experimental nuclear reactoranda larger 50 MWe nuclear power reactor at Yongbyon, and a full-scale 200 MWe power reactor at Taechon.[20] The 50 MWe reactor became operational in 1986 while the other two reactors have not been fully constructed until now. The 5 MWe reactor was well suited for the production of nuclear weapons because they used natural uranium as fuel. As the reactor did not require enriched uranium, for which materials and technology had to be imported, it allowed North Korea to indigenously produce nuclear fuel for nuclear weapons.[21] The country also built a large-scale reprocessing facility to extract plutonium from spent fuel.[22] These facilities were operating without being inspected by IAEA because North Korea was not a party to Nuclear Non-proliferation Treaty (NPT). Meanwhile, North Korea also began negotiations with Soviet Union for building four 440 MWe Light Water Reactor (LWR) in order to meet energy deficits. In 1985, North Korea became a party to NPT, because Soviet

Union made the demand for the construction of the reactors contingent upon joining the treaty.However, the DPRK did not sign the safeguards agreement with the IAEA. Following the disintegration of Soviet Union, Russia cancelled the construction of the reactors in 1992.[23] Until 1992, North Korea's 5 MWe reactor had not only produced electricity but also 6 kg of weapons-grade plutonium per year.[24]

North Korea signed an IAEA safeguards agreement on January 30, 1992 and provided the organisation an initial declaration of its nuclear facilities and materials, and access to IAEA inspectors to verify the completeness and correctness of its initial declaration.[25] The inspections began in May 1992 and concluded in February 1993 during which the IAEA discovered that North Korea had diverted plutonium from its civilian programme for weapons purposes. The IAEA also requested inspections of the waste sites but North Korea denied access declaring those sites as military facilities. In 1993, North Korea finally announced its withdrawal from the NPT.[26] To prevent the country from doing so, the US started bilateral negotiations and North Korea announced it was suspending its withdrawal from the NPT one day before the withdrawal was to take effect. While talks continued with Washington, Pyongyang agreed to suspend its withdrawal but claimed to have a special status with regard to its nuclear safeguards commitments.[27] Under the special arrangement North Korea refused to allow IAEA to carry out inspections of its past nuclear activities. It, however, allowed inspections of its activities at that time.[28]

The negotiations resulted in the US-North Korean Agreed Framework in 1994, under which the latter committed to freezing its plutonium-based weapons programme at Yongbyon in exchange for two light-

water reactors and other forms of energy assistance provided by the US, South Korea and Japan. North Korea halted the operation of a 5 MWe reactor, fuel fabrication plant and the reprocessing facility under the supervision of IAEA stipulated by the Agreed Framework. The DPRK also halted the construction of large power reactors. Even as the Agreed Framework suspended North Korea's plutonium programme for almost a decade, neither party was completely satisfied with its commitments and implementation procedure. The US 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 light water power reactors.[29]

By 2002, the US began suspecting North Korea of pursuing a uranium enrichment programme as an alternative path to nuclear weapons. These activities were also considered against the spirit of earlier Joint Declaration of South and North Korea on the Denuclearisation of the Korean Peninsula,[30] under which both the countries had agreed not to receive, produce, test, deploy or use nuclear weapons.[31] The US State Department claimed that North Korean officials admitted to having a nuclear weapons programme.[32] However, North Korea rejected the claims arguing that it had only admitted to having a plan to produce nuclear weapons for self-defence.[33] These conflicting arguments ultimately led to the collapse of the Agreed Framework. The US cancelled heavy oil shipments to North Korea and the latter responded by lifting the freeze on its nuclear facilities, expelling IAEA inspectors monitoring that freeze, and announced its withdrawal from the NPT on January 10, 2003.[34]

Following North Korea's withdrawal from the NPT, the US intelligence services indicated that North Korea was

reprocessing 8000 spent fuel rods[35]. This indication was later confirmed when the North Korean foreign ministry spokesman said in September 2003 that the DPRK has completed the reprocessing of spent fuel rods and it gave the country plutonium enough for four to six nuclear devices[36]. However, to resolve the issue Six-party Talks were initiated in August 2003 between Russia, China, Japan, the US, South Korea and North Korea. The talks initially failed in ending the North Korea's nuclear programme[37]. However, North Korea signed the 'Statement of Principles' during the fourth round of the talks in September 2005 under which it agreed to abandon its nuclear weapons programme and return to the NPT.[38] It was considered as breakthrough by some parties as North Korea would abandon its nuclear programme and would fully implement the IAEA safeguard regime. However, North Korea and the US failed to implement the agreement owing to the disagreements over LWR transfer to the North.[39] Meanwhile, the US designated Banco Delta Asia (BDA), a small Macanese bank holding DPRK accounts, as an institution of money laundering, accusing it of assisting the North in its illicit trade. North Korea responded by asserting that it would not carry out its obligations under the agreement until sanctions were lifted. These disagreements halted the implementation of September 2005 Agreement.[40]

Amid continued disagreements over the Six-party Talks over the implementation of the Statement of Principles, North Korea conducted its first nuclear test on October 9, 2006.[41] In response, the UNSC adopted resolution 1718 and imposed sanctions on the country[42]. After the nuclear explosion, the Six-party participants once again started efforts to resolve the tensions created by the test on the Korean Peninsula. In February 2007, the six parties agreed on the initial action plan detailing steps to

implement the September 2005 Joint Statement. North Korea agreed to disable its plutonium-production programme at Yongbyon and provide full accounting of all its nuclear activities. In exchange for these actions, North Korea received the remaining energy aid as had been agreed upon. The US also removed North Korea from its list of state sponsors of terrorism and stopped applying the 1917 'Trading with the Enemy Act' against Pyongyang.[43] North Korea started closing its nuclear facilities and resumed its relations with IAEA by extending invitations to its inspectors. Meanwhile, member countries of the Six-Party talks framed a Second Action Plan, calling upon the DPRK to submit a complete and correct declaration regarding its nuclear programme by December 31, 2007. However, North Korea failed to submit the declaration, paving the way for suspicions and distrust amongst the rest of the countries.[44]

Six months later in July 2008, North Korea submitted its declaration in July 2008. The contents of the declaration were not made public and failed to comprehensively address the country's uranium enrichment programme.[45] The talks resumed in 2008 on verification plans regarding North Korea's nuclear programme but failed to reach an agreement.[46] Furthermore, North Korea's failed April 2009 satellite launch initiated a new controversy and was met with UNSC condemnation.[47] The UN urged North Korea not to conduct any further launches using ballistic missile technology. North Korea responded strongly to this by restarting its plutonium production and by withdrawing from the six party talks.[48] North Korea then conducted its second nuclear test on June 25, 2009[49] with the underground detonation of a nuclear device having an estimated yield of 4 kilotons[50]. The UN Security Council responded with Resolution 1874, further intensifying sanctions on Pyongyang.[51]

In March 2010, North Korea announced that it was running a large uranium-enrichment plant and constructing a light-water reactor (LWR) at Yongbyon[52]. The plant contained approximately 2,000 gas centrifuges that were allegedly operating and producing low-enriched uranium (LEU) for a light-water reactor (LWR) that North Korea was constructing.[53] However, following the Kim Jong Il's death in December 2011 North Korea again showed a willingness to restart the Six-party Talks and announced a moratorium on nuclear testing, uranium enrichment, and long-range missile tests on February 29, 2012 in exchange for food aid.[54] Notwithstanding its promise, North Korea launched an Unha rocket with an aim to place a satellite in space on April 12, 2012. The multi-stage rocket failed to achieve its target and blew up after less than two minutes of its flight and crashed in the Yellow Sea.[55] In response, the US withdrew its food aid to the country and called the North's satellite launching attempt a violation of UN resolutions 1718 and 1874 that had restrained the country from testing long-range rockets. On December 12, 2012, North Korea claimed that it successfully launched a satellite into space using an Unha-3 rocket.[56] It appeared similar to the rocket used in the April 2012 failed launch. The UN Security Council passed Resolution 2087 on January 22, 2013 in response to North Korea's satellite launch, saying that Pyongyang's actions violated resolutions 1718 and 1874 because the technology required for a satellite launch has applications to ballistic missile development. Resolution 2087 strengthened existing sanctions against North Korea[57]. On February 12, 2013, the Korean Central News Agency announced that the country had successfully detonated a nuclear device at its underground test site.[58]

Advancements in North Korea's Nuclear and Missile Programme

The expansion of North Korea's nuclear and missile programme became possible with the launching of Kim Jong Un's "Byungjin" strategy, meaning parallel development. This policy sought both economic and nuclear development for the country. During the plenary session of the Party Central Committee on March 31, 2013, Kim had announced his Byungjin strategy as a transition from his father's "Songun" (military first) strategy.[59] The Songun policy gave top priority to the Korean People's Army in running the affairs of the state. The reason behind designating KPA as 'supreme repository of power' was to strengthen the North Korea military. However, Kim found Songun strategy as being costly and ineffective in terms of economic affairs of the country. The implementation of the Byungjin strategy led to the formulation of agricultural and labour reforms that positively impacted the economic growth of the country.[60] It also renewed focus on the development of the nuclear deterrent, as the earlier Songun policy had its focus entirely on military development which required greater budget allocations. Since 2013, the world has witnessed the effectiveness of Byungjin policy with the demonstration of two nuclear tests and several missile tests in 2016 despite crippling sanctions[61]. Advancements in North Korea's nuclear and missile programmes are discussed in the subsequent paragraphs.

Nuclear Programme

As North Korea maintains a high level of secrecy regarding its nuclear programme, determining the country's technological sophistication, stocks of plutonium and uranium and number of nuclear weapons is difficult. Information on stockpiles and nuclear

weapons depends upon various estimates that are derived from the country's released declarations, IAEA inspections, and various other experts and institutions working on it.

In 2008, for example, North Korea had declared it had 30 kg of weapon-grade plutonium extracted from spent fuel.[62] However, other estimates suggest that North Korea is in possession of 34 to 50 kg of plutonium enough for six to eight nuclear weapons.[63] The country is also capable of enriching uranium. Its uranium enrichment facility at Yongbyon nuclear complex has 2000 or more P2-type centrifuges and the country has an HEU stockpile enough for producing 4-8 nuclear weapons.[64] These estimations show that the DPRK has attained self-sufficiency in every stage required for the making of nuclear weapons and has developed a complete nuclear fuel cycle capability. On the basis of aforementioned calculation regarding North Korea's plutonium and uranium programme, it is estimated that the country's arsenal comprises 10 to 16 nuclear weapons.[65]

Plutonium Programme

North Korea's 5 megawatt-electric (MWe) gas graphite experimental nuclear reactor at Yongbyon started operation in 1986 and the country's reprocessing plant to separate plutonium from the spent fuel began operating by 1990. During the same year North Korea started working on the construction of two larger gas graphite reactors including one 50 MWe at Yongbyon and other 200 MWe at Taechon, 25 kilometres north of yongbyon.[66] North Korea froze its 5 MWe reactor, reprocessing facility and construction on two larger reactors as result of its negotiations with the US that led to Agreed Framework of 1994. By 1994 DPRK had reprocessed

some 10 of plutonium that is considered to be enough for one or two crude nuclear weapons.[67]

In 2002, the Bush administration accused the DPRK of secretly enriching uranium and tension escalated on the Korean peninsula. The DPRK denied the accusations and suspended its freeze on its 5 MWe reactor and started reprocessing spent fuel rods to produce plutonium. However, construction work on the two larger nuclear reactors did not resume.[68] North Korea's reactor and separation plant again shut down by the country after the agreement reached at Six-party Talks in 2008. At that time, the core of the reprocessing plant had estimated 8 kg of plutonium which was not separated. Owing to lack of trust on verification procedures, these talks collapsed in 2009 and DPRK resumed its separation plant to reprocess stock fuel.[69] The 5 MWe reactor was reopened in 2013.[70] Satellite imagery revealed that the reactor was operational. However, it worked sporadically due to problems at reactor's new cooling system.[71]

As part of North Korea's declaration in 2008, the country had notified that it possesses 30 kg of plutonium stockpile. If one adds the 8 kg of plutonium which was intact in the core in 2008, it would make the amount of total plutonium stockpile about 38 kg.[72] According to the Institute of Science and International Security (ISIS), assuming that North Korea used 2-4 kg of plutonium in its 2006 and 2009 nuclear tests, it would leave 30 to 32 kg of plutonium in its possession.[73] In February 2013, DPRK conducted its third nuclear test that had a slightly higher yield than the previous two tests. However, it is not clear whether that test was fuelled by plutonium or uranium.[74] In 2014 and 2016, ISIS reported that 5 MWe reactor was operational. IAEA also reported in 2016 that the reactor was operational and unloaded its spent fuel

for reprocessing. In this case, 8 kg more of plutonium could have been added to DPRK's plutonium stockpile.[75]

North Korea had also announced the construction of a 25 to 30 MWe Light Water Power reactor (LWR) at Yongbyon in 2009. The construction work was also shown to a team of experts from the US in 2010. By 2014, the exterior construction was completed by DPRK, however, it is not yet operational.[76]

Uranium Enrichment Programme

Parallel to its plutonium programme, the DPRK was also working on its uranium enrichment programme. During the 1990's the US suspected the country of running a separate uranium enrichment facility. However, DPRK denied working on such a programme.[77] The country itself did not mention about its uranium programme when it submitted its 2008 declaration about its nuclear programme.[78]

However, in 2009, the DPRK announced that it had been successful in developing uranium enrichment technology to produce fuel for its Light Water Reactor (LWR).[79] A US delegation visited the facility in 2010 at Yongbyon and found it operational enriching uranium at 3.5% and contained 2000 centrifuges.[80] Satellite imagery showed that North Korea's LWR facility was considered to be expanding in 2013. The expansion of the facility implied that it might have added 2000 more centrifuges.[81] With uncertainties regarding the operational history of the facility, number of centrifuges, and technical barriers in uranium enrichment, international experts have made two estimates regarding the DPRK's HEU stockpile. One estimate suggests that the country is producing 17 kg of weapon-grade uranium per year with 1000

centrifuges while other estimating suggest the production 4 kg weapon-grade uranium per year with 1000 centrifuges, in case of less efficient enrichment process.[82]

Nuclear Tests and Miniaturisation

North Korea conducted five nuclear device tests in 2006, 2009, 2013 and twice in 2016 at its Punggye-ri testing site. Its first two tests of nuclear devices were based on plutonium and had yields of less than 1 kiloton and 2-7 kiloton respectively.[83] In its 2008 declaration, North Korea had announced that it had used 2 kg of plutonium for its nuclear device tested in 2006. Analysts believe that use of less quantity of plutonium and low yield of DPRK's first two tests indicates that the country may have tested sophisticated implosive devices. Such tests are used for developing miniaturised nuclear warheads.[84]

However, the yield of its third nuclear test was relatively higher than its earlier two tests with 5-10 kiloton yield, notwithstanding uncertainty regarding the fuel of nuclear device. Analysts believe that it was a uranium based device as DPRK had a very limited quantity of plutonium stockpile.[85]

On January 6, North Korea announced that it has successfully detonated a thermonuclear device (Hydrogen bomb or H-bomb).[86] Kim had already made claims of conducting such a test early in December 2015.[87] Both the US and South Korea collected the seismological data. The US Geological Survey had registered a 5.3 magnitude of earthquake. However, international experts doubted the North's claim given the low magnitude of the test.[88] The magnitude of the test indicates that its yield was around 10 to 12 kilotons. Though the technical nature of DPRK's fourth test remains a mystery, its

claim should not be taken lightly. Based on the study of the test, experts have drawn different conclusions. Most of the experts believe that North Korea had conducted a boosted-fission device test that contains high level of efficiency.[89] Some experts called it a miniaturised version of the 2013 nuclear device, since the North is working on miniaturisation of the nuclear device.[90] Further, assuming that DPRK has conducted a H-Bomb test, experts have also said it is possible that the country has somehow managed to produce a single-stage H-Bomb, which is easier to achieve than a two-stage H-Bomb. Another speculation was that the country may have aspects of such a one-stage H-Bomb, which is called the ignition of H-bomb in a predominately fission nuclear explosion.[91] However, it is difficult to decide anything regarding the North's claims, unless a radionuclide monitoring captures particles in the atmosphere for the analysis, which did not occur at those early days of the test.[92]

On September 9, 2016, North Korea conducted its fifth nuclear test.[93] While confirming its nuclear device explosion, the DPRK claimed that it had built a nuclear warhead miniaturised enough to fit on a ballistic missile. The country also warned its enemies that it had the capability of retaliating against any attack.[94] This time the US Geological Survey recorded a 5.3 magnitude of earthquake. Experts estimated that the test had a yield of 15 to 25 kilotons, larger than all the previous tests.[95]

On the basis of the two nuclear tests in 2016, international experts concluded that the DPRK has managed to produce miniaturised nuclear warheads able to be mounted on the country's short, medium and intermediate-range ballistic missiles.[96] A team of nuclear experts at ISIS said that North Korea had already miniaturised a warhead.[97] Even a South Korean Defence

White Paper of 2014 had indicated that the North's ability of miniaturising a nuclear warhead had made considerable strides.[98] In March 2016, North Korea released photographs of Kim examining what the DPRK claimed to be a miniaturised nuclear implosive device.[99]

The increased sophistication of North Korea's programme has raised several questions not only about the fate of security conditions on the Korean peninsula but also regarding the denuclearisation of North Korea. Since the inception of DPRK's nuclear programme, the international community has tried hard to roll back the country's nuclear. The Agreement Framework, Six-party Talks and sanctions enabled the international community to attain some sort of success in slowing down the North's nuclear programme, it could not achieve complete denuclearisation.[100] At present, the DPRK has achieved significant advancements in its nuclear programme including the miniaturisation of its nuclear warhead and detonating a nuclear device having a yield of 15 to 25 kilotons equivalent to the explosive power of nuclear bombs dropped by the US on Hiroshima and Nagasaki in Japan in 1945[101]. With such advancements, it is very difficult to convince or force the country to roll back its nuclear programme. Moreover, Siegfried Hecker,[102] a professor at Stanford University's Centre for International Security and Cooperation, believes that the US cannot destroy North Korea's nuclear arsenal even with pre-emptive strikes. It is impossible to trace all of nuclear warheads. Even if the US succeeds in locating a few of the country's nuclear weapons, it would be difficult to destroy them without detonating them and causing a mushroom cloud over the Korean peninsula. Apart from destroying nuclear devices, there are fewer chances for the US to eliminate all of North Korea's nuclear material, missile launch sites, nuclear test tunnels because the country has road-mobile launchers and

submarine launched missiles which cannot be located accurately and reliably.[103]

North Korea's expansion of its nuclear programme to the extent where it cannot be neutralised with a pre-emptive strike is a major leap forward for the country thus transforming the thinking of the country's leadership regarding nuclear weapons. During the reign of Kim Jong Il, the DPRK tried to get diplomatic benefits with its growing nuclear programme. However, with Kim Jong Un in office, North Korea has shifted the goal of its nuclear programme from diplomatic benefits to attaining a true nuclear deterrent in order to enhance its security against the US and its allies. North Korea considers its nuclear forces the 'treasured sword' for defending the country from the US threats and blackmailing.[104]During a speech at the First Committee of the 71st UN General Assembly on October 6, 2016, officials from DPRK maintained that the country had no other choice but to make the strategic decision of acquiring and retaining nuclear weapons to counter the US. They noted that it was the unswerving stand of the DPRK to rely on its powerful nuclear deterrent and fundamentally remove the danger of a nuclear war being imposed by the US.[105] Based on these arguments, North Korea strongly rejects the notion of its voluntary and unilateral denuclearisation. North Korea calls US and South Korean measures aimed at its voluntary denuclearisation as "silly and useless." However, the country has not out rightly rejected the possibility of its denuclearisation. The DPRK's principle stance towards denuclearisation is that it must applied to the whole Korean peninsula and its vicinity. The country maintains that its denuclearisation entirely hinges on the attitude of the US and South Korean authorities.[106] The DPRK clarified on its denuclearisation during the 7th Congress of the Workers' Party of Korea in July 2016.[107] The government officials laid out following demands,

> Firstly, all the nuclear weapons should be opened to public, first of all, which the US has neither acknowledged nor denied after bringing them to South Korea.
>
> Secondly, all the nukes and their bases should be dismantled and verified in the eyes of the world public.
>
> Thirdly, the US should ensure that it would never bring against the nuclear strike means to South Korea which the US has frequently deployed on the Korean Peninsula and in its vicinity.
>
> Fourthly, the US should commit itself to neither intimidating the DPRK with nukes or through an act of nuclear war nor using nukes against the DPRK in any case.
>
> Fifthly, the withdrawal of the US troops holding the right to use nukes from South Korea should be declared.[108]

North Korea's demands for denuclearisation are patterned over the 1992 North-South Denuclearisation Declaration. Amongst the aforementioned points, the US has already fulfilled the first two demands of North Korea by removing its nuclear weapons from South Korean December 1991.[109]As far as rest of the demands are concerned, the international community may not consider these points in entirety. However, North Korea's this stance severs as an opportunity for engaging the country into negotiations. Therefore, the international community should try utilise this opportunity to being the North on negotiating table in order to set a path way for resolving the nuclear deadlock in the region.

Missile Programme

DPRK's missile programme has also been progressing, expanding and improving over the last few decades. These include the development of artillery rockets as well as short, medium, intermediate and long-range ballistic missiles. The development of medium and long-range ballistic missiles were the North's major goals since 1960s.[110] Though the North's missile programme was slow in development, it has undeniably achieved improvements. Like its nuclear programme, DPRK's missile programme achieved boost by it 'byungjin policy'. This policy focused on the development of multi-stage long-range ballistic missiles, submarine launched ballistic missiles, road-mobile ballistic missile and the development of efficient space programme.[111]

In 2016, DPRK conducted more than a dozen missile launches. During the year, a total of 21 missiles were launched on 14 different occasions. The majority of those tests were considered successful by the international experts.[112] With gaining the capability of mounting the nuclear warhead on the ballistic, the North also gained the capability of launching medium and long-range missiles not only from ground but also from the sea.[113] North Korea's missile capability in terms of range and sophistication is discussed under the following paragraphs.

Short-range Ballistic Missiles (SRBM)

North Korea's development of modern missile began with Russian designed Scuds missiles in 1976. By 1984, the country started building its own version of Scuds called Hwasongs.[114] DPRK possesses large stockpile of Scud missile that can easily target South Korea. They have a maximum range of approximately 300-500 km,

and can carry a warhead weighing up to 1 tonne.[115] With reverse-engineering, DPRK seems to have indigenously improved the range and design of missile and rocket fuel. The country conducted the first test of indigenously modified Scud missile in April 1982. In 1986, the North conducted successful tests of Scud-B (Hwasong-5) and Scud-C (Hwasong-6) with a smaller payload of 700 kg and with a longer range of 500 km. these two missiles were inducted in 1988.[116] North Korea also have another variant of Scud missile, known as Scud D/ER or (Hwasong-7).[117] DPRK's stockpile of SRBMs include some 600–800 regular and extended range Scud missiles. These missiles can deliver conventional warheads, but may also have biological, chemical and nuclear capabilities.[118]

Another missile that North Korea has in its arsenal is Toksa / KN-02, which is very different from that of Scud variants. North Korea started their production in early 2006. They were inducted into service in 2008.[119] The KN-02 is a short-range, solid-fueled, road-mobile ballistic missile. With a range of 120 km, it can carry a payload of approximately 485 kg.[120]

Medium-range Ballistic Missiles

The DPRK is thought to have started 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), during the 1990s. The first flight test of Nodong missile wasconducted in 1993.[121] 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 1000 kg payload.[122] With these ranges, it considered that North Korea can target all of South Korea, much of Japan and the US bases in Okinawa.[123] These missiles

are road-mobile missiles which means that they can be launched from a Transporter Erector Launcher (TEL).[124] Experts believe that North Korea possesses some 200 Nodong missile in its arsenal, however, the missile is still under development. Owing to its accuracy problem, Nodong missiles cannot be used for high precision target, rather they can be used for soft targets like cities or industrial areas.[125]

Intermediate-range Ballistic Missiles (IRBM)

The DPRK is believed to have in its possession a more accurate missile known as Musudan (also known as the Nodong-B, BM-25, Taepodong-X, and Mirim). It is not clear whether DPRK deployed these missiles in 2003 or 2007.[126] Moreover, the exact range of the missile is also not clear. According to the US sources, the missile has a range of 3200 km with a payload of 500 kg.[127] While other sources claim that the missile has a maximum range of 4000 km.[128] With these high ranges, the Musudan could hit any target in East Asia (including US bases in Guam and Okinawa) and Hawaii.[129] In June 2016, DPRK conducted a successful test of Musudan. The US and South Korea also called the test successful.

Multi-Stage Ballistic Missiles & Intercontinental Ballistic Missiles (ICBM)

In its multi-stage ballistic missiles arsenal, DPRK has two ballistic missiles, namely, Taepodong-1 (also known as the Scud Mod-E, Scud-X, Moksong-1, Paektusan-1, and Pekdosan-1) and Taepodong-2 (also known as the Moksong-2 and Paektusan-2). The country had started the development of these missiles in the 1980s and the 1990s. Until 2016, North Korea has not tested these missiles not as ballistic missiles, but as space launchers.[130]

According to different estimations, the Taepodong-1 has a range of approximately 1,800-2,000 km, and is assumed to be a two- or three- stage, liquid fuel propellant ballistic missile. Independent think-tank the Federation of American Scientists (FAS) stated that in Taepodong-1's first stage Nodong missile used and in its second stage a Scud (Hwasong-5 or -6) is used.[131] 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.[132]

North Korea started developing Taepodong-2 between 1987 and 1992. It is a two or three-stage missile with an improved booster. [133] However, the range and the payload of the missile is disputed. According to David Wright of the Union of Concerned Scientists has calculated that the Taepodong-2 ballistic missile could deliver a 500 kg payload as far as 9,000 km.[134] Other estimations, like NTI suggests that with a two-stage version capable of 7,000-7,500 km and a three-stage variant capable of 10,000-10,500 km.[135] The Japanese Defense White Paper of 2010 reported that one failed launch occurred in July 2006. The DPRK undertook a second launch in April 2009 that most likely involved a variant of the Taepodong-2, the Unha-2 SLV, at a range over 3,000 km.[136] 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.[137] A further test was successfully undertaken on December 12, 2012, delivering the Gwangmyongsong-3 satellite into orbit. On February 7, 2016, a month after its fourth nuclear test, the DPRK conducted another long

range ballistic missile test with the Unha-3 (the satellite launch version of the Taepodong-2) under the auspices of launching a satellite. The launch successfully placed an "earth observation satellite" into orbit, and marked an important progression in the DPRK's efforts to develop a functional ICBM.[138]

Experts believe that satellite launches are not similar to ICBM launches, but testing SLVs does assist in developing experience and data that could help in ICBM development. Experts also believe that with the successful tests of different Tapodong variants, the DPRK has attained such improvements in its missile technology that the country is now only a few years away from launching an ICBM successfully.[139]

Apart from Tapodong-2, KN-08 or Hwaseong 13 is also considered to be the DPRK's ICBM. Though the missile is only seen during a 2012 military parade as a mock-up, there is no evidence that it exists in reality.[140]

Submarine Launched Ballistic Missile (SLBM)

In order to achieve an effective second-strike capability, the DPRK is also in the early phase of developing SLBM and Ballistic Missile Submarines SSBN. In 2014, there were reports that North Korea was working on its submarines to modify them for launching SLBMs.[141] The DPRK later released photographs showing what was claimed to be a SLBM launch from a submarine on May 10, 2015. The successfully tested of a two-stage solid-fuelled SLBM that flew roughly 500 km was conducted by DPRK in August 2016. The tested missile was called KN-11. The tested missile breached Japan's air defence identification zone (ADIZ) before landing in the ocean. The range of the missile is not clear. However, the Union of Concerned Scientists has estimated the KN-

11's maximum range up to 1,250 km after ascertaining the flight apogee during the test.[142] The successful test of KN-11 implies that within 2 to 3 years North Korea would be able to deploy these missiles.

In a nutshell, North Korea has not only achieved that capability of launching ballistic missiles at various ranges, it has moved closer to completely developing its SLBMs and ICBMs in the near future.[143]

Like its nuclear programme, the advancements in North Korea's missile programme have raised serious concerns for countries including the US, South Korea and Japan. North Korea with its multiple missile ranges is posing a serious challenge to the US' extended deterrence to South Korea and Japan[144]. It basically implies that the willingness of the US to fight a nuclear war on behalf of South Korea or Japan would risk the major cities of the US. It would be difficult for the US to act against the North in case of a limited or full scale nuclear attack by the DPRK on South Korea and Japan. If the US reacts against North Korea, the situation may escalate to a situation where the DPRK may conduct nuclear strikes on the US mainland with the help of its SLBMs since the country's missile programme is in the position to target the US.[145]

The successful creation of a deliverable deterrent by North Korea and the inability of the US to tackle North Korean provocations may potentially erode South Korean and Japanese confidence in the extended deterrence policy of the US.[146] The US has played a marginal role in repelling the small threats which the South and Japan are facing from the North. Such a marginal role of the US may cause Japan and South Korea to question the US ability to deal with greater provocations including Nuclear attacks.[147] For example, North Korea destroyed

the South Korean frigate Cheonan in 2010 and in the same year the North started shelling Yeonpyeong, in which 65 people died. In response, the US only urged restraint and prevented South Korea retaliation. Consequently, officials in South Korea expressed their doubt over US security commitments and called for the deployment of US nuclear weapons in South Korea which the US had removed in 1991.[148] As the US is not planning to redeploy nuclear weapons in South Korea,[149] it may push South Korea, and Japan as well, to review their own security polices and develop their own nuclear deterrents[150].

Historically, South Korea had an ambitious nuclear weapons programme. South Korea under its former president Park Chung Hee decided to develop nuclear weapons following the US' former president Richard Nixon announced the withdrawal of 26,000 US forces from the country in 1970 over the growing dissatisfaction regarding the Vietnam War[151]. Nixon had announced that the US requires Asian nations to increasingly fend for themselves rather than continue to be dependent on US deployed forces for their defence. With an aim to lower its dependency on the US and to develop nuclear weapons programme, South Korea sought to acquire a reprocessing facility from France and a research reactor and heavy water reactor from Canada to produce weapon-grades plutonium in 1973.[152] However, threats from the US to cancel its security guarantees and economic support to the country led to effectively ending the South's nuclear weapons programme.[153] Consequently, under US pressure, South Korea ratified the NPT in 1975. Despite being a state party to the NPT, it is considered that South Korea had a clandestine nuclear weapons programme that ended following the assassination of its president Park Chung Hee in October 1979[154].

Today, the security concerns of South Korea are reminiscent of the situation during the 1970s. South Korea's security calculations are heavily dependent upon the new US administration. In March 2016, US President Donald Trump stated that South Korea would need to take its security in its own hands while dealing with nuclear North Korea and China[155]. Keeping in view such a stance by the US, it is difficult to predict how President Trump would act in future and what financial costs he would impose on the country for its security[156]. The situation would become clearer following the review of US Nuclear Posture and Ballistic Missile Defence which President Trump has recently ordered[157].

Moreover, public opinion in South Korea has also supported the development of nuclear weapons. For example, surveys regarding nuclear weapons development were conducted in 2011, 2012 and 2013 revealing that more than 60% of South Koreans had supported the idea that South Korea should indigenously develop weapons rather than remaining dependent on US security guarantees[158]. In February 2013, outgoing president of the country Lee Myung-bak gave qualified support for the idea. He stated, "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."[159] These opinions and thoughts amongst South Korean people and its leadership imply that many in the country are concerned that the US might not provide its nuclear umbrella indefinitely, thus intensifying the idea of indigenously developing nuclear weapons. South Korea's vast civilian nuclear programme together with its past experiences provides the country with the latent capability to develop nuclear weapons in the future, if required.

As far as Japan is concerned, the country also has an advanced civilian nuclear programme. Prior to the 2011 earthquake in Tohoku region in Japan that devastated the Fukushima Dai-ichi Nuclear Power Station, the country had 54 nuclear power reactors in operation across the country and was in the process of constructing two new reactors. Post the Fukushima incident, all the operating reactors were closed for reviewing safety measures[160]. After a complete overview of nuclear energy policy and safety measures, only a few reactors were restarted during 2016. The remaining 35 to 40 reactors are scheduled to start operations after the complete implementation of new safety standards in the next two to three years[161]. According to estimates by the end of 2015, Japan possessed 48 metric tons of unirradiated separated plutonium; of these, 11 metric tons were in Japan while 37 metric tons in France and Britain. The external stored fuel stockpile is also scheduled to reach Japan within one or two years. The entire stockpile is enough to make 2000 nuclear weapons[162]. Furthermore, Japan has also completed the construction of its Rokkasho spent fuel recycling complex. The reprocessing plant is still in its testing phase, and will become operational by mid-2018. It is estimated that the plant would be able to separate 8 metric tons of plutonium from the spent fuel annually[163], which is enough for making 1000 nuclear weapons.

Japan's advanced civil nuclear programme with complete fuel cycle capabilities gives the country a latent nuclear weapons capability. Countries including China and Russia have expressed concerns over Japan's reprocessing programme because they believe that Japan may be tacitly pursuing nuclear weapons. These concerns were further strengthened when in 2012 and 2013 countries including China and Russia became suspicious of

Japan's intentions regarding nuclear weapons programme when it failed to include 640 kg of unused plutonium in its annual reports to the IAEA[164].

It is true that nuclear weapons development is taboo in Japan and every successive government has rejected the idea, relying instead on US extended deterrence. However, debates within the governments over the development of nuclear weapons have also existed[165]. Nuclear experts consider Japan to have employed a quasi-nuclear-hedging strategy that would enable the country to quickly develop nuclear weapons, should circumstances dramatically change[166]. Japanese politicians like Deputy Prime Minister Taro Aso and Tomomi Inada, a defence minister and a possible candidate for future prime minister, have claimed that acquiring nuclear weapons was not actually against the Constitution, and was a possible option for the government to pursue[167]. Such political statements are issued to remined neighbours and allies about Japan's technical capabilities. This strategy has also served the country to encourage the US to reaffirm its extended-deterrence commitments.

The assessment regarding Japan's nuclear technology and policy suggest that, as in the case of South Korea, the country is heavily dependent on US security guarantees. Though the US has assured its commitment to Japan's security a number of times[168], it is seen that the US has remained largely unsuccessful in deterring North Korea. In 2017, North Korea lunched its ballistic missiles twice towards Japan which fell into the country' exclusive economic zone (EEZ)[169]. Though the Japanese government has still shown reliance on the US, any sort of inability or unwillingness from the country to assure security to its allies may possibly alter the future of the

East Asian region in terms of non-proliferation with Japan and South Korea becoming nuclear weapon states.

Way Forward

In order to avoid the nuclearisation of Japan and South Korea and a possible nuclear exchange between the US and North Korea owing to pre-emptive strikes or miscalculations, it is time for the international community to engage North Korea in negotiations. As the North Korean nuclear issue has become more complex, policy options are becoming narrower. However, an opportunity-window still exits as North Korea issues policies and guidelines for its denuclearisation[170]. Therefore, it would be too early for the international community to give up efforts to denuclearise North Korea. Until now, states aiming to resolve the issue have only employed limited and short time measures[171]. On the one hand, the US, South Korea, and Japan demand that North Korea should denuclearise as a precondition for resuming talks while China and North Korea advocate that the talks should be resumed immediately without conditions[172].

Since North Korea has now attained the capability of a true deterrent it is highly unlikely that the country would voluntarily abandon its nuclear programme. Instead of short term and reactionary policies, it would be wise to adopt a comprehensive plan to pursues complete denuclearisation in the long term which should be guided with the idea of strategic patience, providing the North maximum incentives in order to change the country's calculus regarding nuclear weapons. Agreements reached amongst negotiating parties on measures should be implemented in complete, transparent, and irreversible ways. Second, the commitment and actions should be undertaken reciprocally. Negotiations patterned this way may reliably lead to the

denuclearisation of the North. This approach needs to be a phased one but with swift implementation of actions without allowing time for the parties to reverse their commitments[173]. For example, in the first phase North Korea may be asked to declare mortarium on further nuclear and missile tests. In response, the international community may provide partial or complete relief from sanctions on the country. In the second the international community may provide more economic and social assistance to the North in exchange for its gradual dismantlement of its nuclear weapons development and missile facilities. While in the third stage North Korea may allow for verification of the complete dismantlement of its nuclear and missile facilities which may be coupled by the restoration of diplomatic ties and commitment for not threatening the North with strategic weaponry of the US. In the last phase, North Korea may destroy its nuclear weapons and long-range missiles and join NPT while the international community may reciprocate by replacing the 1953 Armistice agreement with a peace treaty between the US and the North and restoration of peace on the Korean Peninsula.[174]

Conclusion

During Kim's reign from 2011, Pyongyang has conducted more than twice the number of missile tests that his father Kim Jong Il conducted during his 17 years in office. The accelerated pace of North Korean missile tests implies that Kim Jong Un is seeking to deploy a spectrum of missile systems of various ranges and capabilities to keep the US and its allies under check. North Korea's nuclear and missile capabilities are considered an existential threat to both South Korea and Japan. Apart from South Korea and Japan, North Korea is moving forward rapidly to deploy missiles that could target not only the US bases in Guam but also a

mainland US with its developing ICBM and SLBM. The growing nuclear and missile programme of DPRK has not only become a threat to regional security but has also increased the risks of nuclear proliferation. The international community needs to take immediate action to start negotiations seeking to completely denuclearise North Korea and to create amicable ties on the Korean peninsula. It has become clear that policy options including pre-emptive strikes on DPRK and imposing more sanctions on the country together with military exercises in the region would not bring peace. Rather, these actions would make the North more aggressive. In order to avoid miscalculations and nuclear crisis in the Pacific region, the international community has to start negotiations in a phased manner based on principles of transparency, irreversibility and reciprocity in order to peacefully resolve the heightened tensions in the region.

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