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David versus Goliath – US irrationality and nuclear war in the Korean Peninsula

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North Korea launches its third Hwasong 12 Missile

On September 15 2017 North Korea launched another missile from a site in Sunan close to its capital Pyongyang. While open sources reporting on the launch did not immediately identify the missile the launch trajectory appears to be very similar to the August 28 2017 flight of the Hwasong 12 missile.

Agencies reporting on the missile said that it had a range of 3700 Km, reached an altitude of 770 Km with a flight time of about 19 minutes (1140 seconds). Like the August 28 flight the missile overflowed the southern tip of Japan's Hokkaido Island for two minutes before impacting in the Pacific Ocean. Unlike the earlier flight which had a range of 2700 Km this flight had a longer range of 3700 Km. This launch is the third successful launch of the Hwasong 12 missile and follows launches made in May and August 2017.

Assessment of the September 15 flight

The International Strategic & Security Studies Programme (ISSSP) of the National Institute of Advanced Studies (NIAS) had carried out a detailed assessment of the two earlier flights of the Hwasong 12 missile that took place on May 14 and August 28 respectively. Using the same approach and procedures the ISSSP carried out a trajectory reconstruction exercise of the September 15 launch using the Quo Vadis software developed at NIAS. This was based on the parameters of the Hwasong 12 missile derived from the trajectory reconstruction exercises carried out on the two earlier launches.

A payload mass of 1400 Kg launched in a near maximum range trajectory at an azimuth of 69 degrees (the same azimuth as the August 28 launch and very close to the azimuth of 70 degrees for the May 12 launch) provides a reasonable fit with the observed data. The trajectory reconstruction exercise provided a range of 3709 Km, an altitude of 772 Km and a flight time of 1153 seconds. This compares well with the data put out by agencies tracking the missile.

The 1400 Kg payload mass suggests that the Hwasong 12 can potentially deliver a thermonuclear weapon to a distance of 3700 Km. Translated into simpler language the missile test is a signal to the US and its allies that North Korea can easily reach the US base at Guam (3400 Km) with a very powerful hydrogen bomb.

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Signalling Patterns in North Korea's Missile and Nuclear Tests

When we look at North Korea's recent nuclear weapons and missile tests especially in the last few months one can discern a clear pattern in the signals that are being sent out to the US and its allies. Each missile and nuclear weapon test appears to be designed to clearly communicate what North Korea can actually do. Taken together they are strong signals that tell its adversaries that it has a viable deterrence in place should its security be threatened. A critical appraisal of each missile and nuclear weapon test and the signal that it is sending out is provided in this brief. This is followed by a discussion on North Korea's overall strategy and the logic behind it. The implications of this understanding for dealing with North Korea are also touched upon.

The May 14 Test of the Hwasong 12 IRBM

The first major signal North Korea sent out to the US and its allies was the launch of the [Hwasong 12 IRBM in May 2017](#).

Extrapolating from a reconstruction of the lofted trajectory of the May 14 test, the Hwasong 12 would have a maximum range of 4385 Km with a payload mass of 650 Kg.

The launch of this missile was preceded by five nuclear weapon tests including a possible Boosted Fission test.

This launch conveys the message that North Korea has a fission weapon which can cover all of Japan and the US base in Guam comfortably.

Even if the mass of the RV carrying the fission weapon increases to around 700 to 750 Kg these two targets are well within the range of the Hwasong 12 missile.

With five nuclear tests behind it, a fission weapon with a mass of 650 to 750 Kg should be well within the capabilities of North Korea.

The test provides hard evidence that North Korea can reach all of Japan and the US base at Guam with a nuclear weapon.

The July 4 Test of the Hwasong 14 ICBM

Though the trajectory used to signify capability was a lofted trajectory and not a standard maximum range trajectory the message that the successful launch conveys is clear and unequivocal.

Unlike the first message which was directed towards US bases and allies in North Korea's Asia Pacific neighbourhood, [the July 4 launch of the Hwasong 14 ICBM is aimed directly at the US](#).

The flight establishes that this missile has a range of 7300 Km with a 325 Kg payload. Though this missile cannot reach the US mainland it can cover all of Alaska and parts of Northern Canada.

The launch from an easy to construct platform also demonstrates that in principle such missiles can be launched from anywhere in North Korea and not all of them can be eliminated in a pre-emptive strike. The test therefore also sends a strong signal that North Korea has an assured retaliation capability.

The payload mass of 325 Kg demonstrated in this flight also suggests that North Korea can or will soon have the capability to build such a weapon. There is still some ambiguity about the missile's ability to reach the continental USA with a meaningful payload.

The July 28 Test of the Hwasong 14 ICBM

The second launch of the Hwasong 14 ICBM carried out very soon after the first launch removes much of the ambiguity on the range and the payload. This was also a lofted trajectory flight test. The trajectory reconstruction exercise suggests that this launch carried more propellant and also had a reduced payload mass.

If this missile was flown on a standard maximum range trajectory with a payload of about 300 Kg (not very different from the 325 Kg of the July 4 launch) it can reach a few cities such as Seattle or Portland in mainland USA. With a reduction in the payload to about 200 Kg a large part of the US mainland becomes vulnerable. With five nuclear weapon tests including one possible boosted fission test the claim of a miniaturized weapon becomes a realistic possibility.

The missile was also launched from a different easy to construct platform near Mupyong Ni. This implies that North Korea can launch the missile from anywhere and do so quickly. This reinforces North Korea's claims that it is capable of assured retaliation in case of a pre-emptive attack on its nuclear and missile assets.

The August 28 Test of the Hwasong 12 IRBM

The second [Hwasong 12 flight of August 28 carries a different message](#). Unlike the earlier lofted trajectory flight this missile launched from Sunan near Pyongyang followed a normal maximum range flight path that took it over Japan. The trajectory reconstruction exercise suggests that for this test the Hwasong 12 would have carried a payload of about 3200 Kg to a range of 2700 Km.

The very heavy payload carried on this test suggests that North Korea is sending a signal that it has the capability to add a Post Boost Vehicle (PBV) to the second stage of the Hwasong 12. Such a PBV can release Multiple Independently Targetable Re-entry Vehicles (MIRV) that can overcome any BMD defences that may have been installed. This would also imply that North Korea is or would soon be in a position to develop very small nuclear weapons and mount a number of them on its missiles.

This also reinforces the message that North Korea is sending through its ICBM launches that it will miniaturize its nuclear weapons to reach the US as well as to counter any BMD defences that it may encounter in its strategy of assured retaliation directed at the US mainland, US allies and US bases in its neighbourhood.

The launch from Sunan a different site from Kusong once again reiterates the message of mobility and assured retaliation from different locations in the aftermath of a pre-emptive attack.

The Nuclear Weapon Test of September 3 2017

North Korea conducted its sixth nuclear weapon test at the Punggye Ri test site. Though different sources provided different estimates of the yield there seems to be an emerging consensus that the yield was in the range of 160 to 350 KT. There is also agreement that it was indeed a test of a two stage thermo-nuclear device.

The test, which was preceded by a [possible boosted fission test in 2016](#), increases North Korea's credentials for the deployment of two stage thermo-nuclear devices as well for the miniaturization drive suggested in its ICBM tests of July 2017.

It also lends credibility to its pursuit of a possible MIRV solution to the BMD systems in Japan and the US base at Guam demonstrated in its Hwasong 12 flight of August 28 2017.

The September 15 Test of the Hwasong 12 IRBM

The payload of 1400 Kg and a range of 3700 Km indicate that this missile can easily cover all of Japan and comfortably reach the US base in Guam with a thermo-nuclear weapon.

The August 28 and September 15 flights when viewed together indicate that North Korea has "assured retaliation" against both Japan and Guam not to mention other potential US allies in its region. This assured retaliation is based on mobility, quick response, small & powerful nuclear weapons as well as MIRV to take care of any BMD systems that such retaliation may encounter.

North Korea's Strategic Signalling – Assured Retaliation for Deterrence

Annexure 1 provides a more detailed picture of the major missile and nuclear weapon tests carried out by North Korea starting from the Hwasong 12 launch of May 14 2017 in chronological order.

The IRBM is clearly directed against Japan and the US base in Guam. The ICBM directly threatens the US mainland. The implications of the payload mass in terms of delivery of various kinds of weapons based on ISSSP assessments of the missile and nuclear tests are also provided in the Annexure.

North Korea can comfortably threaten all of Japan and the US base at Guam with a standard fission weapon mounted on the Hwasong 12 IRBM. With a total of six nuclear weapon tests that include boosted fission and thermo-nuclear tests it can easily build the needed RV within a mass of 600 to 700 Kg. The threat is real, current and operational.

It can also reach these locations with a thermo-nuclear weapon which it can build within a mass of about 1400 Kg. With the pedigree of six weapon tests this again seems to signal the shift from potential threat to real threat.

The missiles can be moved around and launched quickly from makeshift platforms around the country. This provides tangible evidence of mobility, flexibility and assured retaliation in case of a pre-emptive attack.

The other strong assured retaliation signal that it sending out is that it has the payload capacity to MIRV the Hwasong 12 missile to counter any BMD system in Japan and Guam. These could be fission weapons, boosted fission weapons or even thermo-nuclear weapons.

North Korea is sending a strong signal to the US and its allies that it has in place a robust retaliation capability to deter any military threat to its survival.

Apart from the neighbourhood threat, which seems to have moved from the realm of possibilities to the real world, North Korea is sending out clear unambiguous signals to the US that it is determined to protect itself from any attempt to destabilize it by directly threatening the US mainland.

The two ICBM launches provide hard evidence to the US about the reality of North Korea's threat to the US mainland. While analysts can quibble about a number of finer nuances such as accuracy, miniaturization etc., North Korea is telling the US that it is well on its way towards developing the small sized nuclear weapon that can reach most of the US mainland.

The sequencing and timing of the signals sent through the various tests over the last few months make it clear that North Korea has crossed the threshold and can now assuredly retaliate with nuclear weapons should it be forced to do so. Short of war with its horrific consequences there is no way in which the US and its allies can quickly get rid of North Korea's nuclear and missile capabilities.

A Possible Way Forward

Taken together the available evidence from these tests is not in accordance with the western portrayal of Kim Jong Un as an irrational madman who will go to nuclear war for some stupid and idiosyncratic reasons.

He comes across rather as a pretty cold, calculating rational actor who is laying out the possible ground rules and thresholds for averting a confrontation with nuclear dimensions in the Korean peninsula. A leader who is telling his adversaries what he can do through complex signalling such as range versus payload curves can hardly be called irrational or mad.

While one may not like him or his actions there is no reason to doubt the rationality behind his actions. Acceptance of this reality is the first step for dealing with North Korea. Only actions that are consistent with this acceptance and the reality of North Korea's nuclear weapons may result in fruitful negotiations that will bring stability to the Korean peninsula.

The US and its allies in the Asia Pacific should accept this reality. Rather than queering the pitch through angry exchanges in the public media every time North Korea launches a missile or conducts a nuclear weapon test the US must take the North Korean signalling seriously and engage in direct talks with its leader.

There is no reason to doubt that a satisfactory arrangement can be worked out if the North Korean leader's existential threat is taken into account and negotiations initiated on such a basis. This kind of an approach may yield better results than threats or sanctions which have so far had no impact whatsoever on North Korea.

In any case the US and its allies have no choice but to accept the reality of a nuclear armed North Korea and deal with it appropriately. Instead of threatening it with regime change or a war which cannot be fought and won, direct talks with North Korea's leadership may yield more fruitful outcomes. The Korean peninsula is now nuclearized. Reversing this trend may not be immediately feasible. However there is no reason to believe that the North Korean leader is averse to direct talks for stabilizing the situation on the ground. Once this immediate purpose is achieved it may then be possible to think of reversing the trend.

Annexure 1

Chronology of North Korea’s Missile & Nuclear Weapon Tests

Date	Missile and Nuclear Weapon Test Details and Implications
May 14 2017	A Hwasong 12 IRBM is launched from a platform near Kusong. It has a range of 4350 Km with a 650 Kg Payload. The test provides hard evidence that North Korea can reach all of Japan and the US base in Guam with a fission device. The missile test is preceded by five nuclear weapon tests suggesting that North Korea can build a RV with a fission weapon within a mass of 650 to 700 Kg. The test establishes the credibility of North Korea’s missiles to threaten the US base at Guam and Japan with a fission weapon.
July 4 2017	A Hwasong 14 ICBM is launched from a mobile platform near the Panghyon Base. The range of the missile with a 325 Kg payload is 7300 Km. It can completely cover the US state of Alaska and parts of Northern Canada. The launch was preceded by four fission weapon test and one possible Boosted Fission weapon test in September 2016. The sequence of nuclear tests and the successful launch makes the threat of a smaller miniaturized nuclear weapon credible putting the US state of Alaska at risk.
July 28 2017	A second Hwasong 14 ICBM is launched from a different platform near Mupyong Ni. The different launch site makes clear that North Korea can launch ICBMs from any location within North Korea making its threat of assured retaliation more credible. This test provides clear evidence that the Hwasong 14 can reach the US mainland cities of Portland and Seattle (range 8500 Km) with a 300 Kg weapon. If it can reduce the mass of the RV to 250 Kg it can reach all the cities up to Los Angeles on the west coast of the US. If the RV mass can be reduced even further to 200 Kg (range 10600 Km) all the cities of the West Coast as well as Chicago can be reached. The test sends a clear signal that North Korea has the delivery vehicle and a RV with a mass of 200 to 300 Kg that can reach many large US cities.
Aug 28 2017	A second launch of the Hwasong 12 takes place from Sunan the airport near the capital city of Pyongyang. The different launch site used for this test implies that North Korea can guarantee assured retaliation in case it is attacked. The missile is launched in a standard maximum range trajectory that overflies the southern tip of Japan’s Hokkaido island. The test shows a range of 2700 Km implying a payload of about 3200 Kg. The large payload suggests that North Korea has or will soon have an MIRV capability to threaten Japan and possibly Guam in the near future. The missile test takes place just a week before North Korea conducts its sixth nuclear weapon test on September 3 2017. MIRV is a direct response to a BMD systems being installed in Japan and South Korea. The US base in Guam would also be heavily defended with BMD systems. Through this test North Korea is clearly communicating to the US and its allies that it has the technical wherewithal to counter BMD and its threat of assured retaliation is therefore credible. The September 3 nuclear weapon test of a thermo-nuclear device makes this threat even more credible.
Sep 3 2017	North Korea conducts its sixth nuclear weapon test at the Punggye Ri test site. Though different sources provided different estimates of the yield there seems to be an emerging consensus that the yield was in the range of 160 to 350 KT. There is also agreement that it was indeed a test of a two stage Thermo-nuclear

Date	Missile and Nuclear Weapon Test Details and Implications
	device. The test increases North Korea’s credentials for building hydrogen bombs as well for the miniaturization drive suggested in its ICBM tests of July 2017. It also lends credibility to a possible MIRV solution to the BMD systems in Japan and the US base at Guam demonstrated in its Hwasong 12 flight of August 28 2017.
Sep 15 2017	<p>A third Hwasong 12 IRBM is launched from Sunan on a near standard maximum range trajectory. The realized range of the missile is 3700 Km. The flight path is very similar to that of the missile launched on 28 August 2017. The missile overflew the southern tip of Japan’s Hokkaido island before impacting in the Pacific Ocean. The trajectory of the missile is consistent with a delivered payload mass of 1400 Kg. This is the first launch of a missile after the September 3 2017 nuclear weapon test. The launch provides hard evidence that North Korea can reach all of Japan and the US base in Guam with a thermo-nuclear weapon.</p> <p>Six nuclear weapon tests including one boosted fission and one two stage thermo-nuclear test provide credibility to a 1400 Kg RV carrying a large yield nuclear bomb. The second launch from Sunan on a standard maximum range trajectory also enables the US and its allies to make accurate inferences about the range payload capabilities of the Hwasong 12 missile. This should help them make better and more informed judgements about North Korea’s true retaliation capabilities and promote deterrence.</p>